RCA TUBE
HANDBOOK
HB-3

PHOTOSENSITIVE DEVICE SECTION

This Section contains data on phototubes of the single-unit, twin-unit, and multiplier types; photocells; television camera tubes such as image orthicons, iconoscopes, and vidicons; and other devices employing photosensitive materials.

For further Technical Information, write to Commercial Engineering, Tube Division, Radio Corporation of America, Harrison, N. J.

Photosensitive Devices

World Radio History

World Radio History

CAMERA TUBES

Image Orthicons

Tube Diameter inches	Recommended Service		
	Live Television Pickup		Military and Industrial
	Black & White	Color	
3	4401V1 5820A 7293A 8093A	4415, 4416[a] 7513 7513/V1[b]	7198
4-1/2	7295A 7389A		

Vidicons

Tube Diameter inches	Recommended Service		
	Broadcast Studio Film Pickup	Live Television and Industrial	Special Military and Industrial
1/2			4427 4429
1	6326 7038	7262A 7697 7735A 8134	2048A 7263A
1-1/2	8051		8051

[a] Supplied as a set of two 4415's and one 4416 having matched characteristics.

[b] Set of three 7513's having matched characteristics.

IMAGE-CONVERTER TUBES

Spectral Response	Recommended Service		
	Infrared	Ultra-violet	Photographic Shutter
S-1	6032A 6381 6914 6914A 6929		
S-11			4449
S-21		7404	

All types utilize a P20 phosphor screen except type 4449 which has a P11 phosphor screen.

For photocell data, see foldout sheet—
RCA PHOTOCELL DATA TABLES

PHOTOSENSITIVE DEVICES

PHOTOSENSITIVE DEVICES

World Radio History

MULTIPLIER PHOTOTUBES

Number of Stages		6	9	10		12	14
Dynode Material		Cu-Be	Cs-Sb	Cu-Be	Cs-Sb - Ag-Mg*	Cu-Be	Cu-Be - Ag-Mg*
Spectral Response	S-1				7102*		
	S-4		1P21 931A 6328 6472 7117				
	S-5		1P28				
	S-8		1P22				
	S-10				6217		
	S-11	7764		2020 6342A 7746 7767 8053 8054 8055	2067 4438 4439 4440 4441 5819 6199 6655A	7850	6810A 7264*
	S-11[a]						7046*
	S-13				6903		
	S-17				7029		
	S-19		7200				
	S-20				7326*		7265

[a] Extended Spectral Response.

VACUUM AND GAS PHOTOTUBES

Spectral Response	Single-Unit		Twin Unit	Composite Anode-Cathode
	Vacuum	Gas	Gas	Vacuum
S-1	917 919 922 925 6570	1P40 1P41 868 918 921 923 927 928 930 6405/1640 6953	920	
S-3	926	1P29		
S-4	1P39 929 934 5653 7043	1P37 4409 5581 5582 5583	5584	5652
S-5	935			
S-9	1P42			

World Radio History

JUNCTION PHOTOCELLS — Germanium P-N Alloy Types

RCA Type	Spectral Response	MAXIMUM RATINGS: Volt. bet Term. dc volts	Power Dissipation[p] watt	Ambient Temp. Range °C	Min. Dia. of Sensitive Surface inch
SQ2516	S-14	50	0.03	-40 to +50	0.045

Voltage Between Terminals dc volts	CHARACTERISTICS AT 25°C — SENSITIVITY: Illumination μa/fc	Typical Luminous a/lm	Typical Radiant at 1.5 microns a/w	Max. Dark Current μa
45	0.3 min. 0.7 typ.	0.014	0.52	35

JUNCTION PHOTOVOLTAIC CELLS — Silicon N on P Types

RCA Type	Spectral Response	Ambient Temp. Range °C	Sensitive Area[r] (Av.) sq. in.	Sensitive Area[r] (Av.) sq. cm
SL2205	q	-100 to +125	0.278	1.795
SL2206	q		0.586	3.783

CHARACTERISTICS AT 27° ± 1°C: Min. Current ma	Min. Power Output mw	Min. Efficiency %	Sensitivity (Typ. Values): Illumination μa●/fc	Luminous ma●/lm	Radiant @ 8600 A° a●/w
48	17.9	10.0	14.5	7.13	0.58
101.5	37.8	10.0	29	7.13	0.58

a The maximum ambient operating temperature range for these cells is -75°C to +75°C.

b The maximum ambient operating temperature range for these cells is -40°C to +75°C.

c With sensitive surface of cell fully illuminated. These dissipation ratings apply up to a temperature of +40°C from which point the cells are derated linearly to 0 watts at +75°C.

d The demand rating is a dissipation rating to which the cell may be exposed in outdoor applications. The rating may be utilized twice every 24 hours for a period of 20 minutes each time provided the interval between demand periods is not less than 4 hours.

e For conditions where light flux from a tungsten-filament lamp operated at 2870°K is transmitted through a filter (Corning C.S. No.1-62 which has an effective transmission of luminous flux of 13.3%) onto the sensitive surface. The value of illumination incident on the sensitive surface is 7.5 footcandles measured before positioning the filter between the lamp and the cell. The sensitive surface of the cell is fully illuminated.

f This characteristic determined after the cell has been exposed for a period of 16 to 24 hours to 500 footcandle illumination (white fluorescent light).

g Measured 10 seconds after removal of incident-illumination level.

h For renewal use only. Not for new equipment design.

j The maximum ambient operating temperature range for these cells is -75°C to +60°C.

k The maximum ambient operating temperature range for these cells is -40°C to +60°C.

l In continuous service with sensitive surface of cell fully illuminated. The power dissipation rating applies up to the maximum rated ambient operating temperature.

m For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K.

n This characteristic is determined after the cell has been exposed for a period of 16 to 24 hours to 50 to 100 footcandle illumination (white fluorescent light).

p These ratings apply up to maximum rated ambient temperature.

q Wavelength of maximum response is 8600 ± 750 angstroms.

r Including metallic grid lines but excluding negative contact terminal.

Refer to SPECTRAL-SENSITIVITY CHARACTERISTIC CHART of PHOTOCONDUCTIVE CELL HAVING S-15 RESPONSE at front of Photosensitive Device Section.

* Additional technical data for this type are given on individual data sheets in this section.

● Short-circuit current.

World Radio History

PHOTOCONDUCTIVE CELLS – Cadmium-Sulfide Types

RCA TYPES			MAXIMUM RATINGS				CHARACTERISTICS AT 25°C				
Glass-Metal Types[a]	Plastic-Filled Glass-Metal Types[b]	Spectral Response	Voltage Between Terminals DC or Peak AC volts	Power Dissipation[c] watt: Continuous Service	Power Dissipation[c] watt: Demand Service[d]	Photocurrent ma	Voltage Between Terminals ac volts	Illumination[e] foot-candles	Photocurrent[f] ma: Min.	Photocurrent[f] ma: Max.	Max. Decay Current[g] µa
1-inch Diameter Broad-Area											
4451	SQ2533	S-15	600	0.75	1.0	50	50	35	2	3.5	40
4450	SQ2533V1	S-15	600	0.75	1.0	50	50	3.5	2	3.5	40
SQ2503	SQ2533V2	S-15	600	0.75	1.0	50	50	1	0.8	1.7	40
7163*	SQ2533V3	S-15	600	0.75	1.0	50	50	1	1	3	40
4448	SQ2533V4	S-15	600	0.75	1.0	50	50	1	1.5	4	40
4404, SQ2502[h]	SQ2533V5	S-15	600	0.75	1.0	50	50	1	2.5	5	40
4453	SQ2533V6	S-15	600	0.75	1.0	50	50	1	3	7	40
4403	SQ2533V7	S-15	250	0.75	1.0	50	50	1	8	16	78

RCA TYPES				MAXIMUM RATINGS			CHARACTERISTICS AT 25°C				
Glass-Metal Types[j]	All-Glass Types[j]	Plastic-Filled Glass-Metal Types[k]	Spectral Response	Voltage Between Terminals DC or Peak AC volts	Power Dissipation[l] watt	Photocurrent ma	Voltage Between Terminals volts	Illumination[m] foot-candles	Photocurrent ma: Min.	Photocurrent ma: Max.	Max. Decay Current[g] µa
1/2-inch Diameter Broad-Area											
SQ2525	SQ2500	SQ2532	S-15	250	0.2	20	12 (dc)	1	0.24[n]	0.8[n]	6
SQ2521	4423	SQ2532V1	S-15	250	0.2	20	50 (ac)	1[e]	1.5[f]	4[f]	40
SQ2526	SQ2523	SQ2532V2	S-15	110	0.2	50	12 (dc)	1	1[n]	3[n]	80
SQ2527	SQ2524	SQ2532V3	S-15	110	0.2	50	12 (dc)	1	2[n]	6[n]	80
SQ2520	4425	SQ2532V4	S-15	110	0.2	50	12 (dc)	1	3.6[n]	14.5[n]	80
1/4-inch Diameter Broad-Area											
SQ2529	SQ2528	SQ2531	S-15	300	0.05	5	12	1	0.004[f]	0.012[f]	0.1
-	-	SQ2531V1	S-15	200	0.05	5	12	1	0.04[f]	0.12[f]	1
SQ2508	7412*	SQ2531V2	S-15	200	0.05	5	12	1	0.065[f]	0.275[f]	1
-	4413	SQ2531V3	S-15	110	0.05	5	12	10	1.4[f]	2.75[f]	12
SQ2519	4402	SQ2531V4	S-15	300	0.05	5	12	10	1.6[n]	-	12
-	-	SQ2531V5	S-15	110	0.05	7	12	1	1[f]	3[f]	15
-	-	SQ2531V6	S-15	110	0.05	7	12	1	1.6[f]	4.8[f]	15

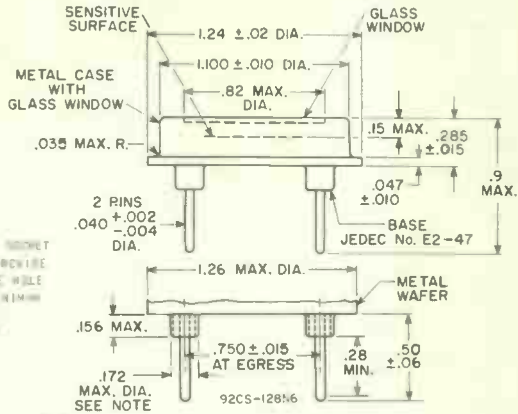
World Radio History

1-Inch Diameter Cells

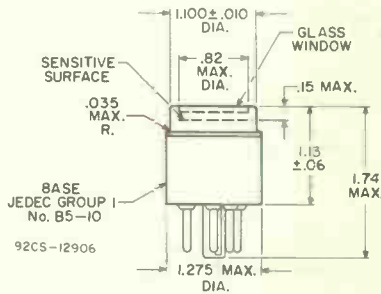
GLASS-METAL TYPES

4403
4404
4448
4450
4451
4453
7163
SQ2503

NOTE: FOR SOCKET DESIGN, PROVIDE CLEARANCE HOLE HAVING MINIMUM DIAMETER OF 0.188"

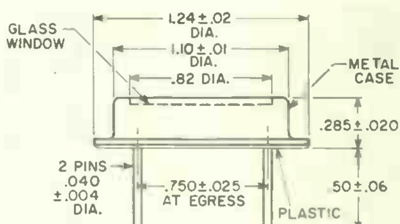


SQ2502



PLASTIC-FILLED GLASS-METAL TYPES

SQ2533
SQ2533V1
SQ2533V2
SQ2533V3
SQ2533V4
SQ2533V5
SQ2533V6
SQ2533V7



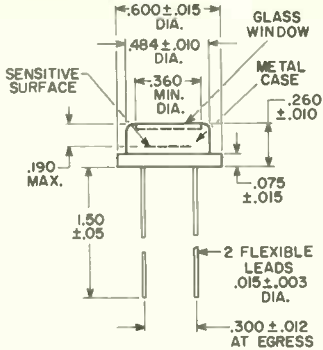
DIMENSIONS IN INCHES 92CS-12857

World Radio History

½-Inch Diameter Cells

GLASS-METAL TYPES
MODIFIED TO-8 CASE

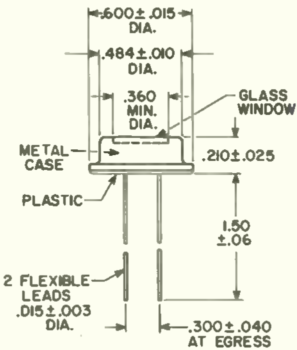
SQ2520
SQ2521
SQ2526
SQ2527



92CS-12862

PLASTIC-FILLED GLASS-METAL TYPES

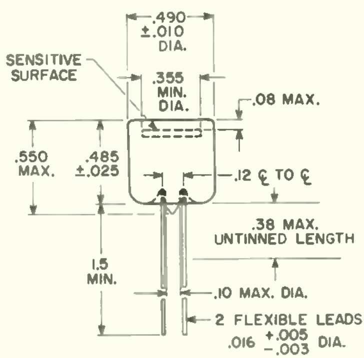
SQ2532
SQ2532V1
SQ2532V2
SQ2532V3
SQ2532V4



92CS-12863

ALL-GLASS TYPES

4423
4425
SQ2500
SQ2523
SQ2524



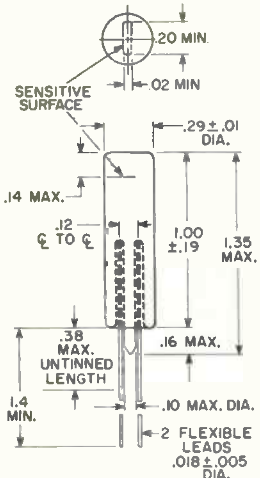
92CS-12864

DIMENSIONS IN INCHES

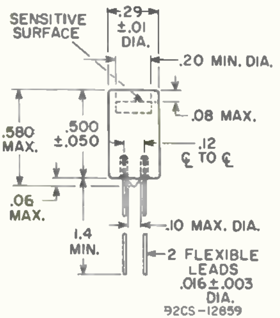
World Radio History

¼-Inch Diameter Cells

ALL-GLASS TYPES

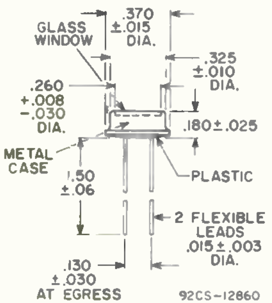


7412



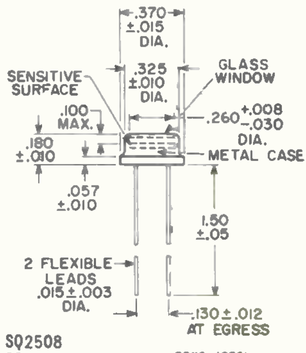
4402
4413
SQ2528

PLASTIC-FILLED GLASS-METAL TYPES



SQ2531
SQ2531V2
SQ2531V4
SQ2531V6
SQ2531V1
SQ2531V3
SQ2531V5

GLASS-METAL TYPES
MODIFIED TO-5 CASE

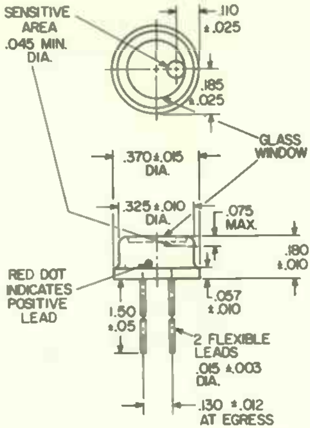


SQ2508
SQ2529
SQ2519

DIMENSIONS IN INCHES

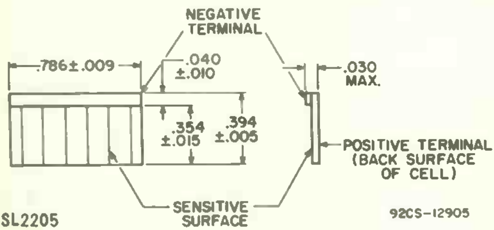
World Radio History

PHOTOJUNCTION CELL

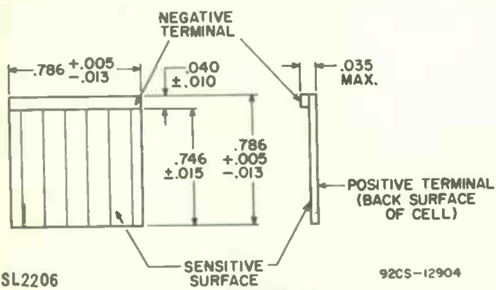


S02516 92CS-12358R2

PHOTOVOLTAIC CELLS



SL2205 92CS-12905



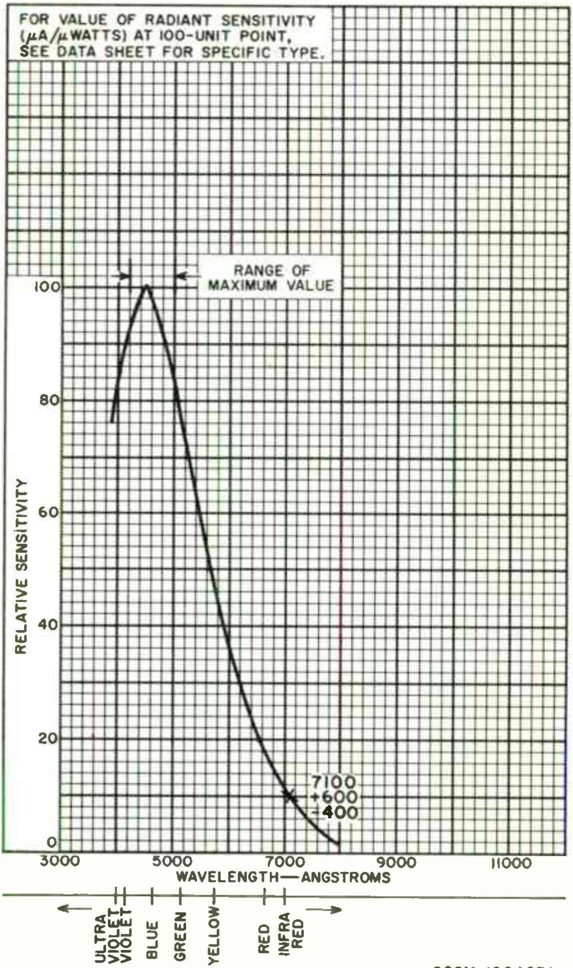
SL2206 92CS-12904

DIMENSIONS IN INCHES

World Radio History

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-18 RESPONSE

For Equal Values of Radiant Power at All Wavelengths



92CM-10848R1

World Radio History

PHOTOTUBE SENSITIVITY AND SENSITIVITY MEASUREMENTS

GENERAL CONSIDERATIONS

The range of luminous-sensitivity limits given for a phototube on the data sheets of this Section is that which the tube will display when operated under low-current conditions.

If the tube is to be operated under conditions approaching its maximum-current rating, the equipment design should provide for a wider sensitivity range having a minimum value equal to one-half of that shown for low-current operation. The sensitivity of a phototube under such high-current conditions is dependent upon the tube type, as follows:

1. **Single-Unit and Twin Phototubes**

   a. **Gas Types:** For high-current operation, and particularly in applications in which the type is subjected to these higher values continuously, a drop in sensitivity below the values for low-current operation may be expected, the extent of the drop being affected by the severity of the operating conditions. After a period of idleness, a gas phototube usually recovers most of its initial sensitivity.

   b. **Vacuum Types:** Unlike gas phototubes, this class of phototubes shows negligible drop in sensitivity values for different degrees of illumination and over long periods of use. The output current of a vacuum phototube is a linear function of the exciting illumination under normal operating conditions. The frequency response is flat up to frequencies at which transit-time effects become the limiting factor.

2. **Multiplier Phototubes**

   Although RCA Multiplier Phototubes are vacuum types, a drop in sensitivity is to be expected from this class of phototubes when operated at high anode-current values. The extent of the drop is affected by the nature and severity of the operating conditions to which the tube is subjected. After a period of idleness, the multiplier phototube usually recovers a substantial percentage of this loss of sensitivity.

   Multiplier-phototube-sensitivity values are dependent on the respective amplification of each dynode stage. Hence, large variations in sensitivity can be expected between individual tubes of a given type. The overall amplification of a multiplier phototube is equal to the average amplification per stage raised to the nth power, where n is the number of stages. Thus, very small variations in amplification per stage produce very large changes in overall tube amplification.

   Because these overall changes are very large, it is advisable for designers to provide adequate adjustment of the supply voltage per stage so as to be able to adjust the amplification of individual tubes to the desired design value. It is suggested that an overall voltage-adjustment

(continued on next page)

World Radio History

range of at least 2 to 1 be provided. When the output current can be controlled by change in the illumination of the photocathode of the multiplier phototube, the required range of adjustment in the voltage per stage can be reduced.

SENSITIVITY MEASUREMENTS

The luminous-sensitivity values shown on the data pages of this Section are measured according to the following procedures:

1. Single-Unit and Twin Phototubes

a. **Gas Types:** The light source consists of a tungsten lamp operating at a filament color temperature of 2870°K. For the 0-cycle measurements, a light input of 0.1 lumen is used, unless otherwise specified. For the 5000- and 10000 cycle measurements, the light input is varied sinusoidally about a mean value of 0.015 lumen from zero to a maximum of twice the mean. For all measurements, a dc anode-supply voltage of 90 volts and a 1.0-megohm load resistor are employed. Under these conditions, the effect of tube capacitance is negligible.

b. **Vacuum Types:** The light source consists of a tungsten lamp operating at a filament color temperature of 2870°K. A steady light input of 0.1 lumen is used, unless otherwise specified, together with a dc anode-supply voltage of 250 volts and a 1-megohm load resistor.

2. Multiplier Phototubes

The light source consists of a tungsten lamp operating at a filament color temperature of 2870°K. A light flux of 10 microlumens from a rectangular aperture approximately 0.8" long and 0.2" wide is projected normal to the cathode in the direction noted on the basing diagram and outline. The load resistor has a value of 0.01 megohm. The applied voltages are specified on the individual data sheets.

World Radio History

DEFINITIONS

of Photosensitive-Device Terms

Radiant Sensitivity. The quotient of output current by incident radiant power of a given wavelength, at constant electrode voltages.

Radiant Intensity Sensitivity. The quotient of output current by incident radiant power per unit area, at constant electrode voltages.

Cathode Radiant Sensitivity. The quotient of current leaving the photocathode by incident radiant power of a given wavelength.

Luminous Sensitivity. The quotient of output current by incident luminous flux, at constant electrode voltages.

Luminous Intensity Sensitivity. The quotient of the output current by the incident luminous intensity, at constant electrode voltages.

Cathode Luminous Sensitivity. The quotient of current leaving the photocathode by the incident luminous flux.

Illumination Sensitivity. The quotient of output current by the incident illumination, at constant electrode voltages.

Dynamic Sensitivity. The quotient of the modulated component of the electrical output by the modulated component of the incident radiation.

Current Amplification. Ratio of the output current to the photocathode current, at constant electrode voltages.

Equivalent Anode-Dark-Current Input. The quotient of the anode dark current by the luminous sensitivity.

Equivalent Noise Input. That value of incident luminous flux which when modulated in a stated manner produces an rms output current equal to the rms noise current within a specified bandwidth.

Electrode Dark Current. The electrode current which flows when there is no radiant flux incident on the photocathode.

Transit-Time Spread. The increase in width of the output pulse over that of the input pulse. Pulse width is measured at 50 per cent of the pulse height.

Pulse Rise Time. The time required for the instantaneous amplitude of the pulse to go from 10 per cent to 90 per cent of the peak value.

Median. That value in a series such that half of the devices in the series are on one side of it, and half on the other.

World Radio History

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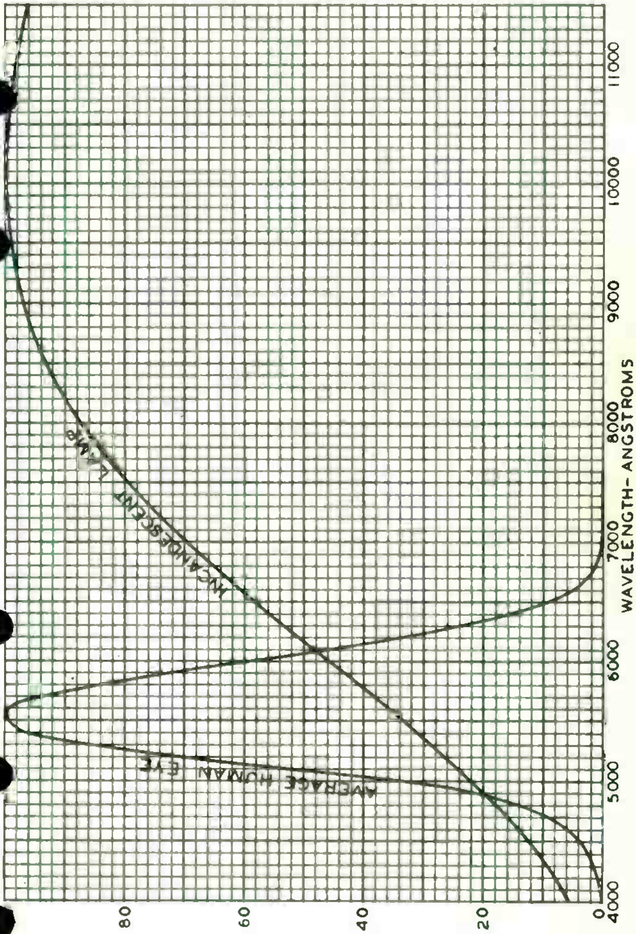
SPECTRAL CHARACTERISTIC OF HUMAN EYE & OF TUNGSTEN LAMP AT COLOR TEMPERATURE OF 2870 °K

EYE CURVE IS ON BASIS OF EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



OCT. 20, 1947

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

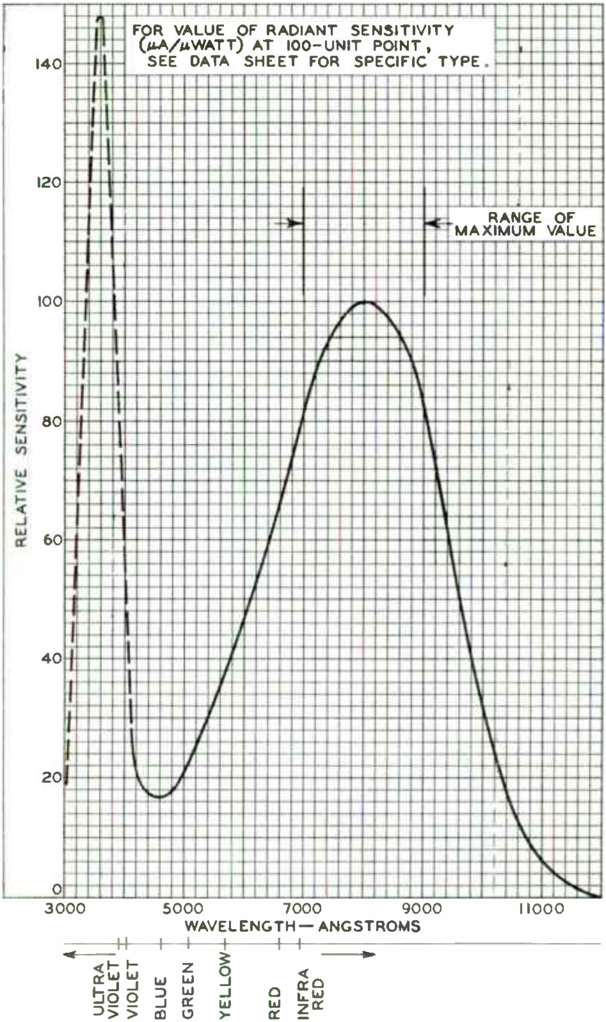
92CM-6435R1

World Radio History

World Radio History

SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOTUBE HAVING
S-1 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



ELECTRON TUBE DIVISION

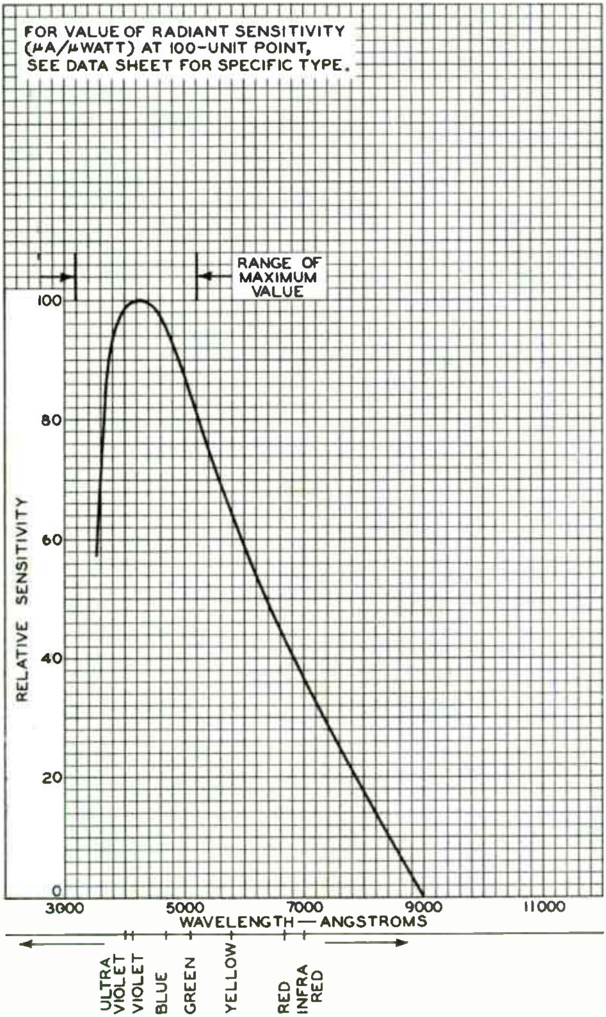
92CM-6056R6

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-3 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



ELECTRON TUBE DIVISION

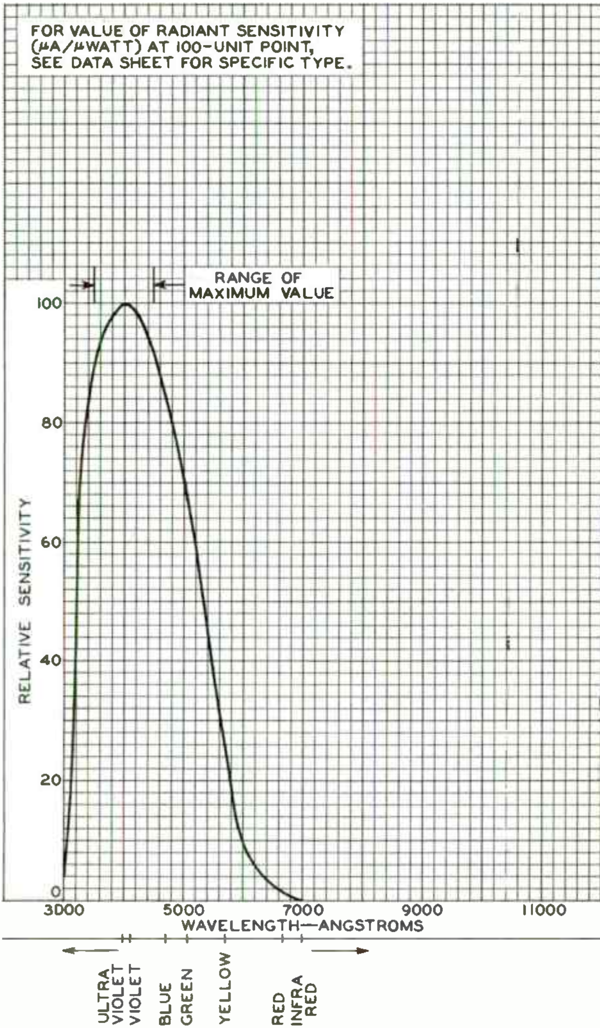
92CM-6057R6

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-4 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



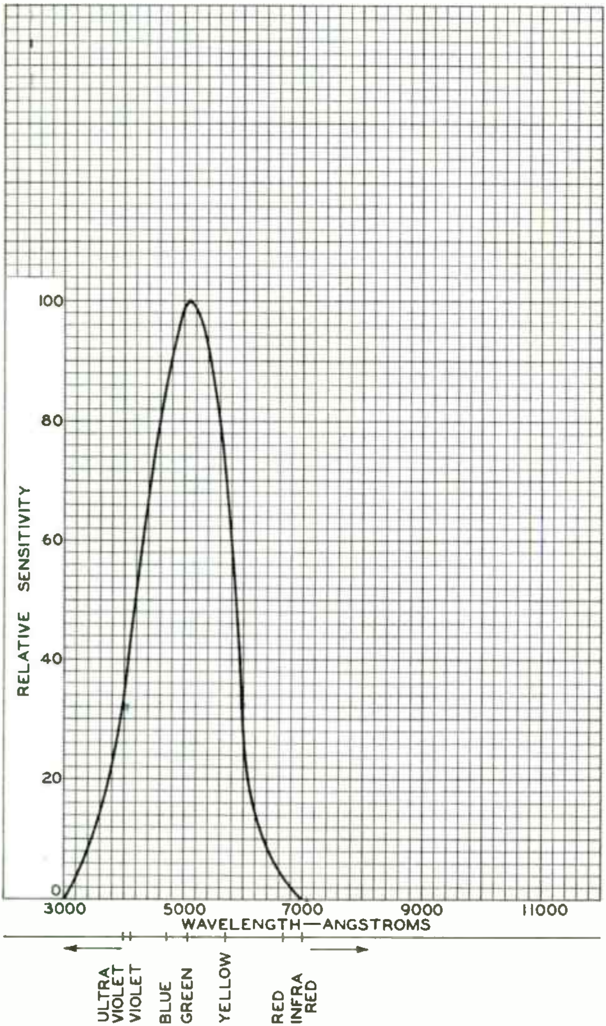
92CM-6152R9

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOTUBE HAVING
S-4 RESPONSE

RADIANT FLUX FROM TUNGSTEN SOURCE AT 2870° K



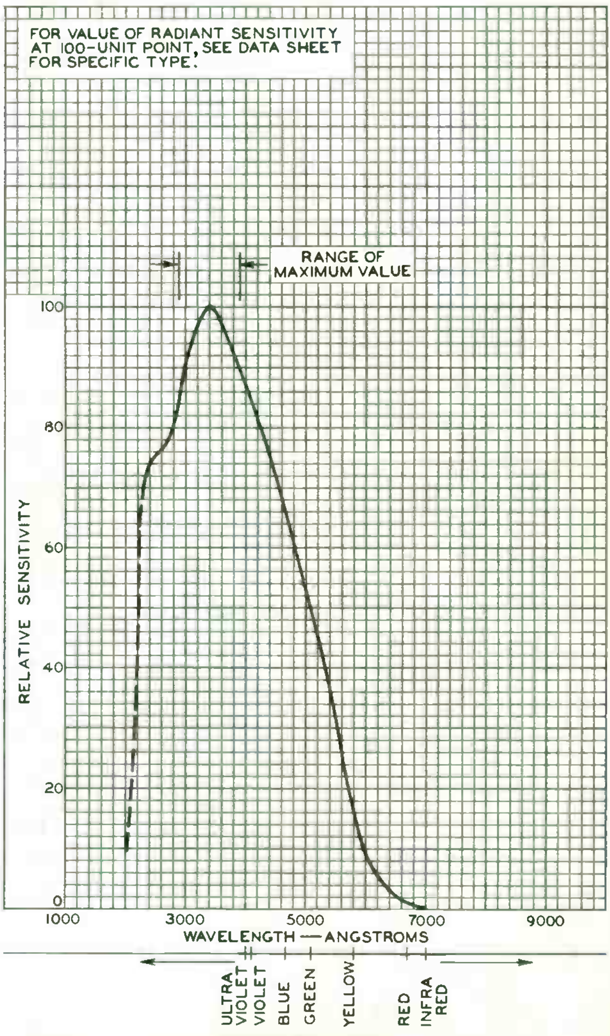
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6652R3

RCA

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-5 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



ELECTRON TUBE DIVISION

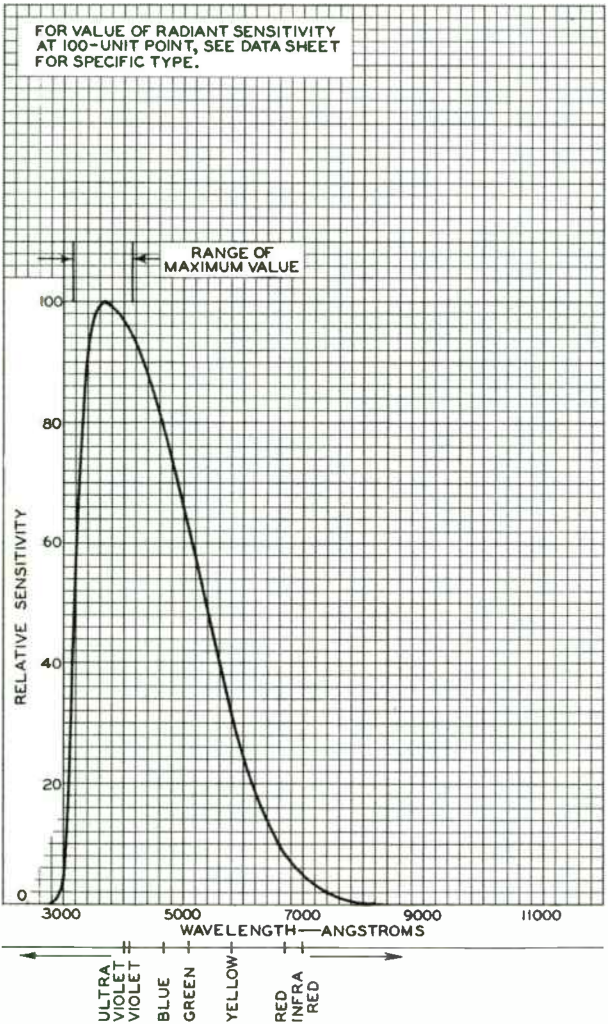
92CM-6814R2

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-8 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



ELECTRON TUBE DIVISION

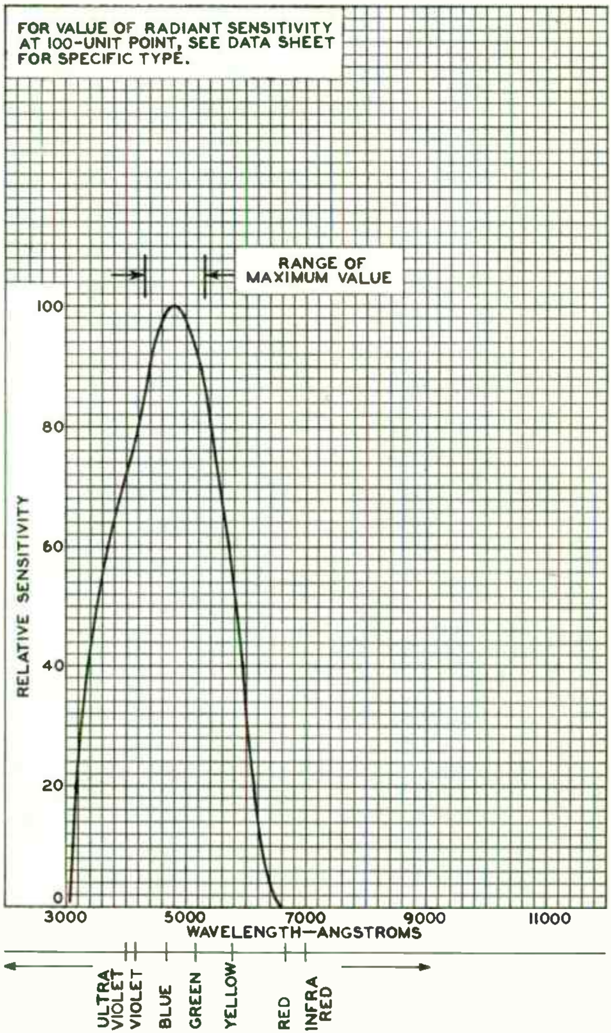
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6592R3

RCA

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-9 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



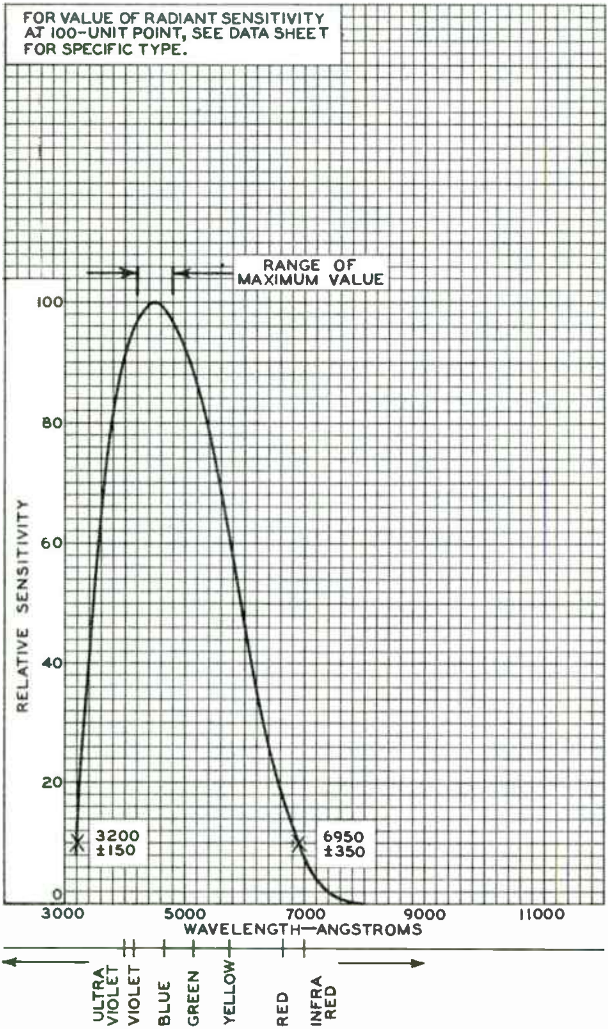
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7274R2

World Radio History

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-10 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



ELECTRON TUBE DIVISION

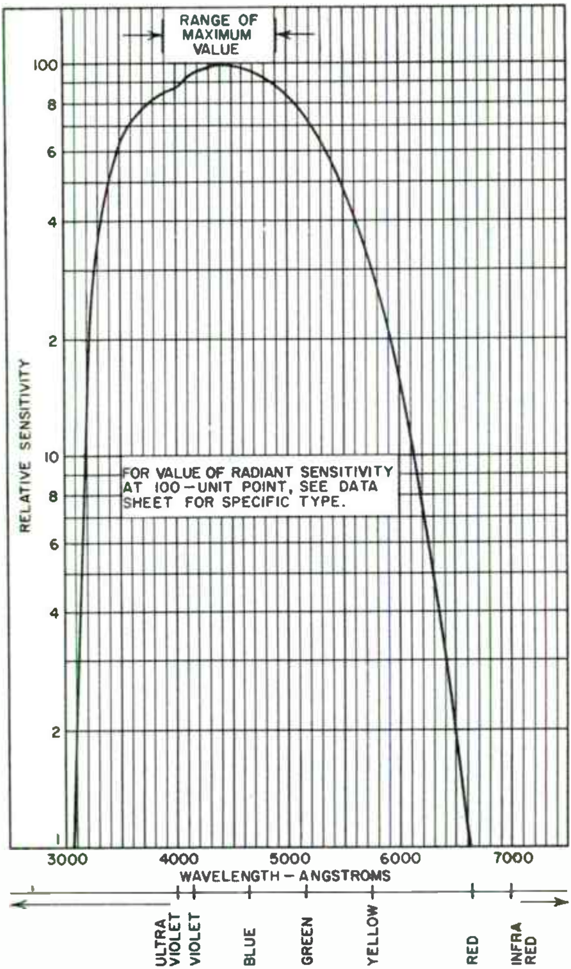
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7821R2

World Radio History

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-11 RESPONSE

For Equal Values of Radiant Power at All Wavelengths

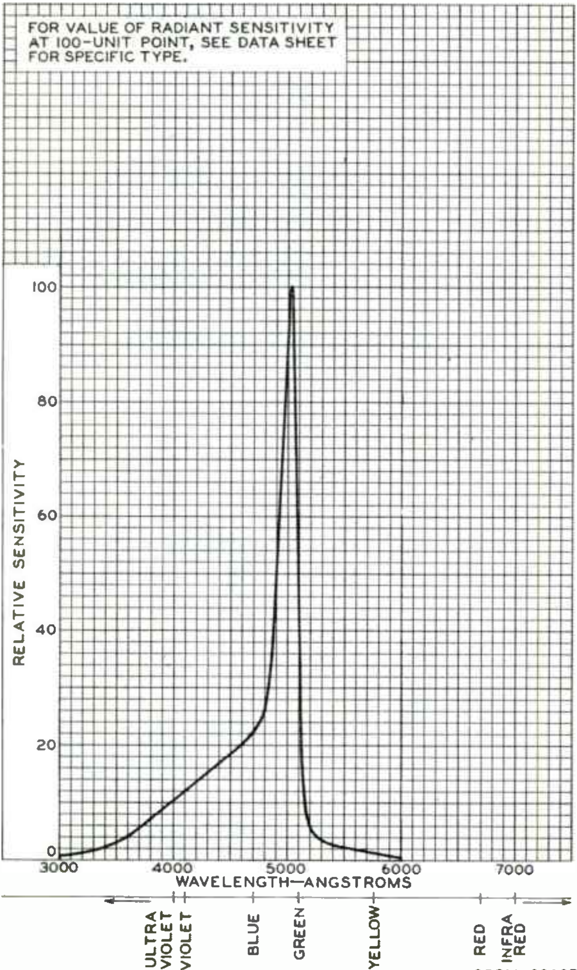


92CM-10662R1

World Radio History

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-12 RESPONSE

For Equal Values of Radiant Power at All Wavelengths

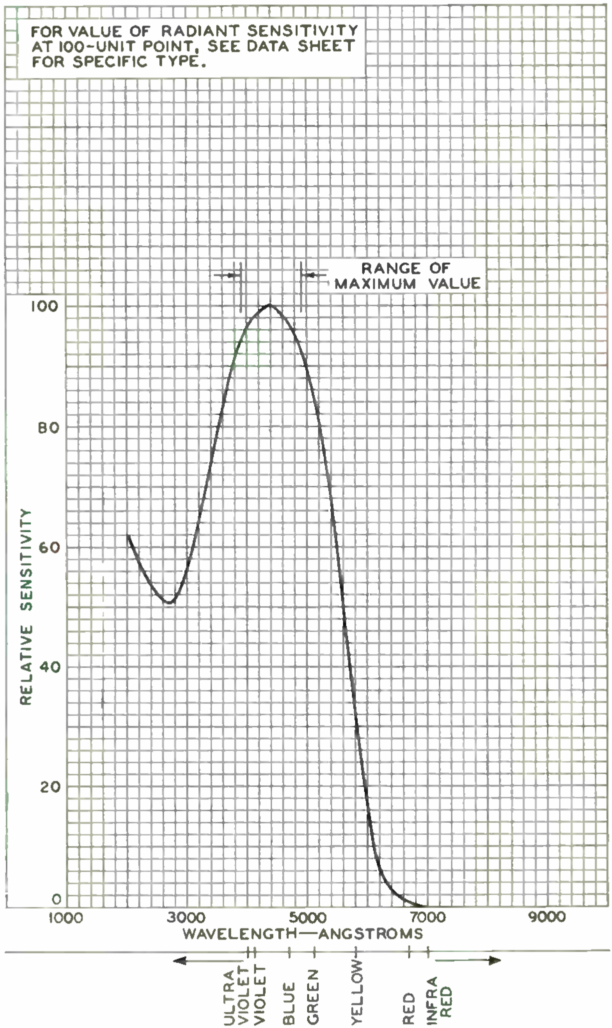


92CM-8569RI

RCA

TENTATIVE SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-13 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



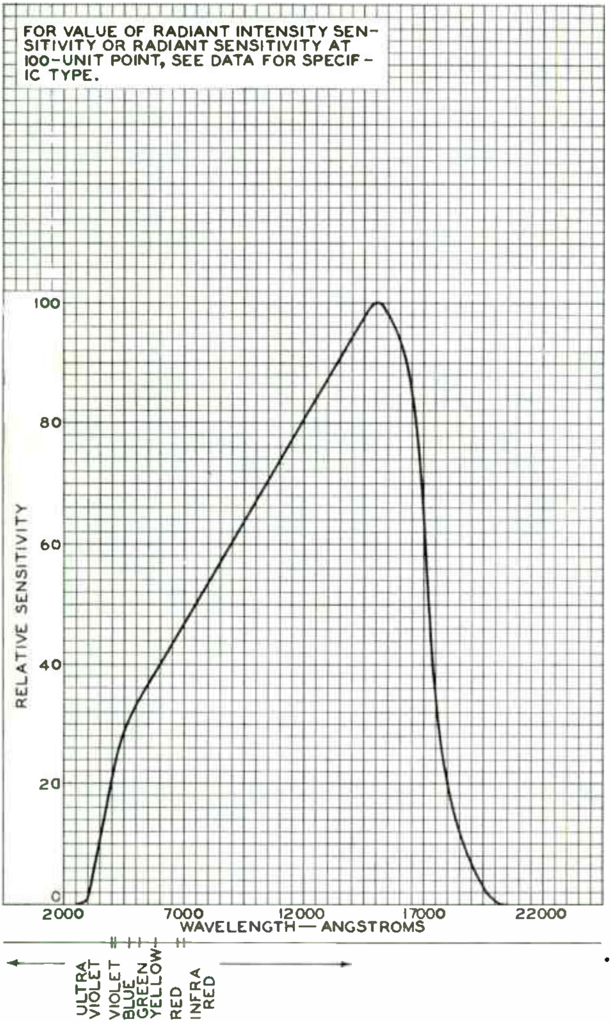
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9037R1

World Radio History

TENTATIVE SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOJUNCTION CELL HAVING S-14 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



