8571

Photomultiplier Tube[a]

S-4 RESPONSE

VERY SMALL, RUGGEDIZED, SIDE-ON, 9-STAGE TYPE

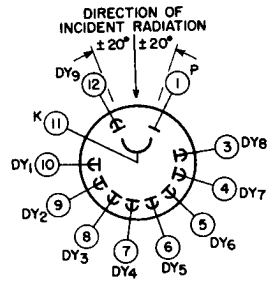
TESTED FOR SHOCK, VIBRATION, CONSTANT ACCELERATION, AND TEMPERATURE CYCLING

For Ultra-Compact Systems in Low-Light Detection and Measurement Applications

GENERAL

Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 angstroms
Cathode	Cesium-Antimony
Minimum projected length[b]	0.375 in
Minimum projected width[b]	0.06 in
Minimum projected area[b]	0.023 sq. in
Secondary-Emitting Surface	Cesium-Antimony
Window	Lime Glass, (Corning[c] No.0080), or equivalent
Direct Interelectrode Capacitances (Approx.)	
Anode-to-dynode No.9	2.5 pF
Anode to all other electrodes	3.0 pF
Maximum Overall Length	1.37 in
Excluding semiflexible leads	
Length	0.43 ± 0.03 in
Bulb top to useful center cathode area	
Maximum Diameter	0.53 in
Operating Position	Any
Weight (Approx.)	0.17 oz
Bulb	T-4
Magnetic Shield	See footnote ([d])
Base	See *Dimensional Outline* and *Base Drawing*
Basing Designation for BOTTOM VIEW	12FZ

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



MAXIMUM RATINGS, ABSOLUTE-MAXIMUM VALUES

DC Supply Voltage	
Between anode and cathode[e]	1250 V
Between anode and dynode No.9	250 V
Between consecutive dynodes	250 V
Between dynode No.1 and cathode	250 V

Average Anode Current[f]	20	μA
Ambient Temperature	75	°C
Lead Temperature (1/16" ± 1/32" from protective shell for 10 sec. max.)	250	°C

CHARACTERISTICS RANGE VALUES

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.

With E = 1000 volts (except as noted)

	Min	Typ	Max	
Sensitivity				
Radiant, at 4000 angstroms	-	7.3×10^{4}	-	A/W
Cathode Radiant, at 4000 angstroms	-	0.034	-	A/W
Luminous, at 0 c/s[g]	20	75	300	A/lm
Cathode Luminous[h]	2×10^{-5}	3.5×10^{-5}	-	A/lm
Cathode Quantum Efficiency at 3800 Angstroms (Approx.)	-	10.5	-	%
Current Amplification	-	2.1×10^{6}	-	
Equivalent Anode-Dark-Current Input[j]	-	1×10^{-10}[k]	5×10^{-10}[k]	lm
	-	1×10^{-13}[m]	5.1×10^{-13}[m]	W
Anode-Pulse Rise Time[n]	-	1.4×10^{-9}	-	s
Electron Transit Time[p]	-	6×10^{-9}	-	s

With E = 750 volts (except as noted)

	Min	Typ	Max	
Sensitivity				
Radiant, at 4000 angstroms	-	1×10^{4}	-	A/W
Cathode Radiant, at 4000 angstroms	-	0.034	-	A/W
Luminous, at 0 c/s[g]	-	10	-	A/lm
Cathode Luminous[h]	2×10^{-5}	3.5×10^{-5}	-	A/lm
Cathode Quantum Efficiency at 3800 Angstroms (Approx.)	-	10.5	-	%
Current Amplification	-	3×10^{5}	-	
Equivalent Anode-Dark-Current Input[j]	-	1×10^{-10}[k]	5×10^{-10}[k]	lm
	-	1×10^{-13}[m]	5.1×10^{-13}[m]	W
Anode-Pulse Rise Time[n]	-	1.8×10^{-9}	-	s
Electron Transit Time[p]	-	7.4×10^{-9}	-	s

[a] Alternate designation is Multiplier Phototube.

[b] On a plane parallel to the grill wires. See *Schematic Arrangement of Structure*.

[c] Made by Corning Glass Works, Corning, N.Y.

[d] Magnetic shielding material in the form of foil or tape as available from the Magnetic Shield Division, Prefection Mica Company, 1322 North Elston Avenue, Chicago 22, Illinois, or equivalent.