ELECTRON TUBE DIVISION

92CM-9647

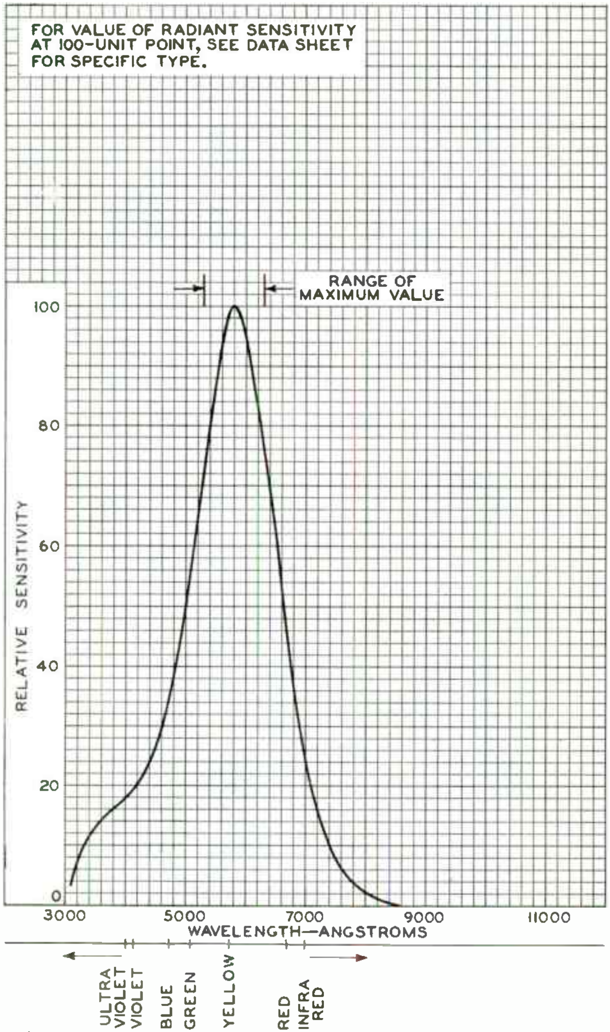
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

TENTATIVE SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOCONDUCTIVE CELL HAVING S-15 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



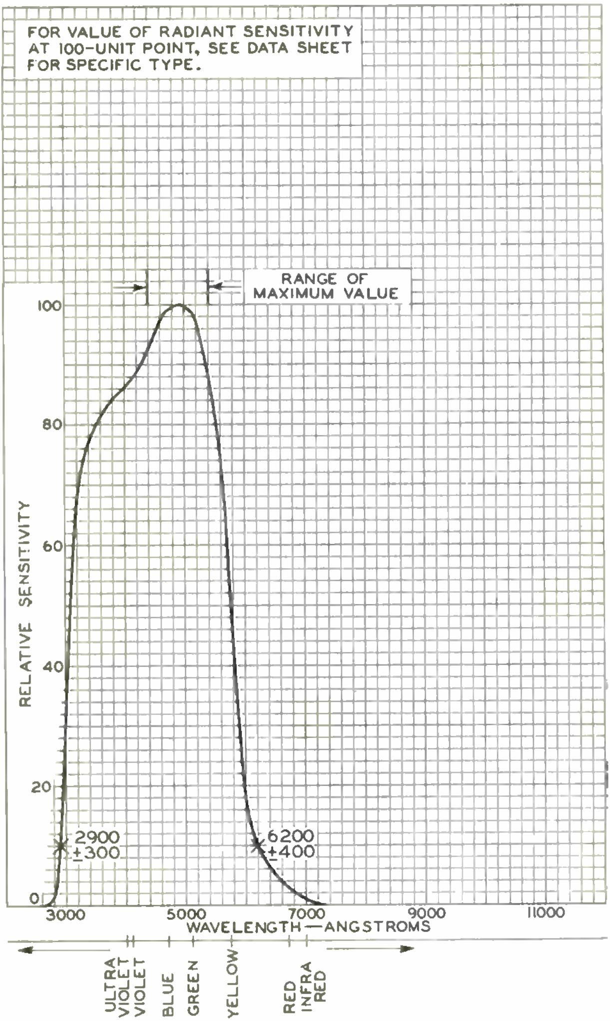
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9206R1

World Radio History

TENTATIVE SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-17 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



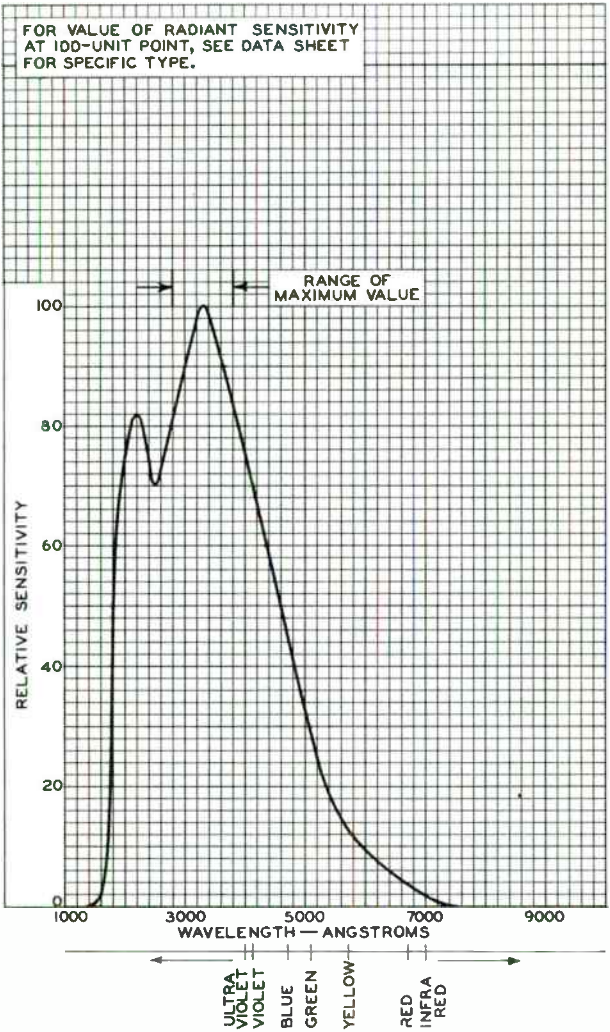
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9477R1

RCA

TENTATIVE SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-19 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



ELECTRON TUBE DIVISION

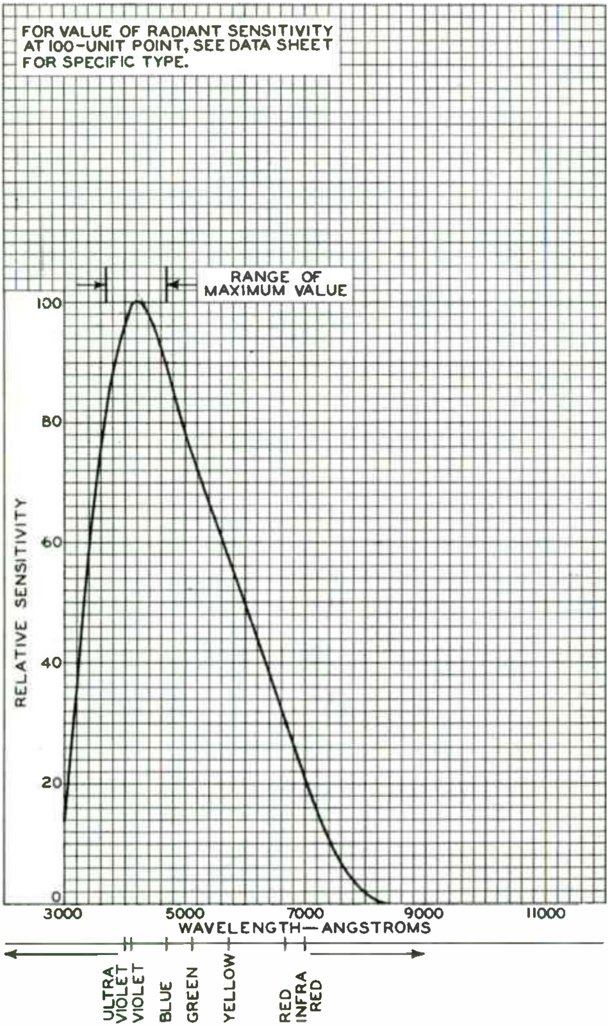
92CM-9582

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

TENTATIVE SPECTRAL–SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S–20 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



ELECTRON TUBE DIVISION 92CM–9779

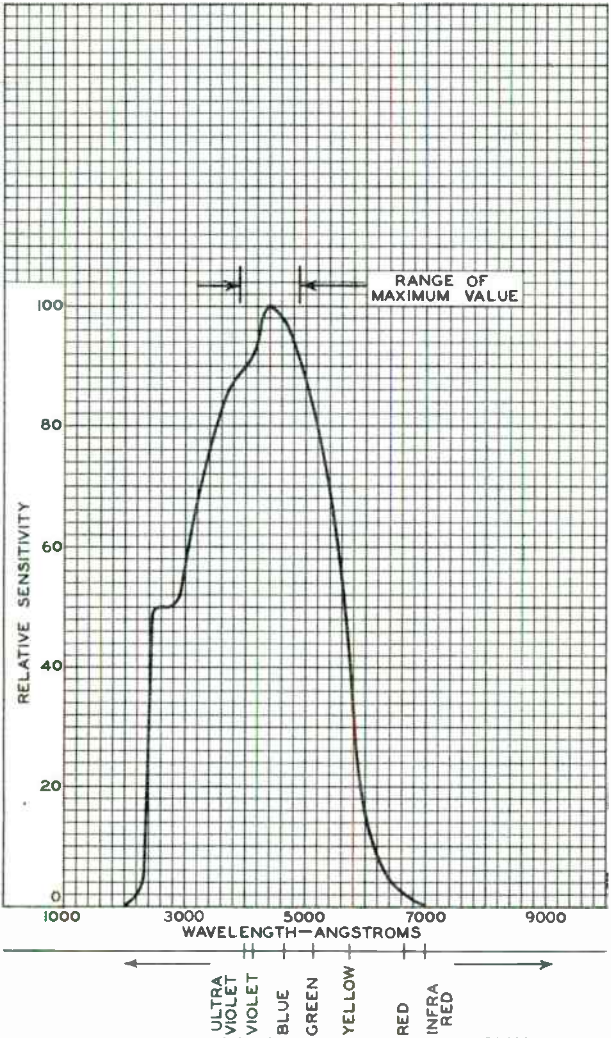
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

TENTATIVE SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-21 RESPONSE

FOR EQUAL VALUES OF RADIANT POWER AT ALL WAVELENGTHS



ELECTRON TUBE DIVISION

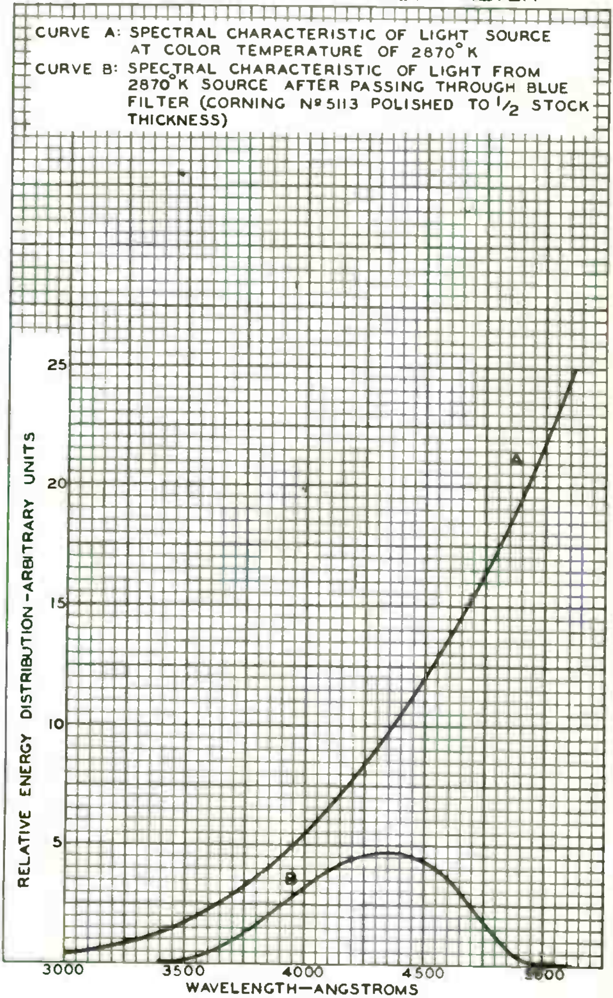
92CM-9980

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

World Radio History

SPECTRAL CHARACTERISTIC OF 2870°K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870°K SOURCE AFTER PASSING THROUGH INDICATED BLUE FILTER

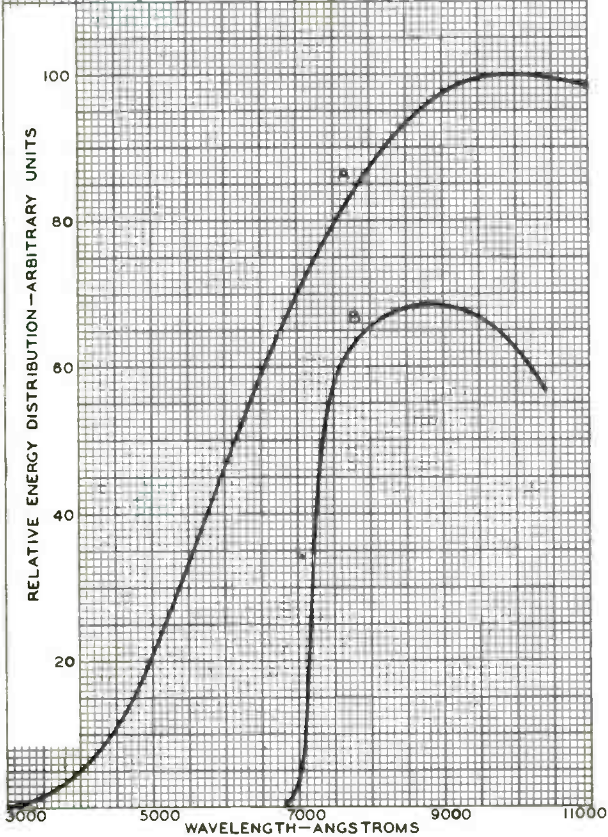


RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
World Radio History

SPECTRAL CHARACTERISTIC OF 2870°K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870°K SOURCE AFTER PASSING THROUGH INDICATED RED-INFRARED FILTER

CURVE A: SPECTRAL CHARACTERISTIC OF LIGHT SOURCE AT COLOR TEMPERATURE OF 2870° K

CURVE B: SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870°K SOURCE AFTER PASSING THROUGH RED-INFRARED FILTER (COMBINATION OF CORNING, GLASS CODE № 3482 AND № 5850 FILTERS)



SEPT. 3, 1952

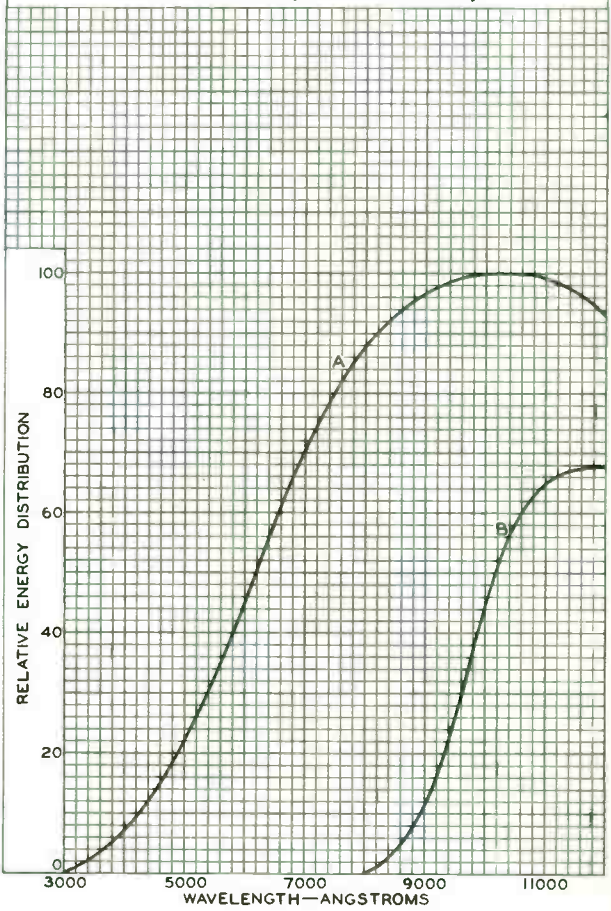
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7838

World Radio History

SPECTRAL CHARACTERISTIC OF 2870° K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF RADIATION FROM 2870° K SOURCE AFTER PASSING THROUGH INDICATED INFRARED FILTER

CURVE A: SPECTRAL CHARACTERISTIC OF LIGHT SOURCE AT COLOR TEMPERATURE OF 2870° K.
CURVE B: SPECTRAL CHARACTERISTIC OF RADIATION FROM 2870° K SOURCE AFTER PASSING THROUGH INFRARED FILTER (CORNING № 2540).



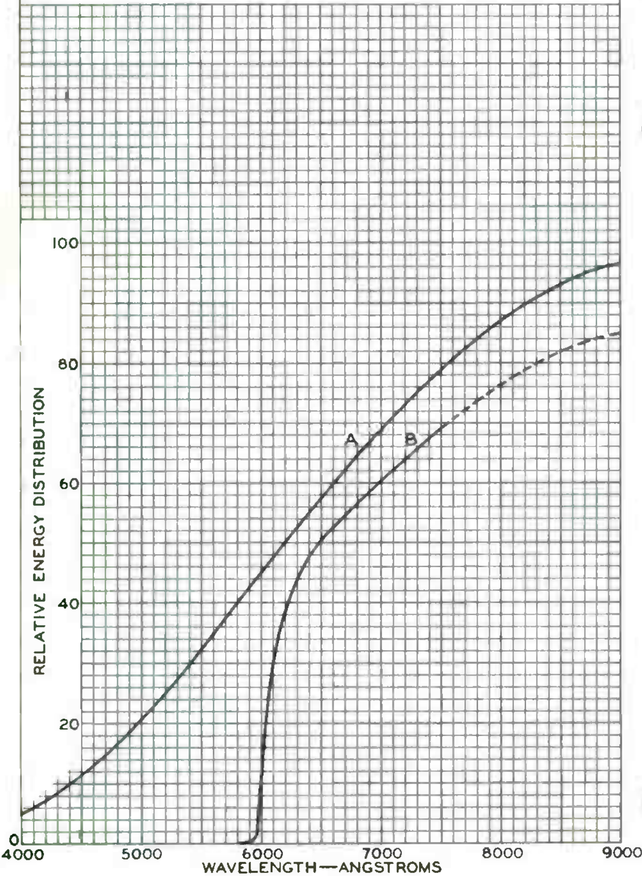
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9454

World Radio History

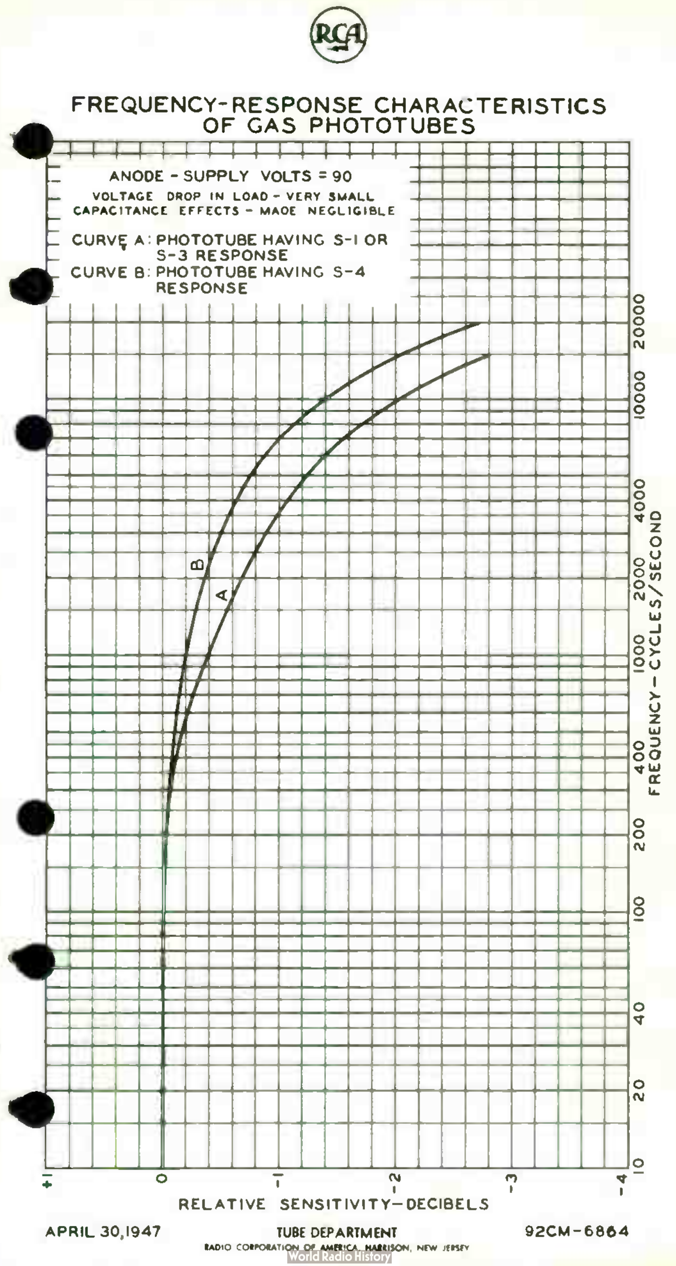
SPECTRAL CHARACTERISTIC OF 2870° K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870° K SOURCE AFTER PASSING THROUGH INDICATED RED FILTER

CURVE A: SPECTRAL CHARACTERISTIC OF LIGHT SOURCE AT COLOR TEMPERATURE OF 2870° K.
CURVE B: SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870° K SOURCE AFTER PASSING THROUGH RED FILTER (CORNING № 2418).
DASHED PORTION IS EXTRAPOLATED.



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9883



World Radio History

World Radio History

Multiplier Phototube

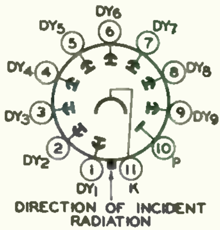
9-STAGE, SIDE-ON TYPE **S-4 RESPONSE**

For Detection and Measurement of Extremely Low Light Levels

General:

Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 angstroms
Cathode, Opaque	Cesium-Antimony
Minimum projected length[a]	15/16"
Minimum projected width[a]	5/16"
Window	Lime Glass[b]
Dynode Material	Cesium-Antimony
Direct Interelectrode Capacitances (Approx.):	
Anode to dynode No.9	4.4 pf
Anode to all other electrodes	6.0 pf
Maximum Overall Length	3-11/16"
Maximum Seated Length	3-1/8"
Length from Base Seat to Center of Useful Cathode Area	1-15/16" ± 3/32"
Maximum Diameter	1-5/16"
Operating Position	Any
Weight (Approx.)	1.6 oz
Bulb	T9
Socket	Amphenol[c] No.78S11T, or equivalent
Magnetic Shield	Perfection Mica Co.[d], No.P-101-1, or equivalent
Base	Small-Shell Submagnal 11-Pin (JEDEC Group 2, No.B11-88), Non-hygroscopic
Basing Designation for BOTTOM VIEW	11K

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 - Photocathode



Maximum Ratings, ***Absolute-Maximum Values:***

For operation at altitudes up to 40,000 feet

Supply Voltage Between Anode and Cathode[e] (DC or Peak AC)	1250 max.	volts
Supply Voltage Between Dynode No.9 and Anode (DC or Peak AC)	250 max.	volts
Supply Voltage Between Consecutive Dynodes (DC or Peak AC)	250 max.	volts
Supply Voltage Between Dynode No.1 and Cathode (DC or Peak AC)	250 max.	volts
Average Anode Current[f]	0.1 max.	ma
Ambient Temperature	75 max.	°C

← indicates a change.

World Radio History

→ 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. . .	–	7.8×10^4	–	a/w
Cathode radiant, at 4000 angstroms.	–	0.04	–	a/w
Luminous, at 0 cps[g]	40	80	800	a/lm
Cathode luminous[h]	2×10^{-5}	4×10^{-5}	–	a/lm
Current Amplification	–	2×10^6	–	
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 20 a/lm[j,k]	–	–	5×10^{-10}	lm
Equivalent Noise Input[m]	–	5×10^{-13}	1.3×10^{-12}	lm

With E = 750 volts (Except as noted)

	Min.	*Typ.*	*Max.*	
Sensitivity:				
Radiant, at 4000 angstroms. . .	–	1.2×10^4	–	a/w
Cathode radiant, at 4000 angstroms.	–	0.04	–	a/w
Luminous, at 0 cps[g]	5.4	12	100	a/lm
Cathode luminous[h]	–	4×10^{-5}	–	a/lm
Current Amplification	–	3x10[illegible]	–	

[a] On plane perpendicular to the indicated direction of incident light and passing through the major axis of tube.

[b] Corning No.0080, Corning Glass Works, Corning, New York, or equivalent.

[c] Made by Amphenol Electronics Corporation, 1830 South 54th Avenue, Chicago 50, Illinois.

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

[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 cathode photocurrent does not exceed approximately 1×10^{-8} ampere.

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

[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 10 microlumens is used.

[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 0.01 lumen and 100 volts are applied between cathode and all other electrodes connected as anode.

[j] At a tube temperature of 25°C. Dark current may be reduced by a refrigerant.

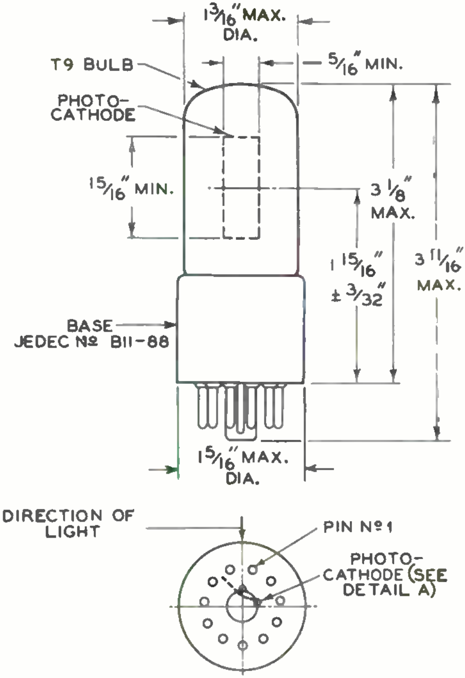
[k] For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1000 volts is recommended.

[m] 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.

→ Indicates a change.

World Radio History

SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOSENSITIVE DEVICE HAVING S-4 RESPONSE
is shown at the front of this section

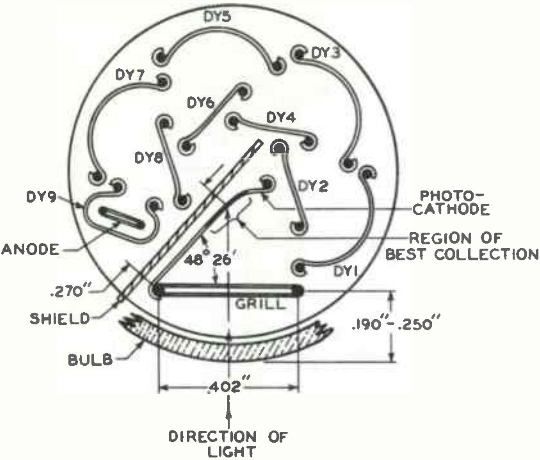


92CM-6264R8

CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE.

World Radio History

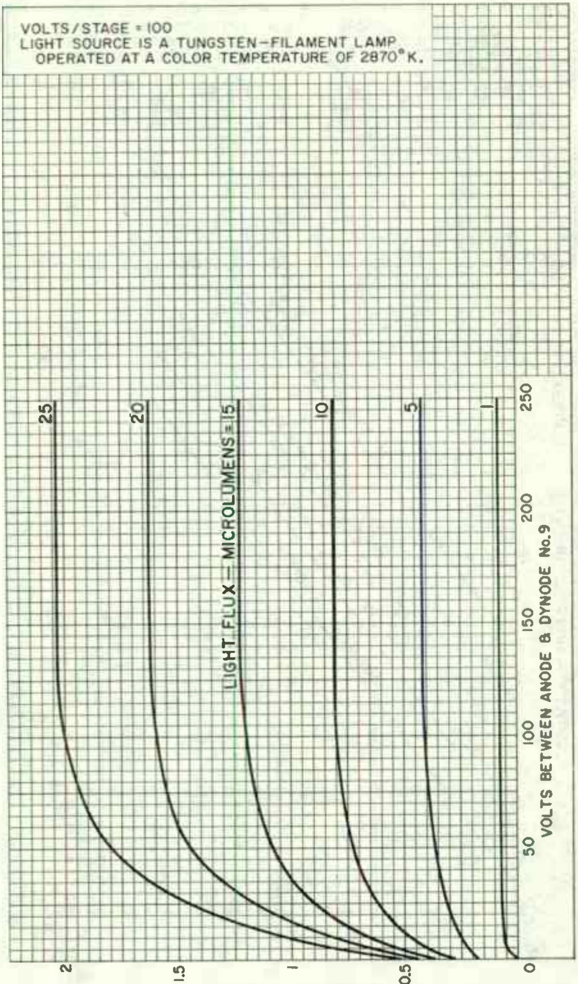
DETAIL A



92CS-8674R1

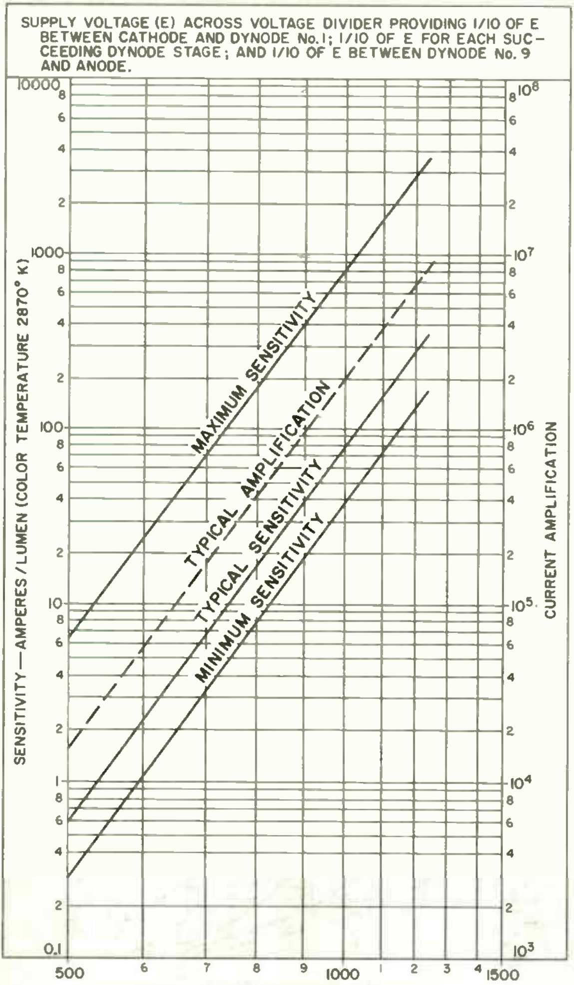
World Radio History

TYPICAL ANODE CHARACTERISTICS



92CM-6456R4

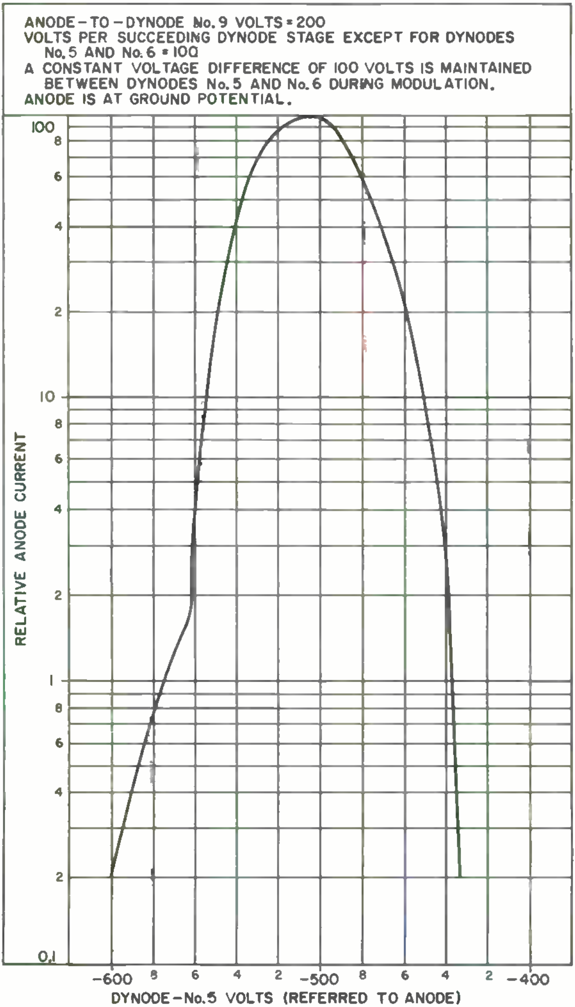
TYPICAL SENSITIVITY AND CURRENT AMPLIFICATION CHARACTERISTICS



92CM-6454 R5

World Radio History

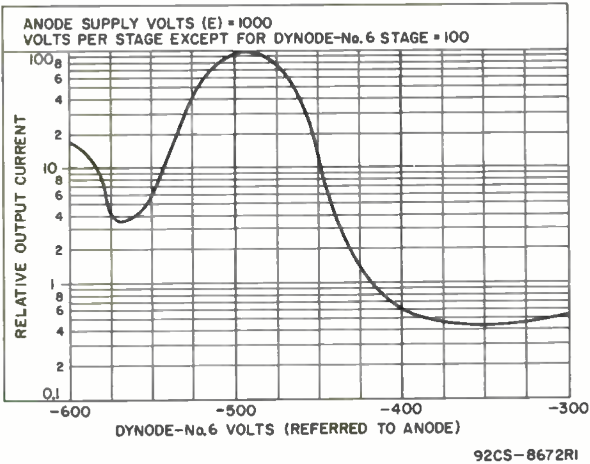
TYPICAL ANODE-CURRENT CHARACTERISTIC



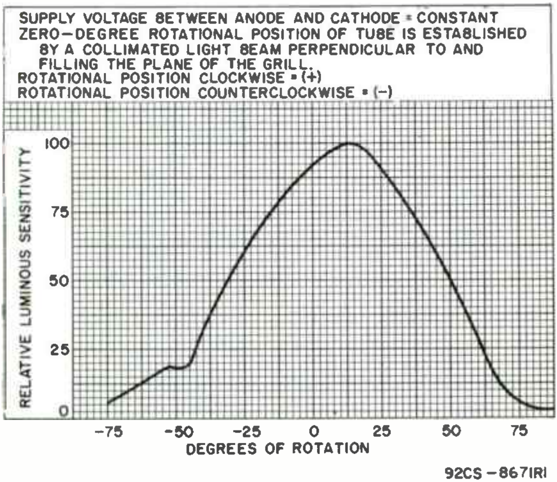
92CM-11375

World Radio History

TYPICAL OUTPUT-CURRENT CHARACTERISTIC

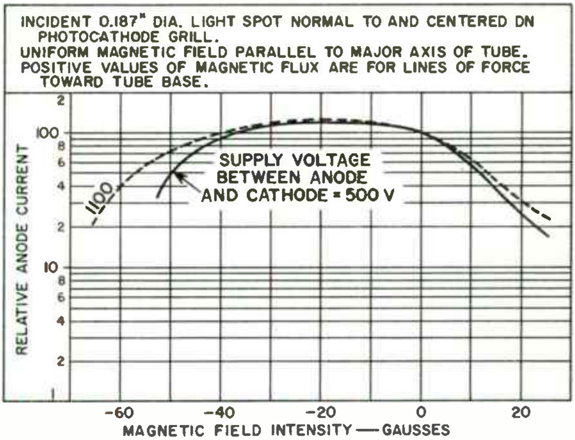


VARIATION IN LUMINOUS SENSITIVITY



World Radio History

TYPICAL EFFECT OF MAGNETIC FIELD ON ANODE CURRENT



92CS-7664R2

World Radio History

World Radio History

Multiplier Phototube

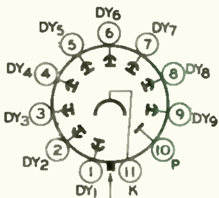
9-STAGE, SIDE-ON TYPE — **S-8 RESPONSE**

Especially Useful in Colorimetric and Spectroscopic Applications. High Sensitivity to Green-and-Blue Rich Light

General:

Spectral Response	S-8
Wavelength of Maximum Response	3650 ± 500 angstroms
Cathode, Opaque	Cesium-Bismuth
Minimum projected length[a]	15/16"
Minimum projected width[a]	5/16"
Window	Lime Glass[b]
Dynode Material	Cesium-Antimony
Direct Interelectrode Capacitances (Approx.):	
Anode to dynode No.9	4.4 pf
Anode to all other electrodes	6.0 pf
Maximum Overall Length	3-11/16"
Maximum Seated Length	3-1/8"
Length from Base Seat to Center of Useful Cathode Area	1-15/16" ± 3/32"
Maximum Diameter	1-5/16"
Operating Position	Any
Weight (Approx.)	1.6 oz
Bulb	T9
Socket	Amphenol[c] No.78S11T, or equivalent
Magnetic Shield	Perfection Mica Co.[d] No.P-101-2, or equivalent
Base	Small-Shell Submagnal 11-Pin (JEDEC Group 2, No.B11-88), Non-hygroscopic
Basing Designation for BOTTOM VIEW	11K

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 - Photocathode



DIRECTION OF INCIDENT RADIATION

Maximum Ratings, ***Absolute-Maximum Values:***

Supply Voltage Between Anode and Cathode (DC or Peak AC)	1250 max.	volts
Supply Voltage Between Dynode No.9 and Anode (DC or Peak AC)	250 max.	volts
Supply Voltage Between Consecutive Dynodes (DC or Peak AC)	250 max.	volts
Supply Voltage Between Dynode No.1 and Cathode (DC or Peak AC)	250 max.	volts
Average Anode Current[e]	1 max.	ma
Ambient Temperature	50 max.	°C

← Indicates a change.

World Radio History

→ Characteristics Range Values:

Under conditions with 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 3650 angstroms. .	-	750	-	a/w
Cathode radiant, at 3650 angstroms.	-	2.3×10^{-3}	-	a/w
Luminous, at 0 cps[f].	0.115	1	16	a/lm
Cathode luminous[g].	1.5×10^{-6}	3×10^{-6}	-	a/lm
Current Amplification.	-	3.3×10^{5}	-	
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 0.4 a/lm[h,j]	-	7.5×10^{-9}	3.75×10^{-7}	lm
Equivalent Noise Input[k]. . . .	-	7.5×10^{-12}	-	lm

With E = 750 volts (Except as noted)

	Min.	*Typ.*	*Max.*	
Sensitivity:				
Radiant, at 3650 angstroms . .	-	110	-	a/w
Cathode radiant, at 3650 angstroms.	-	2.3×10^{-3}	-	a/w
Luminous, at 0 cps[f].	0.016	0.145	1.85	a/lm
Cathode luminous[g].	1.5×10^{-6}	3×10^{-6}	-	a/lm
Current Amplification.	-	4.8×10^{4}	-	

a On plane perpendicular to the indicated direction of incident light and passing through the major axis of the tube.

b Corning No.0080, Corning Glass Works, Corning, New York, or equivalent.

c Made by Amphenol Electronics Corporation, 1830 South 54th Avenue, Chicago 50, Illinois.

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

e Averaged over any interval of 30 seconds maximum.

f 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.

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 100 volts are applied between cathode and all other electrodes connected as anode.

h At a tube temperature of 25° C. Dark current may be reduced by use of a refrigerant.

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

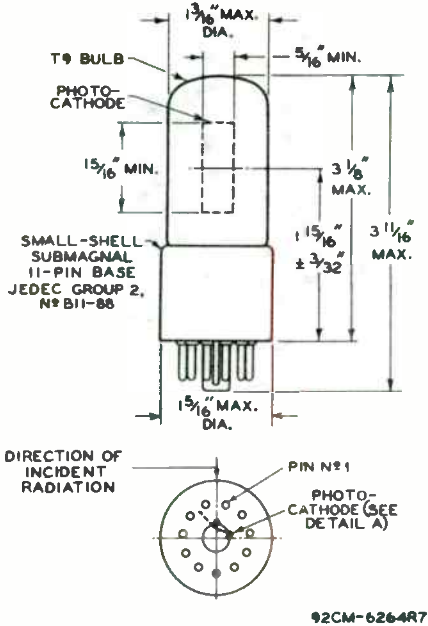
k Under the following conditions: Supply voltage (E) is as shown, 25° C tube temperature, external shield connected to cathode, bandwidth 1 cycle per second, tungsten-light source at a color temperature of 2870° K interrupted at a low audio frequency to produce incident radiation pulses alternating between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

→ Indicates a change.

RCA

IP22

MULTIPLIER PHOTOTUBE



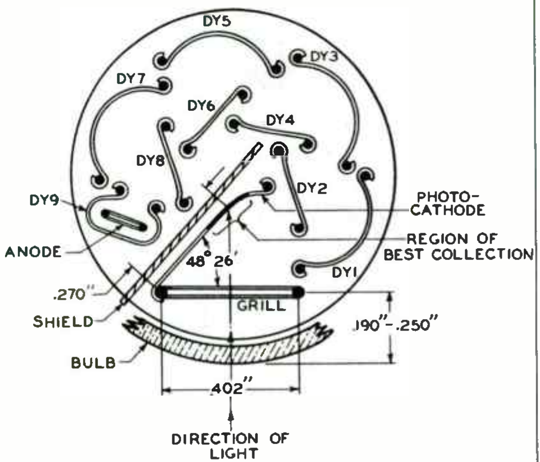
World Radio History

RCA

1P22

MULTIPLIER PHOTOTUBE

DETAIL A



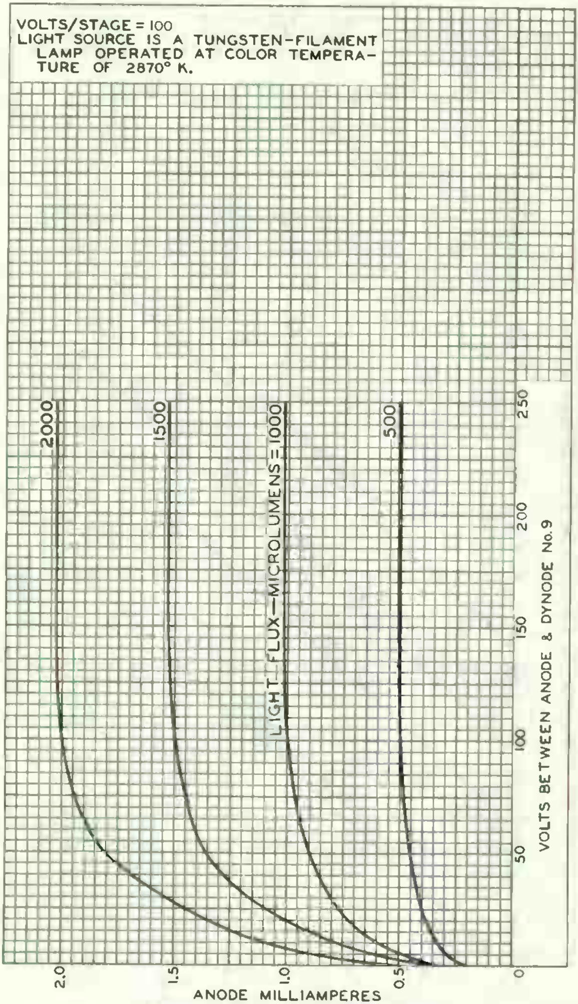
92CS-8674R1

NOTE 1: CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE.

NOTE 2: THE MAXIMUM ANGULAR VARIATION BETWEEN THE PLANE THROUGH PINS 1 AND 11 AND THE PLANE OF THE GRILL WILL NOT EXCEED 6°.

World Radio History

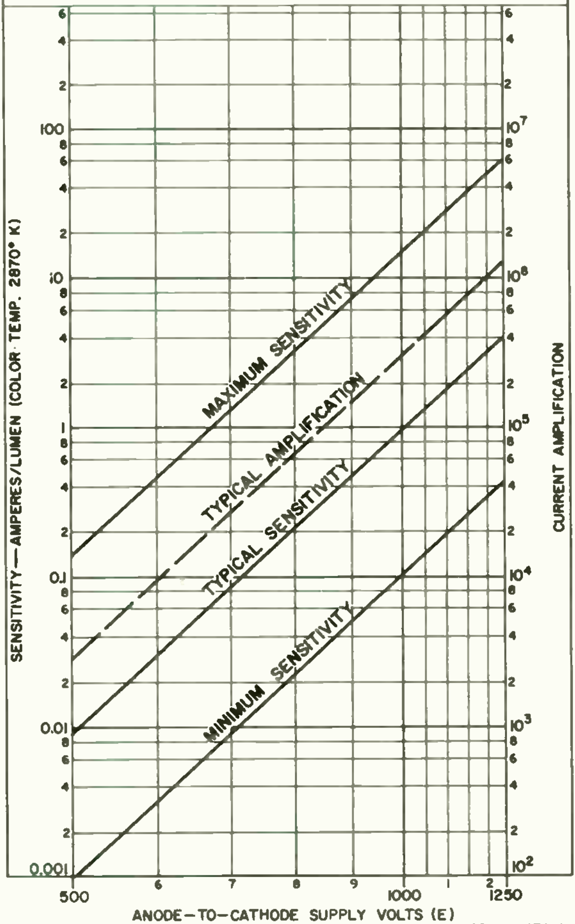
TYPICAL ANODE CHARACTERISTICS



92CM-6585R1

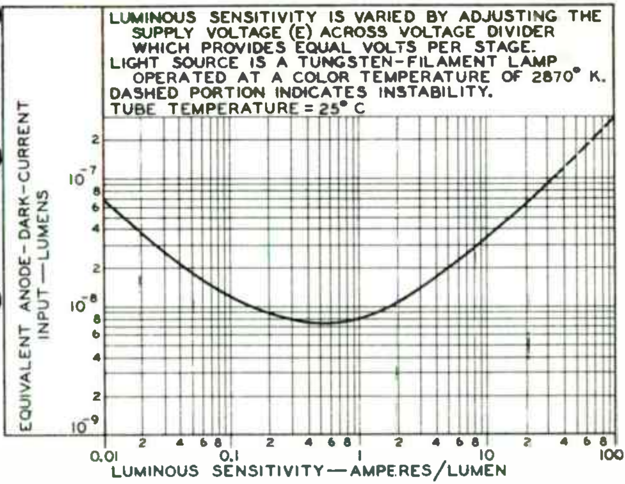
SENSITIVITY AND CURRENT AMPLIFICATION CHARACTERISTICS

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.



92CM-9674R1

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



92CS-9680

World Radio History

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World Radio History

Multiplier Phototube

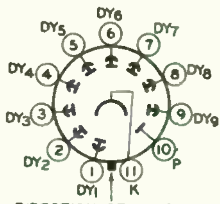
9-STAGE, SIDE-ON TYPE — **S-5 RESPONSE**

For Detection and Measurement of Ultraviolet and Visible Radiation

General:

Spectral Response	S-5
Wavelength of Maximum Response	3400 ± 500 angstroms
Cathode, Opaque	Cesium-Antimony
Minimum projected length[a]	15/16"
Minimum projected width[a]	5/16"
Window	Ultraviolet-Transmitting Glass[b]
Dynode Material	Cesium-Antimony
Direct Interelectrode Capacitances (Approx.):	
Anode to dynode No.9	4.4 pf
Anode to all other electrodes	6.0 pf
Maximum Overall Length	3-11/16"
Maximum Seated Length	3-1/8"
Length from Base Seat to Center of Useful Cathode Area	1-15/16" ± 3/32"
Maximum Diameter	1-5/16"
Operating Position	Any
Weight (Approx.)	1.6 oz
Bulb	T9
Socket	Amphenol[c] No.78S11T, or equivalent
Magnetic Shield	Perfection Mica Co.,[d] No.P-101-3, or equivalent
Base	Small-Shell Submagnal 11-Pin (JEDEC Group 2, No.B11-88), Non-hygroscopic
Basing Designation for BOTTOM VIEW	11K

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 - Photocathode



Maximum Ratings, ***Absolute-Maximum Values:***

Supply Voltage Between Anode and Cathode (DC or Peak AC)	1250 max.	volts
Supply Voltage Between Dynode No.9 and Anode (DC or Peak AC)	250 max.	volts
Supply Voltage Between Consecutive Dynodes (DC or Peak AC)	250 max.	volts
Supply Voltage Between Dynode No.1 and Cathode (DC or Peak AC)	250 max.	volts

← Indicates a change.

World Radio History

Average Anode Current[e], [i]		0.5 max.	ma
Ambient Temperature		75 max.	°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 3400 angstroms.	-	6.18×10^{4}	-	a/w
Cathode radiant, at 3400 angstroms . .	-	0.05	-	a/w
Luminous:				
At 0 cps[f].	17.5	50	300	a/lm
With dynode No.9 as output electrode[g]	-	30	-	a/lm
Cathode luminous[h]. . .	-	4×10^{-5}	-	a/lm
Current Amplification. .	-	1.25×10^{6}	-	
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 20 a/lm:[j,k]				
With anode as output electrode.	-	-	1.25×10^{-9}	lm
With dynode No.9 as output electrode .	-	-	2×10^{-9}	lm
Equivalent Noise Input:				
Luminous[m].	-	7.5×10^{-13}	-	lm
Ultraviolet[n]	-	8.5×10^{-16}	-	w

With E = 750 volts (Except as noted)

	Min.	*Typ.*	*Max.*	
Sensitivity:				
Radiant, at 3400 angstroms.	-	7.9×10^{3}	-	a/w
Cathode radiant, at 3400 angstroms . . .	-	0.05	-	a/w
Luminous, at 0 cps[f]. .	-	6.4	-	a/lm
Cathode luminous[h]. . .	-	4×10^{-5}	-	a/lm
Current Amplification. .	-	1.6×10^{5}	-	

a On plane perpendicular to the indicated direction of incident light and passing through the major axis of the tube.

b Corning No.9741, Corning Glass Works, Corning, New York, or equivalent.

c Made by Amphenol Electronics Corporation, 1830 South 54th Avenue, Chicago 50, Illinois.

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

e Averaged over any interval of 30 seconds maximum.

f 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.

g An output current of opposite polarity to that obtained at the anode may be provided by using dynode No.9 as the output electrode. With this arrangement, the load is connected in the dynode-No.9 circuit and the anode

→ Indicates a change.

World Radio History

serves only as collector. The curves shown in *Typical Anode Characteristics* do not apply when dynode No.9 is used as the output electrode.

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 0.01 lumen and 100 volts are aplied between cathode and all other electrodes connected as anode.