[e] Operation with a supply voltage (E) of less than 500 volts dc is usually not recommended. If such a supply voltage is used, illumination must be limited to such a value that the average cathode photocurrent does not exceed approximately 5×10^{-9} ampere.

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

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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. A light input of 1 microlumen is used and the approximate spot size of the beam incident on the tube envelope is 0.35 inch by 0.05 inch. The tube is rotated to provide maximum anode output current.

h 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 100 volts is applied between cathode and all other electrodes connected as anode. The approximate spot size of the beam incident on the tube envelope is 0.35 inch by 0.05 inch. The tube is rotated to provide maximum output current.

j At a tube temperature of 22°C. Dark current may be reduced by use of a refrigerant.

k With supply voltage (E) adjusted to give a luminous sensitivity of 20 amperes per lumen.

m At 4000 angstroms.

n 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.

p The electron transit time is the time interval between the arrival of a delta function light pulse at the entrance window of the tube and the time at which the output pulse at the anode terminal reaches peak amplitude. The transit time is measured under conditions with the incident light fully illuminating the photocathode.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-4 RESPONSE

is shown at the front of this section

ENVIRONMENTAL TESTS

The 8571 is designed to withstand the following environmental tests:

Shock. With no voltage applied, the 8571 is subjected to a total of 18 impact shocks, three in each direction of the three orthogonal axes, on apparatus which applies half-wave sinusoidal shock pulses. The peak acceleration of the impact shock is 30 ± 3g's and the time duration is 11 ± 1 milliseconds.

Vibration. With no voltage applied, the 8571 is vibrated, in each of the three orthogonal axes and as specified below, on apparatus which applies variable-sinusoidal frequency vibration to the tube. A vibration sweep has a duration of 5 minutes per axis in which time the frequency is varied logarithmically from 5 to 2000 and back to 5 cycles per second. Six vibration sweeps are performed for each axis and the total test period is 1-1/2 hours.

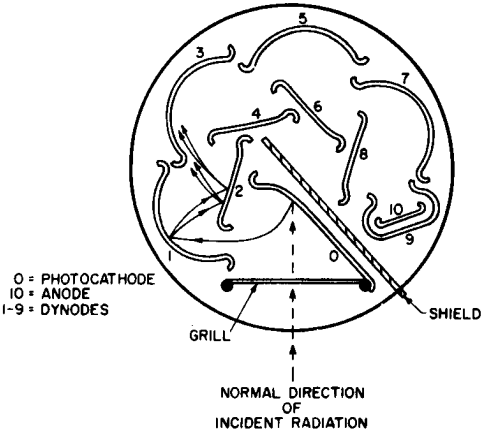
Double Amplitude inches	Acceleration g's	Frequency c/s	Total Sweep Duration Per Axis minutes
0.45	-	5-30	30
-	20	30-2000	
-	20	2000-30	
0.45	-	30-5	

Constant Acceleration. With no voltage applied, the 8571 is subjected for five minutes to an acceleration test level of 15 g's in both directions of the three orthogonal axes in a centrifuge providing constant acceleration.

Temperature Cycling. With no voltage applied, the 8571 is subjected to temperature cycling from -45°C to +75°C and back to -45°C in a period of 8 hours. Three temperature cycles are performed.

SCHEMATIC ARRANGEMENT OF STRUCTURE

(Top View)



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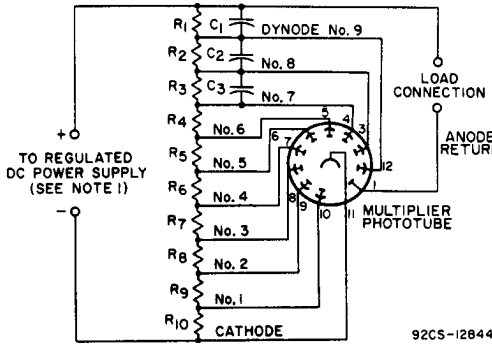
TYPICAL VOLTAGE-DIVIDER ARRANGEMENT

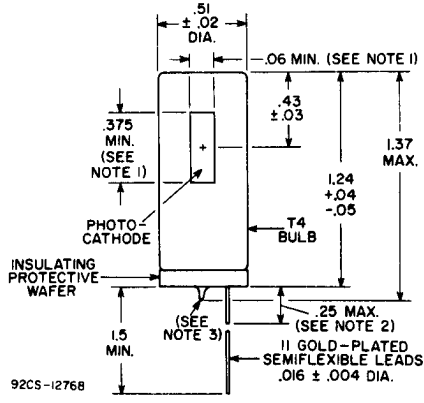


R_1 through R_{10} = 20,000 to 5,000,000 ohms.