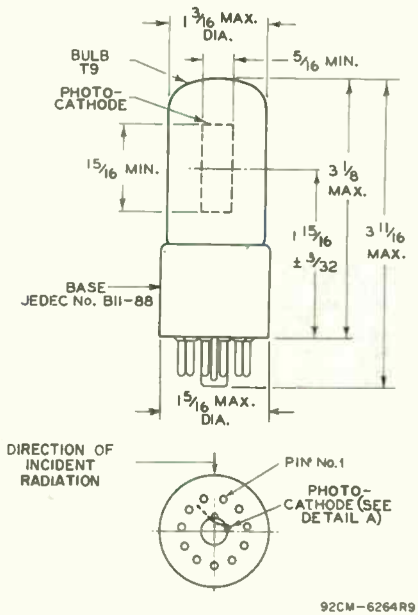
j At a tube temperature of 25° C. Dark current may be reduced by use of a refrigerant.

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

m 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.

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

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-5 RESPONSE is shown at the front of this Section

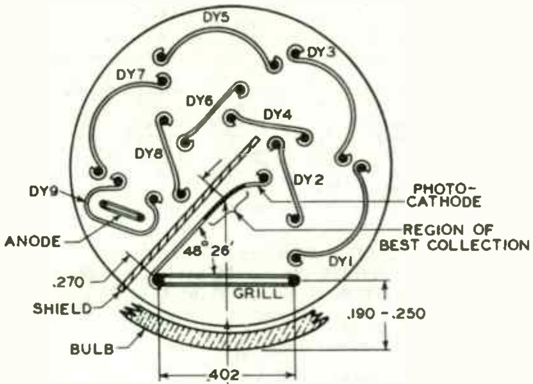


DIMENSIONS IN INCHES

CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE.

World Radio History

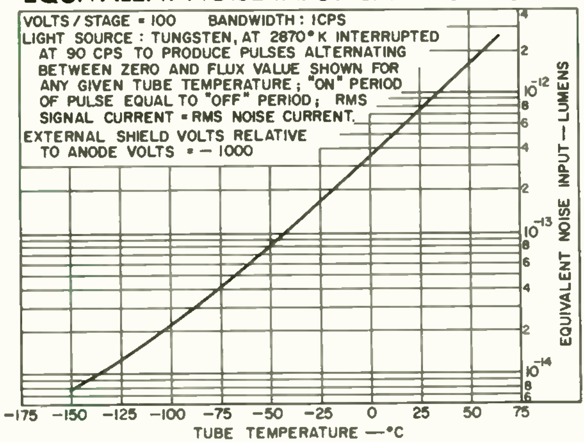
DETAIL A



92CS-8674R2

DIMENSIONS IN INCHES

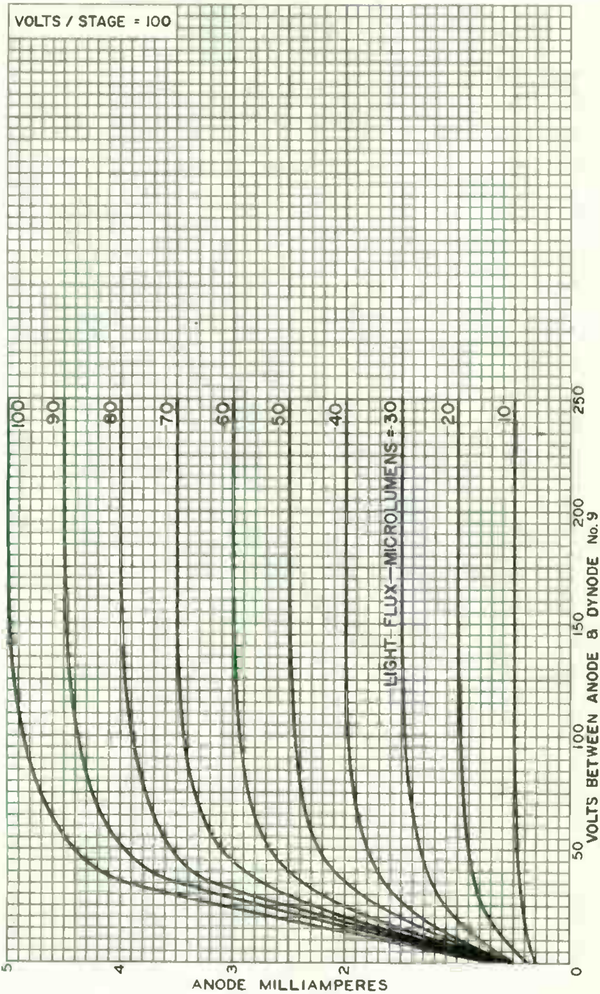
EQUIVALENT-NOISE-INPUT CHARACTERISTIC



92CS-7503R2

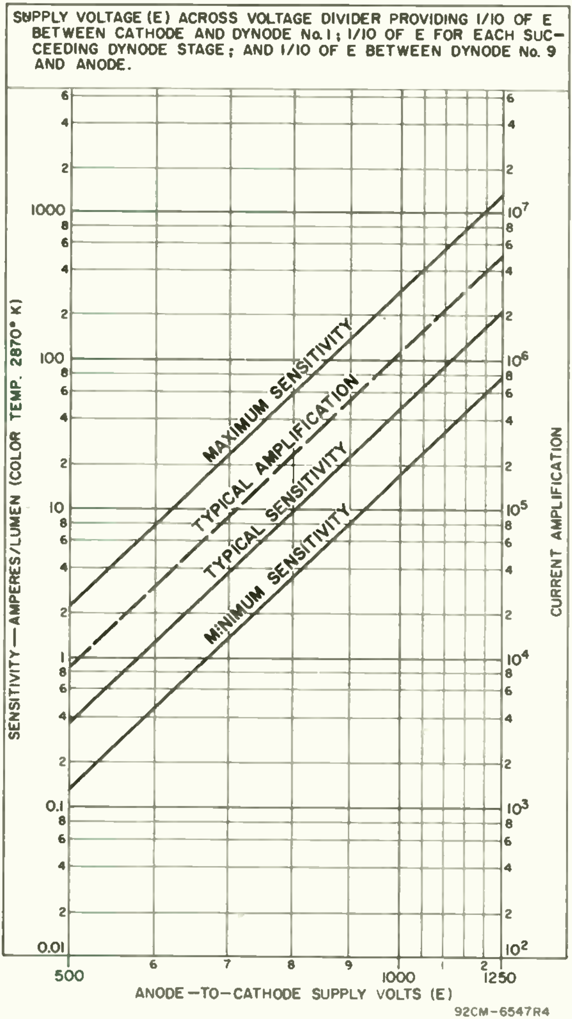
World Radio History

TYPICAL ANODE CHARACTERISTICS



92CM—6632R4

SENSITIVITY AND CURRENT AMPLIFICATION CHARACTERISTICS



World Radio History

Gas Phototube

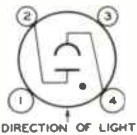
SIDE-ON TYPE HAVING S-3 RESPONSE

DATA

General:

Spectral Response	S-3
Wavelength of Maximum Response	4200 ± 1000 angstroms
Cathode:	
Shape	Semicylindrical
Minimum projected length[a]	1-1/4"
Minimum projected width[a]	5/8"
Direct Interelectrode Capacitance (Approx.)	3 μμf
Maximum Overall Length	4-1/8"
Maximum Seated Length	3-1/2"
Seated Length to Center of Cathode	2-1/8" ± 3/32"
Maximum Diameter	1-1/8"
Operating Position	Any
Weight (Approx.)	1.1 oz
Bulb	T8
Socket	Amphenol No.77-MIP-4-T, or equivalent
Base	Dwarf-Shell Small 4-Pin (JEDEC No.A4-26)
Basing Designation for BOTTOM VIEW	2K

Pin 1 – No Connection
Pin 2 – Anode



Pin 3 – No Connection
Pin 4 – Photocathode

Maximum Ratings, ***Absolute-Maximum Values:***

	Rating I	*Rating II*	
ANODE-SUPPLY VOLTAGE (DC or Peak AC)	80 max.	100 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[b]	50 max.	25 max.	μa/sq. in.
AVERAGE CATHODE CURRENT[b]	10 max.	5 max.	μa
AMBIENT TEMPERATURE	100 max.	100 max.	°C

Characteristics:

With an anode-supply voltage of 90 volts unless otherwise specified

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4200 angstroms	–	0.011	–	amp/watt
Luminous:[c]				
At 0 cps	20	40	70	μa/lumen
At 5000 cps	–	35	–	μa/lumen
At 10000 cps	–	31	–	μa/lumen
Gas Amplification Factor[d]	–	–	9	
Anode Dark Current at 25° C	–	–	0.10	μa

← Indicates a change.

World Radio History

Minimum Circuit Values:

With an anode-supply voltage of	*80 or less*	*100*	*volts*
DC Load Resistance:			
For dc currents above 5 µa. . .	0.1 min.	–	megohm
For dc currents below 5 µa. . .	0 min.	–	megohms
For dc currents above 3 µa. . .	–	2.5 min.	megohms
For dc currents below 3 µa. . .	–	0.1 min.	megohm

a On plane perpendicular to indicated direction of incident light.

b Averaged over any interval of 30 seconds maximum.

c For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A dc anode supply voltage of 90 volts and a 1-megohm load resistor are used. For the 0-cycle measurement, a light input of 0.1 lumen is used. For the 5000- and 10,000-cycle measurements, the light input is varied sinusoidally about a mean value of 0.015 lumen from zero to a maximum of twice the mean value.

d The ratio of luminous sensitivity at an anode supply voltage of 90 volts to luminous sensitivity at an anode supply voltage of 25 volts. In each case, sensitivity is obtained under conditions where the light souce is a tungsten-filament lamp operated at a color temperature of 2870° K, the light input is 0.1 lumen, and the load resistor has a value of 1 megohm.

SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOSENSITIVE DEVICE HAVING S-3 RESPONSE

and

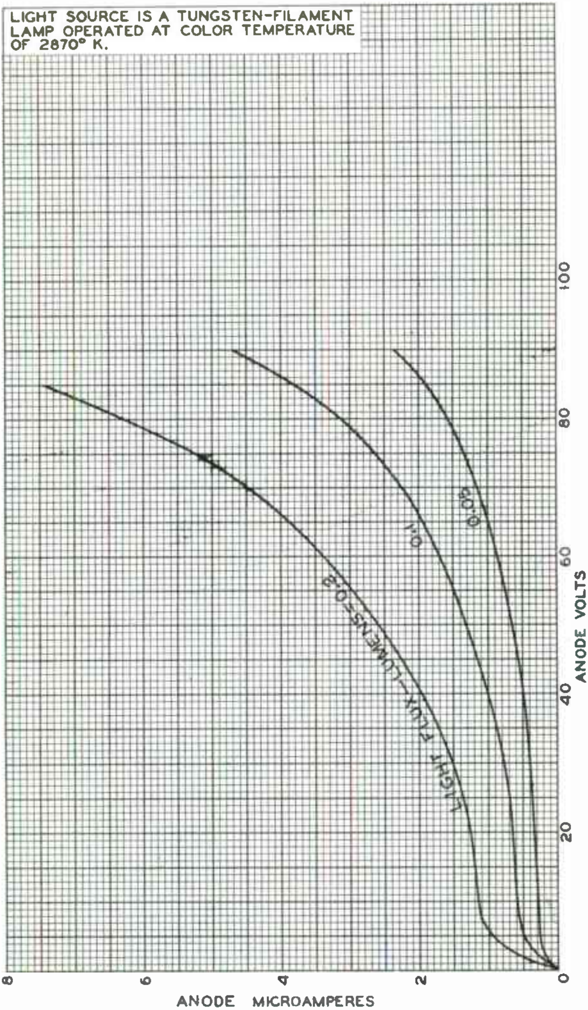
FREQUENCY-RESPONSE CHARACTERISTICS
OF GAS PHOTOTUBES

are shown at the front of this section

DIMENSIONAL OUTLINE
shown under Type 1P37 also applies to the 1P29

World Radio History

AVERAGE ANODE CHARACTERISTICS



92CM-6472R2

World Radio History

World Radio History

Gas Phototube

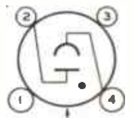
SIDE-ON TYPE HAVING S-4 RESPONSE

DATA

General:

Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 angstroms
Cathode:	
Shape	Semicylindrical
Minimum projected length[a]	1-1/4"
Minimum projected width[a]	5/8"
Direct Interelectrode Capacitance (Approx.)	3 μμf
Maximum Overall Length	4-1/8"
Maximum Seated Length	3-1/2"
Seated Length to Center of Cathode	2-1/8" ± 3/32"
Maximum Diameter	1-1/8"
Operating Position	Any
Weight (Approx.)	1.1 oz ←
Bulb	T8
Socket	Amphenol No.77-MIP-4-T, or equivalent ←
Base	Dwarf-Shell Small 4-Pin (JEDEC No.A4-26) ←
Basing Designation for BOTTOM VIEW	2K

Pin 1 – No Connection
Pin 2 – Anode



Pin 3 – No Connection
Pin 4 – Photocathode

Maximum Ratings, ***Absolute-Maximum Values:*** ←

	Rating I	*Rating II*	
ANODE-SUPPLY VOLTAGE (DC or Peak AC)	80 max.	100 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[b]	50 max.	25 max.	μa/sq. in.
AVERAGE CATHODE CURRENT[b]	10 max.	5 max.	μa
AMBIENT TEMPERATURE	75 max.	75 max.	°C

Characteristics: ←

With an anode-supply voltage of 90 volts unless otherwise specified

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4000 angstroms	–	0.13	–	μa/μw
Luminous:[c]				
At 0 cps	75	135	205	μa/lumen
At 5000 cps	–	124	–	μa/lumen
At 10000 cps	–	108	–	μa/lumen
Gas Amplification Factor[d]	–	–	5.5	
Anode Dark Current at 25° C	–	–	0.05	μa

← Indicates a change.

World Radio History

Minimum Circuit Values:

With an anode-supply voltage of	*80 or less*	*100*	*volts*
DC Load Resistance:			
For dc currents above 5 μa . .	0.1 min.	-	megohm
For dc currents below 5 μa . .	0 min.	-	megohms
For dc currents above 3 μa . .	-	2.5 min.	megohms
For dc currents below 3 μa . .	-	0.1 min.	megohm

a On plane perpendicular to indicated direction of incident light.

b Averaged over any interval of 30 seconds maximum.

c For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A dc anode supply voltage of 90 volts and a 1-megohm load resistor are used. For the 0-cycle measurement, a light input of 0.1 lumen is used. For the 5000- and 10,000-cycle measurements, the light input is varied sinusoidally about a mean value of 0.015 lumen from zero to a maximum of twice the mean value.

d The ratio of luminous sensitivity at an anode supply voltage of 90 volts to luminous sensitivity at an anode supply voltage of 25 volts. In each case, sensitivity is obtained under conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K, the light input is 0.1 lumen, and the load resistor has a value of 1 megohm.

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

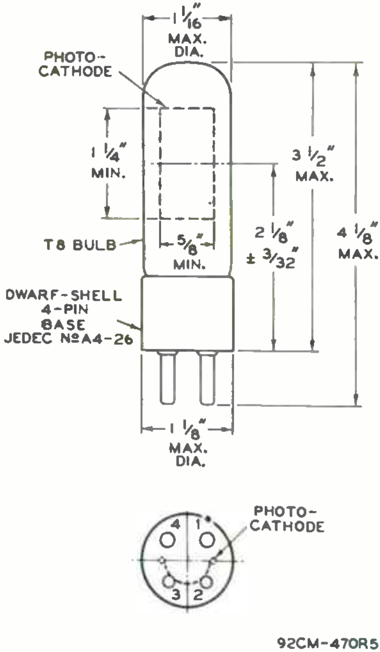
and

FREQUENCY-RESPONSE CHARACTERISTICS OF GAS PHOTOTUBES

are shown at the front of this section

AVERAGE-ANODE-CHARACTERISTICS CURVE
shown under Type 5581 also applies to the 1P37

World Radio History



World Radio History

World Radio History

1P39

VACUUM PHOTOTUBE

WITH S-4 RESPONSE

For applications critical as to leakage under high-humidity conditions

The 1P39 is like the 929, except that the 1P39 has a maximum dark current of 0.005 μa at 250 volts, and has a non-hygroscopic base which insures a value of resistance between anode and cathode pins about 10 times higher than conventional bases under adverse service conditions of high humidity. ←

← Indicates a change.

1P40

GAS PHOTOTUBE

WITH S-1 RESPONSE

For applications critical as to leakage under high-humidity conditions

The 1P40 is like the 930, except that the 1P40 has a maximum dark current of 0.005 μa at 90 volts, and has a non-hygroscopic base which insures a value of resistance between anode and cathode pins about 10 times higher than conventional bases under adverse service conditions of high humidity. ←

← Indicates a change.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
World Radio History

World Radio History

1P41

GAS PHOTOTUBE

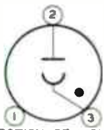
HEAD-ON TYPE WITH S-1 RESPONSE

DATA

General:

Spectral Response	S-1
Wavelength of Maximum Response	8000 ± 1000 angstroms
Cathode:	
Shape	Circular
Minimum diameter	9/16"
Direct Interelectrode Capacitance	1.8 μμf
Maximum Overall Length	2-1/16"
Maximum Seated Length	1-19/32"
Axial Distance from Bulb Top to Plane through Periphery of Cathode Area	5/16" ± 3/32" ←
Maximum Diameter	13/16"
Mounting Position	Any
Weight (Approx.)	0.3 oz ←
Bulb	T6
Base	Small-Shell Peewee 3-Pin (JETEC No.A3-1) ←
Basing Designation for BOTTOM VIEW	2AR ←

Pin 1 – No Connection



DIRECTION OF LIGHT: INTO END OF BULB

Pin 2 – Anode
Pin 3 – Cathode

Maximum Ratings, ***Absolute Values:***

	Rating I	*Rating II*	
ANODE-SUPPLY VOLTAGE (DC or Peak AC)	70 max.	90 max.	volts
AVERAGE CATHODE-CURRENT DENSITY°	40 max.	20 max.	μamp/sq.in. ←
AVERAGE CATHODE CURRENT°	3 max.	1.5 max.	μamp
AMBIENT TEMPERATURE	100 max.	100 max.	°C

Characteristics, ***With 90 Volts on Anode:***

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 8000 angstroms	-	0.008	-	μamp/μwatt ←
Luminous:♦				
At 0 cps	50	90	145	μamp/lumen
At 5000 cps	-	77	-	μamp/lumen
At 10000 cps	-	67	-	μamp/lumen
Gas Amplification Factor	-	-	8.5	
Anode Dark Current at 25 °C	-	-	0.1	μamp ←

°,♦: See next page.

← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

1P41

GAS PHOTOTUBE

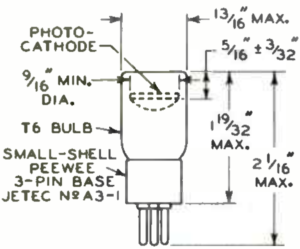
Minimum Circuit Values:

With anode-supply voltage of	*70 or less*	*90*	*volts*
DC Load Resistance:			
For dc currents above 1.5 µamp.	0.1 min.	–	megohm
For dc currents below 1.5 µamp.	0 min.	–	megohm
For dc currents above 1 µamp.	–	2.5 min.	megohms
For dc currents below 1 µamp.	–	0.1 min.	megohm

° Averaged over any interval of 30 seconds maximum.

• For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870 °K. A dc anode supply of 90 volts and a 1-megohm load resistor are used. For the 0-cycle measurements, a light input of 0.06 lumen is used. For the 5000- and 10000-cycle measurements, the light input is varied sinusoidally about a mean value of 0.015 lumen from zero to a maximum of twice the mean.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-1 Response
and
FREQUENCY-RESPONSE CHARACTERISTICS
of Gas Phototubes
are shown at the front of this Section



92CS-6676R2

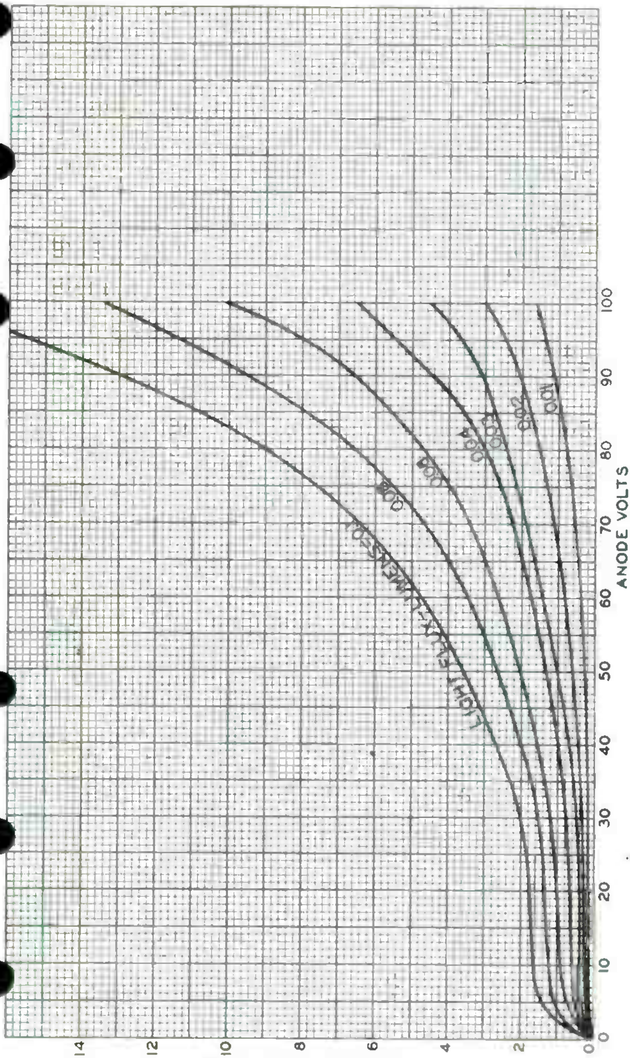
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

1P41

AVERAGE ANODE CHARACTERISTICS



DEC. 13, 1946

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-5217R3

World Radio History

World Radio History

Vacuum Phototube

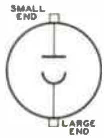
HEAD-ON TYPE WITH S-9 RESPONSE

DATA

General:

Spectral Response	S-9
Wavelength of Maximum Response	4800 ± 500 angstroms
Cathode, Semitransparent:	
Shape	Circular
Window:	
Area	0.03 sq. in.
Minimum diameter	0.19"
Direct Interelectrode Capacitance	1.9 µµf
Maximum Overall Length	1-11/32" ± 1/16"
Maximum Diameter	1/4"
Operating Position	Any
Weight (Approx.)	0.1 oz
Bulb	T2
Terminal Diagram (See *Dimensional Outline*)	2AT

Small End: Anode



Large End: Cathode

DIRECTION OF LIGHT: INTO END OF BULB

Maximum Ratings, *Absolute-Maximum Values:*

ANODE-SUPPLY VOLTAGE (DC or PEAK AC)	180 max.	volts
AVERAGE CATHODE-CURRENT DENSITY●	25 max.	µa/sq. in.
AVERAGE CATHODE CURRENT●	0.4 max.	µa
AMBIENT TEMPERATURE	75 max.	°C

Characteristics:

With an anode-supply voltage of 180 volts unless otherwise specified

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4800 angstroms	-	0.025	-	µa/µW
Luminous#	20	37	70	µa/lumen
Anode Dark Current at 25° C.	-	-	0.005	µa

● Averaged over any interval of 30 seconds maximum.

For conditions where the light source is a tungsten-filament lamp operated a color temperature of 2870° K. The supply voltage is 180 volts, the load resistor is 1 megohm, and the light input is 0.015 lumen.

← Indicates a change.

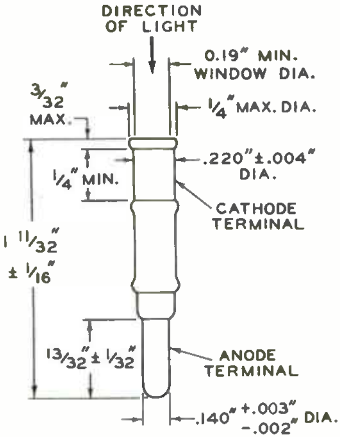
World Radio History

OPERATING CONSIDERATIONS

Exposure to intense illumination, such as direct sunlight, may decrease the sensitivity of the 1P42 even though no voltage is applied to the tube. The magnitude and duration of the decrease depend on the length of the exposure.

Shielding of the 1P42 and its leads to the amplifier is recommended when amplifier gain is high or when the phototube load resistance is high. Whenever frequency response is important in a phototube circuit, the leads from the phototube to the amplifier should be made short so as to minimize capacitance shunting of the phototube load. It is important that insulation of associated circuit parts and wiring be adequate.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-9 Response is shown at front of this Section



NOTE: WHEN TUBE IS ROTATED ABOUT THE LONGITUDINAL AXIS OF ITS CATHODE TERMINAL, NO PART OF THE ANODE TERMINAL WILL FALL OUTSIDE OF A 0.241"-DIAMETER CIRCLE CONCENTRIC WITH THE LONGITUDINAL AXIS OF THE CATHODE TERMINAL.

92CS-6791R2

→ indicates a change.

World Radio History

AVERAGE ANODE CHARACTERISTICS

92CM-10757

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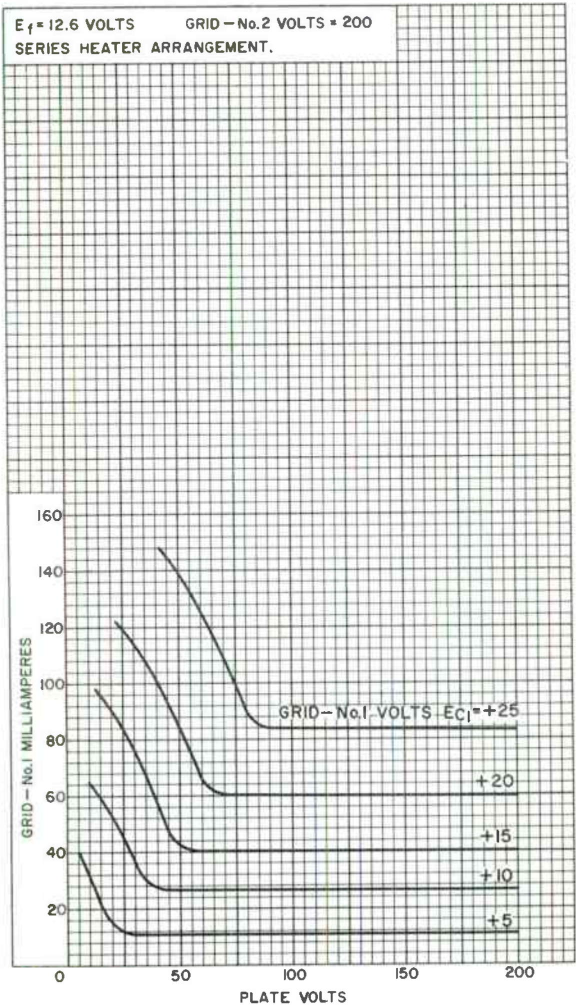
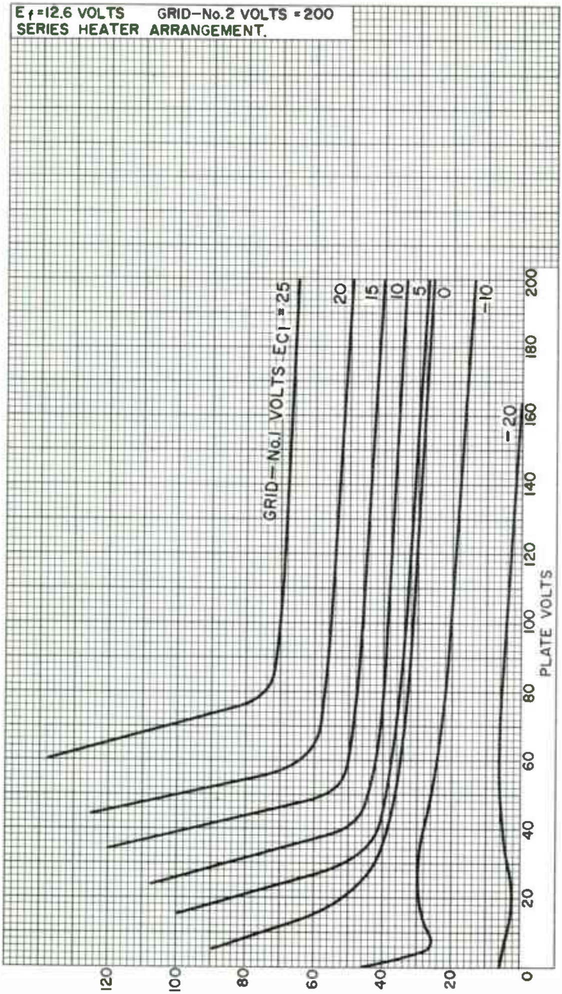
TYPICAL CHARACTERISTICS
For Each Unit



92CM—6114R4

World Radio History

TYPICAL CHARACTERISTICS
For Each Unit



92CM—8308R1

World Radio History

Gas Phototube

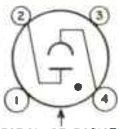
SIDE-ON TYPE HAVING S-1 RESPONSE

DATA

General:

Spectral Response	S-1
Wavelength of Maximum Response	8000 ± 1000 angstroms
Cathode:	
Shape	Semicylindrical
Minimum projected length[a]	1-1/4"
Minimum projected width[a]	5/8"
Direct Interelectrode Capacitance (Approx.)	3 μμf
Maximum Overall Length	4-1/8"
Maximum Seated Length	3-1/2"
Seated Length to Center of Cathode	2-1/8" ± 3/32"
Maximum Diameter	1-1/8"
Operating Position	Any
Weight (Approx.)	1.1 oz ←
Bulb	T8
Socket	Amphenol No.77-MIP-4-T, or equivalent ←
Base	Dwarf-Shell Small 4-Pin (JEDEC No.A4-26) ←
Basing Designation for BOTTOM VIEW	2K

Pin 1 – No Connection
Pin 2 – Anode



DIRECTION OF RADIATION

Pin 3 – No Connection
Pin 4 – Photocathode

Maximum Ratings, ***Absolute-Maximum Values:*** ←

	Rating I	*Rating II*	
ANODE-SUPPLY VOLTAGE (DC or Peak AC)	80 max.	100 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[b]	50 max.	25 max.	μa/sq. in.
AVERAGE CATHODE CURRENT[b]	10 max.	5 max.	μa
AMBIENT TEMPERATURE	100 max.	100 max.	°C

Characteristics: ←

With an anode-supply voltage of 90 volts unless otherwise specified

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 8000 angstroms	–	0.0084	–	amp/watt
Luminous:[c]				
At 0 cps	50	90	145	μa/lumen
At 5000 cps	–	77	–	μa/lumen
At 10000 cps	–	67	–	μa/lumen
Gas Amplification Factor[d]	–	–	8	
Anode Dark Current at 25° C.	–	–	0.1	μa

← indicates a change.

World Radio History

Minimum Circuit Values:

With an anode-supply voltage of	*80 or less*	*100*	*volts*
DC Load Resistance:			
For dc currents above 5 μa.	0.1 min.	–	megohm
For dc currents below 5 μa.	0 min.	–	megohms
For dc currents above 3 μa.	–	2.5 min.	megohms
For dc currents below 3 μa.	–	0.1 min.	megohm

[a] On plane perpendicular to indicated direction of incident radiation.

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

[c] For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A dc anode supply voltage of 90 volts and a 1-megohm load resistor are used. For the 0-cycle measurement, a light input of 0.1 lumen is used. For the 5000- and 10,000-cycle measurements, the light input is varied sinusoidally about a mean value of 0.015 lumen from zero to a maximum of twice the mean value.

[d] The ratio of luminous sensitivity at an anode supply voltage of 90 volts to luminous sensitivity at an anode supply voltage of 25 volts. In each case, sensitivity is obtained under conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K, the light input is 0.1 lumen, and the load resistor has a value of 1 megohm.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-1 RESPONSE

and

FREQUENCY-RESPONSE CHARACTERISTICS OF GAS PHOTOTUBES

are shown at the front of this section

DIMENSIONAL OUTLINE
shown under Type 1P37 also applies to the 868

AVERAGE-ANODE-CHARACTERISTICS CURVE
shown under Type 1P41 also applies to the 868

World Radio History

RCA

917

VACUUM PHOTOTUBE

WITH ANODE-TERMINAL CAP AND S-1 RESPONSE

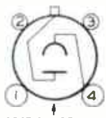
DATA

General:

Spectral Response	S-1
Wavelength of Maximum Response	8000 ± 1000 Angstroms
Cathode:	
Shape	Semi-Cylindrical
Minimum Projected Length*	1-9/16"
Minimum Projected Width*	5/8"
Direct Interelectrode Capacitance	2.2 μμf
Overall Length	4-5/16" ± 1/8"
Seated Length	3-11/16" ± 1/8"
Seated Length to Center of Cathode	2-1/8" ± 3/32"
Maximum Diameter	1-1/8"
Bulb	T-8
Mounting Position	Any
Cap	Small
Base	Dwarf-Shell Small 4-Pin

BOTTOM VIEW

Pin 1 - No Connection
Pin 2 - No Connection



DIRECTION OF LIGHT.

Pin 3 - No Connection
Pin 4 - Cathode
Cap - Anode

Maximum Ratings, *Absolute Values*:

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	500 max.	volts
PEAK CATHODE CURRENT	30 max.	μamp
PEAK CATHODE-CURRENT DENSITY	100 max.	μamp/sq. in.
AVERAGE CATHODE CURRENT°	10 max.	μamp
AMBIENT TEMPERATURE	100 max.	°C

Characteristics:

	Min.	*Av.*	*Max.*	
Dark Current at 250 Volts	-	-	0.005	μamp
Sensitivity:				
At 8000 Angstroms	-	0.002	-	μamp/μwatt
Luminous	12	20	40	μamp/lumen

* On plane perpendicular to indicated direction of incident light.
° Averaged over any interval of 30 seconds maximum.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-1 Response
is shown at the beginning of this Section

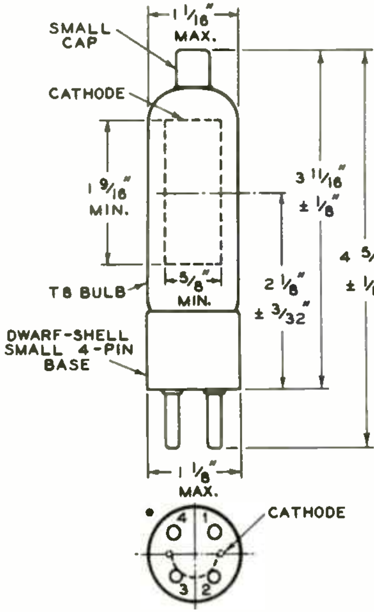
← Indicates a change.

World Radio History

RCA

917

VACUUM PHOTOTUBE



BOTTOM VIEW

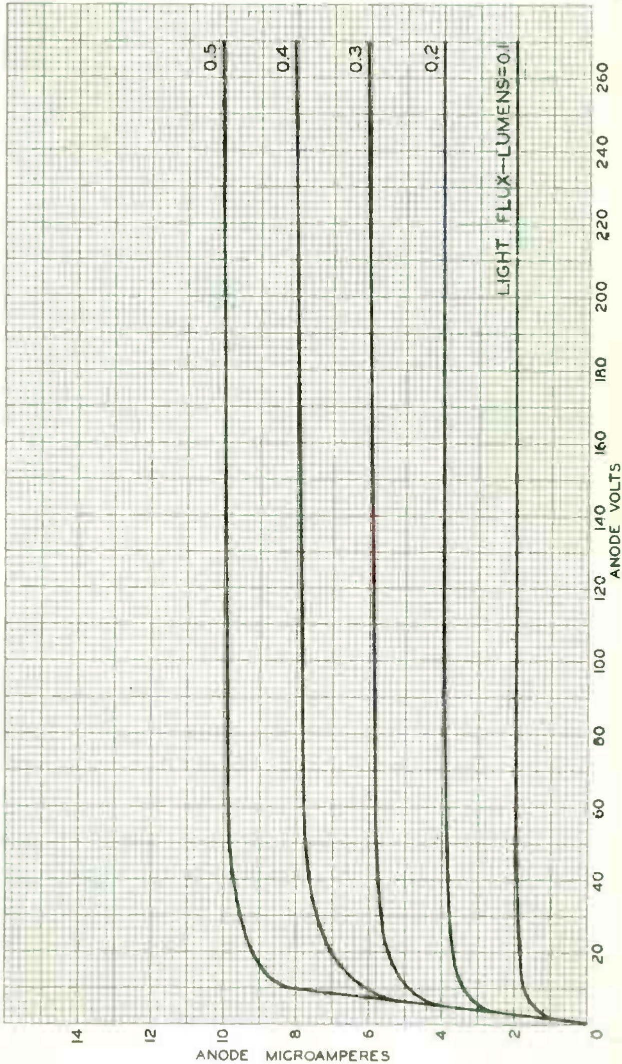
92CS-4359R4

World Radio History

RCA

917

AVERAGE ANODE CHARACTERISTICS



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-4360R2

World Radio History

World Radio History

Gas Phototube

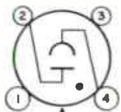
SIDE-ON TYPE HAVING S-1 RESPONSE

DATA

General:

Spectral Response	S-1
Wavelength of Maximum Response	8000 ± 1000 angstroms
Cathode:	
Shape	Semicylindrical
Minimum projected length[a]	1-1/4"
Minimum projected width[a]	5/8"
Direct Interelectrode Capacitance (Approx.)	3 μμf
Maximum Overall Length	4-1/8"
Maximum Seated Length	3-1/2"
Seated Length to Center of Cathode	2-1/8" ± 3/32"
Maximum Diameter	1-1/8"
Operating Position	Any
Weight (Approx.)	1.1 oz ←
Bulb	T8
Socket	Amphenol No.77-MIP-4-T, or equivalent ←
Base	Dwarf-Shell Small 4-Pin (JEDEC No.A4-26) ←
Basing Designation for BOTTOM VIEW	2K

Pin 1 - No Connection
Pin 2 - Anode



DIRECTION OF RADIATION

Pin 3 - No Connection
Pin 4 - Photocathode

Maximum Ratings, ***Absolute-Maximum Values:*** ←

	Rating I	*Rating II*	
ANODE-SUPPLY VOLTAGE (DC or Peak AC)	70 max.	90 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[b]	50 max.	25 max.	μa/sq. in.
AVERAGE CATHODE CURRENT[b]	10 max.	5 max.	μa
AMBIENT TEMPERATURE	100 max.	100 max.	°C

Characteristics: ←

With an anode-supply voltage of 90 volts unless otherwise specified

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 8000 angstroms	-	0.014	-	amp/watt
Luminous:[c]				
At 0 cps	120	150	220	μa/lumen
At 5000 cps	-	120	-	μa/lumen
At 10000 cps	-	105	-	μa/lumen
Gas Amplification Factor[d]	-	-	10.5	
Anode Dark Current at 25° C.	-	-	0.1	μa

← indicates a change.

World Radio History

Minimum Circuit Values:

With an anode-supply voltage of	*70 or less*	*90*	*volts*
DC Load Resistance:			
For dc currents above 5 μa.	0.1 min.	–	megohm
For dc currents below 5 μa.	0 min.	–	megohms
For dc currents above 3 μa.	–	2.5 min.	megohms
For dc currents below 3 μa.	–	0.1 min.	megohm

[a] On plane perpendicular to indicated direction of incident radiation.

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

[c] For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A dc anode supply voltage of 90 volts and a 1-megohm load resistor are used. For the 0-cycle measurement, a light input of 0.1 lumen is used. For the 5000- and 10,000-cycle measurements, the light input is varied sinusoidally about a mean value of 0.015 lumen from zero to a maximum of twice the mean value.

[d] The ratio of luminous sensitivity at an anode supply voltage of 90 volts to luminous sensitivity at an anode supply voltage of 25 volts. In each case, sensitivity is obtained under conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K, the light input is 0.1 lumen, and the load resistor has a value of 1 megohm.

**SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOSENSITIVE DEVICE HAVING S-1 RESPONSE**

and

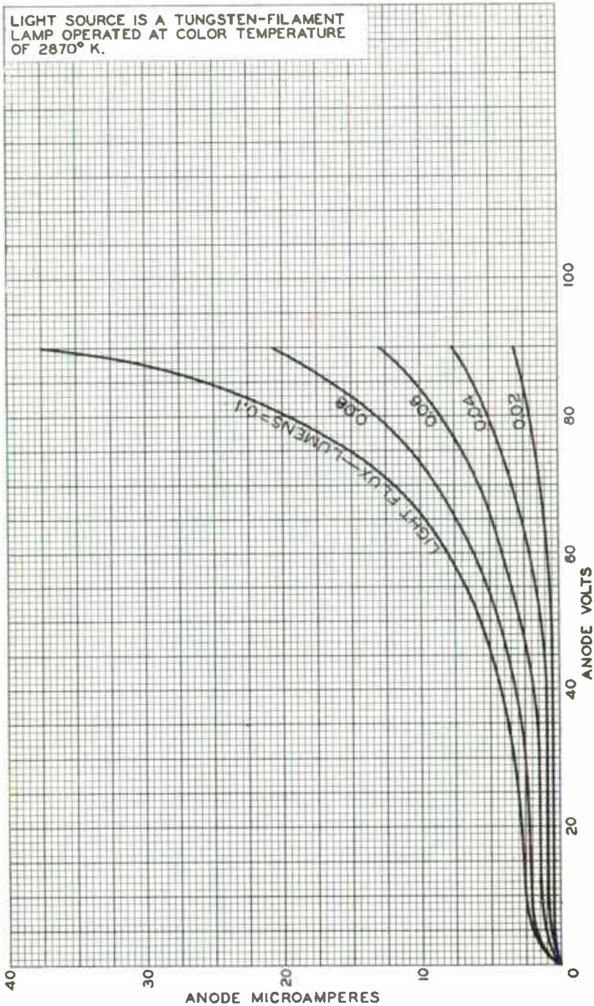
**FREQUENCY-RESPONSE CHARACTERISTICS
OF GAS PHOTOTUBES**

are shown at the front of this section

**DIMENSIONAL OUTLINE
shown under Type 1P37 also applies to the 918**

World Radio History

AVERAGE ANODE CHARACTERISTICS



92CM-4351R3

World Radio History

World Radio History

919

![RCA]

919

VACUUM PHOTOTUBE

LOW-LEAKAGE TYPE WITH CATHODE-TERMINAL CAP AND S-1 RESPONSE

For light-measuring and relay applications

The 919 is the same as the 917 except for the following item:

General:

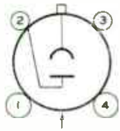
Base . . . . Dwarf-Shell Small 4-Pin (JETEC No. A4-26)

Basing Designation for BOTTOM VIEW 1B

Pin 1 - No Connection

Pin 2 - Anode

Pin 3 - No Connection



DIRECTION OF LIGHT

Pin 4 - No Connection

Cap - Cathode

World Radio History

Gas Phototube

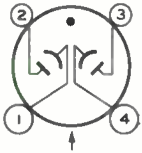
SIDE-ON, TWIN-UNIT TYPE HAVING S-1 RESPONSE

DATA

General:

Spectral Response	S-1
Wavelength of Maximum Response	8000 ± 1000 angstroms
Cathode (Each):	
Shape	Quarter-Cylindrical
Minimum projected length[a]	1-3/16"
Minimum projected width[a]	1/4"
Direct Interelectrode Capacitances (Approx.):	
Cathode to cathode[b]	1.8 μμf
Cathode to anode[c]	1.6 μμf
Anode to anode[d]	0.4 μμf ←
Maximum Overall Length	4"
Maximum Seated Length	3-3/8"
Seated Length to Center of Cathodes	2-1/8" ± 3/32"
Maximum Diameter	1-3/16"
Operating Position	Any
Weight (Approx.)	1.1 oz ←
Bulb	T9
Socket	Amphenol No.77-M1P-4-T, or equivalent ←
Base	Small-Shell Small 4-Pin (JEDEC No.A4-5)
Basing Designation for BOTTOM VIEW	4BG

Pin 1 – Photocathode of Unit No.2
Pin 2 – Anode of Unit No.2



Pin 3 – Anode of Unit No.1
Pin 4 – Photocathode of Unit No.1

DIRECTION OF RADIATION

Maximum Ratings, ***Absolute-Maximum Values:*** ←

Values are for Each Unit

	Rating I	*Rating II*	
ANODE-SUPPLY VOLTAGE (DC or Peak AC)	70 max.	90 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[e]	30 max.	15 max.	μa/sq. in.
AVERAGE CATHODE CURRENT[e]	4 max.	2 max.	μa
AMBIENT TEMPERATURE	100 max.	100 max.	°C

← Indicates a change.

World Radio History

→ **Characteristics:**

Values are for each unit with an anode-supply voltage of 90 volts unless specified

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 8000 angstroms. .	-	0.0094	-	amp/watt
Luminous:[f]				
At 0 cps.	50	100	175	μa/lumen
At 5000 cps	-	85	-	μa/lumen
At 10000 cps.	-	74	-	μa/lumen
Ratio of Luminous Sensitivities (Unit No.1 to Unit No.2). . .	0.5	1.15	2.0	
Gas Amplification Factor[g] . . .	-	-	9	
Anode Dark Current at 25° C . .	-	-	0.1	μa

Minimum Circuit Values:

Values are for Each Unit

With an anode-supply voltage of	*70 or less*	*90*	*volts*
DC Load Resistance:			
For dc currents above 2 μa. .	0.1 min.	-	megohm
For dc currents below 2 μa. .	0 min.	-	megohm
For dc currents above 1 μa. .	—	2.5 min.	megohms
For dc currents below 1 μa. .	-	0.1 min.	megohm

[a] On plane perpendicular to indicated direction of incident radiation.

[b] With anodes grounded.

[c] Each unit, with other unit grounded.

[d] With cathodes grounded.

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

[f] For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A dc anode supply of 90 volts and a 1-megohm load resistor are used. For the 0-cycle measurement, a light input of 0.04 lumen is used. For the 5000- and 10000-cycle measurements, the light input is varied sinusoidally about a mean value of 0.015 lumen from zero to a maximum of twice the mean value.

[g] The ratio of luminous sensitivity at an anode-supply voltage of 90 volts to luminous sensitivity at an anode-supply voltage of 25 volts. In each case, sensitivity is obtained under conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K, the light input is 0.04 lumen, and the load resistor has a value of 1 megohm.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-1 RESPONSE

and

FREQUENCY-RESPONSE CHARACTERISTICS OF GAS PHOTOTUBES

are shown at the front of this section

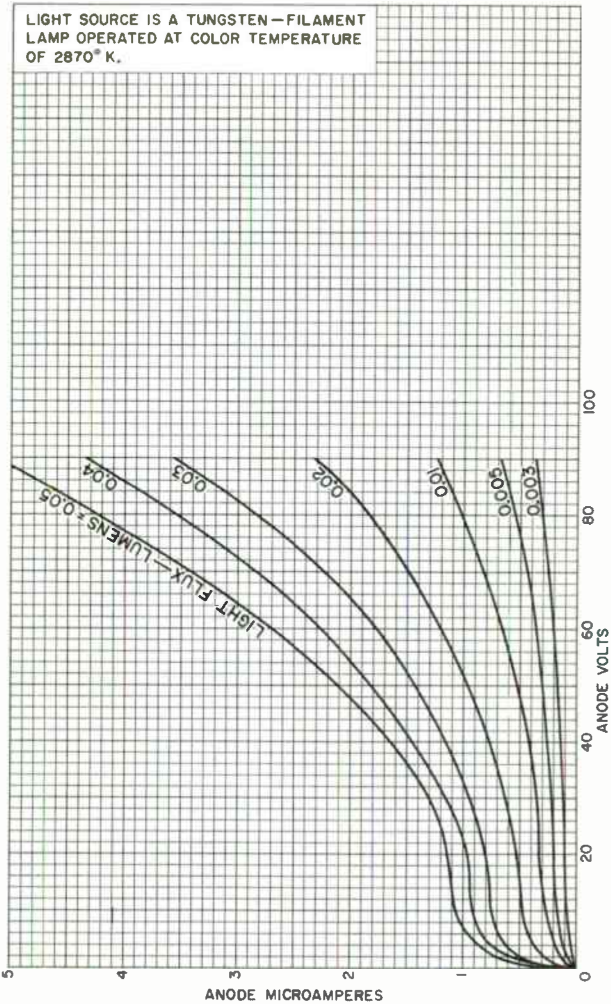
DIMENSIONAL OUTLINE

shown under Type 5584 also applies to the 920

→ Indicates a change.

World Radio History

AVERAGE ANODE CHARACTERISTICS
Each Unit



92CM—4618R4

World Radio History

World Radio History

921
GAS PHOTOTUBE
CARTRIDGE TYPE WITH S-1 RESPONSE

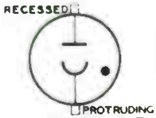
DATA

General:

Spectral Response	S-1
Wavelength of Maximum Response	8000 ± 1000 Angstroms
Cathode:	
Shape	Semi-Cylindrical
Minimum Projected Length*	7/8"
Minimum Projected Width*	1/2"
Direct Interelectrode Capacitance	1.0 μμf
Overall Length	1-21/32" ± 1/16"
Seated Length	1-13/32" ± 1/32"
Length, Cathode Center to plane A-A' (See outline)	11/16" ± 1/16"
Maximum Diameter	0.890"
Mounting Position	Any
Terminal Caps	See Outline

BOTTOM VIEW

Recessed Terminal } Anode



Protruding Terminal } Cathode

DIRECTION OF LIGHT INTO CONCAVE SIDE OF CATHODE

Maximum Ratings, *Absolute Values*:

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	90 max.	volts
PEAK CATHODE CURRENT	10 max.	μamp
PEAK CATHODE-CURRENT DENSITY	100 max.	μamp/sq. in.
AVERAGE CATHODE CURRENT°	3 max.	μamp
AMBIENT TEMPERATURE	100 max.	°C

Characteristics:

	Min.	*Av.*	*Max.*	
Dark Current at 90 Volts	–	–	0.1	μamp
Sensitivity:				
At 8000 Angstroms	–	0.0135	–	μamp/μwatt
Luminous:▲				
At 0 Cycles	75	135	205	μamp/lumen
At 5000 Cycles	–	119	–	μamp/lumen
At 10000 Cycles	–	108	–	μamp/lumen
Gas Amplification Factor	–	–	10	

* On plane perpendicular to indicated direction of incident light.

° Averaged over any interval of 30 seconds maximum. Average current may be doubled when anode-supply voltage is limited to 70 volts.

▲ Measured under conditions specified on sheet "PHOTOTUBE SENSITIVITY and SENSITIVITY MEASUREMENTS", at the front of this Section.

← indicates a change.