NOTE 1: Adjustable between approximately 500 and 1250 volts.

NOTE 2: Capacitors C_1 through C_3 should be connected near tube base for optimum high-frequency performance.

DIMENSIONAL OUTLINE



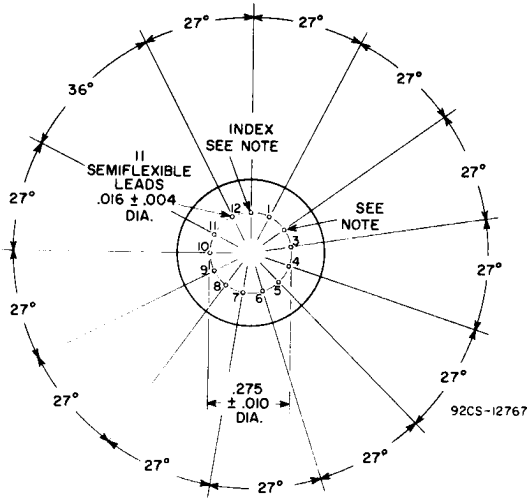
DIMENSIONS IN INCHES

NOTE 1: Minimum projected cathode length and width on plane parallel to grill wires.

NOTE 2: Soldering or welding to the leads within this region is not recommended.

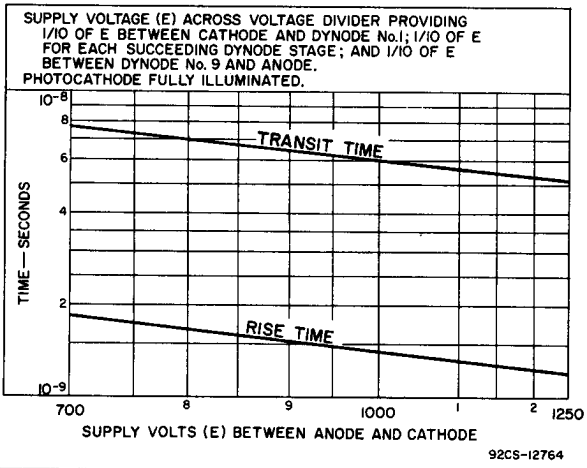
NOTE 3: A 0.15 inch minimum hole diameter should be provided in circuit boards or similar mounting arrangements to allow for clearance of the exhaust tip of the 8571.

BASE DRAWING (Bottom View)



NOTE: Lead is cut off within 0.10 inch of the glass button for indexing.