World Radio History

921

921
GAS PHOTOTUBE

Minimum Circuit Values:

DC Load Resistance:

With anode-supply voltage of 70 volts or less:

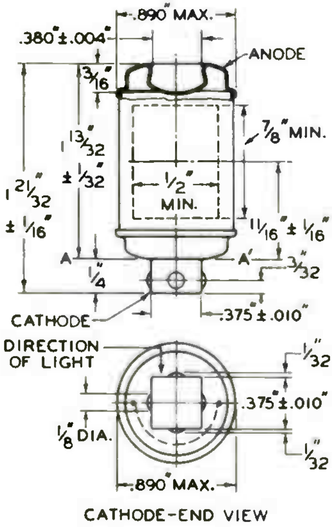
For dc currents	above 3 μamp	. . . 0.1 . . .	megohm
	below 3 μamp	. . . No Minimum	

With anode-supply voltage of 90 volts:

For dc currents	above 2 μamp	. . . 2.5 . . .	megohms
	below 2 μamp	. . . 0.1 . . .	megohm

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-1 Response
and
FREQUENCY-RESPONSE CHARACTERISTICS
of Gas Phototubes
are shown at the front of this Section

AVERAGE ANODE CHARACTERISTICS
of Type 921 are the same
as those shown under Type 930



92CM-4789R4

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

922

VACUUM PHOTOTUBE

CARTRIDGE TYPE WITH S-1 RESPONSE

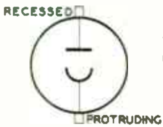
For relay applications

DATA

General:

Spectral Response S-1
Wavelength of Maximum Response. . . . . 8000 ± 1000 angstroms
Cathode:
  Shape . . . . Semicylindrical
  Minimum projected length* . . . . 5/8"
  Minimum projected width*. . . . . 1/2"
Direct Interelectrode Capacitance . . . . 1 $\mu\mu$f
Overall Length. . . . . 1-21/32" + 1/32" − 1/16"
Seated Length . . . . 1-13/32" ± 1/32"
Length from Center of Useful Cathode Area
  to Plane A-A' *(See Dimensional Outline)* . . 11/16" ± 1/16"
Maximum Diameter. . . . . 0.890"
Mounting Position . . . . Any
Weight (Approx.). . . . . 0.4 oz
Terminals:
  Recessed cap. .JETEC No.J1-23
  Protruding cap. . . . . .JETEC No.J1-24
Basing Designation. 2AQ

Recessed Cap } Anode



Protruding Cap } Cathode

DIRECTION OF LIGHT: INTO CONCAVE SIDE OF CATHODE

Maximum Ratings, *Absolute Values:*

ANODE-SUPPLY VOLTAGE (DC or Peak AC).	500 max.	volts
AVERAGE CATHODE-CURRENT DENSITY° . . .	30 max.	μamp/sq.in.
AVERAGE CATHODE CURRENT°.	5 max.	μamp
AMBIENT TEMPERATURE	100 max.	°C

Characteristics, *At 250 Volts on Anode:*

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at				
8000 angstroms. . .	–	0.0018	–	μamp/μwatt
Luminous▲	10	20	40	μamp/lumen
Anode Dark Current				
at 25°C	–	–	0.005	μamp

* On plane perpendicular to indicated direction of incident light.

° Averaged over any interval of 30 seconds maximum.

▲ For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A dc anode supply of 250 volts, a 1-megohm load resistor, and a light input of 0.1 lumen are used.

→ Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

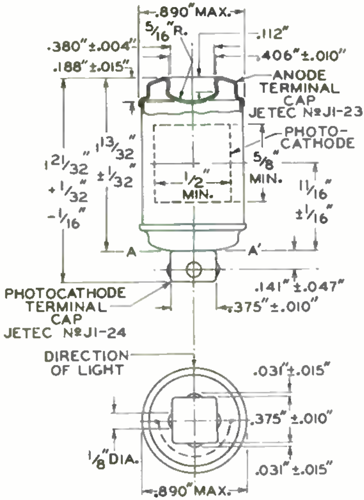
922

922

VACUUM PHOTOTUBE

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-1 Response
is shown at the front of this Section

AVERAGE ANODE CHARACTERISTICS
for Type 922 are the same as those shown for Type 917



A-A' = PLANE PERPENDICULAR TO AXIS OF TUBE

92CM-4818R5

923
GAS PHOTOTUBE

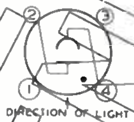
WITH S-1 RESPONSE

DATA

General:

Spectral Response S-1
Wavelength of Maximum Response. . . . . 8000 ± 1000 Angstroms
Cathode:
  Shape . . . . Semi-Cylindrical
  Minimum Projected Length* . . . . 13/16"
  Minimum Projected Width*. . . . . 5/8"
Direct Interelectrode Capacitance . . . . 2 μμf
Maximum Overall Length. . . . . 3-9/16"
Maximum Seated Length . . . . 2-15/16"
Seated Length to Center of Cathode. . . . . . 1-31/32" ± 3/32"
Maximum Diameter. . . . . 1-3/16"
Bulb. T-9
Mounting Position . . . . Any
Base. . . . . Small-Shell Small 4-Pin
  Basing Designation for BOTTOM VIEW. 2K

Pin 1 – No Connection
Pin 2 – Anode



Pin 3 – No Connection
Pin 4 – Cathode

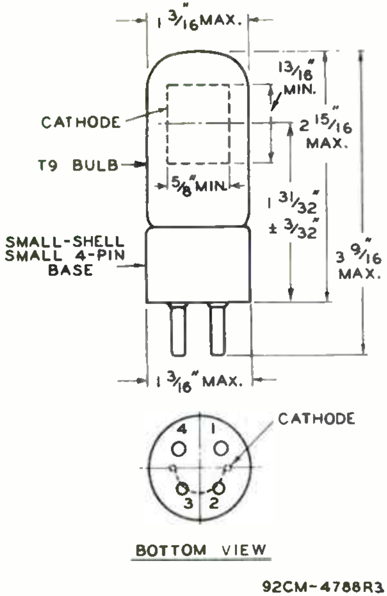
Maximum Ratings, Characteristics, and Curves for the 923 are the same as those shown for Type 930

* On plane perpendicular to indicated direction of incident light.

← Indicates a change.

RCA

923
GAS PHOTOTUBE



World Radio History

Vacuum Phototube

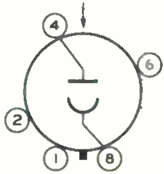
SIDE-ON TYPE HAVING S-1 RESPONSE

DATA

General:

Spectral Response	S-1
Wavelength of Maximum Response	8000 ± 1000 angstroms
Cathode:	
Shape	Semicylindrical
Minimum projected length[a]	13/16"
Minimum projected width[a]	5/8"
Direct Interelectrode Capacitance (Approx.)	1.6 $\mu\mu$f
Maximum Overall Length	2-5/8"
Maximum Seated Length	2-1/16"
Seated Length to Center of Cathode	1-13/32" ± 3/32" ←
Maximum Diameter	1-9/32"
Operating Position	Any
Weight (Approx.)	0.8 oz ←
Bulb	T9
Socket	Cinch No.8JM-1, or equivalent ←
Base	Intermediate-Shell Octal 5-Pin, Arrangement 1 (JEDEC Group 1, No.B5-10)
Basing Designation for BOTTOM VIEW	3J

DIRECTION OF RADIATION



Pin 1 – No Internal Connection
Pin 2 – No Internal Connection
Pin 4 – Anode
Pin 6 – No Internal Connection
Pin 8 – Photocathode

Maximum Ratings, ***Absolute-Maximum Values:*** ←

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	250 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[b]	30 max.	μa/sq.in.
AVERAGE CATHODE CURRENT[b]	5 max.	μa
AMBIENT TEMPERATURE	100 max.	°C

Characteristics: ←

With an anode-supply voltage of 250 volts

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 8000 angstroms	–	0.0019	–	amp/watt
Luminous[c]	12	20	40	μa/lumen
Anode Dark Current at 25° C.	–	–	0.0125	μa

← Indicates a change.

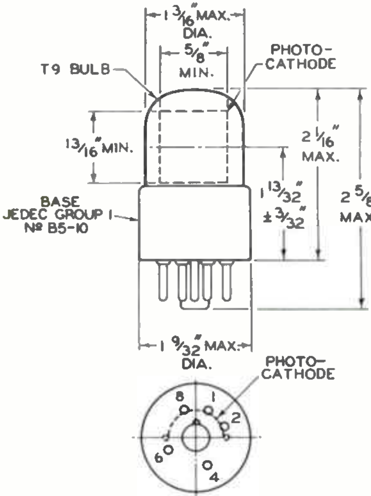
World Radio History

[a] On plane perpendicular to indicated direction of radiation.

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

[c] For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A 1-megohm load resistor and a light input of 0.1 lumen are used.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-1 RESPONSE
is shown at the front of this section



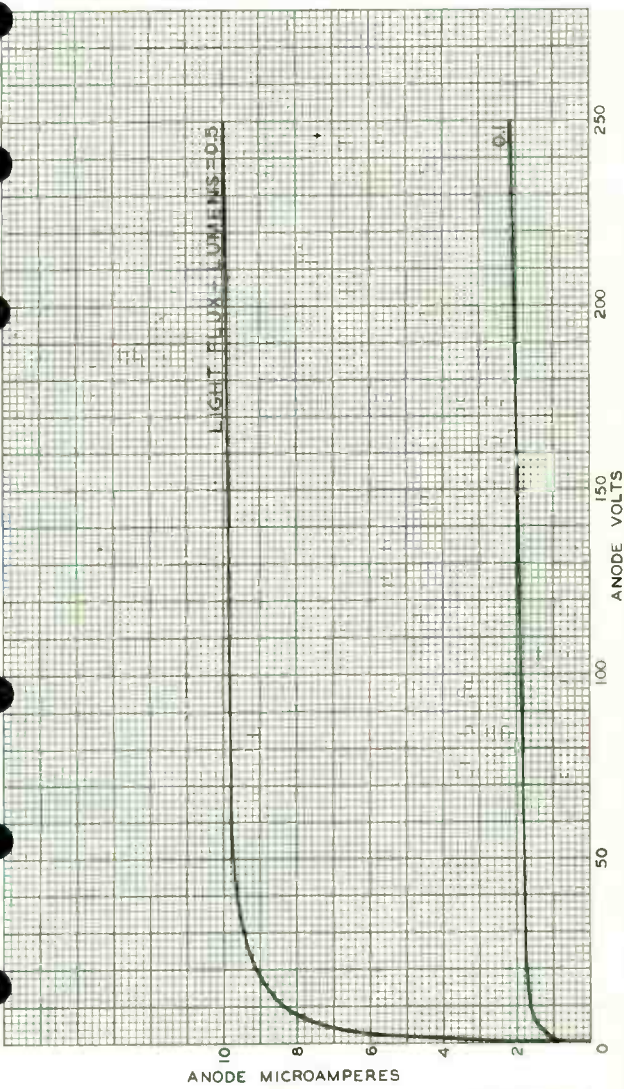
92CM-6054R3

World Radio History

925

925

AVERAGE ANODE CHARACTERISTICS



JULY 31, 1947

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6208R1

World Radio History

World Radio History

RCA

926

VACUUM PHOTOTUBE

CARTRIDGE TYPE WITH S-3 RESPONSE

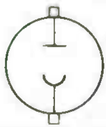
For colorimetric applications

DATA

General:

Spectral Response	S-3
Wavelength of Maximum Response	4200 ± 1000 angstroms
Cathode:	
Shape	Semicylindrical
Minimum projected length*	7/8"
Minimum projected width*	1/2"
Direct Interelectrode Capacitance	1 $\mu\mu$f
Overall Length	1-21/32" ± 1/16"
Seated Length	1-13/32" ± 1/32"
Length from Center of Useful Cathode Area to Plane A-A' *(See Dimensional Outline)*	11/16" ± 1/16"
Maximum Diameter	0.890"
Weight (Approx.)	0.4 oz
Mounting Position	Any
Terminals:	
Recessed cap	JETEC No.J1-23
Protruding cap	JETEC No.J1-24
Basing Designation	2AQ

Recessed Cap } Anode



Protruding Cap } Cathode

DIRECTION OF LIGHT: INTO CONCAVE SIDE OF CATHODE

Maximum Ratings, *Absolute Values:*

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	500 max.	volts
AVERAGE CATHODE-CURRENT DENSITY°	30 max.	μamp/sq.in.
AVERAGE CATHODE CURRENT°	5 max.	μamp
AMBIENT TEMPERATURE	100 max.	°C

Characteristics, *At 250 Volts on Anode:*

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4200 angstroms	-	0.0018	-	μamp/μwatt
Luminous▲	4	6.5	15	μamp/lumen
Anode Dark Current at 25°C	-	-	0.005	μamp

* On plane perpendicular to indicated direction of incident light.

° Averaged over any interval of 30 seconds maximum.

▲ For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A dc anode supply of 250 volts, a 1-megohm load resistor, and a light input of 0.1 lumen are used.

← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

926

RCA

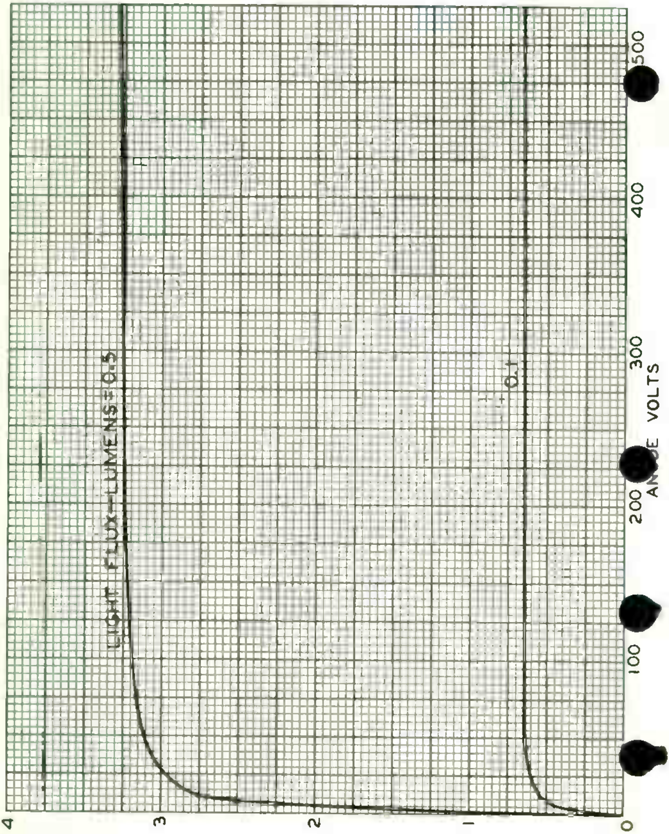
926

VACUUM PHOTOTUBE

DIMENSIONAL OUTLINE
for Type 926 is the same as that shown for Type 921

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-3 Response
is shown at the front of this Section

AVERAGE ANODE CHARACTERISTICS



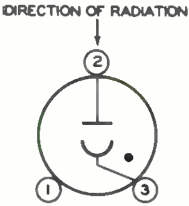
Gas Phototube

SIDE-ON TYPE HAVING S-1 RESPONSE

DATA

General:

Spectral Response S-1
Wavelength of Maximum Response. . . . . 8000 ± 1000 angstroms
Cathode:
  Shape . . . . Semicylindrical
  Minimum projected length[a] . . . . 11/16"
  Minimum projected width[a]. . . . . 7/16"
Direct Interelectrode Capacitance (Approx.) . . . . . . 2 μμf
Maximum Overall Length. . . . . 2-13/32"
Maximum Seated Length . . . . 1-15/16"
Seated Length to Center of Cathode. . . . . . 1-1/4" ± 3/32"
Maximum Diameter. . . . . 0.669"
Operating Position. . . . . Any
Weight (Approx.). . . . . 0.3 oz ←
Bulb. T5-1/4
Socket. . . . . .Amphenol No.78S3S-T, or equivalent ←
Base. . . . . .Small-Shell Peewee 3-Pin (JEDEC No.A3-1)
  Basing Designation for BOTTOM VIEW. 2F



Pin 1 - No Internal Connection
Pin 2 - Anode
Pin 3 - Photocathode

Maximum Ratings, ***Absolute-Maximum Values:*** ←

	Rating I	*Rating II*	
ANODE-SUPPLY VOLTAGE (DC or Peak AC)	70 max.	90 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[b].	60 max.	30 max.	μa/sq.in.
AVERAGE CATHODE CURRENT[b]. . .	4 max.	2 max.	μa
AMBIENT TEMPERATURE	100 max.	100 max.	°C

Characteristics: ←

With an anode-supply voltage of 90 volts unless otherwise specified

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 8000 angstroms	–	0.012	–	amp/watt

← indicates a change.

World Radio History

	Min.	Median	Max.	
Luminous:[c]				
At 0 cps.	75	125	185	μa/lumen
At 5000 cps	–	110	–	μa/lumen
At 10000 cps.	–	100	–	μa/lumen
Gas Amplification Factor[d] . .	–	–	10	
Anode Dark Current at 25° C .	–	–	0.1	μa

Minimum Circuit Values:

With an anode-supply voltage of	*70 or less*	*90*	*volts*
DC Load Resistance:			
For dc currents above 2 μa.	0.1 min.	–	megohm
For dc currents below 2 μa.	0 min.	–	megohm
For dc currents above 1 μa.	–	2.5 min.	megohms
For dc currents below 1 μa.	–	0.1 min.	megohm

[a] On plane perpendicular to indicated direction of radiation.

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

[c] For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A dc anode supply of 90 volts and a 1-megohm load resistor are used. For the 0-cycle measurement, a light input of 0.1 lumen is used. For the 5000- and 10000-cycle measurements, the light input is varied sinusoidally about a mean value of 0.015 lumen from zero to a maximum of twice the mean value.

[d] The ratio of luminous sensitivity at an anode-supply voltage of 90 volts to luminous sensitivity at an anode-supply voltage of 25 volts. In each case, sensitivity is obtained under conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K, the light input is 0.1 lumen, and the load resistor has a value of 1 megohm.

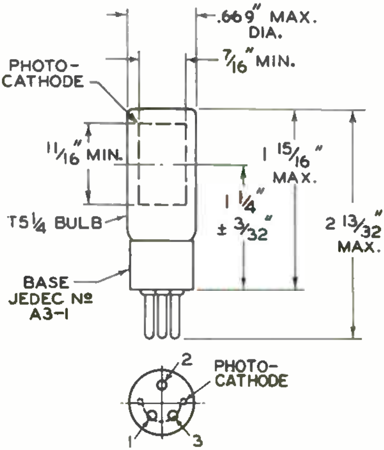
**SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOSENSITIVE DEVICE HAVING S-1 RESPONSE**

and

**FREQUENCY-RESPONSE CHARACTERISTICS
OF GAS PHOTOTUBES**

are shown at the front of this section

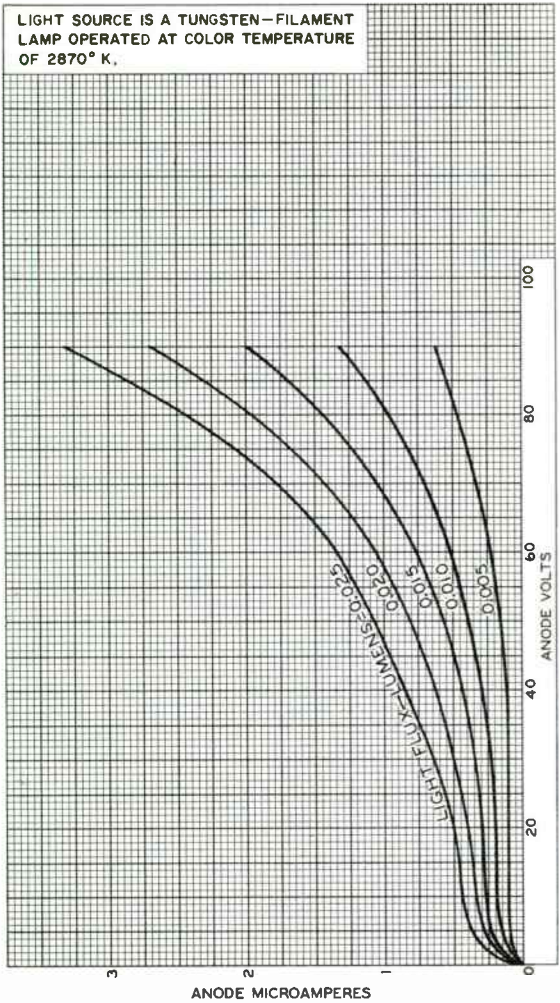
World Radio History



92CM-6053R5

World Radio History

AVERAGE ANODE CHARACTERISTICS



92CM-6258R3

World Radio History

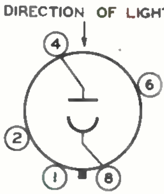
Vacuum Phototube

SIDE-ON TYPE HAVING S-4 RESPONSE

DATA

General:

Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 angstroms
Cathode:	
Shape	Semicylindrical
Minimum projected length[a]	13/16"
Minimum projected width[a]	5/8"
Direct Interelectrode Capacitance (Approx.)	2.6 μμf
Maximum Overall Length	3-1/16"
Maximum Seated Length	2-1/2"
Seated Length to Center of Cathode	1-5/8" ± 3/32"
Maximum Diameter	1-9/32"
Operating Position	Any
Weight (Approx.)	0.9 oz ←
Bulb	T9
Socket	Cinch No.8 JM-1, or equivalent ←
Base	Intermediate-Shell Octal 5-Pin, Arrangement 1 (JEDEC Group 1, No.B5-10) ←
Basing Designation for BOTTOM VIEW	3J



Pin 1 - No Internal Connection
Pin 2 - No Internal Connection
Pin 4 - Anode
Pin 6 - No Internal Connection
Pin 8 - Cathode

Maximum Ratings, ***Absolute-Maximum Values:*** ←

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	250 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[b]	25 max.	μa/sq.in.
AVERAGE CATHODE CURRENT[b]	5 max.	μa
AMBIENT TEMPERATURE	75 max.	°C

Characteristics: ←

With an anode-supply voltage of 250 volts

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4000 angstroms	-	0.044	-	amp/watt
Luminous[c]	25	45	70	μa/lumen
Anode Dark Current at 25° C.	-	-	0.0125	μa

← Indicates a change.

World Radio History

[a] On plane perpendicular to indicated direction of radiation.

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

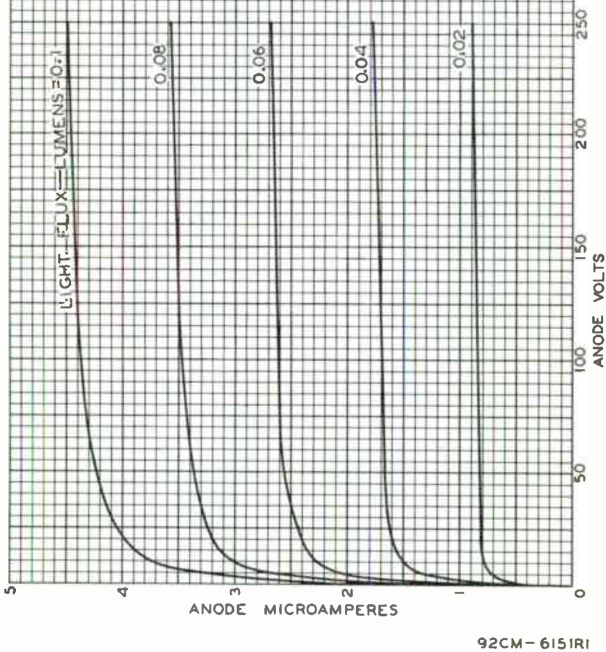
[c] For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A 1-megohm load resistor and a light input of 0.1 lumen are used.

SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOSENSITIVE DEVICE HAVING S-4 RESPONSE
is shown at the front of this section

DIMENSIONAL OUTLINE
shown under Type 5581 also applies to the 929

World Radio History

AVERAGE ANODE CHARACTERISTICS



World Radio History

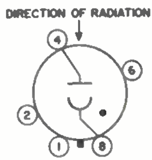
Gas Phototube

SIDE-ON TYPE HAVING S-1 RESPONSE

DATA

General:

Spectral Response S-1
Wavelength of Maximum Response. . . . . 8000 ± 1000 angstroms
Cathode:
  Shape . . . . Semicylindrical
  Minimum projected length[a] . . . . 13/16"
  Minimum projected width[a]. . . . . 5/8"
Direct Interelectrode Capacitance (Approx.) . . . . . . 2.4 μμf
Maximum Overall Length. . . . . 3-1/16"
Maximum Seated Length . . . . 2-1/2"
Seated Length to Center of Cathode. . . . . . . 1-5/8" ± 3/32"
Maximum Diameter. 1-9/32"
Operating Position. Any
Weight (Approx.). . . . . 0.9 oz
Bulb. T9
Socket. . . . . Cinch No.8JM-1, or equivalent ←
Base. . . . . .Intermediate-Shell Octal 5-Pin Arrangement 1, (JEDEC No.B5-10)
  Basing Designation for BOTTOM VIEW. 3J



Pin 1 - No Connection
Pin 2 - No Connection
Pin 4 - Anode
Pin 6 - No Connection
Pin 8 - Photocathode

Maximum Ratings, *Absolute-Maximum Values:*

	Rating I	*Rating II*	
ANODE-SUPPLY VOLTAGE (DC or Peak AC)	70 max.	90 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[b].	60 max.	30 max.	μa/sq. in.
AVERAGE CATHODE CURRENT[b]. .	6 max.	3 max.	μa
AMBIENT TEMPERATURE	100 max.	100 max.	°C

Characteristics:

With an anode-supply voltage of 90 volts unless otherwise specified

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 8000 angstroms	–	0.013	–	amp/watt ←

← Indicates a change.

World Radio History

	Min.	Median	Max.	
Luminous:[c]				
At 0 cps.	90	135	205	μa/lumen
At 5000 cps	–	111	–	μa/lumen
At 10000 cps.	–	101	–	μa/lumen
Gas Amplification Factor[d] . . .	–	–	10	
Anode Dark Current at 25° C . .	–	–	0.1	μa

Minimum Circuit Values:

With an anode-supply voltage of	*70 or less*	*90*	*volts*
DC Load Resistance:			
For dc currents above 3 μa. .	0.1 min.	–	megohm
For dc currents below 3 μa. .	0 min.	–	megohms
For dc currents above 2 μa. .	–	2.5 min.	megohms
For dc currents below 2 μa. .	–	1 min.	megohm

[a] On plane perpendicular to indicated direction of incident radiation.

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

[c] For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A dc anode supply voltage of 90 volts and a 1-megohm load resistor are used. For the 0-cycle measurement, a light input of 0.1 lumen is used. For the 5000- and 10,000-cycle measurements, the light input is varied sinusoidally about a mean value of 0.015 lumen from zero to a maximum of twice the mean value.

[d] The ratio of luminous sensitivity at an anode supply voltage of 90 volts to luminous sensitivity at an anode supply voltage of 25 volts. In each case, sensitivity is obtained under conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K, the light input is 0.1 lumen, and the load resistor has a value of 1 megohm.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-1 RESPONSE

and

FREQUENCY-RESPONSE CHARACTERISTICS OF GAS PHOTOTUBES

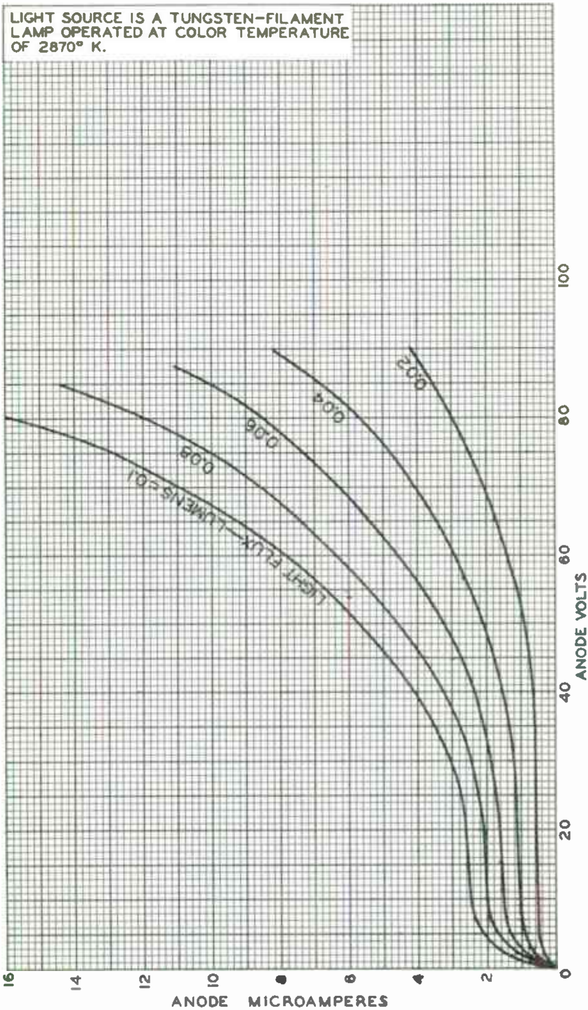
are shown at the front of this section

DIMENSIONAL OUTLINE

shown under Type 5581 also applies to the 930

World Radio History

AVERAGE ANODE CHARACTERISTICS



92CM-4806R2

World Radio History

World Radio History

Multiplier Phototube

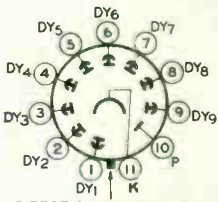
9-STAGE, SIDE-ON TYPE **S-4 RESPONSE**

For General Use in Applications Having Low Light Levels Such as Light-Operated Relays, X-Ray Exposure Control, and Facsimile Transmission

General:

Spectral Response	S-4
Wavelength of Maximum Response	4000 ±500 angstroms
Cathode, Opaque	Cesium-Antimony
Minimum projected length[a]	15/16"
Minimum projected width[a]	5/16"
Window	Lime Glass[b]
Dynode Material	Cesium-Antimony
Direct Interelectrode Capacitances (Approx.):	
Anode to dynode No.9	[illegible].4 pf
Anode to all other electrodes	6.0 pf
Maximum Overall Length	3-11/16"
Maximum Seated Length	3-1/8"
Length from Base Seat to Center of Useful Cathode Area	1-15/16" ±3/32"
Maximum Diameter	1-5/16"
Operating Position	Any
Weight (Approx.)	1.6 oz
Bulb	T9
Socket	Amphenol[c] No.78S11T, or equivalent
Magnetic Shield	Perfection Mica Co.[d], No.P-101-4, or equivalent
Base	Small-Shell Submagnal 11-Pin, (JEDEC Group 2, No.B11-88), Non-hygroscopic
Basing Designation for BOTTOM VIEW	11K

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 - Photocathode



DIRECTION OF INCIDENT RADIATION

Maximum Ratings, ***Absolute-Maximum Values:***

Supply Voltage Between Anode and Cathode (DC or Peak AC)	1250 max.	volts
Supply Voltage Between Dynode No.9 and Anode (DC or Peak AC)	250 max.	volts
Supply Voltage Between Consecutive Dynodes (DC or Peak AC)	250 max.	volts

← Indicates a change.

World Radio History

Supply Voltage Between Dynode No.1 and Cathode (DC or Peak AC)	250 max.	volts
Average Anode Current[e]	1 max.	ma
Ambient Temperature.	75 max.	°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.	–	2.4×10^{4}	–	a/w
Cathode radiant, at 4000 angstroms	–	0.03	–	a/w
Luminous:				
At 0 cps[f].	4.5	24	300	a/lm
Cathode luminous[g]. . . .	–	3×10^{-5}	–	a/lm
Current Amplification. . .	–	8×10^{5}	–	
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 20 a/lm[h,j]	–	–	2.5×10^{-9}	lm
Equivalent Noise Input[k]. .	–	9.5×10^{-13}	–	lm

With E = 750 volts (Except as noted)

	Min.	*Typ.*	*Max.*	
Sensitivity:				
Radiant, at 4000 angstroms.	–	3.3×10^{3}	–	a/w
Cathode radiant, at 4000 angstroms	–	0.03	–	a/w
Luminous:				
At 0 cps[f].	–	3.3	–	a/lm
Cathode luminous[g]. . . .	–	3×10^{-5}	–	a/lm
Current Amplification. . .	–	1.1×10^{5}	–	a/lm

[a] On plane perpendicular to the indicated direction of incident light and passing through the major axis of the tube.

[b] Corning No.0080, Corning Glass Works, Corning, New York, or equivalent.

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

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

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

[f] 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.

[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 100 volts are applied between cathode and all other electrodes connected as anode.

→ Indicates a change.

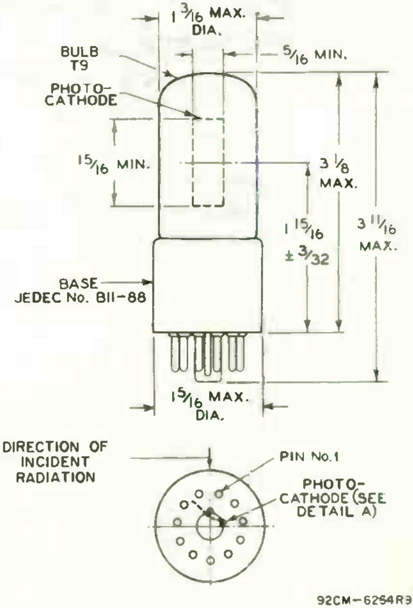
World Radio History

h At a tube temperature of 25° C. Dark current may be reduced by use of a refrigerant.

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

k 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.

SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOSENSITIVE DEVICE HAVING S-4 RESPONSE
is shown at the front of this Section

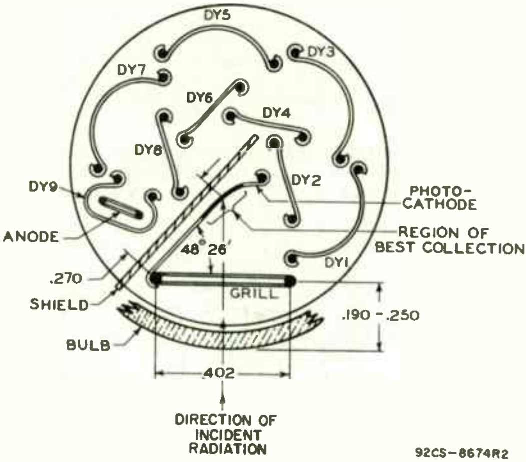


DIMENSIONS IN INCHES

CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE.

World Radio History

DETAIL A

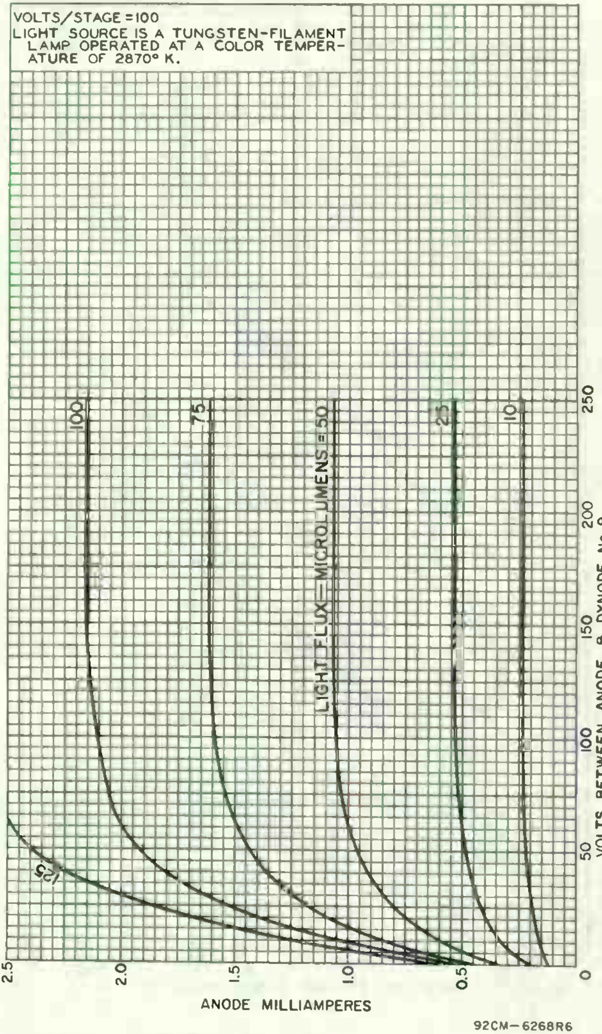


92CS-8674R2

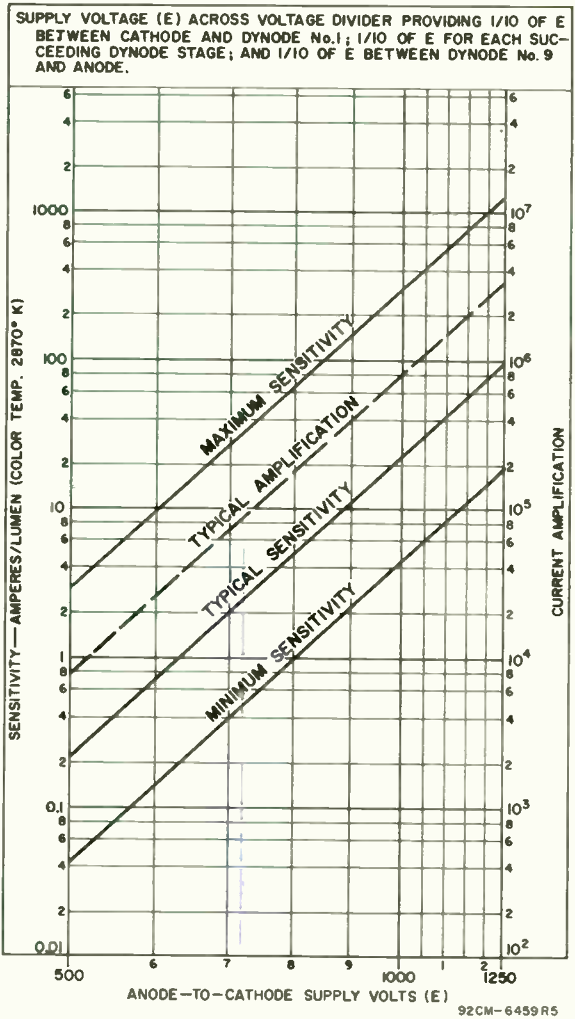
DIMENSIONS IN INCHES

World Radio History

TYPICAL ANODE CHARACTERISTICS

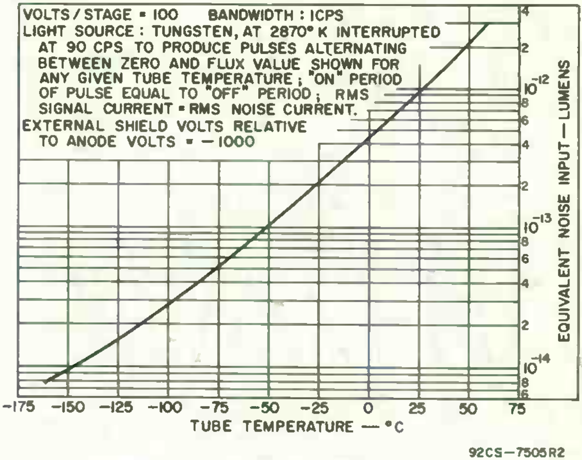


SENSITIVITY AND CURRENT AMPLIFICATION CHARACTERISTICS

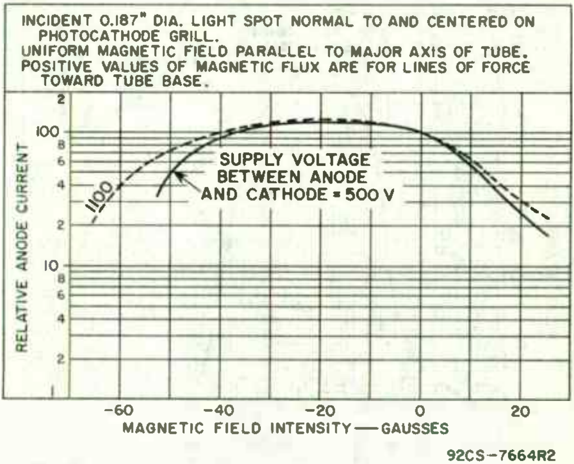


World Radio History

EQUIVALENT-NOISE-INPUT CHARACTERISTIC

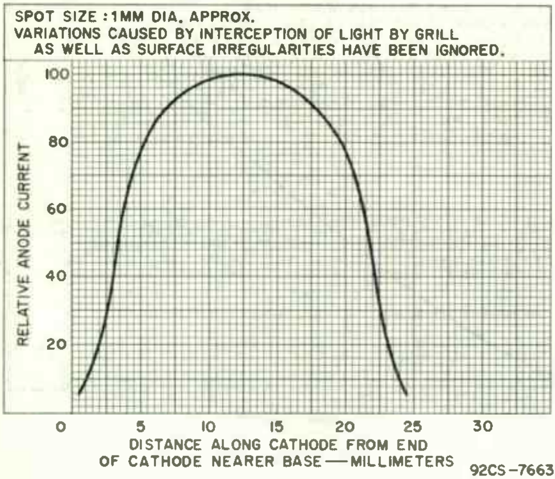


TYPICAL EFFECT OF MAGNETIC FIELD ON ANODE CURRENT

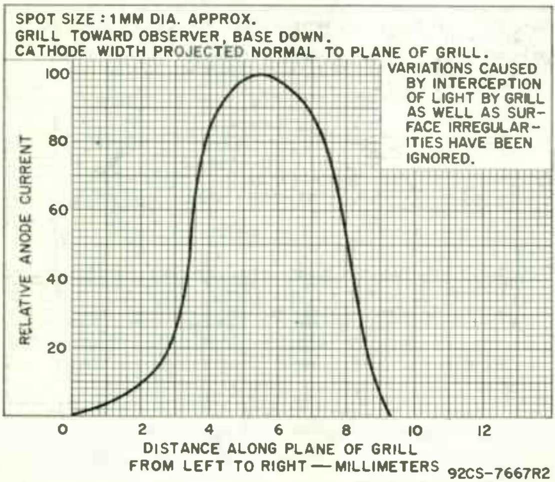


World Radio History

PHOTOCATHODE SENSITIVITY VARIATION ALONG ITS LENGTH



PHOTOCATHODE SENSITIVITY VARIATION ACROSS ITS PROJECTED WIDTH IN PLANE OF GRILL



World Radio History

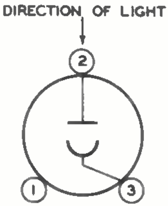
Vacuum Phototube

SIDE-ON TYPE HAVING S-4 RESPONSE

DATA

General:

Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 angstroms
Cathode:	
Shape	Semicylindrical
Minimum projected length[a]	11/16"
Minimum projected width[a]	7/16"
Direct Interelectrode Capacitance (Approx.)	1.5 μμf
Maximum Overall Length	2-13/32"
Maximum Seated Length	1-15/16"
Seated Length to Center of Cathode	1-1/4" ± 3/32"
Maximum Diameter	0.669"
Operating Position	Any
Weight (Approx.)	0.4 oz ←
Bulb	T5-1/4
Socket	Amphenol No.78S3S-T, or equivalent ←
Base	Small-Shell Peewee 3-Pin (JEDEC No.A3-1)
Basing Designation for BOTTOM VIEW	2F



Pin 1 - No Internal Connection

Pin 2 - Anode

Pin 3 - Photocathode

Maximum Ratings, ***Absolute-Maximum Values:*** ←

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	250 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[b]	30 max.	μa/sq. in.
AVERAGE CATHODE CURRENT[b]	4 max.	μa
AMBIENT TEMPERATURE	75 max.	°C

Characteristics: ←

With an anode-supply voltage of 250 volts

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4000 angstroms	-	0.029	-	amp/watt
Luminous[c]	19	30	75	μa/lumen
Anode Dark Current at 25° C	-	-	0.005	μa

← Indicates a change.

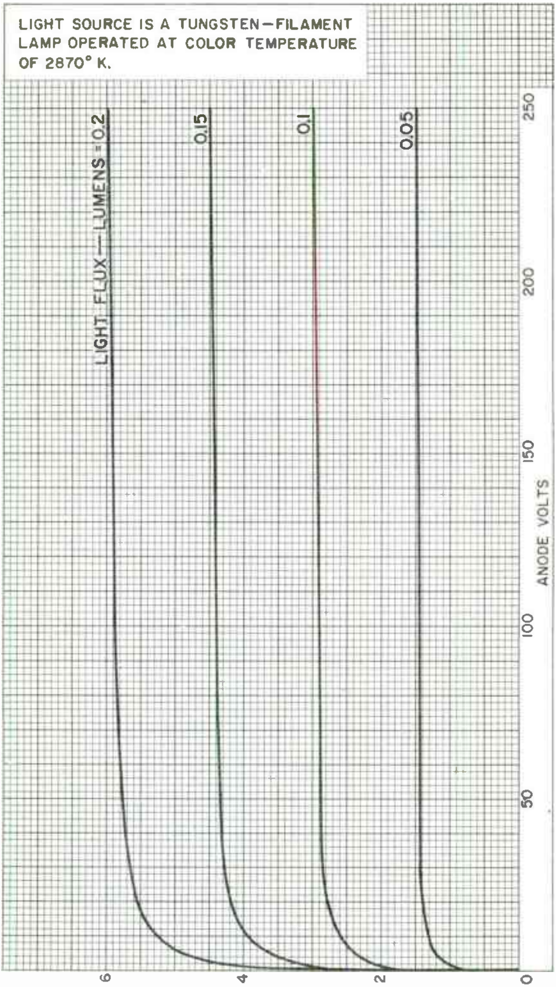
[a] On plane perpendicular to indicated direction of incident light.
[b] Averaged over any interval of 30 seconds maximum.
[c] For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A 1-megohm load resistor and a light input of 0.1 lumen are used.

SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOSENSITIVE DEVICE HAVING S-4 RESPONSE
is shown at the front of this section

DIMENSIONAL OUTLINE
shown under Type 927 also applies to the 934

World Radio History

AVERAGE ANODE CHARACTERISTICS



92CM—6479R1

World Radio History

World Radio History

Vacuum Phototube

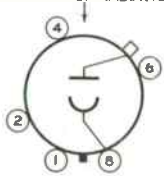
SIDE-ON TYPE HAVING S-5 RESPONSE

DATA

General:

Spectral Response	S-5
Wavelength of Maximum Response	3400 ± 500 angstroms
Cathode:	
Shape	Semicylindrical
Minimum projected length[a]	1-5/16"
Minimum projected width[a]	5/8"
Direct Interelectrode Capacitance (Approx.)	0.6 μμf
Maximum Overall Length	4-1/4"
Seated Length	3-9/16" ± 1/8"
Seated Length to Center of Cathode	2" ± 1/16"
Maximum Diameter	1-9/32"
Operating Position	Any
Weight (Approx.)	1 oz ←
Bulb	T9
Cap	Skirted Miniature (JEDEC No.C1-3) ←
Socket	Cinch No.8JM-1, or equivalent ←
Base	Intermediate-Shell Octal 5-Pin, Arrangement 1 (JEDEC Group 1, No.B5-10) ←
Basing Designation for BOTTOM VIEW	1C

DIRECTION OF RADIATION



Pin 1 – No Internal Connection
Pin 2 – No Internal Connection
Pin 4 – No Internal Connection
Pin 6 – No Internal Connection
Pin 8 – Photocathode
Cap – Anode

Maximum Ratings, ***Absolute-Maximum Values:*** ←

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	250 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[b]	30 max.	μa/sq.in.
AVERAGE CATHODE CURRENT[b]	10 max.	μa
AMBIENT TEMPERATURE	75 max.	°C

Characteristics: ←

With an anode-supply voltage of 250 volts

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 3400 angstroms	–	0.043	–	amp/watt
Luminous[c]	18	35	70	μa/lumen
Anode Dark Current at 25° C.	–	–	0.0005	μa

← Indicates a change.

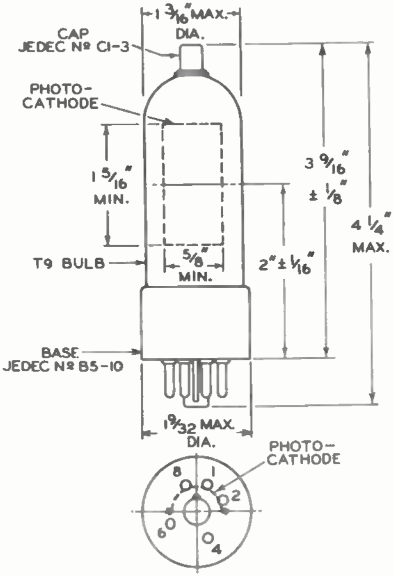
World Radio History

[a] On plane perpendicular to indicated direction of radiation.

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

[c] For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A 1-megohm load resistor and a light input of 0.1 lumen are used.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-5 RESPONSE is shown at the front of this section



92CM-6411R5

RCA

1850-A

ICONOSCOPE

FOR PICKUP FROM MOTION-PICTURE FILM OR SLIDES

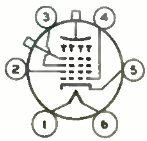
DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3 ± 10%	ac or dc volts
Current	0.6	amp
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to All Other Electrodes	6.5	μμf
Signal Electrode to Grid No.4°	10	μμf
Mosaic, Photosensitive:		
Response		See Curve
Useful Size of Rectangular Image (4 x 3 Aspect Ratio)		5.75" max. diagonal ←
Focusing Method		Electrostatic
Deflection Method		Magnetic
Deflection Angle (Approx.)		55° ←
Max. Width of Mounted Tube		8-1/8"
Height of Mounted Tube		10-3/16" ± 3/4"
Depth of Mounted Tube		12-13/16" ± 3/4"
Mounting Position		Mosaic in vertical plane
Minimum Deflecting-Coil Inside Diameter		1-1/2" ←
Maximum Deflecting-Coil Length		2-1/4" ←
Caps (Two)		Medium (JETEC No.C1-5)
Base		Long Medium-Shell Small 6-Pin

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.2
Pin 3 - Grid No.3
Pin 4 - Grid No.1
Pin 5 - Cathode
Pin 6 - Heater



DIRECTION OF LIGHT IS NORMAL TO MOSAIC

Caps { See Outline Drawing
S_J - Signal Electrode
G_4 - Grid No.4 (Collector)

Maximum Ratings, *Absolute Values*:

AVERAGE MOSAIC ILLUMINATION•	50 max.	ft-c ←
OPERATING TEMPERATURE OF BULB AT LARGE END OF TUBE	40 max.	°C ←
SIGNAL-ELECTRODE VOLTAGE	1200 max.	volts
GRID-No.4 (COLLECTOR) VOLTAGE	1200 max.	volts
GRID-No.3 VOLTAGE	450 max.	volts
GRID-No.2 VOLTAGE	1200 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	125 max.	volts
Positive bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts
GRID-No.4 CURRENT	0.5 max.	μamp

° With external shield.

• Averaged over any interval of 1 sec. max.

← Indicates a change.

RCA

1850-A

ICONOSCOPE

Typical Operation and Characteristics:

Signal-Electrode Voltage	1000	volts
Grid-No.4 Voltage.	1000	volts
Grid-No.3 Voltage (Beam Focus)— 24% to 36% of Grid-No.4 Voltage. . . .	240 to 360	volts
Grid-No.2 Voltage.	1000	volts
→ Max. Grid-No.1 Voltage for Pattern Cutoff— 7% of Grid-No.4 Voltage . . .	-70	volts
→ Grid-No.4 Current (With no illumination on mosaic)*. . .	0.1 to 0.2	μamp
External Load Resistance	0.1	megohm
→ Illumination on Mosaic:		
Steady Highlight Value for Slides. . .	4 to 6	ft-c
Average Pulsed Highlight Value for Motion-Picture Film.	10 to 20	ft-c
→ Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current (Approx.). .	100	
→ Minimum Peak-to-Peak Blanking Voltage. .	20	volts
→ Deflecting-Coil Current (Approx.):**		
Horizontal (Peak to peak).	600	ma
Vertical (Peak to peak).	140	ma

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.0 max.	megohm

* Allowance should be made for leakage currents.

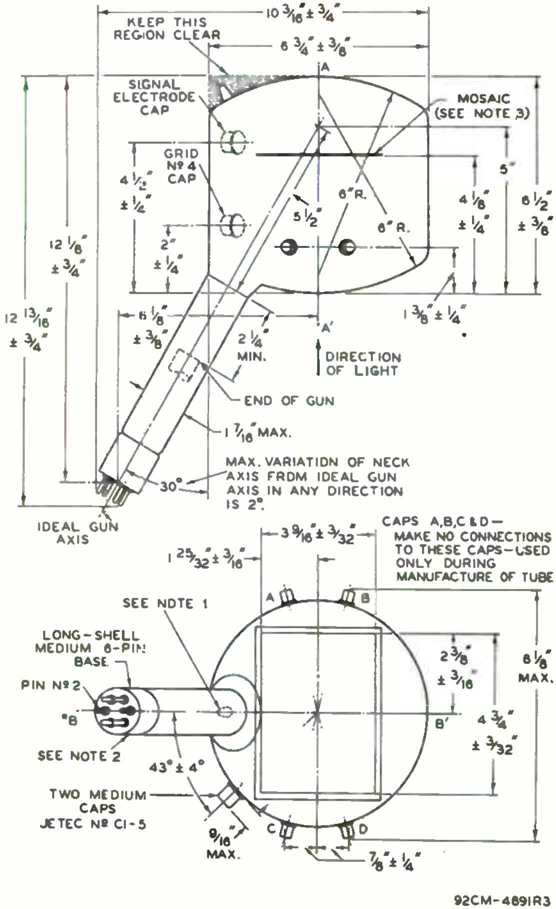
** For RCA Deflecting Yoke No. 201076.

→ Indicates a change.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

1850-A
ICONOSCOPE



* BB' IS THE PLANE THROUGH THE BULB AXIS AA' AND THE IDEAL GUN AXIS.

← Indicates a change.

World Radio History

1850-A

1850-A

ICONOSCOPE

NOTE 1: VARIATION OF TIP CENTER FROM PLANE BB' IS 1/2".

NOTE 2: MAXIMUM ROTATION OF LINE THROUGH PINS 2 AND 5 ABOUT IDEAL GUN AXIS IS ± 10°, MEASURED FROM PLANE BB'.

NOTE 3: DEVIATION OF PLANE OF MOSAIC FROM PLANE PERPENDICULAR TO THE BULB AXIS AA' IS 2.5° MAX. ROTATION OF MOSAIC ABOUT THE BULB AXIS AA' WITH RESPECT TO A LINE OF INTERSECTION FORMED BY MOSAIC PLANE AND PLANE BB' IS 2.5° MAX.

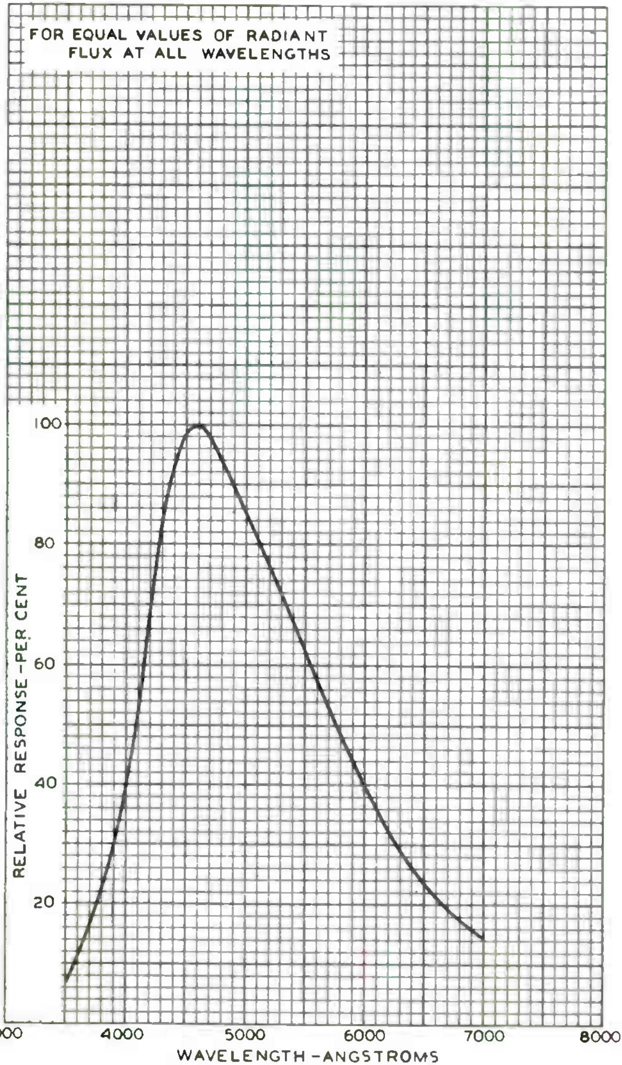
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

1850-A

SPECTRAL SENSITIVITY CHARACTERISTIC



JUNE 18, 1951

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

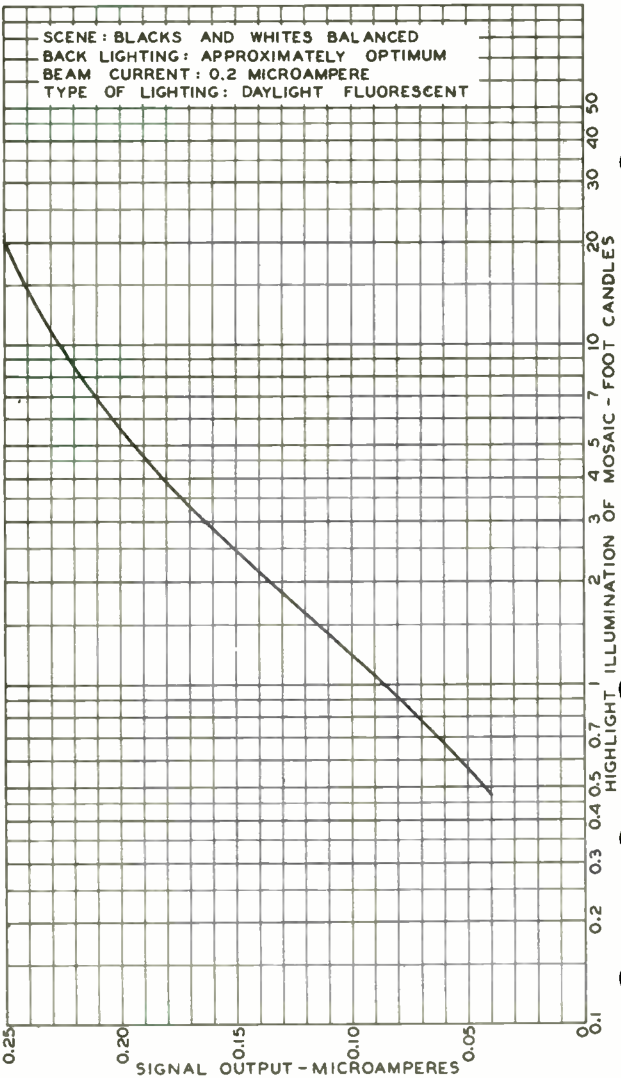
92CM-6404R1

World Radio History

RCA

1850-A

TYPICAL SIGNAL-OUTPUT CHARACTERISTIC



JAN. 2, 1951

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6581R1

World Radio History

Multiplier Phototube

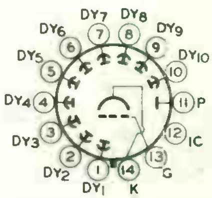
10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE HAVING S-11 RESPONSE

1.5" Minimum Diameter Flat Photocathode With High-Conductivity Grating. For Use as a Scintillation Radiation Detector. Especially Useful in Measuring Transients of Short Duration Involving High Peak Photocathode Currents.

General:

Spectral Response	S-11
Wavelength of Maximum Response	4400 ± 500 angstroms
Cathode, Semitransparent	Cesium-Antimony with High-Conductivity Grating
Shape	Flat, Circular
Minimum area including grating	1.8 sq. in.
Minimum diameter	1.5 in.
Window	Lime Glass[a]
Index of refraction	1.51
Dynode Material	Copper-Beryllium
Direct Interelectrode Capacitances (Approx.):	
Anode to dynode No.10	4.4 pf
Anode to all other electrodes	7.0 pf
Maximum Overall Length	5-13/16"
Seated Length	4-7/8" ± 3/16"
Maximum Diameter	2-5/16"
Operating Position	Any
Weight (Approx.)	5.2 oz
Bulb	T16
Socket	Eby[b] No.9709-7, or equivalent
Magnetic Shield	Perfection Mica Co.,[c] No.P-100-2, 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:*

Supply Voltage between Anode and Cathode (DC or Peak AC)	1500 max.	volts

← Indicates a change.

World Radio History

Supply Voltage between Dynode No.10 and Anode (DC or Peak AC)	250	max.	volts
Supply Voltage between Dynode No.1 and Cathode (DC or Peak AC)	400	max.	volts
Supply Voltage between Focusing Electrode and Cathode (DC or Peak AC)	400	max.	volts
Average Anode Current[d]	2	max.	ma
Cathode Irradiation	0.1[e]	max.	lm
Ambient Temperature	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 = 1500 volts (Except as noted)

	Min.	*Typ.*	*Max.*	
Sensitivity:				
Radiant at 4400 angstroms	-	2.2×10^4	-	a/w
Cathode radiant, at 4400 angstroms	-	0.04	-	a/w
Luminous:				
At 0 cps[f]	-	28	-	a/lm
With dynode No.10 as output electrode[g]	-	17	-	a/lm
Cathode luminous:				
With tungsten light source[h]	3×10^{-5}	5×10^{-5}	-	a/lm
With blue light source[j]	3×10^{-8}	-	-	a
Current Amplification	-	5.6×10^5	-	

With E = 1250 volts (Except as noted)

	Min.	*Typ.*	*Max.*	
Sensitivity:				
Radiant at 4400 angstroms	-	4.8×10^3	-	a/w
Cathode radiant, at 4400 angstroms	-	0.04	-	a/w
Luminous:				
At 0 cps[f]	2.5	6	75	a/lm
With dynode No.10 as output electrode[g]	-	3.6	-	a/lm
Cathode luminous:				
With tungsten light source[h]	3×10^{-5}	5×10^{-5}	-	a/lm
With blue light source[j]	3×10^{-8}	-	-	a

→ Indicates a change.

World Radio History

	Min.	Typ.	Max.	
Current Amplification.	-	1.2×10^{5}	-	
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 20 a/lm[k,m]	-	2.5×10^{-10}	2.25×10^{-9}	lm
Equivalent Noise Input[n]. . . .	-	7×10^{-12}	1.7×10^{-11}	lm

[a] Corning No.0080 made by Corning Glass Works, Corning, New York, or equivalent.

[b] Made by Hugh H. Eby Company, #701 Germantown Avenue, Philadelphia #4, Pennsylvania.

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

[d] Averaged over any interval of 30 seconds maximum. For best stability, the average anode current value should not exceed 250 microamperes.

[e] Above this value of cathode illumination, serious loss in linearity between light input and anode current will be caused by the resistivity of the cathode. For continuous light input of 0.1 lumen from tungsten light source at 2870° K incident on cathode area having diameter of 1-1/4" ± 1/8", and with dynode-No.1 voltage of 200 volts, the loss in linearity will not exceed 30 per cent depending on the magnitude of the cathode current. At 0.1 lumen, the corresponding continuous cathode current is approximately 5 microamperes, regardless of the spectral distribution of the exciting illumination.

[f] 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.

[g] 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 curves shown in *Typical Anode Characteristics* do not apply when dynode No.10 is used as the output electrode.

[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 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected as anode.

[j] 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.

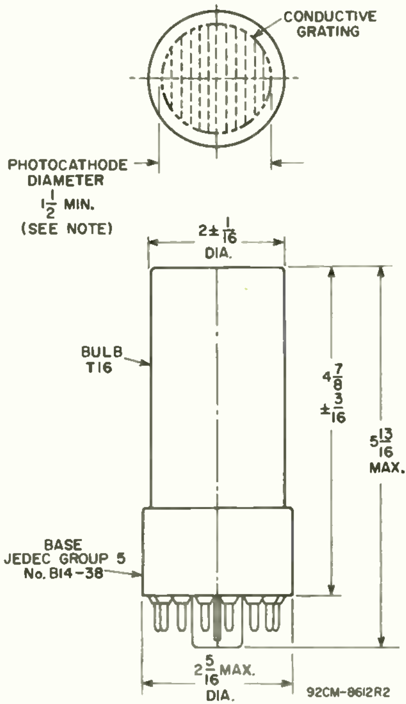
[k] At a tube temperature of 25° C. Dark current may be reduced by use of a refrigerant.

[m] For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1250 volts is recommended.

[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.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-11 RESPONSE
is shown at front of this Section

World Radio History



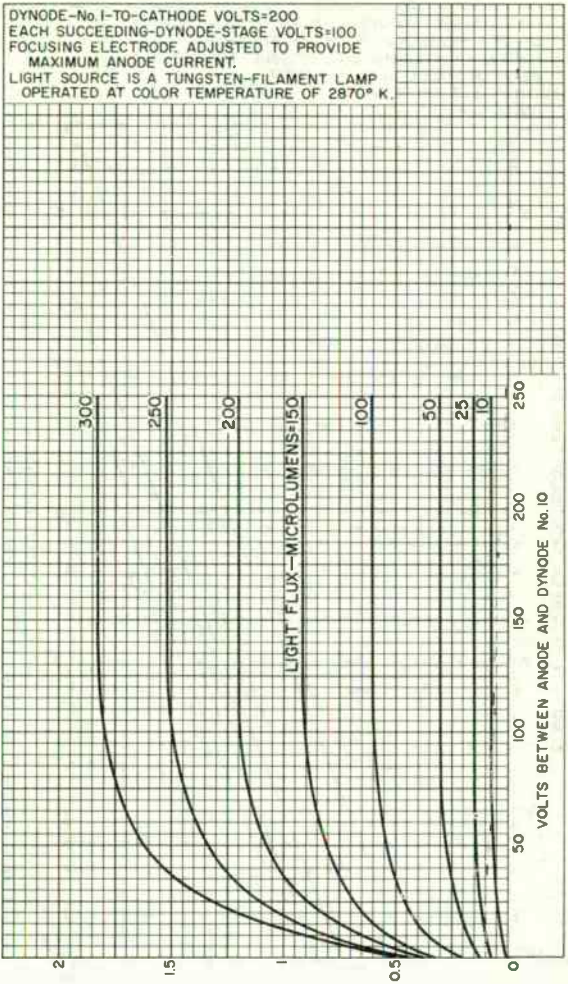
DIMENSIONS IN INCHES

CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

NOTE: WITHIN 1-1/2 INCH DIAMETER, DEVIATION FROM FLATNESS OF EXTERNAL SURFACE OF FACEPLATE WILL NOT EXCEED 0.010 INCH FROM PEAK TO VALLEY.

World Radio History

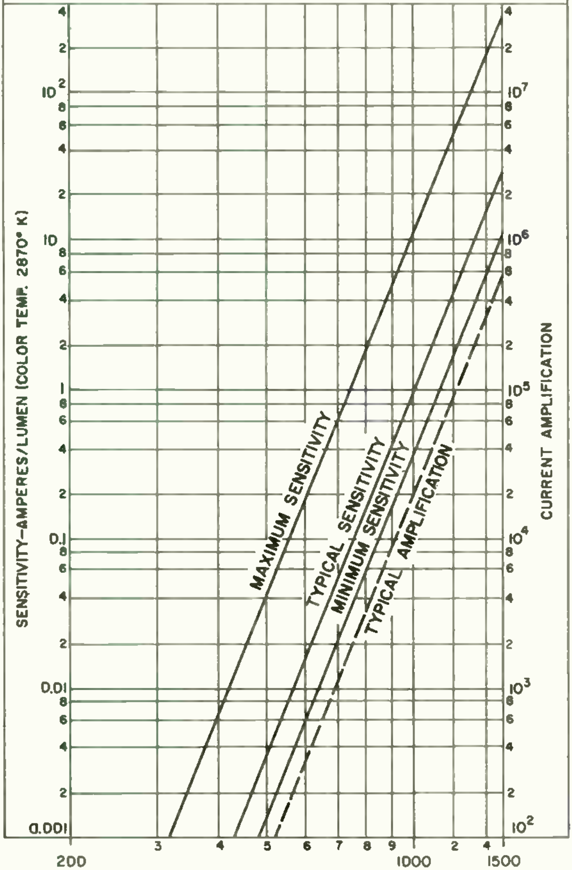
TYPICAL ANODE CHARACTERISTICS



92CM-8641R1

SENSITIVITY AND CURRENT AMPLIFICATION CHARACTERISTICS

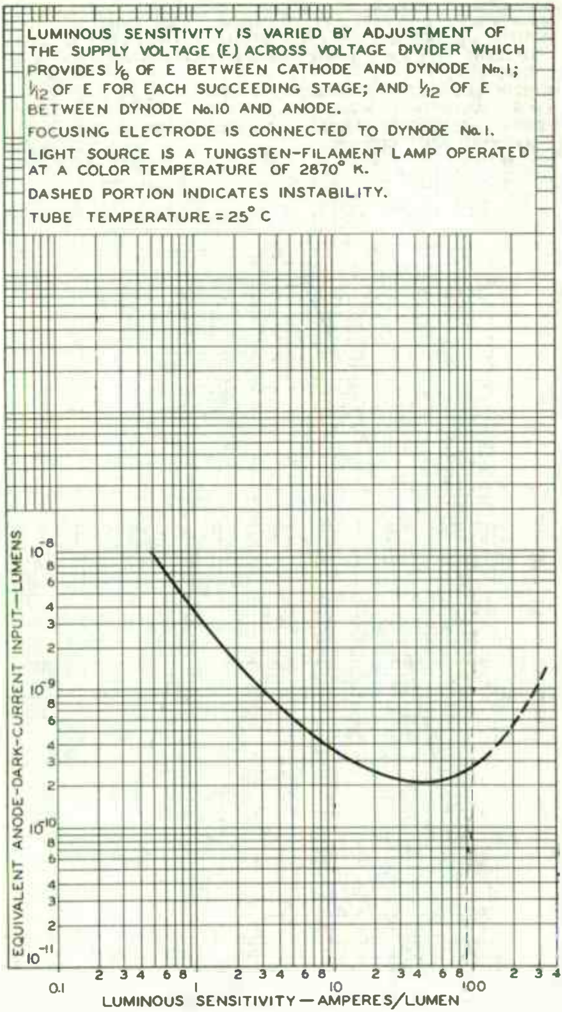
SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER PROVIDING 1/6 OF E BETWEEN CATHODE AND DYNODE No.1; 1/12 OF E FOR EACH SUCCEEDING DYNODE STAGE; AND 1/12 OF E BETWEEN DYNODE No.10 AND ANODE.
FOCUSING ELECTRODE ADJUSTED TO PROVIDE MAXIMUM ANODE ANODE CURRENT.



92CM-8637R2

World Radio History

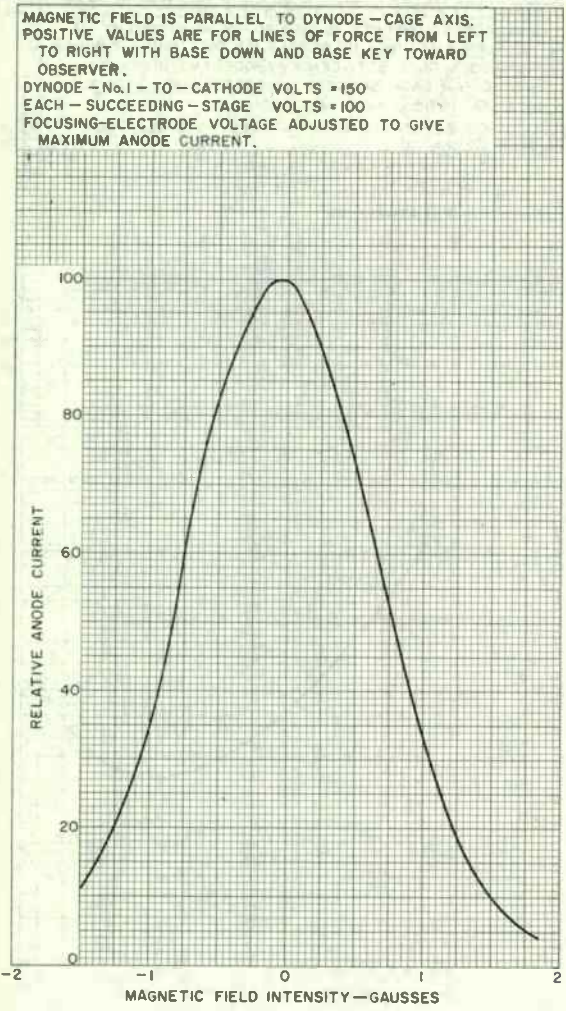
TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



92CM-8640

World Radio History

EFFECT OF MAGNETIC FIELD ON ANODE CURRENT



World Radio History

Photomultiplier Tube

S-11 RESPONSE
10-STAGE, HEAD-ON, FLAT-FACEPLATE

ELECTROSTATICALLY FOCUSED
DYNODE STAGES

For Detection and Measurement of Nuclear Radiation and Other Low-Level Light Sources in Scintillation Counters

The **2061** *is electrically similar to type* **6342A** *except for the following performance characteristic and that the anode luminous sensitivity and equivalent noise input ratings shown for the* **6342A** *do not apply for type* **2061**.

The 2061 is supplied with a medium-shell diheptal base attached to flexible leads to facilitate testing. After testing, the attached base of the 2061 should be removed prior to installing the tube in a given system.

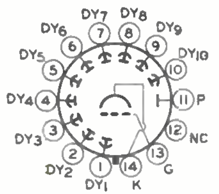
PERFORMANCE CHARACTERISTIC

Minimum Pulse Height[a]	0.13	V

[a] Pulse height is defined as the amplitude of the anode pulse voltage (referred to anode) measured across a 100 ± 5%-kilohm resistor and a total capacitance of 92 ± 3% pF in parallel. An anode-to-cathode voltage of 1130 volts is applied across a voltage-divider network having a 1.5 ± 5% megohm resistor between cathode and dynode No. 1, 450 ± 5%—kilohm resistors between each succeeding stage including dynode No. 10 to anode. The focusing electrode is adjusted to that value between 0% and 60% of dynode No. 1 potential (referred to cathode) which will provide maximum anode current. The 662-KeV photon from an isotope of cesium having an atomic mass of 137 (Cs^{137}) and a cylindrical 2 inch x 2 inch thallium-activated sodium-iodide scintillator [NaI(Tl)] type 8D8, or equivalent are used. The scintillator is manufactured by the Harshaw Chemical Corporation, 1945 East 97th Street, Cleveland 6, Ohio. The Cs^{137} is in direct contact with the metal end of the scintillator. The faceplate end of the crystal is coupled to the 2061 by a coupling fluid such as Dow Corning Corp., Type DC200 (Viscosity of 100 centipoise) manufactured by the Dow Corning Corp., Midland, Michigan, or equivalent.

BASING DIAGRAM (Bottom View)
With Base Attached

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 – No Connection
Pin 13 – Focusing Electrode
Pin 14 – Photocathode

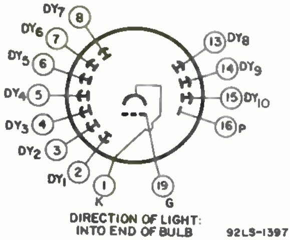


DIRECTION OF RADIATION: INTO END OF BULB

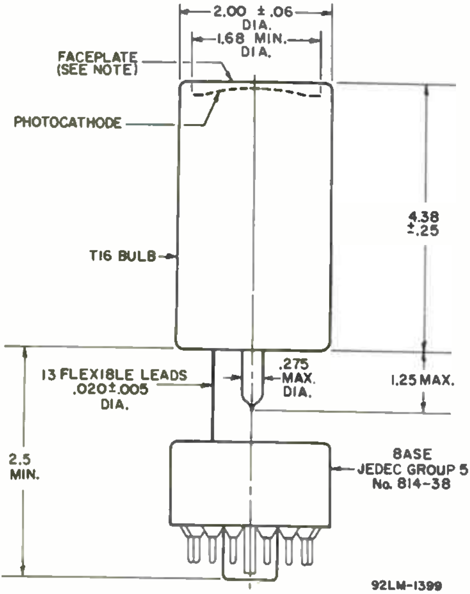
World Radio History

TERMINAL CONNECTIONS (Bottom View)
With Base Removed

Lead 1 – Photocathode
Lead 2 – Dynode No. 1
Lead 3 – Dynode No. 2
Lead 4 – Dynode No. 3
Lead 5 – Dynode No. 4
Lead 6 – Dynode No. 5
Lead 7 – Dynode No. 6
Lead 8 – Dynode No. 7
Lead 13 – Dynode No. 8
Lead 14 – Dynode No. 9
Lead 15 – Dynode No. 10
Lead 16 – Anode
Lead 19 – Focusing Electrode



DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Note: Within 1.68-inch diameter, deviation from flatness of external surface of faceplate will not exceed 0.010 inch from peak to valley.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.
World Radio History

Photomultiplier Tube

10-STAGE, HEAD-ON FLAT-FACEPLACE TYPE HAVING VENETIAN-BLIND-TYPE DYNODE STRUCTURE, 1.68-INCH MINIMUM-DIAMETER, FLAT, CIRCULAR, SEMITRANSPARENT PHOTOCATHODE AND S-11 RESPONSE

For Use in Scintillation Counting Applications

The 2063 is electrically similar to type 8053 except for the following performance characteristics and that the anode luminous sensitivity and equivalent noise input ratings shown for the 8053 do not apply for type 2063.

The 2063 is supplied with a medium-shell diheptal base attached to flexible leads to facilitate testing. After testing, the attached base of the 2063 should be removed prior to installing the tube in a given system.

PERFORMANCE CHARACTERISTICS

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. The focusing electrode is adjusted to that value between 50% and 100% of dynode No. 1 potential (referred to cathode) which will provide maximum anode current.

Maximum Anode Dark Current[a]	0.05	μA
Minimum Pulse Height[b]	0.13	V

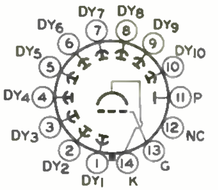
[a] Measured under the following conditions: Light incident on the photocathode is transmitted through a blue filter Corning C.S. No. 5-58, polished to 1/2 stock thickness—Manufactured by the Corning Glass Works, Corning, New York) from a tungsten-filament lamp operated at a color temperature of 2870° K. The light flux incident on the filter is 10 microlumens. The supply voltage is adjusted to obtain an anode current of 9 μA. Dark current is measured with the light source removed.

[b] Pulse height is defined as the amplitude of the anode pulse voltage (referred to anode) measured across a 100 ± 5%-kilohm resistor and a total capacitance of 92 ± 3% pF in parallel. An anode-to-cathode voltage of 1130 volts is applied across a voltage divider network having a 1.5 ± 5%—megohm resistor between cathode and dynode No. 1, 450 ± 5%—kilohm resistors between each succeeding stage including dynode No. 10 to anode. The focusing electrode is adjusted to that value between 50% and 100% of dynode No. 1 potential (referred to cathode) which will provide maximum anode current. The 662-KeV photon from an isotope of cesium having an atomic mass of 137 (Cs^{137}) and a cylindrical 2 inch x 2 inch thallium-activated sodium-iodide scintillator [NaI(Tl)] type 8D8, or equivalent are used. This scintillator is manufactured by the Harshaw Chemical Corporation, 1945 East 97th Street, Cleveland 6, Ohio. The Cs^{137} is in direct contact with the metal end of the scintillator. The faceplate end of the crystal is coupled to the 2063 by a coupling fluid such as Dow Corning Corp., Type DC200 (Viscosity of 100 centipoise) manufactured by the Dow Corning Corp., Midland, Michigan, or equivalent.

World Radio History

BASING DIAGRAM (Bottom View) With Base Attached

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

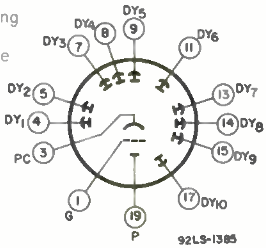


DIRECTION OF RADIATION: INTO END OF BULB

Pin 8 – Dynode No. 8
Pin 9 – Dynode No. 9
Pin 10 – Dynode No. 10
Pin 11 – Anode
Pin 12 – No Connection
Pin 13 – Focusing Electrode
Pin 14 – Photocathode

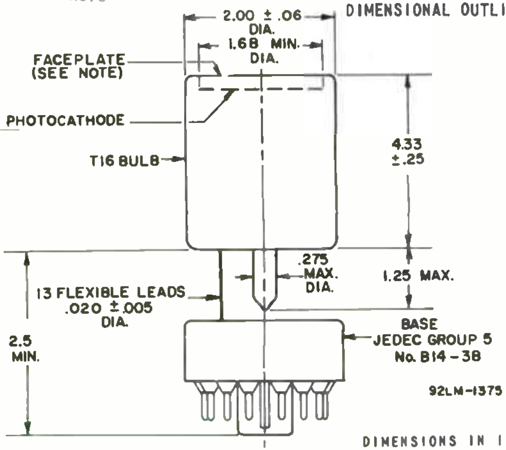
TERMINAL CONNECTIONS (Bottom View) With Base Removed

Lead 1 – Focusing
Lead 3 – Photocathode
Lead 4 – Dynode No. 1
Lead 5 – Dynode No. 2
Lead 7 – Dynode No. 3
Lead 8 – Dynode No. 4
Lead 9 – Dynode No. 5



Lead 11 – Dynode No. 6
Lead 13 – Dynode No. 7
Lead 14 – Dynode No. 8
Lead 15 – Dynode No. 9
Lead 17 – Dynode No. 10
Lead 19 – Anode

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Note: Within 1.68-inch diameter, deviation from flatness of external surface of faceplate will not exceed 0.010 inch from peak to valley.

World Radio History

Photomultiplier Tube

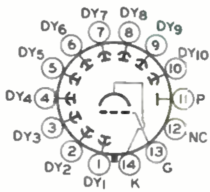
10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE HAVING VENETIAN-BLIND-TYPE DYNODE STRUCTURE, 2.59-INCH MINIMUM-DIAMETER, FLAT, CIRCULAR, SEMITRANSPARENT PHOTOCATHODE AND S-11 RESPONSE

For Use in Scintillation Counting Applications

The 2064 is identical to type 8054 in all respects except that it is supplied with a medium-shell diheptal base attached to flexible leads to facilitate testing. After testing, the attached base should be removed prior to installing the 2064 in a given system.

BASING DIAGRAM (Bottom View)
With Base Attached

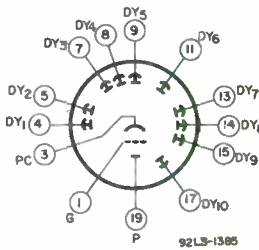
Pin 1 – Dynode No. 1
Pin 2 – Dynode No. 2
Pin 3 – Dynode No. 3
Pin 4 – Dynode No. 4
Pin 5 – Dynode No. 5
Pin 6 – Dynode No. 6
Pin 7 – Dynode No. 7
Pin 8 – Dynode No. 8
Pin 9 – Dynode No. 9
Pin 10 – Dynode No. 10
Pin 11 – Anode
Pin 12 – No Connection
Pin 13 – Focusing Electrode
Pin 14 – Photocathode



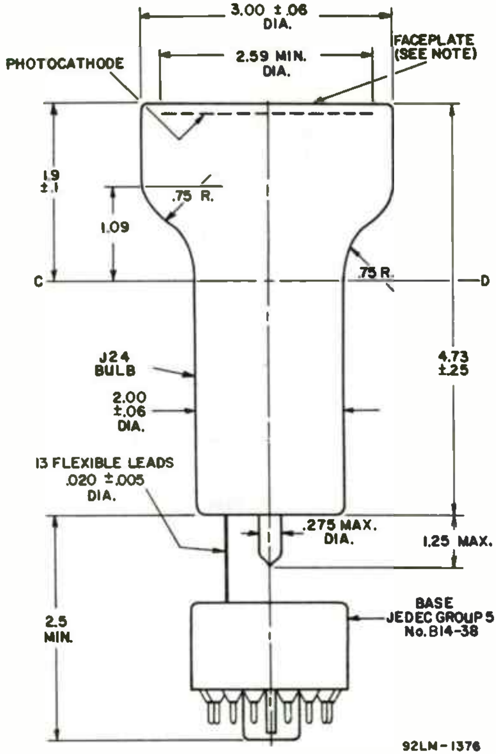
DIRECTION OF RADIATION: INTO END OF BULB

TERMINAL CONNECTIONS (Bottom View)
With Base Removed

Lead 1 – Focusing Electrode
Lead 3 – Photocathode
Lead 4 – Dynode No. 1
Lead 5 – Dynode No. 2
Lead 7 – Dynode No. 3
Lead 8 – Dynode No. 4
Lead 9 – Dynode No. 5
Lead 11 – Dynode No. 6
Lead 13 – Dynode No. 7
Lead 14 – Dynode No. 8
Lead 15 – Dynode No. 9
Lead 17 – Dynode No. 10
Lead 19 – Anode



DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Note: Within 2.59-inch diameter, deviation from flatness of external surface of faceplate will not exceed 0.010 inch from peak to valley.

World Radio History

Photomultiplier Tube

10-STAGE, HEAD-ON, FLAT-FACEPLACE TYPE HAVING VENETIAN-BLIND-TYPE DYNODE STRUCTURE, 2.59-INCH MINIMUM-DIAMETER, FLAT, CIRCULAR, SEMITRANSPARENT PHOTOCATHODE AND S-11 RESPONSE

For Use in Scintillation Counting Applications

The 2064B is electrically similar to type 8054 except for the following performance characteristics and that the anode luminous sensitivity and equivalent noise input ratings shown for the 8054 do not apply for type 2064B.

The 2064B is supplied with a medium-shell diheptal base attached to flexible leads to facilitate testing. After testing, the attached base of the 2064B should be removed prior to installing the tube in a given system.

PERFORMANCE CHARACTERISTICS

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. The focusing electrode is adjusted to that value between 50% and 100% of dynode-No.1 potential (referred to cathode) which will provide maximum anode current.

Maximum Anode Dark Current[a]	0.05	μA
Minimum Pulse Height[b]	0.18	V

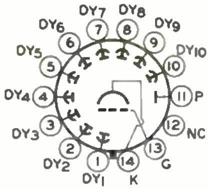
[a] Measured under the following conditions: Light incident on the photocathode is transmitted through a blue filter (Corning C.S. No.5-58, polished to 1/2 stock thickness—Manufactured by the Corning Glass Works, Corning, New York) from a tungsten-filament lamp operated at a color temperature of 2870° K. The light flux incident on the filter is 10 microlumens. The supply voltage is adjusted to obtain an anode current of 9 μA. Dark current is measured with the light source removed.

[b] Pulse height is defined as the amplitude of the anode pulse voltage (referred to anode) measured across a 100 ± 5%-kilohm resistor and a total capacitance of 92 ± 3% pF in parallel. An anode-to-cathode voltage of 1130 volts is applied across a voltage-divider network having a 1.5 ± 5%-megohm resistor between cathode and dynode No.1, 450 ± 5%-kilohm resistors between each succeeding stage including dynode No.10 to anode. The focusing electrode is adjusted to that value between 50% and 100% of dynode No.1 potential (referred to cathode) which will provide maximum anode current. The 662-KeV photon from an isotope of cesium having an atomic mass of 137 (Cs137) and a cylindrical 3 inch x 3 inch thallium-activated sodium-iodide scintillator [NaI(Tl)] type 12A12, or equivalent are used. This scintillator is manufactured by the Harshaw Chemical Corporation, 1945 East 97th Street, Cleveland 6, Ohio. The Cs^{137} is in direct contact with the metal end of the scintillator. The faceplate end of the crystal is coupled to the 2064B by a coupling fluid such as Dow Corning Corp., Type DC200 (Viscosity of 100 centipoise) manufactured by the Dow Corning Corp., Midland, Michigan, or equivalent.

World Radio History

BASING DIAGRAM (Bottom View)
With Base Attached

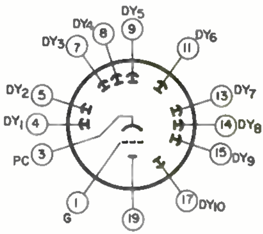
Pin 1 – Dynode No.1
Pin 2 – Dynode No.2
Pin 3 – Dynode No.3
Pin 4 – Dynode No.4
Pin 5 – Dynode No.5
Pin 6 – Dynode No.6
Pin 7 – Dynode No.7
Pin 8 – Dynode No.8
Pin 9 – Dynode No.9
Pin 10 – Dynode No.10
Pin 11 – Anode
Pin 12 – No Connection
Pin 13 – Focusing Electrode
Pin 14 – Photocathode



DIRECTION OF RADIATION: INTO END OF BULB

TERMINAL CONNECTIONS (Bottom View)
With base Removed

Lead 1 – Focusing Electrode
Lead 3 – Photocathode
Lead 4 – Dynode No.1
Lead 5 – Dynode No.2
Lead 7 – Dynode No.3
Lead 8 – Dynode No.4
Lead 9 – Dynode No.5
Lead 11 – Dynode No.6
Lead 13 – Dynode No.7
Lead 14 – Dynode No.8
Lead 15 – Dynode No.9
Lead 17 – Dynode No.10
Lead 19 – Anode



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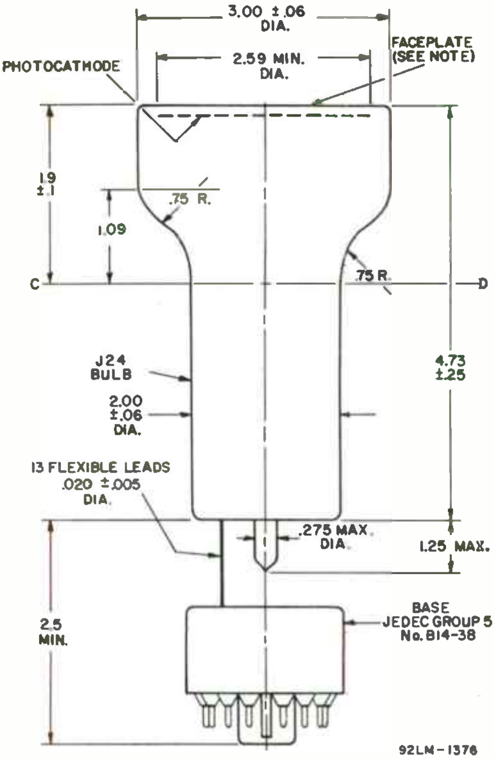
World Radio History

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Note: Within 2.59-inch diameter, deviation from flatness of external surface of faceplate will not exceed 0.010 inch from peak to valley.

World Radio History

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Photomultiplier Tube

10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE HAVING VENETIAN-BLIND-TYPE DYNODE STRUCTURE, 4.38-INCH MINIMUM DIAMETER. FLAT, CIRCULAR, SEMITRANSPARENT PHOTOCATHODE AND S-11 RESPONSE

For Use in Scintillation Counting Applications

The 2065 is electrically similar to type 8055 except for the following performance characteristics and that the anode luminous sensitivity and equivalent noise input ratings shown for the 8055 do not apply for type 2065.

The 2065 is supplied with a medium-shell diheptal base attached to flexible leads to facilitate testing. After testing, the attached base of the 2065 should be removed prior to installing the tube in a given system.

PERFORMANCE CHARACTERISTICS

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. The focusing electrode is adjusted to that value between 50% and 100% of dynode-No. 1 potential (referred to cathode) which will provide maximum anode current.

Maximum Anode Dark Current[a]	0.05	μA
Minimum Pulse Height[b]	0.13	V

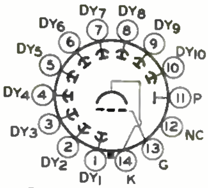
[a] Measured under the following conditions: Light incident on the photocathode is transmitted through a blue filter (Corning C.S. No. 5-58, polished to 1/2 stock thickness — Manufactured by the Corning Glass Works, Corning, New York) from a tungsten-filament lamp operated at a color temperature of 2870° K. The light flux incident on the filter is 10 microlumens. The supply voltage is adjusted to obtain an anode current of 9 μA. Dark current is measured with the light source removed.

[b] Pulse height is defined as the amplitude of the anode pulse voltage (referred to anode) measured across a 100 ± 5%-kilohm resistor and a total capacitance of 92 ± 3% pF in parallel. An anode-to-cathode voltage of 1130 volts is applied across a voltage-divider network having a 1.5 ± 5%-megohm resistor between cathode and dynode No. 1, 450 ± 5%-kilohm resistors between each succeeding stage including dynode No. 10 to anode. The focusing electrode is adjusted to that value between 50% and 100% of dynode No. 1 potential (referred to cathode) which will provide maximum anode current. The 662-KeV photon from an isotope of cesium having an atomic mass of 137 (Cs^{137}) and a cylindrical 3 inch x 3 inch thallium-activated sodium-iodide scintillator [NaI(Tl)] type 12A12, or equivalent are used. This scintillator is manufactured by Harshaw Chemical Corporation, 1945 East 97th Street, Cleveland 6, Ohio. The Cs137 is in direct contact with the metal end of the scintillator. The faceplate end of the crystal is coupled to the 2065 by a coupling fluid such as Dow Corning Corp., Type DC200 (Viscosity of 100 centipoise) manufactured by the Dow Corning Corp., Midland, Michigan, or equivalent.

World Radio History

BASING DIAGRAM (Bottom View)
With Base Attached

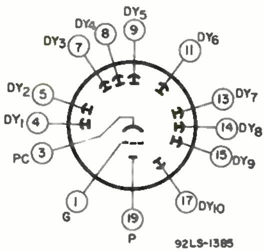
Pin 1 – Dynode No. 1
Pin 2 – Dynode No. 2
Pin 3 – Dynode No. 3
Pin 4 – Dynode No. 4
Pin 5 – Dynode No. 5
Pin 6 – Dynode No. 6
Pin 7 – Dynode No. 7
Pin 8 – Dynode No. 8
Pin 9 – Dynode No. 9
Pin 10 – Dynode No. 10
Pin 11 – Anode
Pin 12 – No Connection
Pin 13 – Focusing Electrode
Pin 14 – Photocathode



DIRECTION OF RADIATION: INTO END OF BULB

TERMINAL CONNECTIONS (Bottom View)
With Base Removed

Lead 1 – Focusing Electrode
Lead 3 – Photocathode
Lead 4 – Dynode No. 1
Lead 5 – Dynode No. 2
Lead 7 – Dynode No. 3
Lead 8 – Dynode No. 4
Lead 9 – Dynode No. 5
Lead 11 – Dynode No. 6
Lead 13 – Dynode No. 7
Lead 14 – Dynode No. 8
Lead 15 – Dynode No. 9
Lead 17 – Dynode No. 10
Lead 19 – Anode



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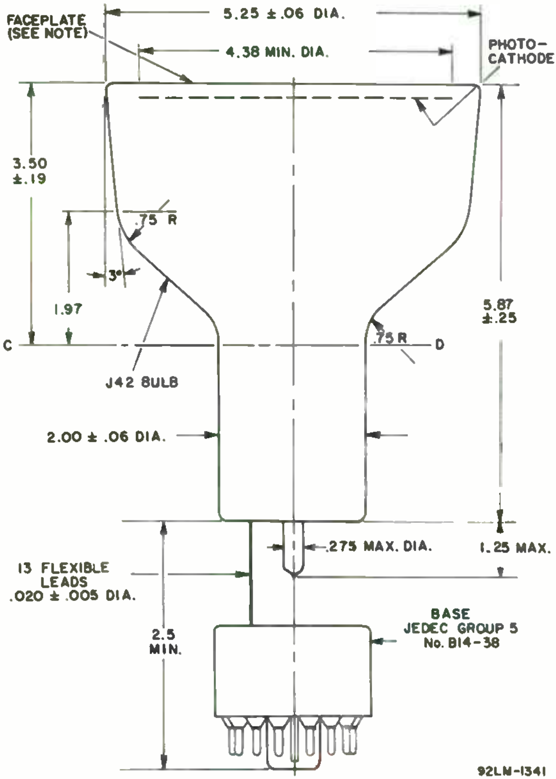
World Radio History

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Note: Within 4.38-inch diameter, deviation from flatness of external surface of faceplate will not exceed 0.010 inch from peak to valley.

World Radio History

World Radio History

Image Orthicon

MAGNETIC FOCUS **MAGNETIC DEFLECTION**

For Low-Light-Level Color Pickup. The 4401 is Unilaterally Interchangeable with Types 5820, 6474, and 7513.

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:		
Anode to all other electrodes	12	μμf
Spectral Response		S-10
Wavelength of Maximum Response	4500 ± 300	angstroms
Photocathode, Semitransparent:		
Rectangular image (4 x 3 aspect ratio):		
Useful size of	1.8" max.	diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

Orientation of . . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	15.20" ± 0.25"
Greatest Diameter of Bulb	3.00" ± 0.06"
Minimum Deflecting-Coil Inside Diameter	2-3/8"
Deflecting-Coil Length	5"
Focusing-Coil Length	10"
Alignment-Coil Length	15/16"
Photocathode Distance Inside End of Focusing Coil	1/2"
Operating Position	See *Operating Considerations*
Weight (Approx.)	1 lb 6 oz
Shoulder Base	Keyed Jumbo Annular 7-Pin

BOTTOM VIEW▲

Pin 1 - Grid No.6
Pin 2 - Photocathode
Pin 3 - Internal Connection—Do Not Use
Pin 4 - Internal Connection—Do Not Use
Pin 5 - Grid No.5
Pin 6 - Target
Pin 7 - Internal Connection—Do Not Use

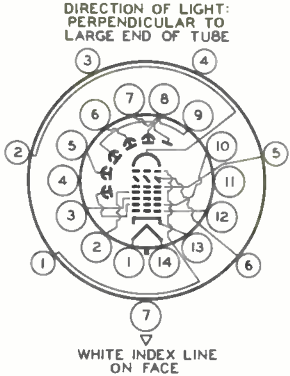
▲ See basing diagram on next page.

World Radio History

End Base. . . . . Small-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-45)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.4
Pin 3 - Grid No.3
Pin 4 - Internal Connection—Do Not Use
Pin 5 - Dynode No.2
Pin 6 - Dynode No.4
Pin 7 - Anode
Pin 8 - Dynode No.5
Pin 9 - Dynode No.3
Pin 10 - Dynode No.1, Grid No.2
Pin 11 - Internal Connection—Do Not Use
Pin 12 - Grid No.1
Pin 13 - Cathode
Pin 14 - Heater



Maximum and Minimum Ratings, ***Absolute-Maximum Values:***

PHOTOCATHODE:		
Voltage	-550 max.	volts
Illumination.	50 max.	fc
OPERATING TEMPERATURE:		
Of any part of bulb	50 max.	°C
Of bulb at large end of tube (Target section).	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between target section and any part of bulb hotter than target section. . .	5 max.	°C
GRID-No.6 VOLTAGE	-550 max.	volts
TARGET VOLTAGE:		
Positive value.	10 max.	volts
Negative value.	10 max.	volts
GRID-No.5 VOLTAGE	150 max.	volts
GRID-No.4 VOLTAGE	300 max.	volts
GRID-No.3 VOLTAGE	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value	125 max.	volts
Positive-bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode .	125 max.	volts
Heater positive with respect to cathode .	10 max.	volts
ANODE SUPPLY VOLTAGE•	1500 max.	volts
VOLTAGE PER MULTIPLIER STAGE.	500 max.	volts

World Radio History

Typical Operation and Characteristics:

Photocathode Voltage (Image Focus) . . .	-400 to -540	volts
Grid-No.6 Voltage (Accelerator)— Approx. 75% of photocathode voltage .	-300 to -405	volts
Target-Cutoff Voltage*	-3 to +1	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam Focus).	140 to 180	volts
Grid-No.3 Voltage♦.	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff. .	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Minimum Peak-to-Peak Blanking Voltage. .	5	volts
Field Strength at Center of Focusing Coil♣	75	gausses
Field Strength of Alignment Coil. . . .	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operation and with picture highlights at the "knee" of the accompanying Basic-Light-Transfer-Characteristic Curve

	Min.	Average	Max.	
Cathode Radiant Sensitivity at 4500 angstroms	-	0.03	-	μa/μw
Anode Current (DC).	-	40	-	μa
Signal-Output Current (Peak-to-peak)	10	25	50	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc	35:1	45:1	-	
Photocathode Illumination at 2870° K Required to Reach "Knee" of Light-Transfer Characteristic . . .	-	0.007	0.01	fc
Peak-to-Peak Response to Square-Wave Test Pattern at 400 TV Lines per Picture Height (Per cent of large-area black to large-area white)♠	28	35	-	%

● Ratio of dynode voltages is shown under *Typical Operation*.

* Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from -3 to +5 volts.

♦ Adjust to give the most uniformly shaded picture near maximum signal.

♣ Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

♠ Measured with amplifier having flat frequency response.