Typical Time Resolution Characteristics



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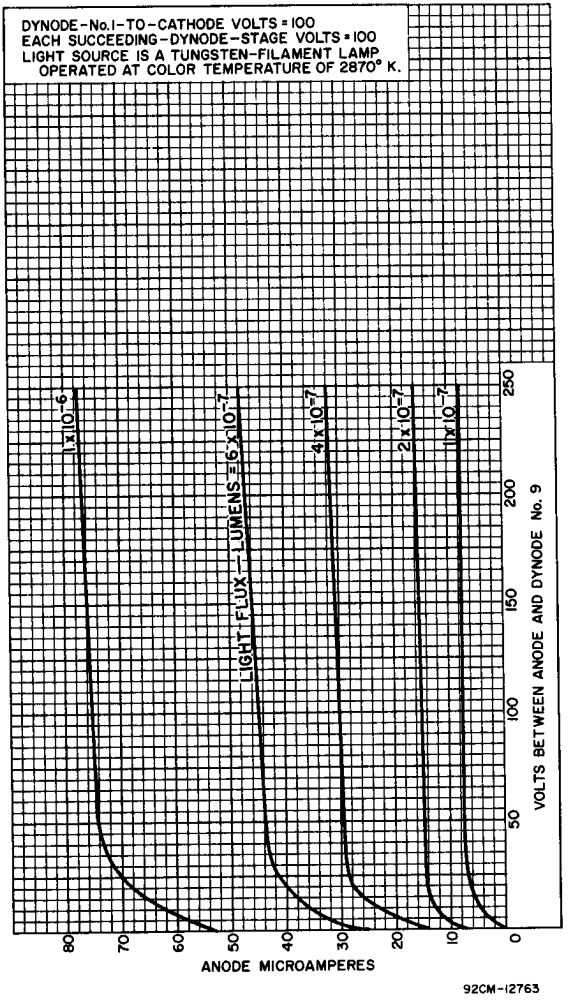
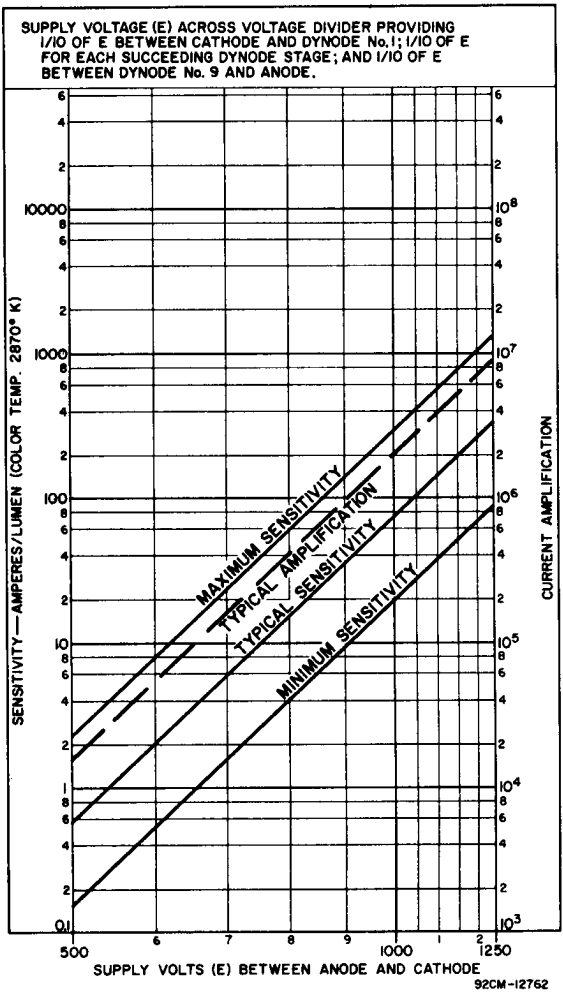
Average Anode Characteristics



Typical Sensitivity and Current Amplification Characteristics



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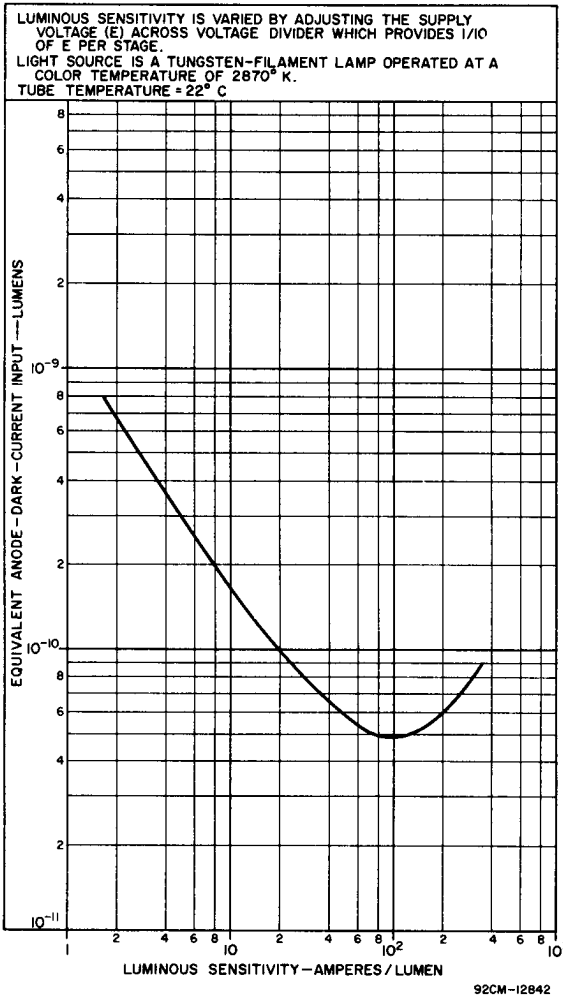
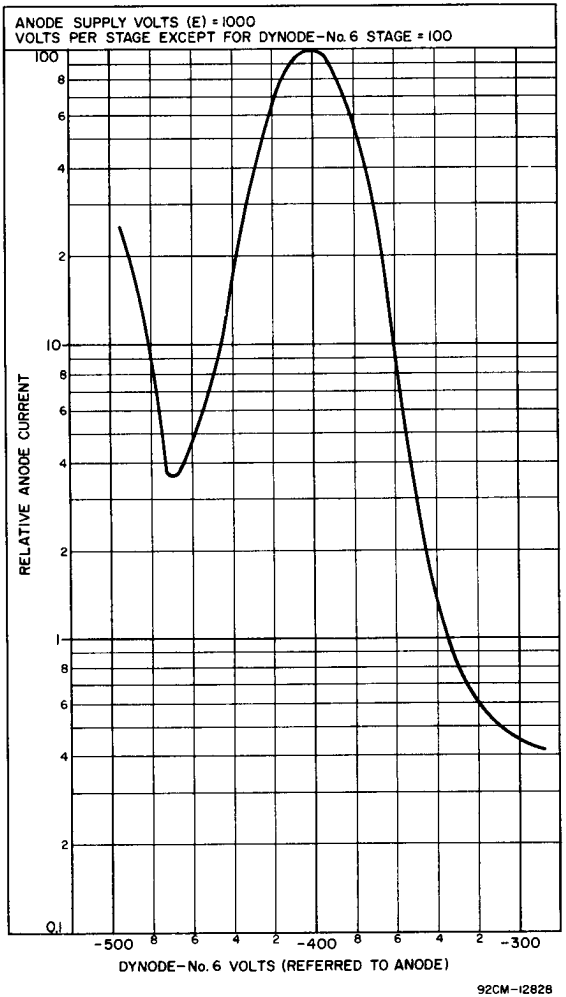
Typical Anode-Dark-Current Characteristic



Typical Anode Current Modulation Characteristic



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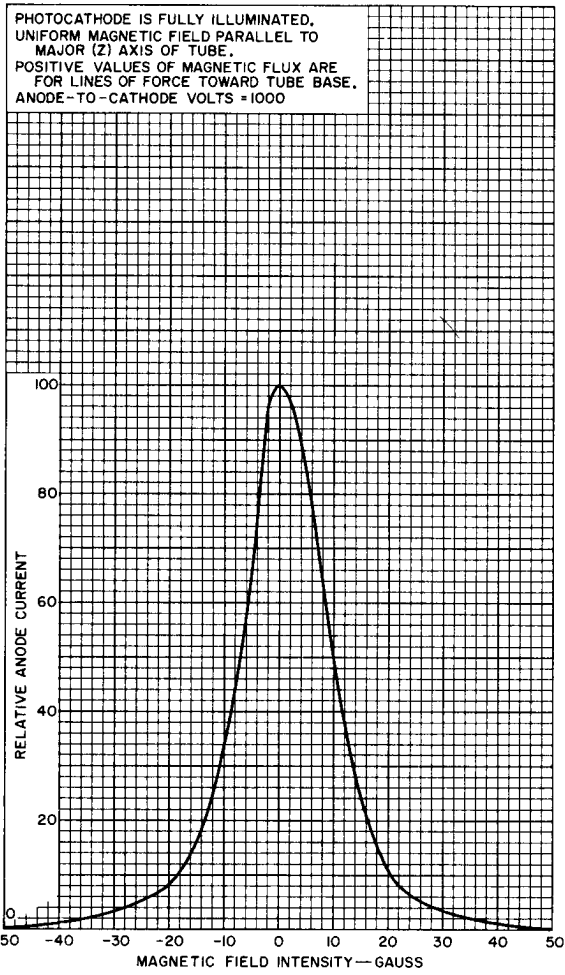
Typical Effect of Magnetic Field on Anode Current



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