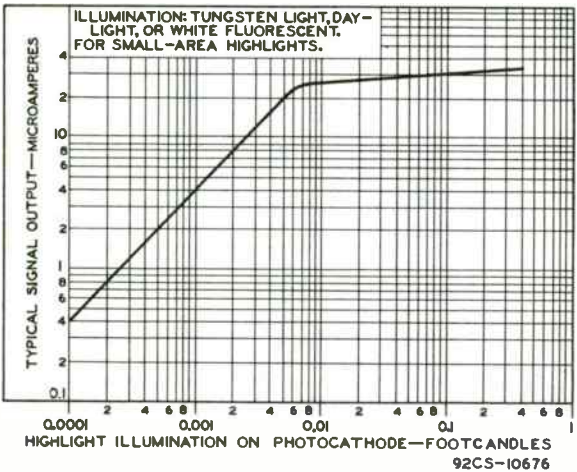
World Radio History

OPERATING CONSIDERATIONS

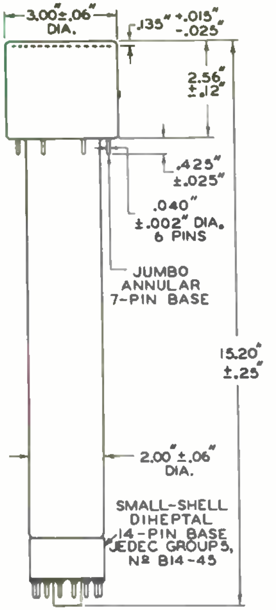
The *operating position* of the 4401 should preferably be such that any loose particles in the neck of the tube will not fall down and strike or become lodged on the target. Therefore, it is recommended that the tube never be operated in a vertical position with the Diheptal-base end up nor in any other position where the axis of the tube with base up makes an angle of less than 20° with the vertical.

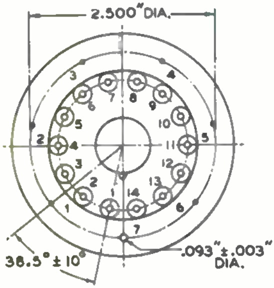
SPECTRAL-SENSITIVITY CHARACTERISTIC
of Photosensitive Device having S-10 Response
is shown at the front of this Section

BASIC LIGHT-TRANSFER CHARACTERISTIC



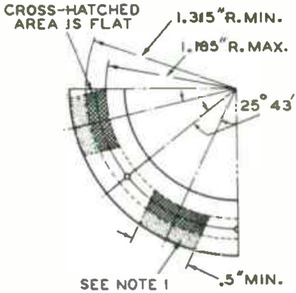
World Radio History





ENLARGED BOTTOM VIEW

DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR-BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

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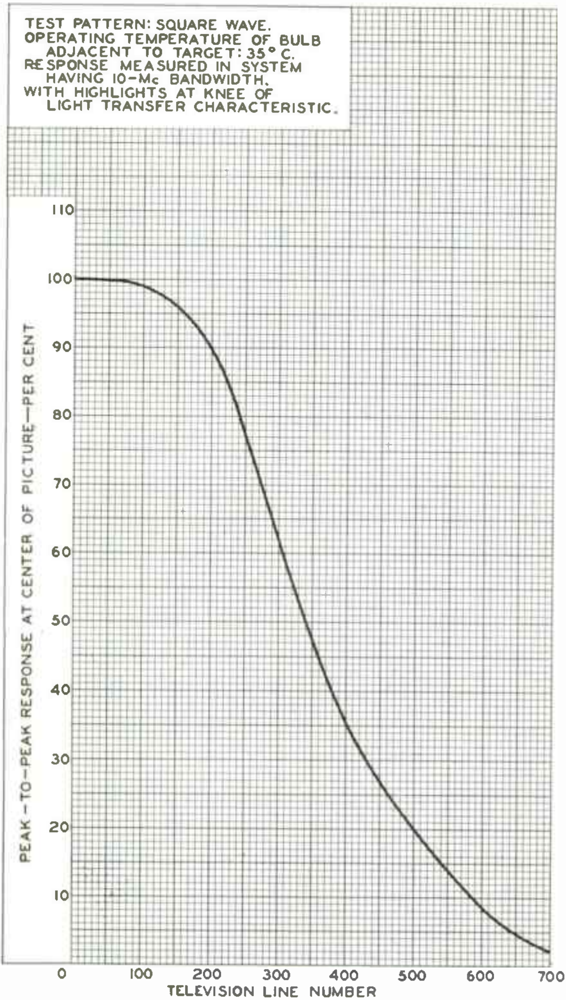
World Radio History

SQUARE-WAVE-RESPONSE CHARACTERISTIC



World Radio History

Image Orthicon

MAGNETIC FOCUS — S-10 RESPONSE — MAGNETIC DEFLECTION

For Low-Light-Level Black-and-White Pickup

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:		
Anode to all other electrodes	12	pf
Spectral Response		S-10
Wavelength of Maximum Response	4500 ± 300	angstroms
Photocathode, Semitransparent:		
Rectangular image (4 x 3 aspect ratio):		
Useful size	1.8" max.	diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

Orientation . . . . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	15.20" ± 0.25"
Greatest Diameter of Bulb	3.00" ± 0.06"
Minimum Deflecting-Coil Inside Diameter	2-3/8"
Deflecting-Coil Length	5"
Focusing-Coil Length	10"
Alignment-Coil Length	15/16"
Photocathode Distance Inside End of Focusing Coil	1/2"
Operating Position	See *Operating Considerations*
Weight (Approx.)	1.4 lbs
Shoulder Base	Keyed Jumbo Annular 7-Pin

BOTTOM VIEW▲

Pin 1 - Grid No.6
Pin 2 - Photocathode
Pin 3 - Do Not Use
Pin 4 - Do Not Use
Pin 5 - Grid No.5
Pin 6 - Target
Pin 7 - Do Not Use

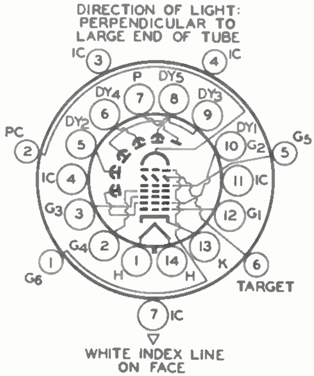
▲ See basing diagram on next page.

World Radio History

End Base. . . . . Small-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-45)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.4
Pin 3 - Grid No.3
Pin 4 - Do Not Use
Pin 5 - Dynode No.2
Pin 6 - Dynode No.4
Pin 7 - Anode
Pin 8 - Dynode No.5
Pin 9 - Dynode No.3
Pin 10 - Dynode No.1, Grid No.2
Pin 11 - Do Not Use
Pin 12 - Grid No.1
Pin 13 - Cathode
Pin 14 - Heater



Maximum and Minimum Ratings, *Absolute-Maximum Values:*

Photocathode:			
Voltage	-550	max.	volts
Illumination	50	max.	fc
Operating Temperature:			
Of any part of bulb	50	max.	°C
Of bulb at large end of tube (Target section)	35	min.	°C
Temperature Difference:			
Between target section any any part of bulb hotter than target section	5	max.	°C
Grid-No.6 Voltage	-550	max.	volts
Target Voltage:			
Positive value	10	max.	volts
Negative value	10	max.	volts
Grid-No.5 Voltage	150	max.	volts
Grid-No.4 Voltage	300	max.	volts
Grid-No.3 Voltage	400	max.	volts
Grid-No.2 & Dynode-No.1 Voltage	350	max.	volts
Grid-No.1 Voltage:			
Negative-bias value	125	max.	volts
Positive-bias value	0	max.	volts
Peak Heater-Cathode Voltage:			
Heater negative with respect to cathode	125	max.	volts
Heater positive with respect to cathode	10	max.	volts
Anode Supply Voltage[a]	1500	max.	volts
Voltage Per Multiplier Stage	500	max.	volts

World Radio History

Typical Operation and Characteristics:

Photocathode Voltage (Image Focus). . . .	-400 to -540	volts
Grid-No.6 Voltage (Accelerator)— Approx. 75% of photocathode voltage . .	-300 to -405	volts
Target-Cutoff Voltage[b].	-3 to +1	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam Focus).	140 to 180	volts
Grid-No.3 Voltage[c].	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff. . .	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Minimum Peak-to-Peak Blanking Voltage . .	5	volts
Field Strength at Center of Focusing Coil[d]	75	gausses
Field Strength of Alignment Coil.	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operation and with picture highlights at the "knee" of the accompanying Basic-Light-Transfer-Characteristic Curve

	Min.	*Typ.*	*Max.*	
Cathode Radiant Sensitivity at 4500 angstroms	-	0.03	-	a/w
Anode Current (DC).	-	40	-	μa
Signal-Output Current (Peak-to-peak).	10	15	35	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc	35:1	40:1	-	
Photocathode Illumination at 2570°K Required to Reach "Knee" of Light-Transfer Characteristic	-	0.005	0.008	fc
Peak-to-Peak Response to Square-Wave Test Pattern at 400 TV Lines per Picture Height (Per cent of large-area black to large-area white)[e]	35	60	-	%

[a] Ratio of dynode voltages is shown under *Typical Operation*.

[b] Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from -3 to +5 volts.

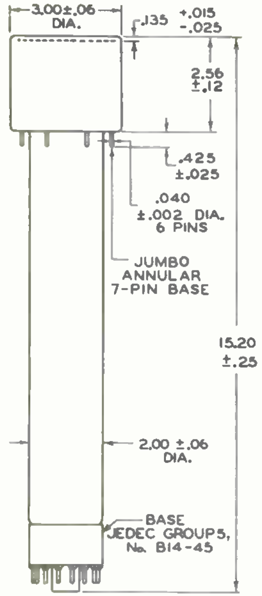
[c] Adjust to give the most uniformly shaded picture near maximum signal.

[d] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

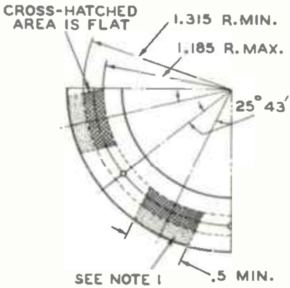
[e] Measured with amplifier having flat frequency response.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-10 RESPONSE is shown at front of this Section

World Radio History



DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



Note 1: Dotted area is flat or extends toward diheptal-base end of tube by 0.060" max.

ANNULAR-BASE GAUGE

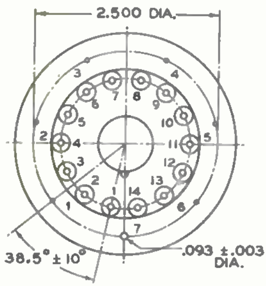
Angular variations between pins as well as eccentricity of neck cylinder with respect to photocathode cylinder are held to tolerances such that pins and neck cylinder will fit flat-plate gauge with:

a. Six holes having diameter of 0.065" ± 0.001" and one hole having diameter of 0.150" ± 0.001". All holes have depth of 0.265" ± 0.001". The six 0.065" holes are enlarged by 45° taper to depth of 0.047". All holes are spaced at angles of 51°26 ± 5' on circles diameter of 2.500" ± 0.001".

b. Seven stops having height of 0.187" ± 0.001", centered between pin holes to bear against flat areas of base.

c. Rim extending out a minimum of 0.125" from 2.812" diameter and having height of 0.126" ± 0.001".

d. Neck-cylinder clearance hole having diameter of 2.200" ± 0.001".



ENLARGED BOTTOM VIEW

DIMENSIONS IN INCHES

92CM-8293R3

World Radio History

Image Orthicon

MAGNETIC FOCUS MAGNETIC DEFLECTION

HIGH SENSITIVITY

For Outdoor and Studio Pickup. The 4414/7611 is Unilaterally Interchangeable with Types 5820, 5820A, and 7611[a].

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:		
Anode to all other electrodes	12	pf
Spectral Response		S-10
Wavelength of Maximum Response	4500 ± 300	angstroms
Photocathode, Semitransparent:		
Rectangular image (4 x 3 aspect ratio):		
Useful size of	1.8" max.	diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

Orientation of . . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	15.20" ± 0.25"
Greatest Diameter of Bulb	3.00" ± 0.06"
Minimum Deflecting-Coil Inside Diameter	2-3/8"
Deflecting-Coil Length	5"
Focusing-Coil Length	10"
Alignment-Coil Length	15/16"
Photocathode Distance Inside End of Focusing Coil	1/2"

Operating Position. . . The tube should never be operated in a vertical position with the diheptal-base end up nor in any other position where the axis of the tube with the base up makes an angle of less than 20° with the vertical.

Weight (Approx.)	1 lb 6 oz
Shoulder Base	Keyed Jumbo Annular 7-Pin▲

BOTTOM VIEW

Pin 1 - Grid No.6
Pin 2 - Photocathode
Pin 3 - Do Not Use
Pin 4 - Do Not Use
Pin 5 - Grid No.5
Pin 6 - Target
Pin 7 - Do Not Use

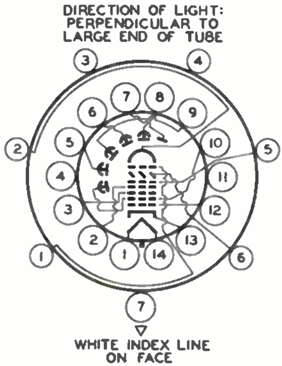
▲ See basing diagram on next page.

World Radio History

End Base. . . . . Small-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-45)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.4
Pin 3 - Grid No.3
Pin 4 - Do Not Use
Pin 5 - Dynode No.2
Pin 6 - Dynode No.4
Pin 7 - Anode
Pin 8 - Dynode No.5
Pin 9 - Dynode No.3
Pin 10 - Dynode No.1, Grid No.2
Pin 11 - Do Not Use
Pin 12 - Grid No.1
Pin 13 - Cathode
Pin 14 - Heater



Maximum and Minimum Ratings, ***Absolute-Maximum Values:***

PHOTOCATHODE:		
Voltage	-550 max.	volts
Illumination	50 max.	fc
OPERATING TEMPERATURE:		
Of any part of bulb	50 max.	°C
Of bulb at large end of tube (Target section)	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between target section and any part of bulb hotter than target section	5 max.	°C
GRID-No.6 VOLTAGE	-550 max.	volts
TARGET VOLTAGE:		
Positive value	10 max.	volts
Negative value	10 max.	volts
GRID-No.5 VOLTAGE	150 max.	volts
GRID-No.4 VOLTAGE	300 max.	volts
GRID-No.3 VOLTAGE	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value	125 max.	volts
Positive-bias value	0 max.	volts
VOLTAGE PER MULTIPLIER STAGE	350 max.	volts
ANODE SUPPLY VOLTAGE[b]	1350 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts

Typical Operating Values:

Photocathode Voltage (Image Focus)	-400 to -540	volts
Grid-No.6 Voltage (Accelerator)— Approx. 75% of photocathode voltage	-300 to -405	volts

World Radio History

Target Cutoff Voltage[c]	-3 to 1	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam Focus)	140 to 180	volts
Grid-No.3 Voltage[d]	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil[e]	75	gausses
Field Strength of Alignment Coil	0 to 3	gausses

Performance Data:[f]

With conditions shown under Typical Operating Values and with camera lens set to bring the picture highlights one stop above the "knee" of the accompanying Basic Light-Transfer-Characteristic Curve

	Min.	*Average*	*Max.*	
Cathode Radiant Sensitivity at 4500 angstroms	-	0.030	-	a/w
Luminous Sensitivity	30	60	-	μa/lm
Anode Current (DC)	-	30	-	μa
Signal-Output Current (Peak-to-Peak)	3	8	24	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc	35:1	-	-	
Photocathode Illumination at 2870° K Required to Bring Picture Highlights One Stop Above "Knee" of Light Transfer Characteristic	-	0.02	0.04	fc
Peak-to-Peak Response to Square-Wave Test Pattern at 400 TV Lines per Picture Height (Per cent of large-area black to large-area white)[g]	35	-	-	%
Uniformity:				
Ratio of Shading (Background) Signal to Highlight Signal	-	0.12	0.15	
Variation of Highlight Signal (Per cent of maximum highlight signal)[h]	-	20	25	%

World Radio History

[a] The 4414/7611 when operated within the temperature range of 35° to 45° C is unilaterally interchangeable with types 5820, 5820A, and 7611.

[b] Dynode-voltage values are shown under *Typical Operating Values*.

[c] Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from -3 to 5 volts.

[d] Adjust to give the most uniformly shaded picture near maximum signal.

[e] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

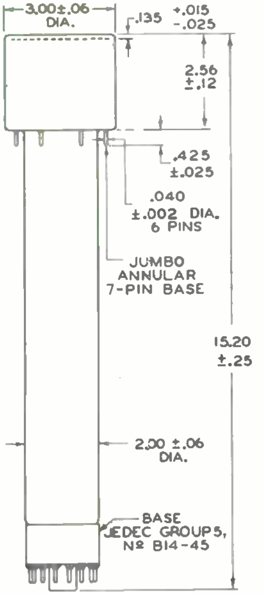
[f] With 4414/7611 operated in properly adjusted RCA TK-31 camera.

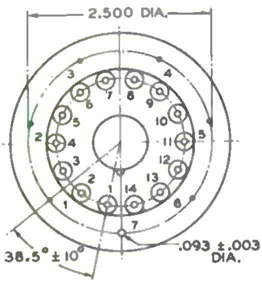
[g] Measured with amplifier having flat frequency response.

[h] Variation of response over scanned area.

SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOSENSITIVE DEVICE HAVING S-10 RESPONSE
is shown at front of this Section

World Radio History



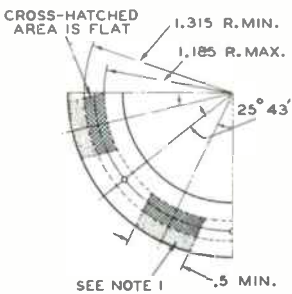


ENLARGED BOTTOM VIEW

ALL DIMENSIONS IN INCHES

92CM-8293R3

DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR-BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

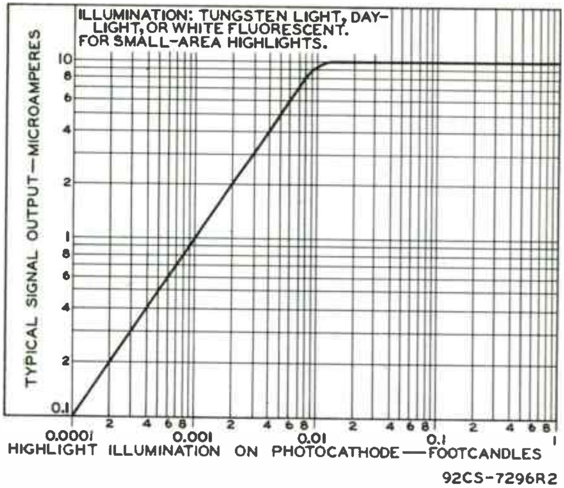
b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

World Radio History

BASIC LIGHT-TRANSFER CHARACTERISTIC



World Radio History

Image Orthicons

MAGNETIC FOCUS **MAGNETIC DEFLECTION**

For Color Pickup at Light Levels of Studios Equipped for Black-and-White Pickup. Two 4415's for the Red and Green Channels and One 4416 for the Blue Channel are Supplied as a Specially Selected Set having High Sensitivity for Simultaneous-Pickup Color TV Cameras.

DATA

General:

Heater, for Unipotential Cathode:

Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp

Direct Interelectrode Capacitance:

Anode to all other electrodes	12	μμf
Maximum Target-to-Mesh Spacing	0.0008	inch

Photocathode, Semitransparent:

Response:

Type 4415	S10
Type 4416	S11

Wavelength of maximum response:

Type 4415	4500 ± 300	angstroms
Type 4416	4400 ± 500	angstroms

Rectangular image (4 x 3 aspect ratio):

Useful size of. . . . . 1.8" max. diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

Orientation of. .Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base. The horizontal and vertical scan should start at the corner of the raster nearest pin 6 of the shoulder base.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	15.20" ± 0.25"
Greatest Diameter of Bulb	3.00" ± 0.06"
Minimum Deflecting-Coil Inside Diameter	2-3/8"
Deflecting-Coil Length	5"
Focusing-Coil Length	10"

Alignment Coil:

Length. . . . . 15/16"

Position on neck. .Centerline of coil located 8.5" from the flat area of the jumbo annular base

Photocathode Distance Inside End of Focusing Coil	1/2"
Operating Position	See *Operating Considerations*
Weight (Approx.)	1 lb 6 oz

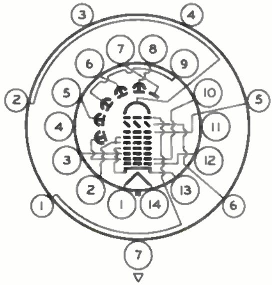
World Radio History

Shoulder Base. . . . . .Keyed Jumbo Annular 7-Pin
BOTTOM VIEW

Pin 1 - Grid No.6
Pin 2 - Photocathode
Pin 3 - Internal Connection—Do Not Use
Pin 4 - Internal Connection—Do Not Use
Pin 5 - Grid No.5
Pin 6 - Target
Pin 7 - Internal Connection—Do Not Use

End Base . . . . .Small-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-45)
BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.4, Field-Mesh Grid
Pin 3 - Grid No.3
Pin 4 - Internal Connection—Do Not Use
Pin 5 - Dynode No.2
Pin 6 - Dynode No.4
Pin 7 - Anode
Pin 8 - Dynode No.5
Pin 9 - Dynode No.3
Pin 10 - Dynode No.1, Grid No.2
Pin 11 - Internal Connection—Do Not Use
Pin 12 - Grid No.1
Pin 13 - Cathode, Suppressor Grid
Pin 14 - Heater



NOTE: In the tube symbol, the suppressor grid connected to the cathode, and the field-mesh grid connected to grid No.4, are intentionally without numbers to avoid upsetting industry practice of associating functional camera control knobs with specific grid numbers. For example, beam-focus control is generally associated with knob identified as G_4 (grid No.4).

Maximum and Minimum Ratings, ***Absolute-Maximum Values:***

PHOTOCATHODE:		
Voltage.	-550 max.	volts
Illumination	50 max.	fc
OPERATING TEMPERATURE:		
Of any part of bulb.	50 max.	°C
Of bulb at large end of tube (Image section).	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between image section and any part of bulb hotter than image section. . .	5 max.	°C
GRID-No.6 VOLTAGE.	-550 max.	volts
TARGET VOLTAGE:		
Positive value	10 max.	volts
Negative value	10 max.	volts
GRID-No.5 VOLTAGE.	150 max.	volts
GRID-No.4 VOLTAGE.	300 max.	volts
GRID-No.3 VOLTAGE.	400 max.	volts

World Radio History

GRID-No.2 & DYNODE-No.1 VOLTAGE	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value	125 max.	volts
Positive-bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts
ANODE-SUPPLY VOLTAGE[a]	1350 max.	volts
VOLTAGE PER MULTIPLIER STAGE	350 max.	volts

Typical Operating Values:

Photocathode Voltage (Image focus)[b]	-400 to -540	volts
Grid-No.6 Voltage (Accelerator)— Approx. 65% of photocathode voltage	-260 to -350	volts
Target-Cutoff Voltage[c]	-3 to +1	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam focus)[b]	140 to 180	volts
Grid-No.3 Voltage[d]	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for picture cutoff	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Target-Temperature Range	35 to 45	°C
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil[e]	75	gausses
Field Strength of Alignment Coil (Approx.)	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operating Values and with picture highlights at the "knee" of the light-transfer characteristic

	Min.	*Average*	*Max.*	
Type 4415:				
Cathode Radiant Sensitivity at 4500 angstroms	-	0.028	-	μa/μw
Signal-Output Current (Peak-to-Peak)	4	-	30	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc.	30:1	37:1	-	
Type 4416:				
Cathode Radiant Sensitivity at 4400 angstroms	-	0.04	-	μa/μw
Signal-Output Current (Peak-to-Peak)	4	-	30	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc.	30:1	37:1	-	

World Radio History

[a] Ratio of dynode voltages is shown under *Typical Operating Values.*

[b] Within this range, the actual focusing-voltage value will not differ by more than 2% from that for any other tube when all other operating conditions are held constant, i.e., when different tubes are operated in the same camera with the same deflecting yoke, with fixed focusing-field current, with grid-No.6 voltage at a fixed percentage of the photocathode voltage, and with all other voltages held constant.

[c] Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from -3 to +5 volts.

[d] Adjust to give the most uniformly shaded picture near maximum signal.

[e] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

OPERATING CONSIDERATIONS

The *operating position* of these types should preferably be such that any loose particles in the neck of the tubes will not fall down and strike or become lodged on the target. Therefore, it is recommended that these tubes never be operated in a vertical position with the Diheptal-base end up nor in any other position where the axis of the tubes with base up makes an angle of less than 20° with the vertical.

PERFORMANCE CHARACTERISTICS

Because of the high sensitivity of the 4416 in the blue channel, cameras employing the 4415-4416 set will have greatly increased overall sensitivity. Color reproduction will also be excellent. With a lens opening of f/8, the set is capable of producing high-quality color pictures when scenes illuminated by incandescent light provide scene-luminance levels of approximately 100 footlamberts.

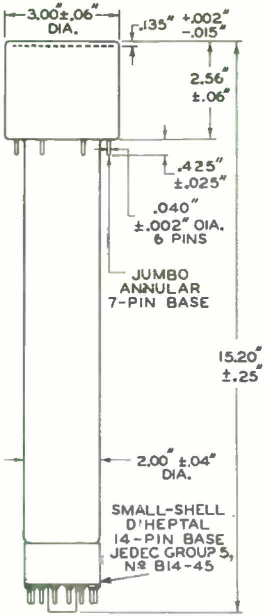
INSTALLATION PRECAUTION

The 4416 has S-11 response and is specifically intended for use in the blue channel. Its sensitivity to blue light is nearly twice that of the 4415's. However, its low green response and negligible red response restrict its use to this channel only. Either of the 4415's, which have the panchromatic S-10 response, may be used in the green or red channels. Improved performance is obtained, however, if the most sensitive of the 4415's is placed in the least sensitive of these two channels.

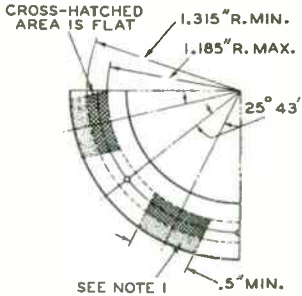
If a replacement tube is desired for any given set of tubes, reference should be made in the replacement order to the serial numbers of the remaining tubes in the set.

SPECTRAL-SENSITIVITY CHARACTERISTICS OF PHOTOSENSITIVE DEVICES HAVING S-10 OR S-11 RESPONSE are shown at front of this Section

World Radio History



DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR-BASE GAUGE

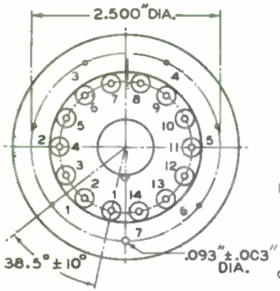
ANNULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265"±0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".



ENLARGED BOTTOM VIEW

92CM-10154R1

World Radio History

World Radio History

Multiplier Phototube

S-11 RESPONSE

"RUGGEDIZED", 10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE

ELECTROSTATICALLY FOCUSED DYNODE STAGES

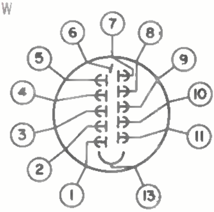
For Detection and Measurement of Nuclear Radiation and Other Low-Level Light Sources in Industrial, Military, and Missile Applications

DATA

General:

Spectral Response S-11
Wavelength of Maximum Response. . . . . 4400 ± 500 angstroms
Cathode, Semitransparent. . . . . Cesium-Antimony
  Shape . . . . .Flat, Circular
  Minimum area. . . . . 1.2 sq. in.
  Minimum diameter. 1.24"
Window. . . . . .Lime Glass (Corning[a] No.0080), or equivalent
  Index of refraction 1.51
Dynode Material . . . . Cesium-Antimony
Direct Interelectrode Capacitances (Approx.):
  Anode to dynode No.10 . . . . 4 pf
  Anode to all other electrodes . . . . 7 pf
Maximum Overall Length (Excluding flexible leads) . . . . 3.91"
Maximum Diameter. . . . . 1.56"
Operating Position. . . . . Any
Weight (Approx.). . . . . 2 oz
Bulb. T12
Magnetic Shield . . . . b
Base. . . . . Special
Terminal Diagram: BOTTOM VIEW

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 7 - Dynode No.10
Lead 8 - Dynode No.8
Lead 9 - Dynode No.6
Lead 10 - Dynode No.4
Lead 11 - Dynode No.2
Lead 13 - Photocathode



DIRECTION OF RADIATION: INTO END OF BULB

Maximum Ratings, ***Absolute-Maximum Values:***

DC SUPPLY VOLTAGE BETWEEN ANODE CATHODE	1250 max.	volts
DC SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE	250 max.	volts
DC SUPPLY VOLTAGE BETWEEN CONSECUTIVE DYNODES	200 max.	volts
DC SUPPLY VOLTAGE BETWEEN DYNODE No.1 AND CATHODE	300 max.	volts

World Radio History

AVERAGE ANODE CURRENT[c]	0.75 max.	ma
AMBIENT TEMPERATURE	75 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 = 1000 volts (Except as noted)

	Min.	*Typ.*	*Max.*	
Sensitivity:				
Radiant, at 4400 angstroms	-	2.2×10^4	-	a/w
Cathode radiant, at 4400 angstroms	-	0.036	-	a/w
Luminous:				
At 0 cps[d]	10	27	300	a/lm
With dynode No.10 as output electrode[e]. . .	-	16	-	a/lm
Cathode luminous:				
With tungsten light source[f] .	3×10^{-5}	4.5×10^{-5}	-	a/lm
With blue light source[g,m]	2.8×10^{-8}	-	-	a
Current Amplification	-	6×10^5	-	
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 20 a/lm:[h,j]. . . .	-	8×10^{-10}	2.5×10^{-9}	lm
Equivalent Noise Input[k]	-	4×10^{-12}	1.7×10^{-11}	lm
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. . . .	-	2.2×10^3	-	a/w
Cathode radiant, at 4400 angstroms . . .	-	0.036	-	a/w
Luminous:				
At 0 cps[d] . . .	-	2.7	-	a/lm
With dynode No.10 as output electrode[e]. .	-	1.6	-	a/lm

World Radio History

	Min.	Typ.	Max.	
Cathode Luminous:				
With tungsten light source[f] . .	3×10^{-5}	4.5×10^{-5}	-	a/lm
With blue light source[g,m] .	2.8×10^{-8}	-	-	a
Current Amplification	-	6×10^{4}	-	

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

[b] Magnetic shielding material in the form of foil or tape as available from The Magnetic Shield Division, Perfection Mica Company, 1829 Civic Opera Building, 20 North Wacker Drive, Chicago 6, Illinois, or equivalent.

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

[d] 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.

[e] 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 curves shown in the accompanying *Typical Anode Characteristics* curve, do not apply when dynode No.10 is used as the output electrode.

[f] 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.

[g] 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.

[h] At a tube temperature of 25° C. Dark current may be reduced by use of a refrigerant.

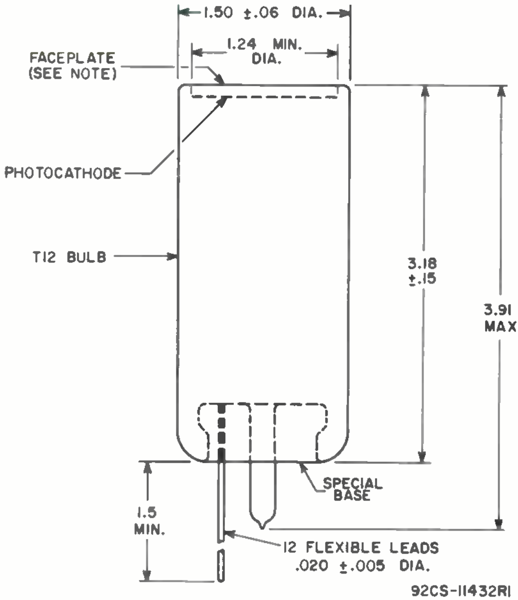
[j] For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1000 volts is recommended.

[k] 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.

[m] 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-11 RESPONSE is shown at the front of this Section

World Radio History

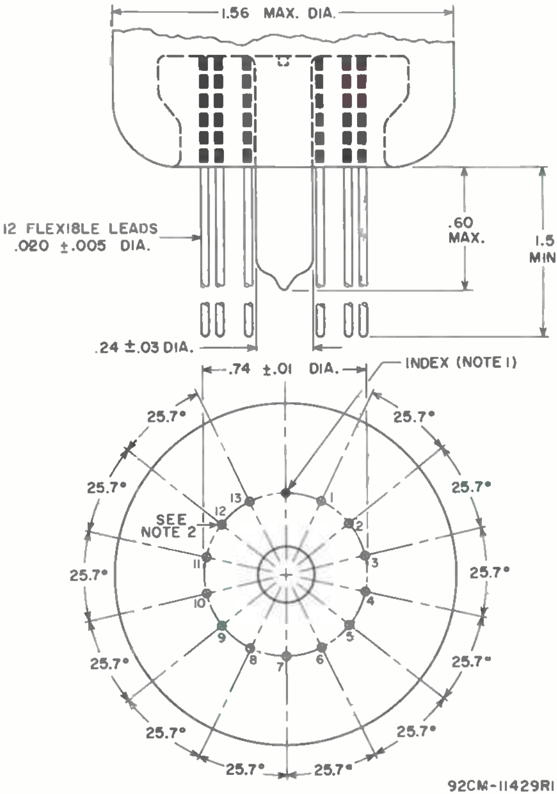


DIMENSIONS IN INCHES

NOTE: WITHIN 1.24 INCH DIAMETER, DEVIATION FROM FLATNESS OF EXTERNAL SURFACE OF FACEPLATE WILL NOT EXCEED 0.010 INCH FROM PEAK TO VALLEY.

World Radio History

SPECIAL BASE
Pin Dimensions and Orientation and Index Guide



DIMENSIONS IN INCHES

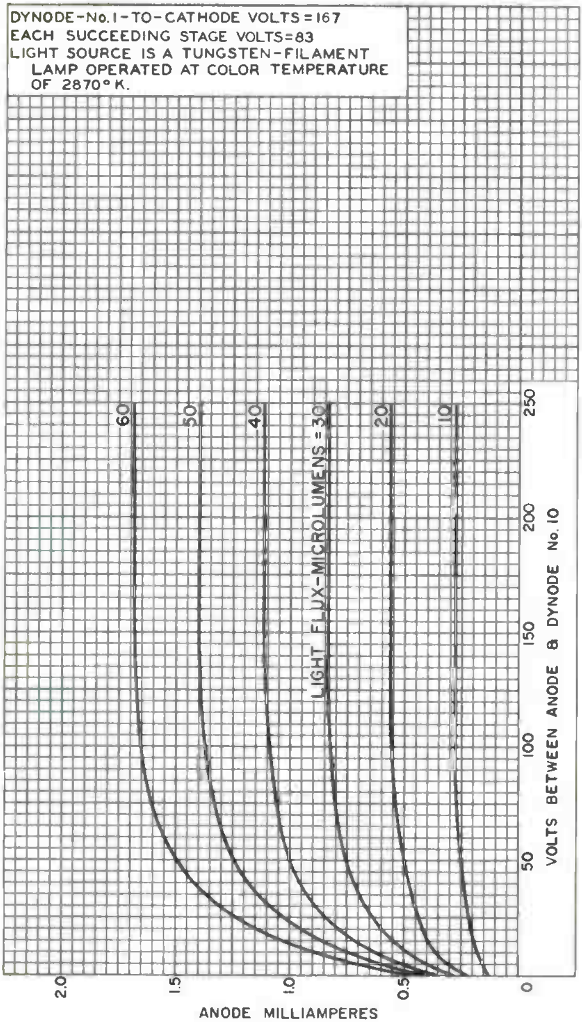
12-Lead Base 1,2,3,4,5,6,7,8,9,10,11,13

NOTE 1: LEAD IS CUT OFF WITHIN 0.04 INCH OF THE GLASS BUTTON FOR INDEXING.

NOTE 2: LEAD No.12 IS CUT OFF WITHIN 0.04 INCH OF THE GLASS BUTTON.

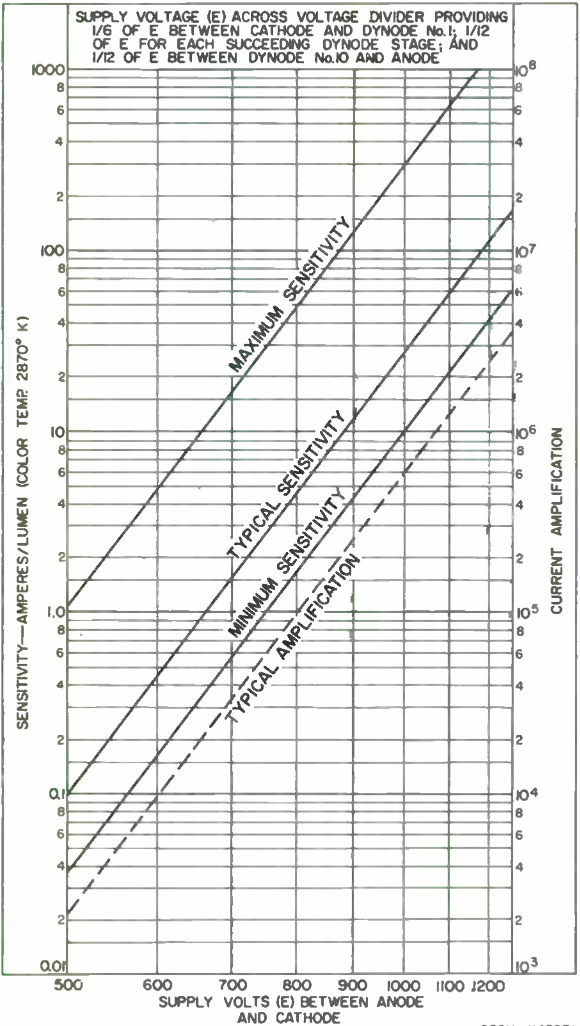
World Radio History

TYPICAL ANODE CHARACTERISTICS



92CM-7255R6

TYPICAL CHARACTERISTICS



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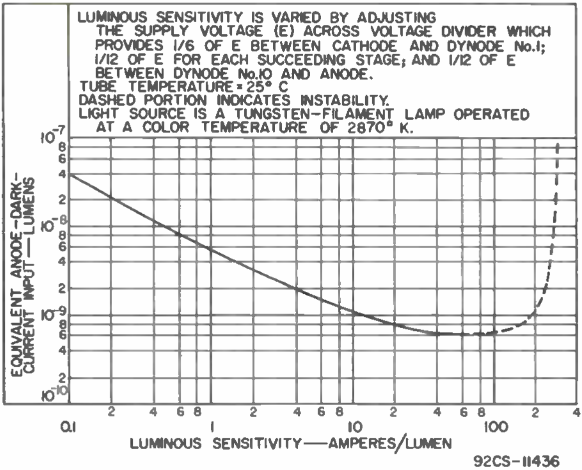
World Radio History

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



World Radio History

Multiplier Phototube

S-11 RESPONSE

"RUGGEDIZED", 10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE

ELECTROSTATICALLY FOCUSED DYNODE STAGES

For Detection and Measurement of Nuclear Radiation and Other Low-Level Light Sources in Industrial and Military Applications

The 4439 is the same as the 4438 except for the following:

The 4439 is supplied with a small-shell duodecal base attached to the flexible leads to facilitate testing. After testing, and prior to installing the 4439 in a given system, the attached base should be removed.

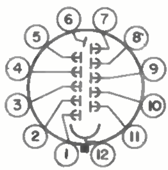
DATA

General:

Base (Attached to flexible leads). Small-Shell Duodecal 12-Pin (JEDEC Group 4, No.B12-43)

Terminal Diagram for BOTTOM VIEW 12AE

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 - Photo-cathode

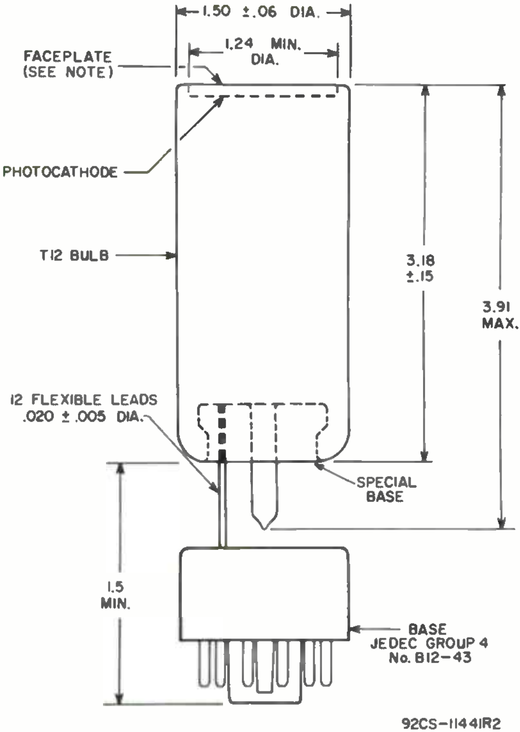


DIRECTION OF RADIATION: INTO END OF BULB

Base (With JEDEC No.B12-43 removed from flexible leads) . . . . Special

Terminal Diagram. . . . . Same as for type 4438

World Radio History



DIMENSIONS IN INCHES

NOTE: WITHIN 1.24 INCH DIAMETER, DEVIATION FROM FLATNESS OF EXTERNAL SURFACE OF FACEPLATE WILL NOT EXCEED 0.010 INCH FROM PEAK TO VALLEY.

World Radio History

Multiplier Phototube

S-11 RESPONSE

"RUGGEDIZED", 10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE — ELECTROSTATICALLY FOCUSED DYNODE STAGES

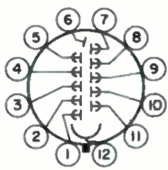
For Detection and Measurement of Nuclear Radiation and Other Low-Level Light Sources in Industrial, Military, and Missile Applications

DATA

General:

Spectral Response	S-11
Wavelength of Maximum Response	4400 ± 500 angstroms
Cathode, Semitransparent	Cesium-Antimony
Shape	Flat, Circular
Minimum Area	1.2 sq. in.
Minimum diameter	1.24"
Window	Lime Glass (Corning[a] No.0080), or equivalent
Index of refraction	1.51
Dynode Material	Cesium-Antimony
Direct Interelectrode Capacitances (Approx.):	
Anode to dynode No.10	4 pf
Anode to all other electrodes	7 pf
Maximum Overall Length	4.12"
Seated Length	3.50" ± 0.12"
Maximum Diameter	1.56"
Operating Position	Any
Weight (Approx.)	2.2 oz
Bulb	T12
Socket	Amphenol[b] No.59-402, or equivalent
Magnetic Shield	Millen[c] No.80802C, or equivalent
Base	Ultrashort Small-Shell Duodecal 12-Pin, (JEDEC Group 4, No.B12-186), Non-hygroscopic
Basing Designation for BOTTOM VIEW	12AE

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



DIRECTION OF RADIATION: INTO END OF BULB

Maximum Ratings, ***Absolute-Maximum Values:***

DC SUPPLY VOLTAGE BETWEEN ANODE AND CATHODE	1250 max.	volts
DC SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE	250 max.	volts
DC SUPPLY VOLTAGE BETWEEN CONSECUTIVE DYNODES	200 max.	volts

DC SUPPLY VOLTAGE BETWEEN DYNODE No. 1 AND CATHODE	300 max.	volts
AVERAGE ANODE CURRENT[d]	0.75 max.	ma
AMBIENT TEMPERATURE	75 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 = 1000 volts (Except as noted)

	Min.	*Typ.*	*Max.*	
Sensitivity:				
Radiant, at 4400 angstroms. . . .	–	2.2×10^4	–	a/w
Cathode radiant, at 4400 angstroms. . . .	–	0.036	–	a/w
Luminous:				
At 0 cps[e]. . . .	10	27	300	a/lm
With dynode No. 10 as output electrode[f] . .	–	16	–	a/lm
Cathode luminous:				
With tungsten light source[g].	3×10^{-5}	4.5×10^{-5}	–	a/lm
With blue light source[h,n]. . .	2.8×10^{-8}	–	–	a
Current Amplification	–	6×10^{-5}	–	
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 20 a/lm[j,k] . . .	–	8×10^{-10}	2.5×10^{-9}	lm
Equivalent noise input[m]	–	4×10^{-12}	1.7×10^{-11}	lm
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. . . .	–	2.2×10^3	–	a/w
Cathode radiant, at 4400 angstroms. . . .	–	0.036	–	a/w
Luminous:				
At 0 cps[e]. . . .	–	2.7	–	a/lm
With dynode No. 10 as output electrode[f] . .	–	1.6	–	a/lm

	Min.	Typ.	Max.	
Cathode luminous:				
With tungsten light source[g] . . .	3×10^{-5}	4.5×10^{-5}	-	a/lm
With blue light source[h,n]	2.8×10^{-8}	-	-	a
Current Amplification . .	-	6×10^{4}	-	

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

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

[c] Made by James Millen Manufacturing Company, 150 Exchange Street, Malden 48, Massachusetts.

[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 curves shown in the accompanying *Typical Anode Characteristics* curve do 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] At a tube temperature of 25° C. Dark current may be reduced by use of a refrigerant.

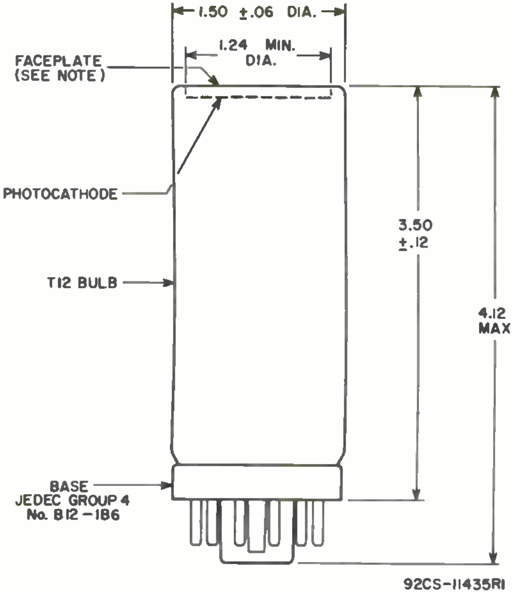
[k] For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1000 volts is recommended.

[m] 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.

[n] 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-11 RESPONSE
is shown at the front of this Section

World Radio History



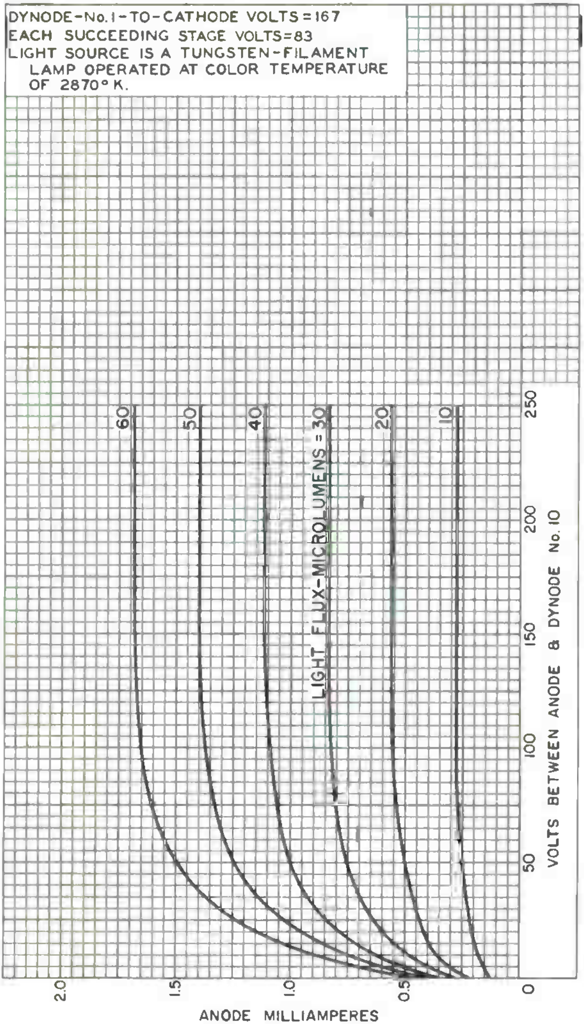
DIMENSIONS IN INCHES

CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

NOTE: WITHIN 1.24 INCH DIAMETER, DEVIATION FROM FLATNESS OF EXTERNAL SURFACE OF FACEPLATE WILL NOT EXCEED 0.010 INCH FROM PEAK TO VALLEY.

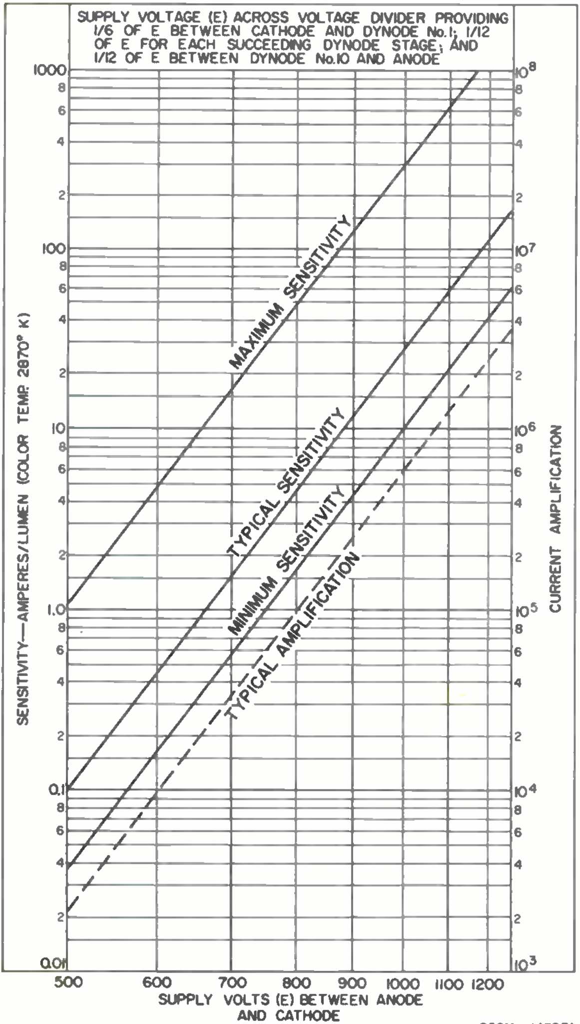
World Radio History

TYPICAL ANODE CHARACTERISTICS



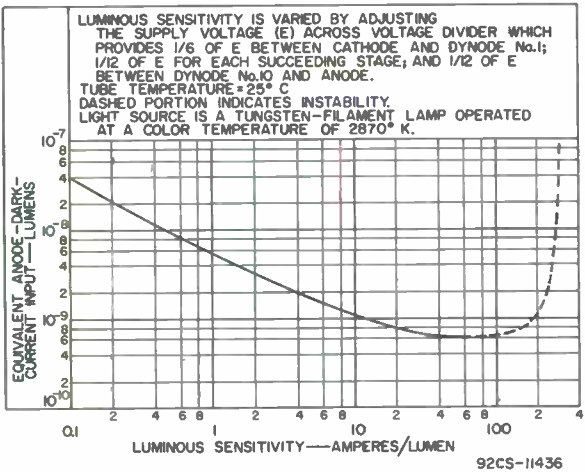
92CM-7255R6

TYPICAL CHARACTERISTICS



World Radio History

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



World Radio History

World Radio History

Multiplier Phototube

S-11 RESPONSE

"RUGGEDIZED", 10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE

ELECTROSTATICALLY FOCUSED DYNODE STAGES

For Detection and Measurement of Nuclear Radiation and Other Low-Level Light Sources in Industrial, Military, and Missile Applications

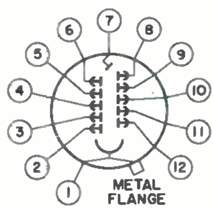
DATA

General:

Spectral Response	S-11
Wavelength of Maximum Response	4400 ± 500 angstroms
Cathode, Semitransparent	Cesium-Antimony
Shape	Flat, Circular
Minimum area	1.2 sq. in.
Minimum diameter	1.24"
Window	Lime Glass (Corning[a] No.0080), or equivalent
Index of refraction	1.51
Dynode Material	Cesium-Antimony
Direct Interelectrode Capacitances (Approx.):	
Anode to dynode No. 10	3.2 pf
Anode to all other electrodes	5.0 pf
Maximum Overall Length (Excluding flexible leads)	3.18"
Maximum Diameter	1.56"
Operating Position	Any
Weight (Approx.)	3 oz
Bulb	T12
Magnetic Shield	[b]
Base	Special

Terminal Diagram: BOTTOM VIEW

- Lead 1 & Metal Flange-Photocathode
- Lead 2 - Dynode No.1
- Lead 3 - Dynode No.3
- Lead 4 - Dynode No.5
- Lead 5 - Dynode No.7
- Lead 6 - Dynode No.9
- Lead 7 - 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



DIRECTION OF RADIATION: INTO END OF BULB

Maximum Ratings, ***Absolute-Maximum Values:***

DC SUPPLY VOLTAGE BETWEEN ANODE AND CATHODE	1250 max.	volts
DC SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE	250 max.	volts
DC SUPPLY VOLTAGE BETWEEN CONSECUTIVE DYNODES	200 max.	volts

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DC SUPPLY VOLTAGE BETWEEN DYNODE NO.1 AND CATHODE	300	max.	volts
AVERAGE ANODE CURRENT[c]	0.75	max.	ma.
AMBIENT TEMPERATURE	75	max.	°C

Characteristic 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 = 1000 volts (Except as noted)

	Min.	*Typ.*	*Max.*	
Sensitivity:				
Radiant, at 4400 angstroms	–	2.2×10^4	–	a/w
Cathode radiant, at 4400 angstroms	–	0.036	–	a/w
Luminous:				
At 0 cps[d]	10	27	300	a/lm
With dynode No.10 as output electrode[e]	–	16	–	a/lm
Cathode luminous:				
With tungsten light source[f]	3×10^{-5}	4.5×10^{-5}	–	a/lm
With blue light source[g,m]	2.8×10^{-8}	–	–	a
Current Amplification	–	6×10^5	–	
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 20 a/lm:[h,j]	–	8×10^{-10}	2.5×10^{-9}	lm
Equivalent Noise Input[k]	–	4×10^{-12}	1.7×10^{-11}	lm
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	–	2.2×10^3	–	a/w
Cathode radiant, at 4400 angstroms	–	0.036	–	a/w
Luminous:				
At 0 cps[d]	–	2.7	–	a/lm
With dynode No.10 as output electrode[e]	–	1.6	–	a/lm
Cathode luminous:				
With tungsten light source[f]	3×10^{-5}	4.5×10^{-5}	–	a/lm
With blue light source[g,m]	2.8×10^{-8}	–	–	a
Current Amplification	–	6×10^4	–	

World Radio History

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

b Magnetic shielding material in the form of foil or tape as available from the Magnetic Shield Division, Perfection Mica Company, 1829 Civic Opera Building, 20 North Wacker Drive, Chicago 6, Illinois, or equivalent.

c Averaged over any interval of 30 seconds maximum.

d 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.

e 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 curves shown in the accompanying *Typical Anode Characteristics* curve do not apply when dynode No.10 is used as the output electrode.

f 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.

g 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.

h At a tube temperature of 25° C. Dark current may be reduced by use of a refrigerant.

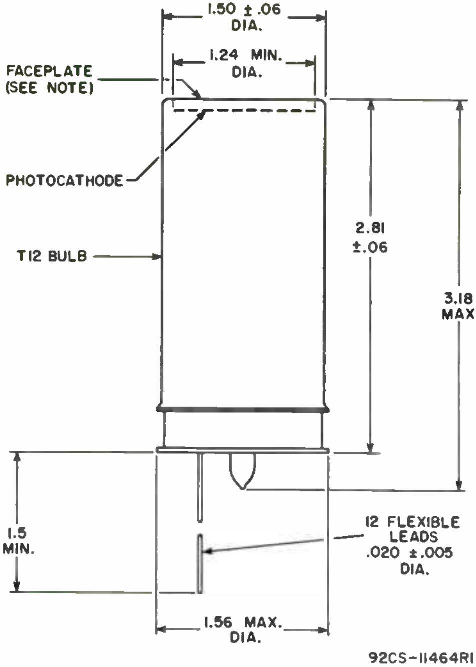
j For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1000 volts is recommended.

k 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.

m 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-11 RESPONSE **is shown at the front of this Section**

World Radio History



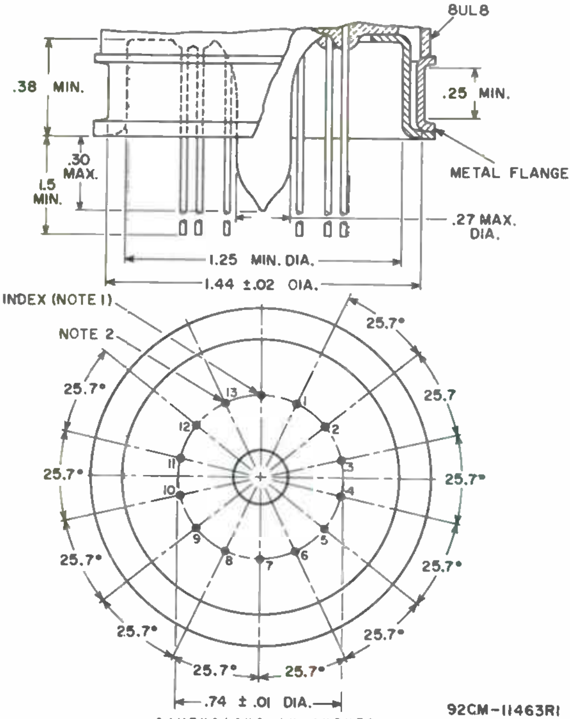
DIMENSIONS IN INCHES

CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE FLANGE.

NOTE: DEVIATION FROM FLATNESS WITHIN THE 1.24 INCH DIAMETER AREA WILL NOT EXCEED 0.010 INCH FROM PEAK TO VALLEY.

World Radio History

SPECIAL BASE
Pin Dimensions and Orientation and Index Guide



DIMENSIONS IN INCHES

12-Lead Base 1,2,3,4,5,6,7,8,9,10,11,12

NOTE 1: LEAD IS CUT OFF WITHIN 0.04 INCH OF THE GLASS BUTTON FOR INDEXING.

NOTE 2: LEAD NO. 13 IS CUT OFF WITHIN 0.04 INCH OF THE GLASS BUTTON.

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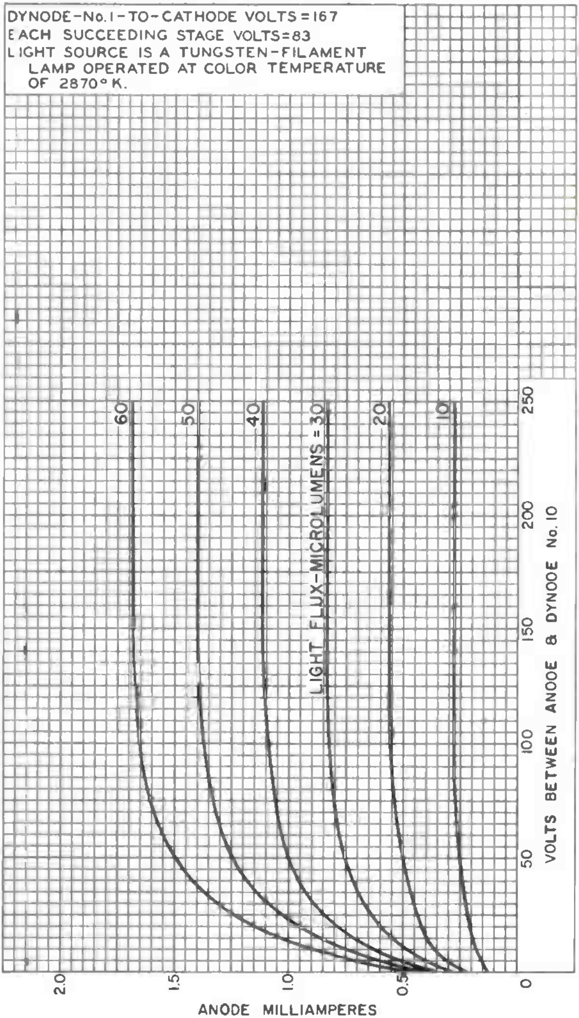
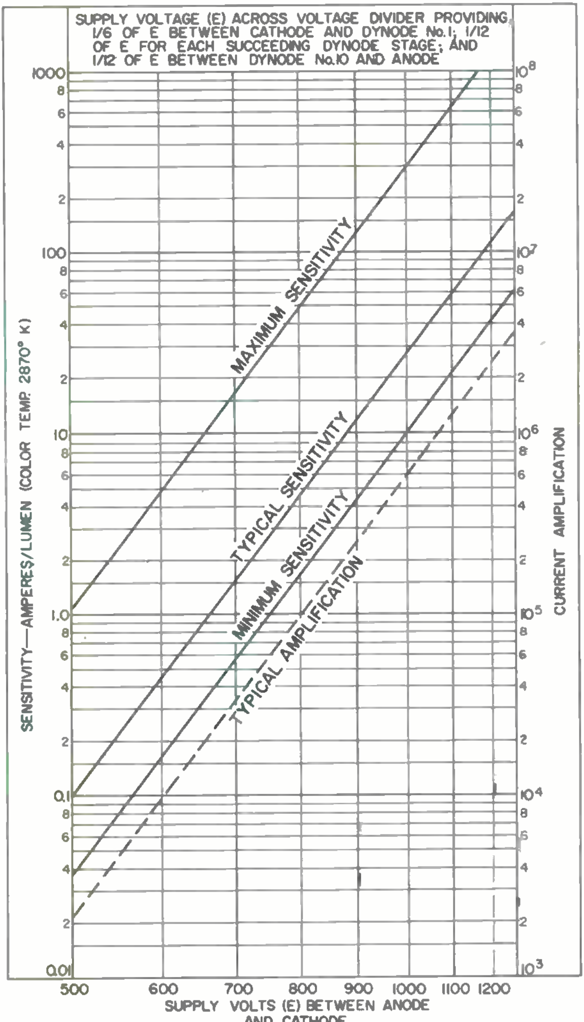
TYPICAL ANODE CHARACTERISTICS



92CM-7255R6

TYPICAL CHARACTERISTICS



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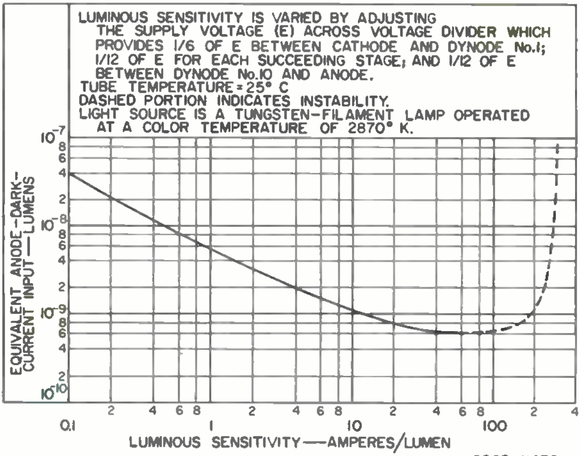
World Radio History

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



World Radio History

Multiplier Phototube

RUGGED VIBRATION-RESISTANT STRUCTURE

S-11 RESPONSE — ELECTROSTATICALLY FOCUSED

10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE — DYNODE STAGES

For Detection and Measurement of Nuclear Radiation and other Low-Level Light Sources. Especially Useful in Missile and Rocket Service and other Industrial and Military Applications where Severe Environmental Conditions may be Encountered.

The 4441A is the same as the 4441 except for the following:

Characteristics Range Values for Equipment Design:

	Min.	Typ.	Max.	
With E = 1000 volts				
Anode-Pulse Rise Time[a]	-	2.3×10^{-9}	-	sec.
With E = 750 volts				
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 20 a/lm[b,c]	-	8×10^{-10}	2.5×10^{-9}	lm

ENVIRONMENTAL TESTS:

The 4441A is designed to withstand environmental tests equivalent to those specified in MIL-E-5272C* for equipment mounted on the structures of missiles propelled or launched by high-thrust rocket engines. The accelerations specified in these tests are applied directly to the tubes.

One-Hundred Per-Cent Shock and Vibration Testing:

Shock. These tests are performed first, per method of MIL-E-5272C*, Par.4.15.5.1, Proc.V, on apparatus which provides a half-wave sinusoidal shock pulse. One-hundred percent testing of all 4441A's is performed. Each 4441A (non-operating) is subjected to three impact shocks in each direction of the three orthogonal axes. Each impact shock has a peak acceleration of 30 ± 3 g's and a time duration of 11 ± 1 milliseconds. Each tube is subjected to a total of 18 impact shocks.

Vibration. These tests are performed next, on apparatus which applies a variable-sinusoidal frequency vibration to the tube in accordance with MIL-E-5272C*, par.4.7.14 and par.4.7.14.1, except for the cycle duration. This test is performed on all 4441A tube types. Each 4441A (Operating under the conditions specified under *Tube Rejection Criterion*) is vibrated in each of the three orthogonal axes and as specified in the following schedule. A vibration cycle has a duration of 5 minutes per axis in which time the frequency is varied logarithmically from 20 to 2000 and back to 20 cycles per second. One vibration cycle is performed for each axis and the total test period for each tube is 15 minutes.

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Double Amplitude inches	Accelera-tion g's	Fre-quency cps	Cycle Duration Per Axis minutes
0.050 ± 0.005	–	20–87	5
–	20	87–2000	
–	20	2000–87	
0.050 ± 0.005	–	87–20	

Tube Rejection Criterion. After completion of the shock tests, tubes are operated at an anode-to-cathode voltage of 1000 volts with the light level incident on the tube adjusted to provide an anode current of 8 microamperes. Electrical and/or mechanical tube failures due to shock or vibration are observed during the vibration test when the specified anode current is monitored. Tube rejection criterion for both tests is that the anode current of 8 microamperes will not change more than ± 20 per cent at any time during the vibration test for each axis.

Design Tests:

Vibration. These tests are performed under conditions equivalent to those described in MIL-E-5272C*, par.4.7.14 and par.4.7.14.1. The vibration cycle has a duration of one hour and two cycles are performed for each of the three orthogonal axes. The total test period for each tube is six hours.

Acceleration. These tests are performed in a centrifuge providing unidirectional acceleration by a method equivalent to that specified in MIL-E-5272C*, par.4.16.3, Proc.III except that tubes are subjected for one minute to an increased acceleration test level of 100 ± 10 g's in both directions of the three orthogonal axes and the tubes are non-operating.

* Military Specification MIL-E-5272C (ASG), 13 April 1959; and Amendment 1, 5 January 1960.

World Radio History

Image-Converter Tube

S-11 RESPONSE

For Use as a High-Speed Light Shutter
in Extremely-High-Speed Photography

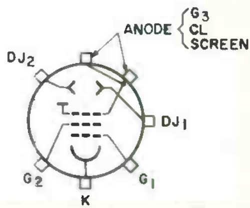
General:

Spectral Response	S-11
Wavelength of Maximum Response	4400 ± 500 angstroms
Photocathode, Semitransparent:	
Shape	Spherical, Circular
Window:	
Area	9.52 sq.cm (1.48 sq.in.)
Minimum diameter	3.48 cm (1.37 in.)
Index of refraction	1.48
Fluorescent Screen:	
Shape	Flat, Circular
Phosphor	P11[a], Aluminized
Fluorescence	Blue
Phosphorescence	Blue
Persistence[a]	Medium Short
Window:	
Useful deflection area (Approx.)	18 sq.cm (2.8 sq.in.)
Minimum diameter	7.1 cm (2.8 in.)
Index of refraction	1.48
Direct Interelectrode Capacitances (Approx.):	
Grid No.1 to all other electrodes	20 pf
Deflecting electrode DJ1 to deflecting electrode DJ2	1 pf
Deflecting electrode DJ1 to all other electrodes	6 pf
Deflecting electrode DJ2 to all other electrodes	6 pf
Focusing Method	Electrostatic
Deflection Method	Electrostatic
Overall Length	9.37" ± 0.06"
Diameter	3.37" ± 0.07"
Operating Position	Any
Weight (Approx.)	28 oz

Terminal Connections (See *Dimensional Outline*):

G_1 – Grid No.1
G_2 – Grid No.2
DJ1 – Deflecting Electrode No.1
K – Photocathode
DJ2 – Deflecting Electrode No.2
Anode – (Grid No.3, Collector, Screen)

DIRECTION OF LIGHT: PERPENDICULAR TO PHOTOCATHODE END OF TUBE



World Radio History

Maximum Ratings, *Absolute-Maximum Values:*

DC Anode Voltage[b]	15000 max.	volts
DC Grid-No.2 Voltage[b]	2200 max.	volts
Grid-No.1 Voltage[b]	190 max.	volts
Deflecting Electrode Voltage:		
DJ1 and DJ2[c]	±1500 max.	volts
Peak Photocathode Current[d]	0.02 max.	ampere
Photocathode Current Density:		
Peak[d]	0.002 max.	amp/cm^2
Average[e]	0.1 max.	$\mu a/cm^2$

Typical Operating Values:

Anode Voltage[b]	15000	volts
Grid-No.2 Voltage[b,f]	1500 to 1900	volts
Grid-No.1 Voltage:[b]		
Operating (Minimum)[f]	110 to 170	volts
Cutoff (Maximum)	-90	volts
Deflection Factor	1050 to 1250	volts/in.

Characteristics:

With conditions shown under Typical Operating Values and at an ambient temperature of 25° C

	Min.	*Typical*	*Max.*	
Photocathode Sensitivity:				
Radiant, at 4400 angstroms	–	0.04	–	amp/watt
Luminous, at 0 cps[g]	2×10^{-5}	5×10^{-5}	–	amp/lumen
Paraxial Image Magnification (Cmx)[h,j]	0.69	–	0.78	
Distortion[h,k]	–	–	0.03	
Paraxial Resolution[b,m]	25	–	–	line-pairs/mm
Edge Resolution[b,m,n]	15	–	–	line-pairs/mm
Radiant Power Gain,[p,q]	50	–	–	
Equivalent Background Screen Brightness Input[r]	–	–	5×10^{-12}	watts/sq.cm
Screen Uniformity Factor[s]	–	–	1.3	
Alignment	–	–	t	

[a] For P11 Spectral-Energy Emission Characteristic curve, see *front of Cathode-Ray Tube, Storage-Tube, & Monoscope Section.* See also accompanying *Operating Considerations.*

[b] Referred to photocathode.

[c] Referred to anode.

[d] Over an interval not exceeding 1 microsecond.

[e] Averaged over any interval of 8 minutes maximum.

[f] Adjusted to minimize shadowing effects in the displayed image caused by the wires of grid No.1.

[g] For conditions where the light source is a tungsten-filament lamp having a lime glass envelope (Corning Glass Code No.0080, or equivalent). The lamp is operated at a color temperature of 2870° K. A light input of 0.01 lumen is used to irradiate a centered 1/2-inch diameter of the photocathode.

[h] Defined as the ratio of the separation of two diametrically opposite image points on the screen to the separation of the corresponding image points on the photocathode.

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j Determined as follows: The image incident on the photocathode is perpendicular to the grid-No.1 wires and consists of 2 parallel lines on a bright background approximately 0.16" in length and separated by a distance of 0.160" ± 0.002". The image on the photocathode is focused and positioned so that the separation between the image lines is an equal distance on both sides of the geometric center of the photocathode. The line spacing on the screen is measured adjacent to the faint image of the center grid-No.1 wire.

k A second magnification value (Emx) is measured under the conditions established in (j) except that the lines are separated by a distance of 1.00" ± 0.01". Distortion (D) is defined by the equation:

$$D = \frac{Emx}{Cmx} - 1$$

m Determined with a resolution pattern consisting of horizontal and vertical bars. The limiting resolution value is measured adjacent to the faint image of the center grid-No.1 wire and applies to both vertical and horizontal resolution.

n Measured at the edge of a 1-inch diameter circle positioned concentric with the geometric center of the photocathode under the same conditions established in (m).

p Under the following conditions: Light incident on the photocathode is transmitted through a blue filter (Corning C. S. No.5-58 filter from Melt No.5113 polished to 1/2 stock thickness—Manufactured by the Corning Glass Works, Corning, New York) from a tungsten-filament lamp having a lime-glass envelope. The lamp is operated at a color temperature of 2870° K. A 1/2-inch diameter of the photocathode is irradiated and the value of light flux incident on the filter is 0.1 lumen. A calibrated receiver having S-11 spectral response and masked to have a 1/2-inch-diameter aperture is positioned 12 inches from the screen of the 4449A. The output current (I_1) of the receiver is noted. The same receiver is then positioned to receive the radiant flux originally incident on the photocathode and its output current (I_2) is noted. Radiant power gain (G) is defined by the equation:

$$G = 2000 \times \frac{I_1}{I_2}$$

The coefficient 2000 is derived by assuming that the integrated light radiated by the screen is 79 per cent of that value that would be obtained if the light emitted by the screen has a cosine distribution.

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.

r Defined as that value of incident radiation required to cause an increase in screen brightness equal to the screen background brightness.

s The ratio of the luminance values of the brightest area to the darkest area of the screen with the entire photocathode uniformly illuminated. The value of incident illumination on the photocathode is 1 footcandle and the light spot on the screen has a diameter of 0.10" ± 0.01".

t A trace produced on the screen, when the center of the photocathode is irradiated with a 0.025-inch diameter light spot and an ac voltage is applied to the deflecting electrodes, will not deviate more than 4° from the plane passing through the center of the recessed ball cap of grid No.1 and the major axis of the tube. The angle produced by the trace and the faint images of the grid wires, that are observed when the photocathode is uniformly illuminated, will be 90° ± 3°.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-11 RESPONSE is shown at front of this Section

OPERATING CONSIDERATIONS

Magnetic shielding of the 4449A is required to minimize the effects of extraneous fields on tube performance; ac magnetic fields are particularly objectionable in that they seriously impair tube resolution. If an iron or steel case is used, care should be taken in its construction to insure that the case is completely demagnetized.

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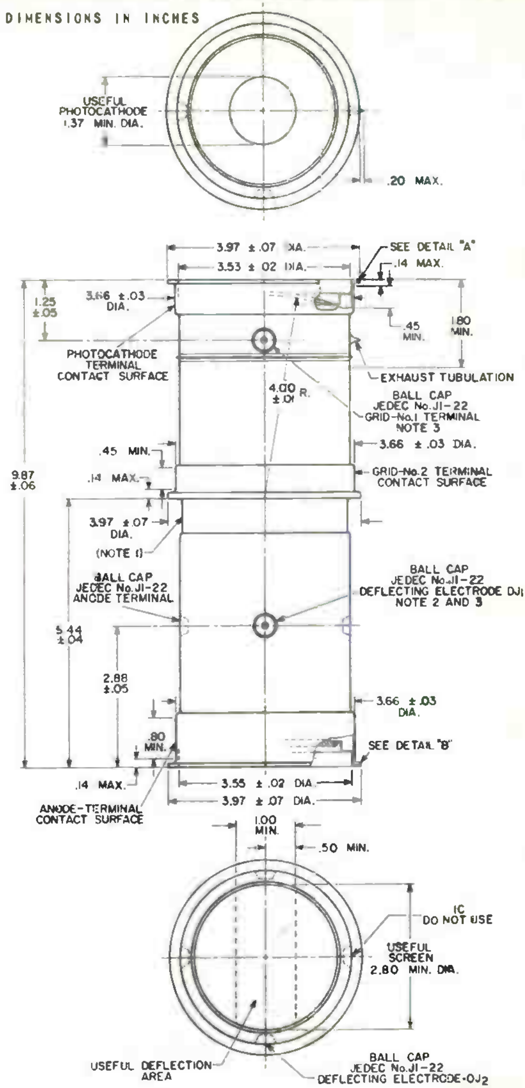
The *P-11 phosphor screen* employed by the 4449A emits high-intensity actinic blue fluorescence and has a persistence characteristic, within the range of 10 microseconds to 1 millisecond, that is dependent on the current density employed.

To *prevent degradation in the resolution of deflected images* care must be taken to assure that the deflecting voltage is free of ac ripple and that shielded semiflexible leads are used for making connection to the deflecting electrode terminals. Balanced deflection with respect to anode should be used.

Exposure Time. In practice, the shutter speeds attainable with the 4449A are limited by the ability of the external circuitry to supply to grid No. 1 good rectangular-wave pulses of sufficiently short duration. With perfect pulse-forming circuits, the minimum exposure time of the 4449A is limited by electron transit time which, for an anode voltage of 15 kilovolts, is in the order of 10^{-9} seconds. Electrons are defocused if they are not beyond the influence of the gating (control) grid when its voltage returns to cutoff value at the end of the gating pulse.

The high voltage at which the 4449A is operated may be very dangereous. Great care should be taken in the design of apparatus to prevent the user from coming in contact with the high voltage. Precautions must include safeguards which eliminate all hazards to operating personnel. In the use of high-voltage tubes, such as the 4449A, it should always be remembered that high voltage may appear at normally low-potential points in the circuit because of capacitor breakdown or incorrect circuit connections. Before any part of the circuit is touched, the voltage-supply switch should be turned off and both terminals of any capacitors grounded.

World Radio History



For DETAIL "A" and "B" and notes, see back page.

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NOTES FOR DIMENSIONAL OUTLINE

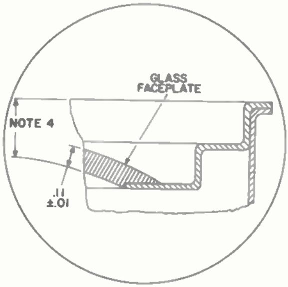
Note 1: Not to be used for mechanical support or electrical connection.

Note 2: The plane passing through the center of the recessed ball cap DJ2 and the major axis of the tube will not deviate more than 3° from the plane passing through the center of the recessed ball cap DJ1 and the major axis of the tube.

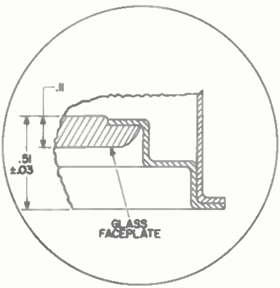
Note 3: The plane passing through the center of the recessed ball cap DJ1 and the major axis of the tube will not deviate more than 5° from the plane passing through the center of the recessed ball cap for grid No.1 and the major axis of the tube.

Note 4: This distance on the major axis of the tube is .33 ± .03.

DETAIL "A"



DETAIL "B"



DIMENSIONS IN INCHES

World Radio History

Multiplier Phototube

12-STAGE, HEAD-ON SPHERICAL-FACEPLATE TYPE
HIGH CURRENT AMPLIFICATION

S-20 RESPONSE

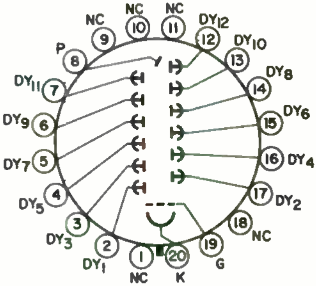
ENCLOSED, IN-LINE DYNODE STRUCTURE
EXTREMELY SHORT RISE TIME

For Near-Infrared Ruby-Laser Detector Systems, Flying-Spot Scanning, Photometry, and Scintillation Counters Requiring Low-Dark Current and High Sensitivity over the Visible and Near-Infrared Regions of the Spectrum.

General:

Spectral Response	S-20
Wavelength of Maximum Response	4200 ± 500 angstroms
Cathode, Semitransparent	K-Na-Cs-Sb (Multialkali)
Shape	Spherical, Circular
Minimum area	2.2 sq. in.
Minimum diameter	1.68 in.
Window	Borosilicate Glass[a]
Index of refraction	1.48
Dynode Material	Copper-Beryllium
Direct Interelectrode Capacitances (Approx.):	
Anode to dynode No.12	3.8 pf
Anode to all other electrodes	5.7 pf
Dynode No.12 to all other electrodes	6.8 pf
Maximum Overall Length	6.31"
Seated Length	5.50" ± 0.19"
Maximum Diameter	2.06"
Operating Position	Any
Weight (Approx.)	7 oz
Bulb	T16
Socket	Cinch[b] No.20-PM, or equivalent
Magnetic Shield	Perfection Mica Co.[c], or equivalent
Base	Small-Shell Bidecal 20-Pin (JEDEC No.B20-102), Non-hygroscopic
Basing Designation for BOTTOM VIEW	20E

Pin 1 - No Internal Connection
Pin 2 - Dynode No.1
Pin 3 - Dynode No.3
Pin 4 - Dynode No.5
Pin 5 - Dynode No.7
Pin 6 - Dynode No.9
Pin 7 - Dynode No.11
Pin 8 - Anode
Pin 9 - Same as Pin 1
Pin 10 - Same as Pin 1
Pin 11 - Same as Pin 1
Pin 12 - Dynode No.12
Pin 13 - Dynode No.10
Pin 14 - Dynode No.8
Pin 15 - Dynode No.6
Pin 16 - Dynode No.4
Pin 17 - Dynode No.2
Pin 18 - Same as Pin 1
Pin 19 - (Focusing Electrode)
Pin 20 - Photocathode



DIRECTION OF LIGHT:
INTO END OF BULB

World Radio History

Maximum Ratings, ***Absolute-Maximum Values:***

DC Supply Voltage:		
Between anode and cathode.	2800 max.	volts
Between anode and dynode No.12	400 max.	volts
Between consecutive dynodes.	400 max.	volts
Between dynode No.1 and cathode.	600 max.	volts
Between focusing electrode and cathode.	600 max.	volts
Average Anode Current[d]	1 max.	ma
Ambient-Temperature Range.	-200 to +85	°C

Characteristics Range Values:

Under conditions with dc supply voltage (E) across a voltage divider providing electrode voltages shown in Table I. Focusing electrode is connected to arm of a potentionmeter between cathode and dynode No.1 and its voltage is adjusted to that value which provides maximum anode current.

With E = 2300 volts (Except as noted)

	Min.	*Typ.*	*Max.*	
Sensitivity:				
Radiant, at 4200 angstroms . . .	-	4.3×10^5	-	a/w
Cathode radiant, at 4200 angstroms . . .	-	0.064	-	a/w
Luminous, at 0 cps[e] . . .	250	1000	12000	a/lm
Cathode luminous:				
With tungsten light source[f]	1.1×10^{-4}	1.5×10^{-4}	-	a/lm
With blue light source[g,h] . .	5.5×10^{-8}	-	-	a
With red light source[j,k] . .	3×10^{-7}	5×10^{-7}	-	a
Current Amplification.	-	6.6×10^6	-	
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 300 a/lm[m]	-	1×10^{-10}	1.3×10^{-9}	lm
Anode-Pulse Rise Time[n]	-	2×10^{-9}	-	sec
Greatest Delay Between Anode Pulses:				
Due to position from which electrons are simultaneously released within a circle centered on tube				

World Radio History

	Min.	Typ.	Max.	
face having a diameter of—				
1.4"	–	3×10^{-10}[p]	–	sec
1.6"	–	5×10^{-10}[p]	–	sec

With E = 1800 volts (Except as noted)

	Min.	Typ.	Max.	
Sensitivity:				
Radiant, at 4200 angstroms	–	4.3×10^{4}	–	a/w
Cathode radiant, at 4200 angstroms. .	–	0.064	–	a/w
Luminous, at 0 cps[e].	–	100	–	a/lm
Cathode luminous:				
With tungsten light source[f] .	1.1×10^{-4}	1.5×10^{-4}	–	a/lm
With blue light source[g,h] . . .	5.5×10^{-8}	–	–	a
With red light source[j,k] . . .	3×10^{-7}	5×10^{-7}	–	a
Current Amplification	–	6.6×10^{5}	–	
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 300 a/lm[m]	–	1×10^{-10}	1.3×10^{-9}	lm
Equivalent Noise Input[q].	–	1.1×10^{-12}	2.4×10^{-12}	lm

[a] Corning No. 7056, made by Corning Glass Works, Corning, New York, or equivalent.

[b] Made by Cinch Manufacturing Company, 1026 South Homan Avenue, Chicago 24, Illinois.

[c] Magnetic shielding material in the form of foil or tape as available from the Magnetic Shield Division, Perfection Mica Company, 1829 Civic Opera Bldg., 20 North Wacker Drive, Chicago 6, Illinois, or equivalent.

[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 0.1 microlumen is used.

[f] 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.

[g] 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 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected as anode.

[h] 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.

[j] 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 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected as anode.

World Radio History

k See *Spectral Characteristic of 2870° K Light Source* and *Spectral Characteristic of Light from 2870° K Source after passing through Indicated Red Filter* at front of this Section.

m At a tube temperature of 25° C. Dark current may be reduced by use of a refrigerant.

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 These values also represent the difference in time of transit between the photocathode and dynode No.1 for electrons simultaneously released from the center and from the periphery of the specified areas.

q 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.

TABLE I

VOLTAGE TO BE PROVIDED BY DIVIDER	
Between	6.95% of Supply Voltage (E) multiplied by
Cathode and Dynode No.1	2
Dynode No.1 and Dynode No.2	1.4
Dynode No.2 and Dynode No.3	1
Dynode No.3 and Dynode No.4	1
Dynode No.4 and Dynode No.5	1
Dynode No.5 and Dynode No.6	1
Dynode No.6 and Dynode No.7	1
Dynode No.7 and Dynode No.8	1
Dynode No.8 and Dynode No.9	1
Dynode No.9 and Dynode No.10	1
Dynode No.10 and Dynode No.11	1
Dynode No.11 and Dynode No.12	1
Dynode No.12 and Anode	1
Anode and Cathode	14.4
Focusing electrode is connected to arm of potentiometer between cathode and dynode No.1. The focusing-electrode voltage is varied to give maximum anode current.	

OPERATING CONSIDERATIONS

The *operating stability* of the 4459 is dependent on the magnitude of the anode current and its duration. When the 4459 is operated at high average values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends of the severity of the operating conditions. After a period of idleness, the 4459 usually recovers a substantial percentage of such loss in sensitivity.

It is recommended that the average anode current be well below the maximum-rated value of 1 milliampere when stability of operation is important. When maximum stability is required, the average anode current should not exceed 10 microamperes.

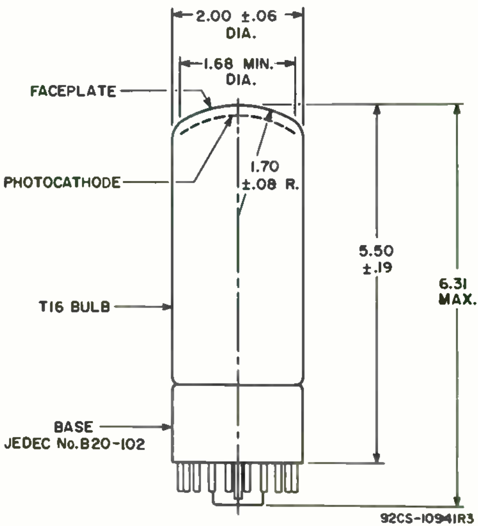
World Radio History

Electrostatic and/or *magnetic shielding* of the 4459 may be necessary.

Adequate *light shielding* should be provided to prevent extraneous light from reaching any part of the 4459.

The *high voltages at which the 4459 is operated are very dangerous.* Care should be taken in the design of apparatus to prevent the operator from coming in contact with these high voltages. Precautions should include the enclosure of high-potential terminals and the use of interlock switches to break the primary circuit of the high-voltage power supply when access to the apparatus is required.

SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOSENSITIVE DEVICE HAVING S-20 RESPONSE
is shown at the front of this Section

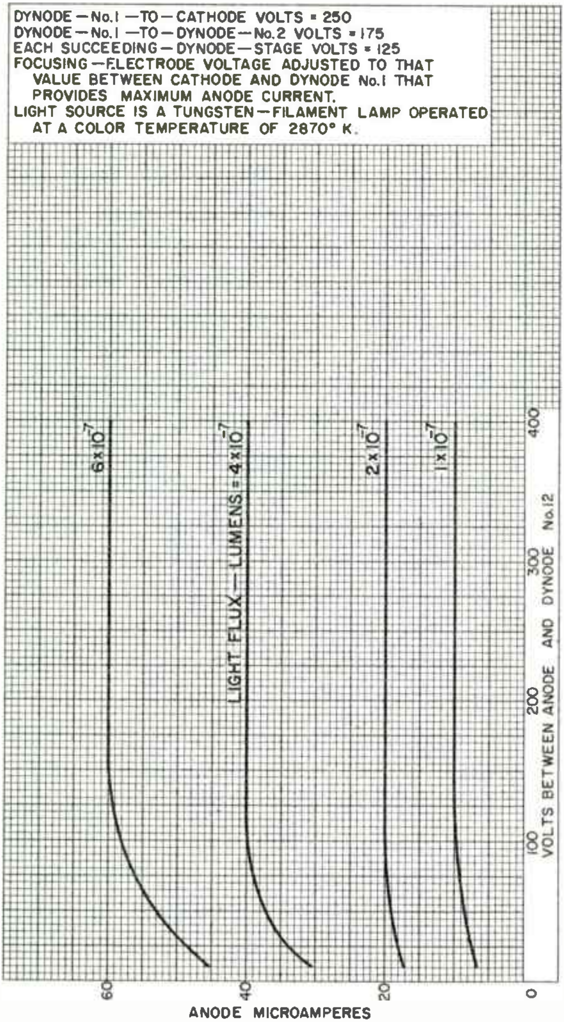


DIMENSIONS IN INCHES

Center line of bulb will not deviate more than 2° in any direction from the perpendicular erected at the center of bottom of the base.

World Radio History

TYPICAL ANODE CHARACTERISTICS



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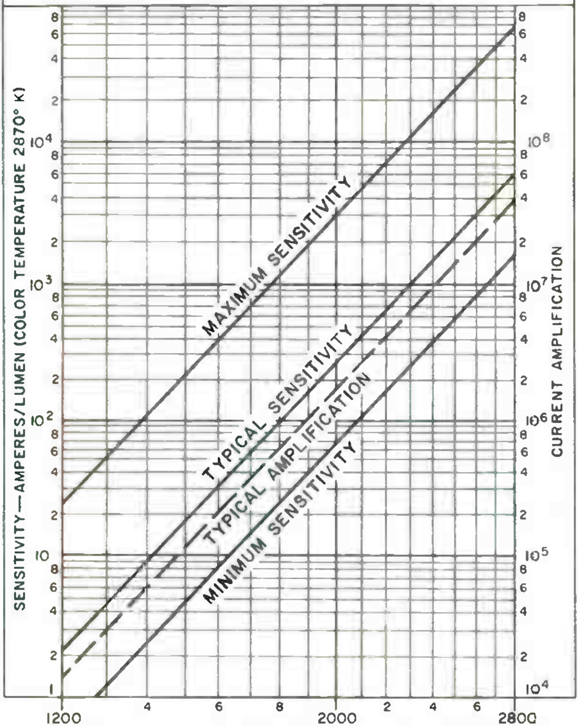
World Radio History

SENSITIVITY AND AMPLIFICATION CHARACTERISTICS

THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	6.95 % OF E MULTIPLIED BY
CATHODE & DY_1	2.0
DY_1 & DY_2	1.4
DY_2 & DY_3 THROUGH DY_{12} & ANODE	1.0
ANODE & CATHODE	14.4

FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN CATHODE AND DYNODE No. 1 THAT PROVIDES MAXIMUM ANODE CURRENT.



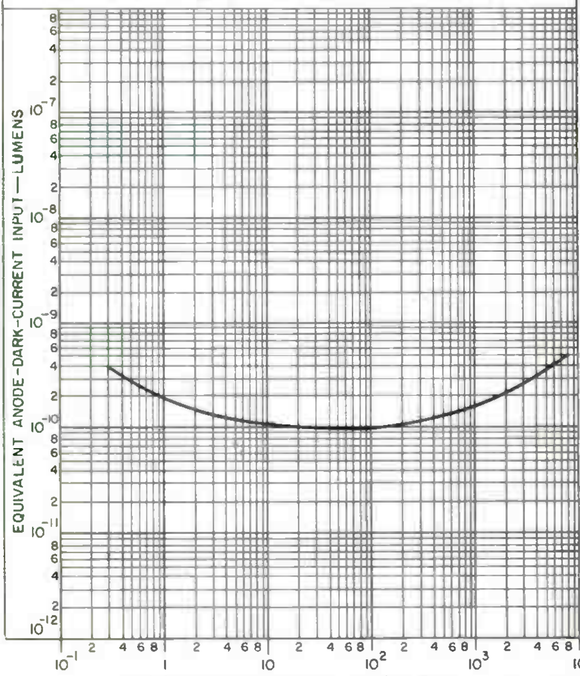
World Radio History

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	6.95% OF E MULTIPLIED BY
CATHODE & DY_1	2.0
DY_1 & DY_2	1.4
DY_2 & DY_3 THROUGH DY_{12} & ANODE	1.0
ANODE & CATHODE	14.4

FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN CATHODE AND DYNODE No.1 THAT PROVIDES MAXIMUM ANODE CURRENT.
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.
TUBE TEMPERATURE=25° C



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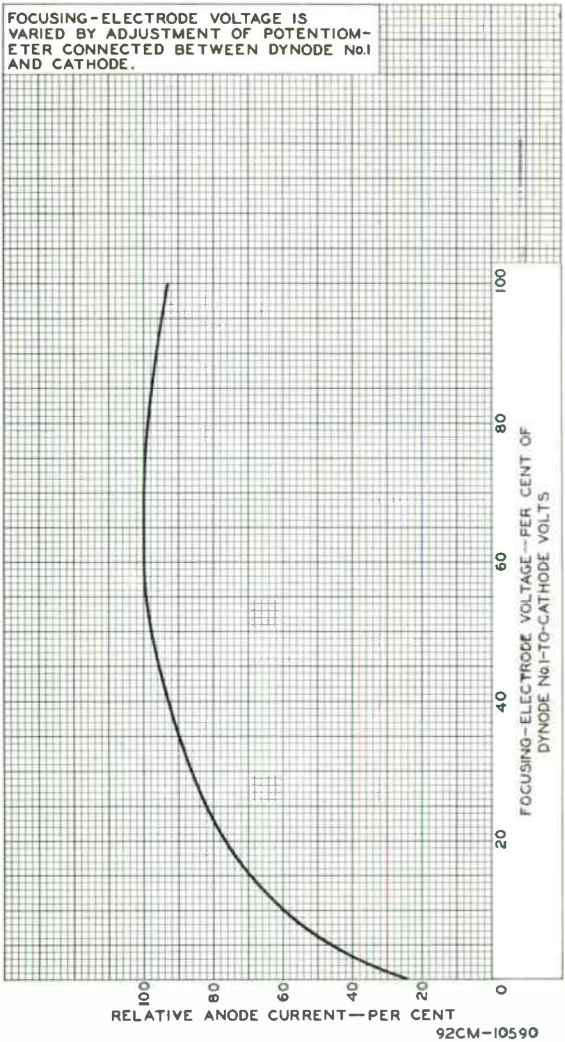
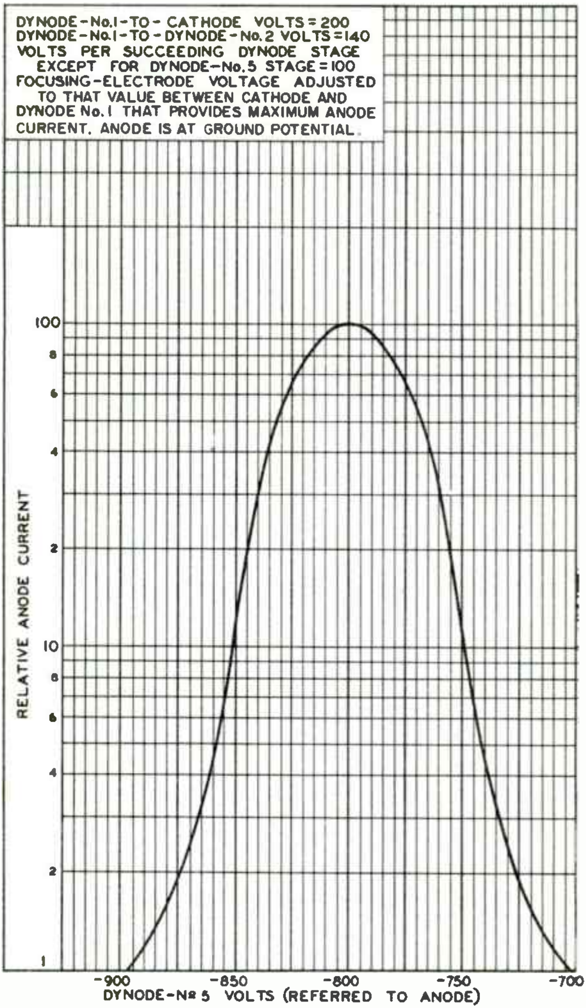
World Radio History

AVERAGE FOCUSING-ELECTRODE-VOLTAGE CHARACTERISTIC



World Radio History

TYPICAL ANODE-CURRENT CHARACTERISTIC



World Radio History

Multiplier Phototube

S-11 RESPONSE

"RUGGEDIZED", 10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE

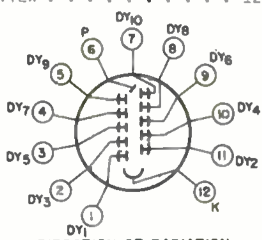
ELECTROSTATICALLY FOCUSED IN-LINE DYNODE STAGES

For Detection and Measurement of Nuclear-Radiation and Low-Level Light in Compact Industrial and Military Equipment

General:

Spectral Response	S-11
Wavelength of Maximum Response	4400 ± 500 angstroms
Cathode, Semitransparent	Cesium-Antimony
Minimum area	0.2 sq. in.
Minimum diameter	0.5 in.
Window	Lime Glass (Corning[a] No.0080), or equivalent
Shape	Plano-Concave
Index of refraction at 5893 angstroms	1.51
Dynode Material	Copper-Beryllium
Direct Interelectrode Capacitances (Approx.):	
Anode to dynode No.10	2.4 pf
Anode to all other electrodes	3.2 pf
Maximum Overall Length (Excluding semiflexible leads)	3.38"
Maximum Diameter	0.78"
Operating Position	Any
Weight (Approx.)	0.9 oz
Bulb	T6
Magnetic Shield	Perfection Mica Co.[b], or equivalent
Base	Small-Button Thirteenar 12-Semiflexible Lead, (JEDEC No.E12-72), and Protective Shell
Basing Designation for BOTTOM VIEW	12BG

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 7 – Dynode No.10
Lead 8 – Dynode No.8
Lead 9 – Dynode No.6
Lead 10 – Dynode No.4
Lead 11 – Dynode No.2
Lead 12 – Photocathode



DIRECTION OF RADIATION: INTO END OF BULB

Maximum Ratings, ***Absolute-Maximum Values:***

Supply Voltage (DC or Peak AC):		
Between Anode and Cathode	1500 max.	volts
Between Anode and Dynode No.10	300 max.	volts
Between Consecutive Dynodes	250 max.	volts
Between Dynode No.1 and Cathode	400 max.	volts
Average Anode Current[c]	0.5 max.	ma
Ambient Temperature	75 max.	°C

World Radio History

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

With E = 1250 volts (Except as noted)

	Min.	Typ.	Max.	
Sensitivity:				
Radiant, at 4400 angstroms.	-	6×10^{3}	-	a/w
Cathode radiant, at 4400 angstroms. . .	-	0.048	-	a/w
Luminous, At 0 cps[d].	3	7.5	60	a/lm
Cathode luminous:				
With tungsten light source[e].	4×10^{-5}	6×10^{-5}	-	a/lm
With blue light source[f,g].	4×10^{-8}	6×10^{-8}	-	a
Current Amplification. . .	-	1.25×10^{5}	-	
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 7.5 a/lm[h].	-	8×10^{-10}	2×10^{-9}	lm
Equivalent Noise Input[j]. .	-	3×10^{-12}	1×10^{-11}	lm
Anode-Pulse Rise Time[k] . .	-	2.1×10^{-9}	-	sec
Electron Transit Time[m] . .	-	2.3×10^{-8}	—	sec
Quantum Efficiency at 4300 angstroms	-	14	-	%

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

[b] Magnetic shielding in the form of foil or tape as available from the Magnetic Shield Division, Perfection Mica Company, 1322 North Ellston, Chicago 24, Illinois, or equivalent.

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

[d] 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.

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

[f] 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 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected as anode.

[g] 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.

[h] At a tube temperature of 25° C. Dark current may be reduced by use of a refrigerant such as dry ice.

[j] 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.

World Radio History

k 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.

m 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-11 RESPONSE
is shown at the front of this Section

ENVIRONMENTAL TESTS-

The 4460 is designed to withstand the shock, vibration, and acceleration tests shown below which are equivalent to those specified in MIL-E-5272C* for equipment mounted on the structures of missiles propelled or launched by high-thrust rocket engines. The accelerations specified in these tests are applied directly to the tubes.

One-Hundred Per-Cent Shock and Vibration Testing:

Each 4460 is subjected in sequence to shock and then to vibration as specified below with the tube non-operating.

Shock. These tests are performed first, per method of MIL-E-5272C*, Paragraph 4.15.5.1, Procedure V, on apparatus which provides a half-wave sinusoidal shock pulse. One-hundred per-cent testing of all 4460's is performed. Each 4460 is subjected to three impact shocks in each direction of the three orthogonal axes shown in the accompanying *Orthogonal Axes Used During Environmental Tests* drawing. The peak acceleration of the impact shock is 30 ± 3 g's and the time duration is 11 ± 1 milliseconds. Each tube is subjected to a total of 18 impact shocks.

Vibration. These tests are performed next, on apparatus which applies variable-sinusoidal frequency vibration to the tube, per method of MIL-E-5272C*, paragraph 4.7.14 and paragraph 4.7.14.1. One-hundred per-cent testing of all 4460's is performed. Each 4460 is vibrated in each of the three orthogonal axes shown in the accompanying *Orthogonal Axes Used During Environmental Tests* drawing and as specified in the schedule below. A vibration cycle has a duration of 5 minutes per axis in which time the frequency is varied logarithmically from 20 to 2000 and back to 20 cycles per second. One vibration cycle is performed for each axis and the total test period for each tube is 15 minutes.

Double Amplitude inches	Acceleration g's	Frequency cps	Cycle Duration per axis minutes
0.050 ± 0.005	-	20 - 87	5
-	20 ± 2	87 - 2000	
-	20 ± 2	2000 - 87	
0.050 ± 0.005	-	87 - 20	

World Radio History

Tube Rejection Criterion. Upon completion of the *One-Hundred Per-Cent Shock and Vibration Testing* each tube is tested at a anode-to-cathode voltage of 1250 volts under the conditions shown under *Characteristics Range Values for Equipment Design* and will meet the specified values.

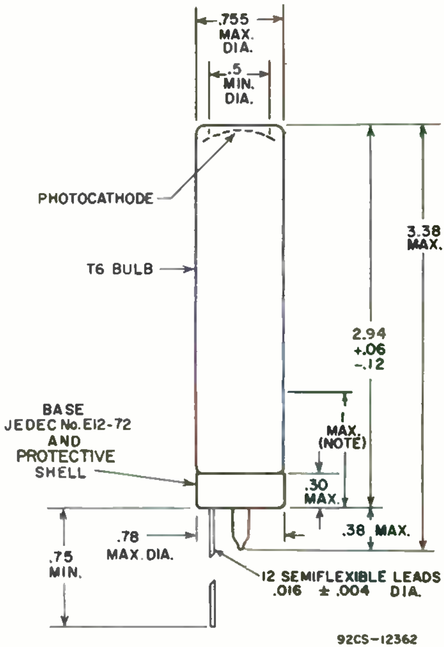
Design Tests:

Vibration. These tests are performed under conditions equivalent to those described in MIL-E-5272C*, paragraph 4.7.14 and paragraph 4.7.14.1. The vibration cycle has a duration of one hour and two cycles are performed for each of the three orthogonal axes shown in the accompanying *Orthogonal Axes Used During Environmental Tests* drawing. The total test period for each tube is six hours. Tubes are operating during the test.

Acceleration. These tests are performed in a centrifuge providing unidirectional acceleration by a method equivalent to that specified in MIL-E-5272C*, paragraph 4.16.3, Procedure III, except that tubes are subjected for one minute to an increased acceleration test level of 100 ± 10 g's in both directions of the three orthogonal axes shown in the accompanying *Orthogonal Axes Used During Environmental Tests* drawing and the tubes are non-operating.

* Military Specification MIL-E-5272C (ASG), 13 April 1959; and Amendment 1, 5 January 1960.

World Radio History

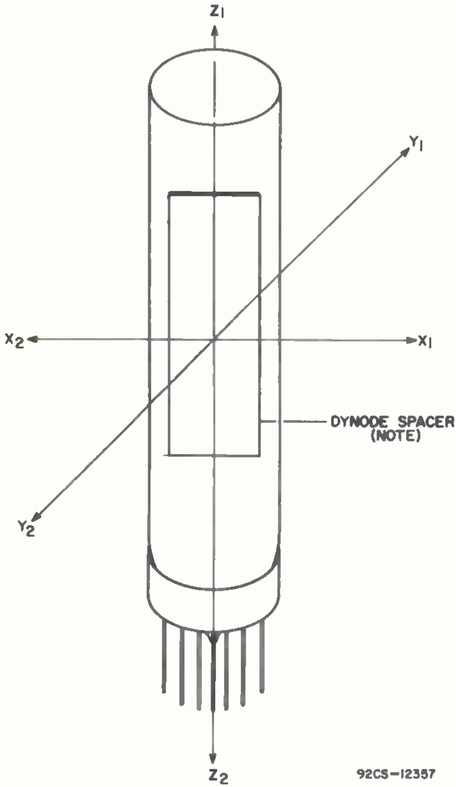


DIMENSIONS IN INCHES

Note: Within this length, maximum diameter of tube is 0.78".

World Radio History

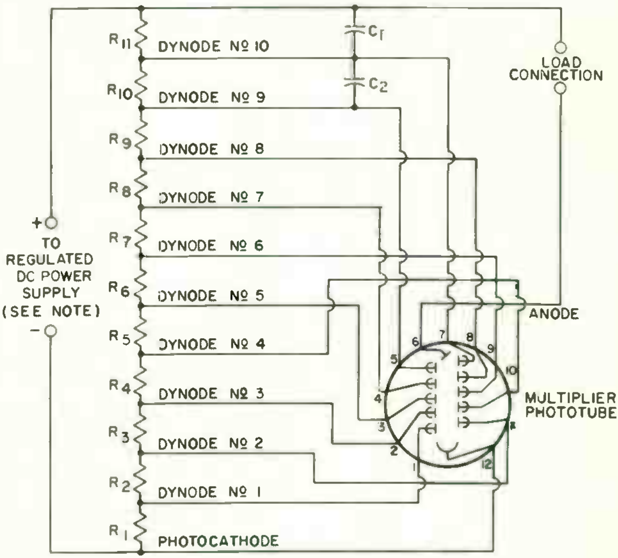
ORTHOGONAL AXES USED
DURING ENVIRONMENTAL TESTS



Note: The plane of each dynode spacer is parallel to the X-Z plane. The Z-axis is the major axis of the tube.

World Radio History

TYPICAL VOLTAGE-DIVIDER ARRANGEMENT



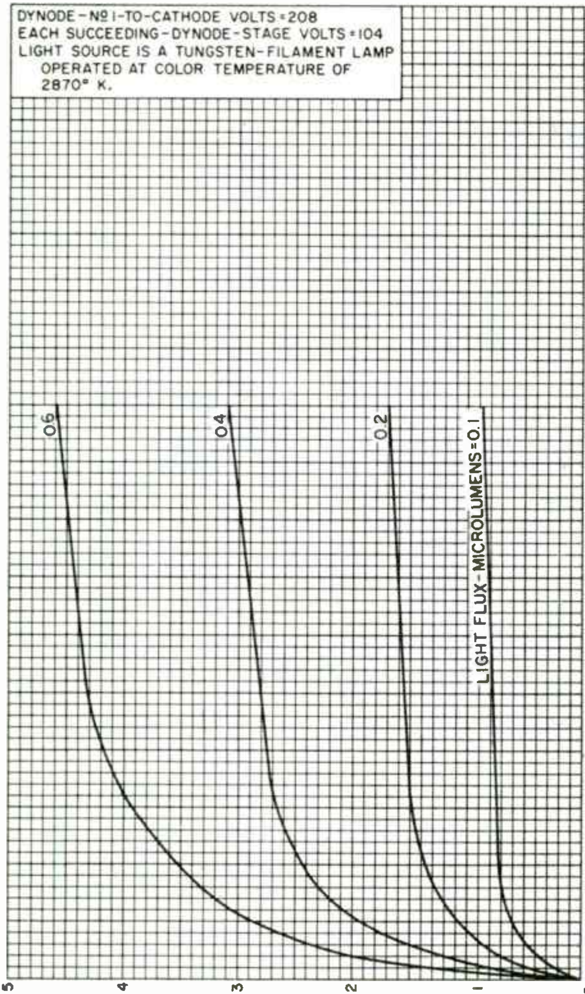
92CS—10656RI

Note: Adjustable between approximately 500 and 1500 volts DC.

C_1,C_2: 0.01 μf, 500 volts (dc working)
R_1: 91,000 ohms, 2 watts
R_2 through R_{11}: 47,000 ohms, 1 watt

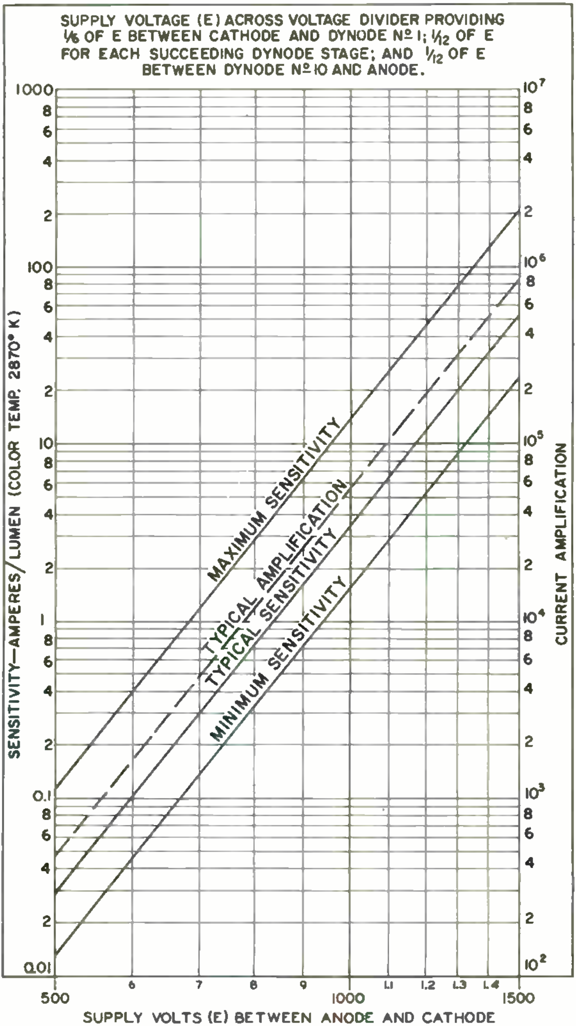
World Radio History

AVERAGE ANODE CHARACTERISTICS



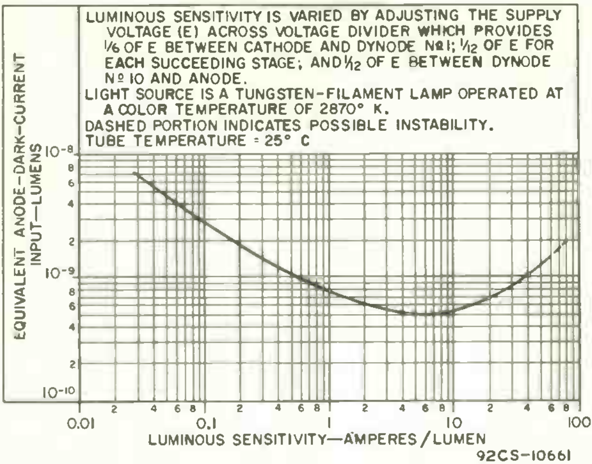
92CM-10660

SENSITIVITY AND CURRENT AMPLIFICATION CHARACTERISTICS

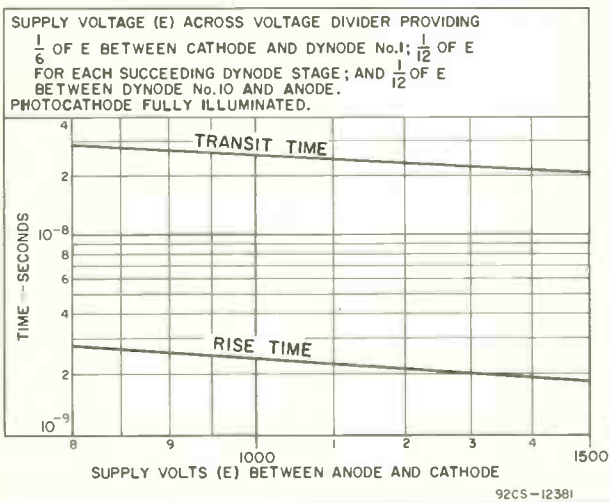


World Radio History

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



TYPICAL TIME RESOLUTION CHARACTERISTICS



World Radio History

Photomultiplier Tube[q]

RUGGED VIBRATION-RESISTANT STRUCTURE

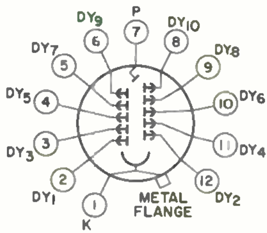
S-11 RESPONSE | **ELECTROSTATICALLY FOCUSED**
10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE | **DYNODE STAGES**

For Detection and Measurement of Nuclear Radiation and other Low-Level Light Sources. Especially Useful in Missile and Rocket Service and other Industrial and Military Applications where Severe Environmental Conditions may be Encountered.

General:

Spectral Response. S-11
Wavelength of Maximum Response . . . . . 4400 ± 500 angstroms
Cathode, Semitransparent . . . . .Cesium-Antimony
  Minimum area . . . . 1.2 sq. in.
  Minimum diameter . . . . 1.24"
Window . . . . . Lime Glass (Corning[a] No.0080), or equivalent
  Shape. . . . . Plano-plano
  Index of refraction at 5893 angstroms. 1.51
Dynode Material. . . . . Copper-Beryllium
Direct Interelectrode Capacitances (Approx.):
  Anode to dynode No.10 . . . . 3.2 pf
  Anode to all other electrodes. . . . . 5.0 pf
Maximum Overall Length (Excluding semiflexible leads). . 3.18"
Maximum Diameter . . . . 1.56"
Operating Position . . . . Any
Weight (Approx.) . . . . 2.2 oz
Bulb T12
Magnetic Shield. . . . . Millen Co.[b], or equivalent
Base . . . . .Special
Terminal Diagram: BOTTOM VIEW

Lead 1 & Metal Flange–Photocathode
Lead 2 – Dynode No.1
Lead 3 – Dynode No.3
Lead 4 – Dynode No.5
Lead 5 – Dynode No.7
Lead 6 – Dynode No.9
Lead 7 – 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



DIRECTION OF RADIATION:
INTO END OF BULB

Maximum Ratings, ***Absolute-Maximum Values:***

DC Supply Voltage:
  Between anode and cathode. . . . . 1500 volts
  Between anode and dynode No.10 . . . . 250 volts
  Between consecutive dynodes. . . . . 200 volts
  Between dynode No.1 and cathode. . . . . 400 volts
Average Anode Current[c] . . . . 1 ma
Average Cathode Current[c,d] . . . . 2 μa
Ambient Temperature. . . . . 75 °C

World Radio History

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 anode and dynode No. 10 and anode.

With E = 1250 volts (Except as noted)

	Min.	Typ.	Max.	
Sensitivity:				
Radiant, at 4400 angstroms		8×10^{-3}	-	a/w
Cathode radiant, at 4400 angstroms	-	0.048	-	a/w
Luminous, at 0 cps[e] . . .	3	10	90	a/lm
With dynode No. 10 as output electrode[f]. . .	-	6	-	a/lm
Cathode luminous:				
With tungsten light source[g].	4×10^{-5}	6×10^{-5}	-	a/lm
With blue light source[h].	4×10^{-8}	6×10^{-8}	-	a
Current Amplification .	-	1.7×10^{-5}	-	
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 10 a/lm[j]	-	5×10^{-10}	2×10^{-9}	lm
Equivalent Noise Input[k,m]	-	2.8×10^{-12}	1.8×10^{-11}	lm
Anode-Pulse Rise Time[n]. .	-	2.4×10^{-9}	-	sec
Electron Transit Time[p]. .	-	2.9×10^{-8}	-	sec
Quantum Efficiency at 4300 angstroms.	-	14	-	%

With E = 750 volts (Except as noted)

	Min.	Typ.	Max.	
Sensitivity:				
Radiant, at 4400 angstroms	-	1.8×10^{-2}	-	a/w
Cathode radiant, at 4400 angstroms	-	0.048	-	a/w
Luminous, at 0 cps[e] . . .	-	0.22	-	a/lm
Cathode luminous:				
With tungsten light source[g].	4×10^{-5}	6×10^{-5}	-	a/lm
With blue light source[h].	4×10^{-8}	6×10^{-8}		a
Current Amplification . .	-	3.7×10^{-3}	-	
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 10 a/lm[j]	-	5×10^{-10}	2×10^{-9}	lm
Anode-Pulse Rise Time[k]. . .	-	3.1×10^{-9}	-	sec
Electron Transit Time[p] . .	-	3.8×10^{-8}	-	sec

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

[b] Magnetic shielding in the form of foil or tape as available from the James Millen Manufacturing Company, 150 Exchange Street, Malden 48, Massachusetts, or equivalent.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

World Radio History

c Averaged over any interval of 30 seconds maximum.

d For a uniformly illuminated area of 0.5 square inches minimum.

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 at a light input of 10 microlumens.

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 a collector. The curves under *Typical Anode Characteristics* do 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, 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 At a tube temperature of 25° C. Dark current may be reduced by use of a refrigerant.

k For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1250 volts is recommended.

m 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.

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 variations and is measured under conditions with an 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.

q Alternate designation for Multiplier Phototube.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-11 RESPONSE is shown at the front of this Section

ENVIRONMENTAL TESTS:

The 4461 is designed to withstand the shock, vibration, and acceleration tests shown below which are equivalent to those specified in MIL-E-5272C* for equipment mounted on the structures of missiles propelled or launched by high-thrust rocket engines. The accelerations specified in these tests are applied directly to the tubes.

One-Hundred Per-Cent Shock and Vibration Testing:

Each 4461 is subjected in sequence to shock and then to vibration as specified below with the tube non-operating.

Shock. These tests are performed first, per method of MIL-E-5272C*, Paragraph 4.15-5.1, Procedure V, on apparatus which provides a half-wave sinusoidal shock pulse. One-hundred per-cent testing of all 4461's is performed. Each 4461 (non-operating) is subjected to three impact shocks in each direction of the three orthogonal axes. The peak acceler-

World Radio History

ation of the impact shock is 30 ± 3 g's and the time duration is 11 ± 1 milliseconds. Each tube is subjected to a total of 18 impact shocks.

Vibration. These tests are performed next, on apparatus which applies variable-sinusoidal frequency vibration to the tube, per method of MIL-E-5272C*, paragraph 4.7.14 and paragraph 4.7.14.1. One hundred per-cent testing of all 4461's is performed. Each 4461 is vibrated in each of the three orthogonal axes as specified in the schedule below. A vibration cycle has a duration of 5 minutes per axis in which time the frequency is varied logarithmically from 20 to 2000 and back to 20 cycles per second. One vibration cycle is performed for each axis and the total test period for each tube is 15 minutes.

Double Amplitude Inches	Acceleration g's	Frequency cps	Cycle Duration Per Axis minutes
0.050 ± 0.005	-	20 - 87	5
-	20 ± 2	87 - 2000	
-	20 ± 2	2000 - 87	
0.050 ± 0.005	-	87 - 20	

Tube Rejection Criterion. Upon completion of the *Shock and Vibration Testing* each tube is tested at a anode-to-cathode voltage of 1250 volts with the light level incident on the tube adjusted to provide an anode current of approximately 8 microamperes. Electrical and/or mechanical tube failures due to shock or vibration will be observed during the vibration test when the specified anode current is monitored. Tube rejection criterion for both tests is that the anode current of 8 microamperes will not change more than ±20 per cent upon completion of the vibration test for each axis.

Design Tests:

Vibration. These tests are performed under conditions equivalent to those described in MIL-E-5272C*, paragraph 4.7.14 and paragraph 4.7.14.1. The vibration cycle has a duration of one hour and two cycles are performed for each of the three orthogonal axes. The total test period for each tube is six hours.

Acceleration. These tests are performed in a centrifuge providing unidirectional acceleration by a method equivalent to that specified in MIL-E-5272C*, paragraph 4.16.3, Procedure III, except that tubes are subjected for one minute to an increased acceleration test level of 100 ± 10 g's in both directions of the three orthogonal axes. The tubes are non-operating during the test.

* Military Specification MIL-E-5272C (ASG), 13 April 1959; and Amendment 1, 5 January 1960.

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OPERATING CONSIDERATIONS

The *operating stability* of the 4461 is dependent on the magnitude of the anode current and its duration. When operating at high average values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 4461 usually recovers a substantial percentage of such loss in sensitivity.

It is recommended that the average anode current be well below the maximum rated value of 1 milliampere when stability of operation is important. When maximum stability is required, the average anode current should not exceed 10 microamperes.

Electrostatic and/or *magnetic shielding* of the 4461 may be necessary.

Adequate *shielding* should be provided to prevent extraneous radiation from reaching any part of the 4461.

The *high voltages* at which the 4461 is operated are very dangerous. Before any part of the circuit is touched, the power supply switch should be turned off and both terminals of any capacitors grounded.

Accompanying *Typical Voltage-Divider Arrangement* is recommended for use with the 4461. *Resistance values* for the voltage-divider arrangement range from 10,000 ohms per stage to 1,000,000 ohms per stage. The choice of resistance values for the voltage-divider network is usually a compromise. If low values of resistance per stage are utilized, the power drawn from the regulated power supply and the required wattage rating of the resistors increase. Phototube noise may also increase due to heating if the divider network is near the photocathode. The use of resistance values near 1 megohm per stage may cause deviation from linearity if the voltage-divider current is not maintained at a value several times that of the maximum value of anode current, and may limit anode-current response to pulsed light. The latter effect may be reduced by connecting capacitors between the leads for dynodes No.7 and No.8, dynodes No.8 and No.9, dynodes No.9 and No.10, and between dynode No.10 and anode return. In addition to non-linearity and pulse-limiting effects, the use of resistance values exceeding 1 megohm per stage make the 4461 more susceptible to leakage effects between terminals with possible resulting deviation in interstage voltage leading to a loss of current amplification.

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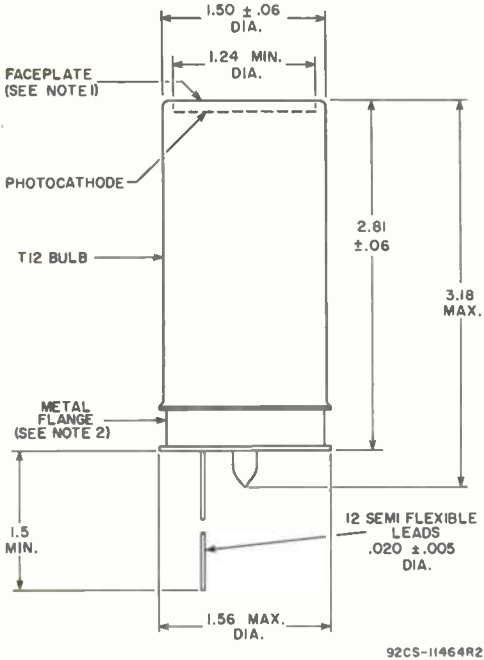
DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Center line of bulb will not deviate more than 2° in any direction from the perpendicular erected at the center of bottom of the base flange.

Note 1: Deviation from flatness within the 1.24 inch diameter area will not exceed 0.010 inch from peak to valley.

Note 2: The metal flange should never be employed for mechanical mounting purposes.

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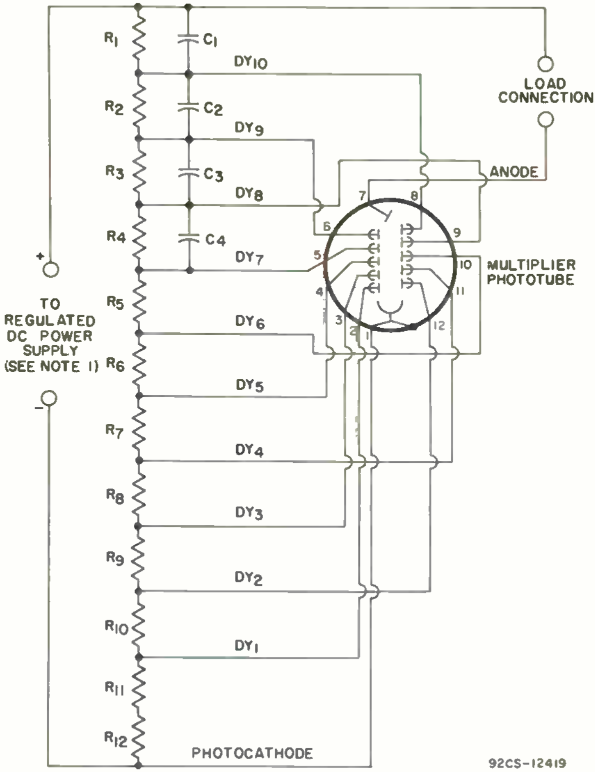
TYPICAL VOLTAGE-DIVIDER ARRANGEMENT



C_1: 0.05 µf, 500 volts (dc working)
C_2: 0.02 µf, 500 volts (dc working)
C_3: 0.01 µf, 500 volts (dc working)
C_4: 0.005 µf, 500 volts (dc working)
R_1 through R_{12}: 33,000 ohms, 2 watts

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

Note 2: Capacitors C_1 through C_4 should be connected at tube socket for optimum high-frequency performance.

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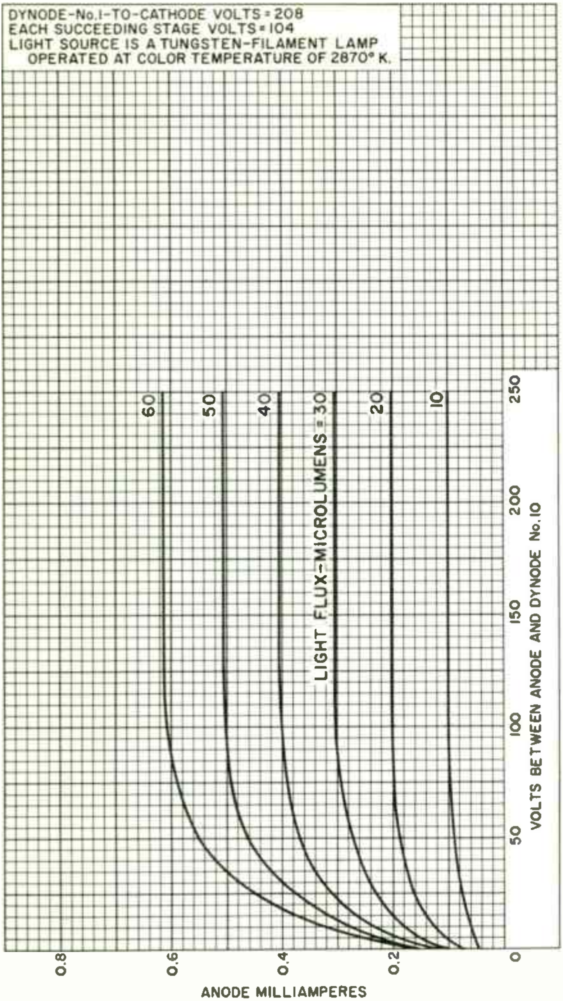
Typical Anode Characteristics



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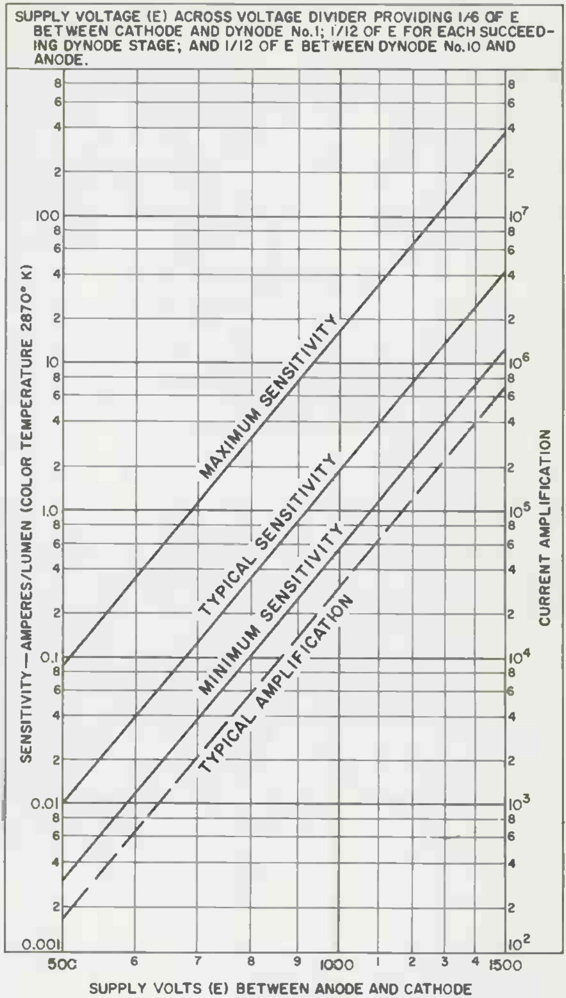
Typical Sensitivity And Current Amplification Characteristics



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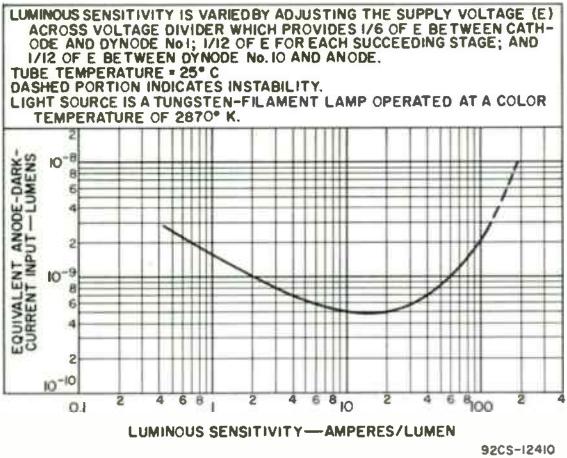
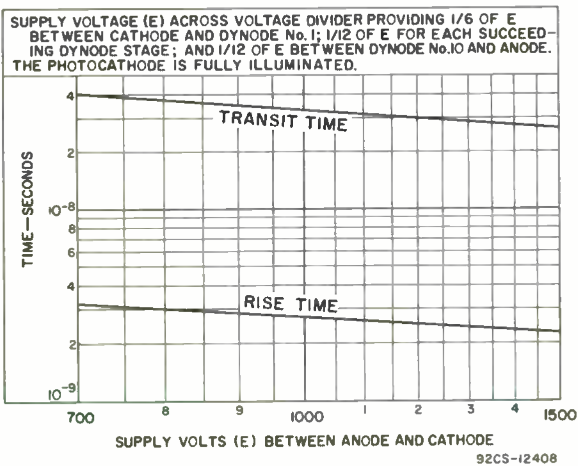
Typical Anode-Dark-Current Characteristic



Typical Time Resolution Characteristics



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Electronic Components and Devices Harrison, N. J.

World Radio History

Multiplier Phototube

S-20 RESPONSE

10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE

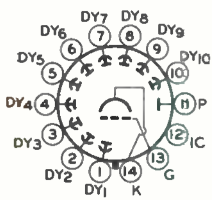
VENETIAN-BLIND-TYPE DYNODE STRUCTURE

For Photometry, Flying-Spot Scanning, and Scintillation-Counter Equipment Requiring Low-Dark Current and High Sensitivity Over a Wide Spectrum (Blue through Near-Infrared).

General:

Spectral Response S-20
Wavelength of Maximum Response . . . . 4200 ± 500 angstroms
Cathode, Semitransparent . . Potassium-Sodium-Cesium-Antimony (Multialkali)
  Shape. . . . . Flat, Circular
  Minimum area . . . . 2.2 sq. in.
  Minimum diameter . . . . 1.68 in.
Window . . . . Borosilicate Glass[a]
  Index of refraction at 5893 angstroms. 1.48
Dynode Material. . . . . Copper-Beryllium
Direct Interelectrode Capacitances (Approx.):
  Anode to dynode No. 10. . . . . 7 pf
  Anode to all other electrodes. . . . . 8.5 pf
Maximum Overall Length . . . . 5.81"
Seated Length. . . . . 4.87" ± 0.19"
Maximum Diameter . . . . 2.31"
Operating Position . . . . Any
Weight (Approx.) . . . . 7 oz
Bulb T16
Socket . . . . Cinch[b] No. 3M14, or equivalent
Magnetic Shield. . . . . JAN[c] No. S-2004, 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

World Radio History

Maximum Ratings, *Absolute-Maximum Values:*

DC Supply Voltage:		
Between anode and cathode	2500 max.	volts
Between anode and dynode No.10	300 max.	volts
Between consecutive dynodes	300 max.	volts
Between dynode No.1 and cathode	600 max.	volts
Between focusing electrode and cathode	600 max.	volts
Average Anode Current[d]	1 max.	ma
Ambient Temperature	85 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 anode and dynode No.10. Focusing-electrode voltage is adjusted to that value between 50 and 100 per cent of dynode-No.1 potential (referred to cathode) which provides maximum anode current.

With E = 2000 volts (Except as noted)

	Min.	*Typ.*	*Max.*	
Sensitivity:				
Radiant, at 4200 angstroms	-	1.1×10^{4}	-	a/w
Cathode radiant, at 4200 angstroms	-	6.8×10^{-2}	-	a/w
Luminous, at 0 cps[e]	12	25	240	a/lm
Cathode luminous:				
With tungsten light source[f]	1.2×10^{-4}	1.6×10^{-4}	-	a/lm
With blue light source[g,h]	5×10^{-8}	-	-	a
With red light source[j,k]	3×10^{-7}	-	-	a
Current Amplification	-	1.6×10^{5}	-	
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 12 a/lm[m]	-	4×10^{-10}	1×10^{-9}	lm
Equivalent Noise Input	-	-	3.8×10^{-12}	lm
Anode-Pulse Rise Time[n]	-	9.8×10^{-9}	-	sec
Electron Transit Time[p]	-	5.2×10^{-8}	-	sec

With E = 1500 volts (Except as noted)

	Min.	*Typ.*	*Max.*	
Sensitivity:				
Radiant, at 4200 angstroms	-	2.1×10^{3}	-	a/w
Cathode radiant, at 4200 angstroms	-	6.8×10^{-2}	-	a/w
Luminous, at 0 cps[e]	-	5	-	a/lm

World Radio History

	Min.	*Typ.*	*Max.*	
Cathode luminous:				
With tungsten light source[f] .	1.2×10^{-4}	1.6×10^{-4}	-	a/lm
With blue light source[g,h] . . .	5×10^{-8}	-	-	a
With red light source[j,k] . . .	3×10^{-7}	-	-	a
Current Amplification	-	3.1×10^{4}	-	
Equivalent Anode-Dark Current Input at a luminous sensitivity of 12 a/lm[m]	-	4×10^{-10}	1×10^{-9}	lm

[a] Corning No. 7056 made by Corning Glass Works, Corning, New York, or equivalent.

[b] Made by Cinch Manufacturing Company, 1026 South Homan Avenue, Chicago 24, Illinois.

[c] Made by JAN Hardware Manufacturing Company, 38-01 Queens Blvd., Long Island City 1, New York.

[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 1 microlumen is used.

[f] 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.

[g] 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 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected as anode.

[h] 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.

[j] 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 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected as anode.

[k] See *Spectral Characteristic of 2870° K Light Source and Spectral Characteristic of Light from 2870° K Source after passing through Indicated Red Filter* at front of this Section.

[m] At a tube temperature of 25° C. Dark current may be reduced by use of a refrigerant.

[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.

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OPERATING CONSIDERATIONS

The *operating stability* of the 4463 is dependent on the magnitude of the anode current and its duration. When the 4463 is operated at high average values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 4463 usually recovers a substantial percentage of such loss in sensitivity.

It is recommended that the average anode current be well below the maximum-rated value of 1 milliampere when stability of operation is important. When maximum stability is required, the average anode current should not exceed 10 microamperes.

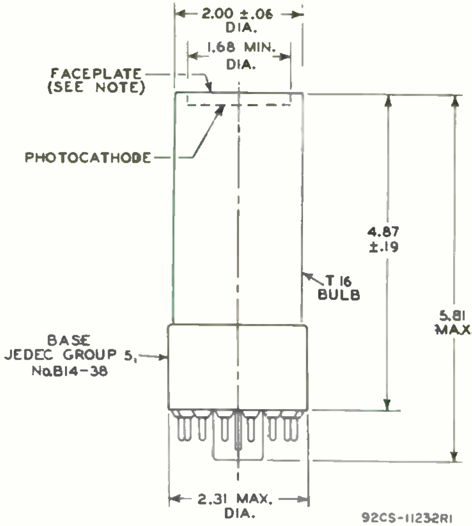
Electrostatic and/or *magnetic shielding* of the 4463 may be necessary.

Adequate *shielding* should be provided to prevent extraneous radiation from reaching any part of the 4463.

The *high voltages at which the 4463 is operated are very dangerous*. Care should be taken in the design of apparatus to prevent the operator from coming in contact with these high voltages. Precautions should include the enclosure of high-potential terminals and the use of interlock switches to break the primary circuit of the high-voltage power supply when access to the apparatus is required.

SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOSENSITIVE DEVICE HAVING S-20 RESPONSE
is shown at the front of this Section

World Radio History



DIMENSIONS IN INCHES

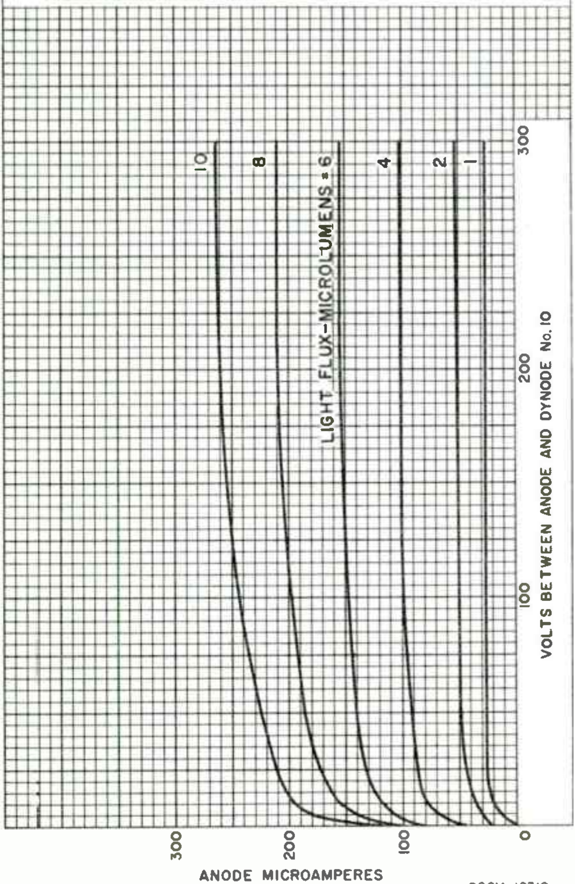
Center line of bulb will not deviate more than 2° in any direction from the perpendicular erected at the center of bottom of the base.

Note: Within 1.68" diameter, deviation from flatness of external surface of faceplate will not exceed 0.010" from peak to valley.

World Radio History

TYPICAL ANODE CHARACTERISTICS

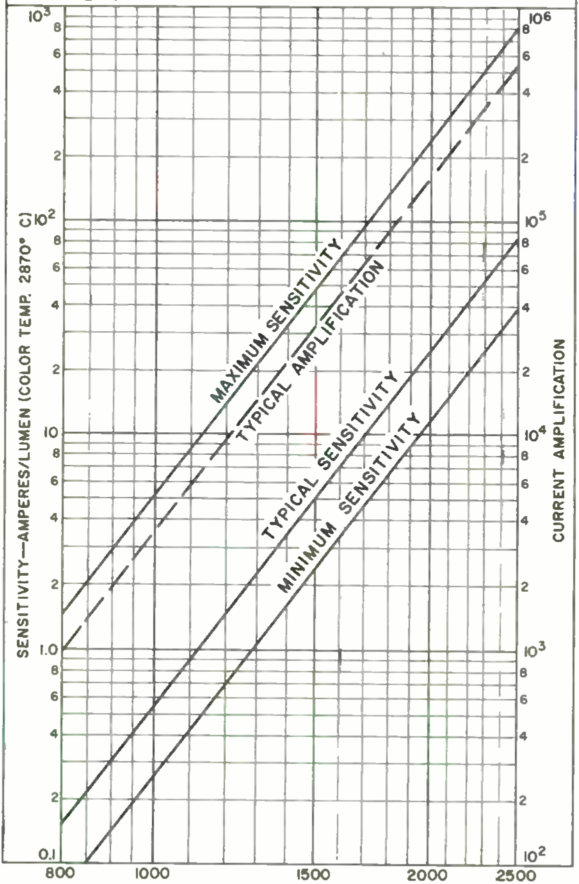
DYNODE No.1-TO-CATHODE VOLTS = 250
EACH SUCCEEDING DYNODE-STAGE VOLTS = 125
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No.1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.



92CM-12310

SENSITIVITY AND CURRENT AMPLIFICATION CHARACTERISTICS

DYNODE No. 1-TO-CATHODE VOLTS = 1/6 E
EACH SUCCEEDING DYNODE-STAGE VOLTS = 1/12 E
ANODE-TO-DYNODE No. 10 VOLTS = 1/12 E
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No. 1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.

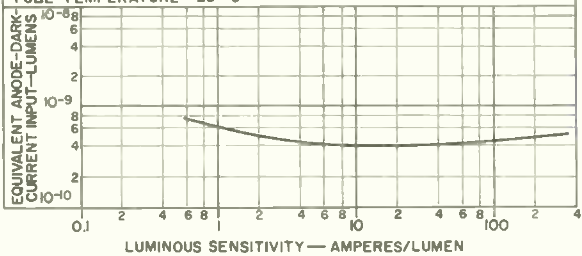


92CM-12312

World Radio History

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

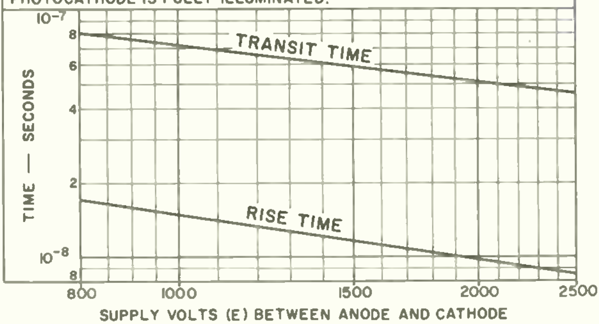
LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E).
DYNODE No. 1-TO-CATHODE VOLTS = 1/6 E
EACH SUCCEEDING DYNODE-STAGE VOLTS = 1/12 E
ANODE-TO-DYNODE No. 10 VOLTS = 1/12 E
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No. 1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.
TUBE TEMPERATURE = 25° C



92CS-12311

TYPICAL TIME RESOLUTION CHARACTERISTICS

DYNODE No. 1-TO-CATHODE VOLTS = 1/6 E
EACH SUCCEEDING DYNODE-STAGE VOLTS = 1/12 E
ANODE-TO-DYNODE No. 10 VOLTS = 1/12 E
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No. 1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.
PHOTOCATHODE IS FULLY ILLUMINATED.

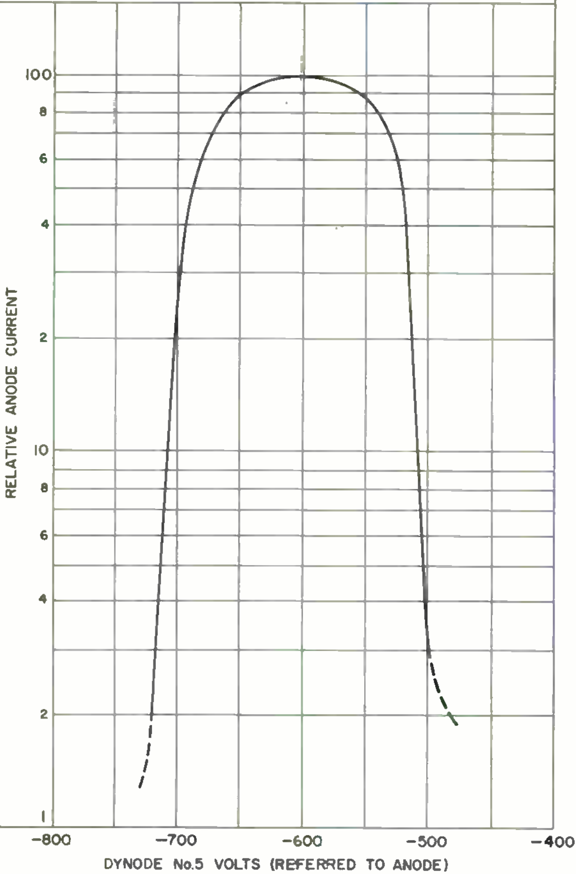


92CS-12309

World Radio History

TYPICAL ANODE-CURRENT CHARACTERISTIC

DYNODE No.1-TO-CATHODE VOLTS = 200
VOLTS PER SUCCEEDING DYNODE STAGE EXCEPT FOR DYNODE-No. 5 STAGE = 100
ANODE-TO-DYNODE No.10 VOLTS = 100
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No.1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.
ANODE IS AT GROUND POTENTIAL.

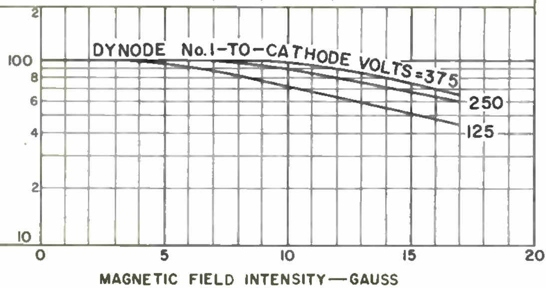


92CM-11078R1

World Radio History

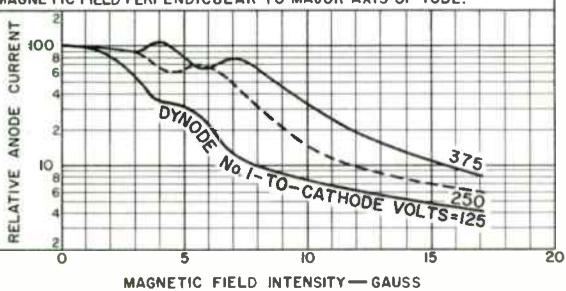
TYPICAL ANODE-CURRENT CHARACTERISTICS

DYNODE No. 1-TO-CATHODE VOLTS = AS INDICATED
EACH SUCCEEDING DYNODE-STAGE VOLTS = 125
ANODE-TO-DYNODE No. 10 VOLTS = 125
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No. 1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.
PHOTOCATHODE FULLY ILLUMINATED BY A POINT LIGHT SOURCE POSITIONED APPROX. 1 FOOT FROM CENTER OF TUBE FACE.
MAGNETIC FIELD PARALLEL TO MAJOR AXIS OF TUBE.



92CS-11235R2

DYNODE No. 1-TO-CATHODE VOLTS = AS INDICATED
EACH SUCCEEDING DYNODE-STAGE VOLTS = 125
ANODE-TO-DYNODE No. 10 VOLTS = 125
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No. 1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.
PHOTOCATHODE FULLY ILLUMINATED BY A POINT LIGHT SOURCE POSITIONED APPROX. 1 FOOT FROM CENTER OF TUBE FACE.
MAGNETIC FIELD PERPENDICULAR TO MAJOR AXIS OF TUBE.



92CS-11236R2

World Radio History

Multiplier Phototube

S-20 RESPONSE

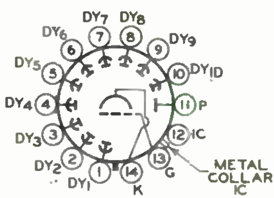
10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE | **VENETIAN-BLIND-TYPE DYNODE STRUCTURE**

For Photometry, Flying-Spot Scanning, and Scintillation-Counter Equipment Requiring Low-Dark Current and High Sensitivity Over a Wide Spectrum (Blue through Near-Infrared).

General:

Spectral Response S-20
Wavelength of Maximum Response . . . . . 4200 ± 500 angstroms
Cathode, Semitransparent . . . . K-Na-Cs-Sb (Multialkali)
  Shape. . . . . .Flat, Circular
  Minimum area . . . . 5.27 sq. in.
  Minimum diameter . . . . 2.59 in.
Window . . . . .Lime Glass[a]
  Index of refraction at 5893 angstroms. 1.51
Dynode Material. . . . . Copper-Beryllium
Direct Interelectrode Capacitances (Approx.):
  Anode to dynode No.10. . . . . 7 pf
  Anode to all other electrodes. . . . . 8.5 pf
Maximum Overall Length . . . . 6.31"
Seated Length. . . . . 5.38" ± 0.18"
Maximum Diameter . . . . 3.06"
Operating Position . . . . .Any
Weight (Approx.) . . . . 7 oz
Bulb J24
Socket . . . . .Cinch[b] No.3M14, or equivalent
Magnetic Shield. . . . . . .Perfection Mica Co.[c], or equivalent
Base . . . . Medium-Shell Diheptal 14-Pin
  (JEDEC Group 5, No.B14-45) Non-hygroscopic
  Basing Designation for BOTTOM VIEW 14AM

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
Metal Collar - Do Not Use



DIRECTION OF LIGHT: INTO END OF BULB

World Radio History

Maximum Ratings, *Absolute-Maximum Values:*

DC Supply Voltage:		
Between anode and cathode	2500 max.	volts
Between anode and dynode No.10	300 max.	volts
Between consecutive dynodes	300 max.	volts
Between dynode No.1 and cathode	600 max.	volts
Between focusing electrode and cathode	600 max.	volts
Average Anode Current[d]	1 max.	ma
Ambient Temperature	85 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 anode and dynode No.10. Focusing-electrode voltage is adjusted to that value between 50 and 100 per cent of dynode-No.1 potential (referred to cathode) which provides maximum anode current.

With E = 2000 volts (Except as noted)

	Min.	*Typ.*	*Max.*	
Sensitivity:				
Radiant, at 4200 angstroms	–	1.1×10^{4}	–	a/w
Cathode radiant, at 4200 angstroms	–	6.8×10^{-2}	–	a/w
Luminous, at 0 cps[e]	12	25	240	a/lm
Cathode luminous:				
With tungsten light source[f]	1.2×10^{-4}	1.6×10^{-4}	–	a/lm
With blue light source[g,h]	5×10^{-8}	–	–	a
With red light source[j,k]	3×10^{-7}	–	–	a
Current Amplification	–	1.6×10^{5}	–	
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 12 a/lm[m]	–	4×10^{-10}	1×10^{-9}	lm
Equivalent Noise Input	–	–	3.8×10^{-12}	lm
Anode-Pulse Rise Time[n]	–	1.16×10^{-8}	–	sec
Electron Transit Time[p]	–	5.8×10^{-8}	–	sec

With E = 1500 volts (Except as noted)

	Min.	*Typ.*	*Max.*	
Sensitivity:				
Radiant, at 4200 angstroms	–	2.1×10^{3}	–	a/w
Cathode radiant, at 4200 angstroms	–	6.8×10^{-2}	–	a/w
Luminous, at 0 cps[e]	–	5	–	a/lm

World Radio History

	Min.	Typ.	Max.	
Cathode luminous:				
With tungsten light source[f]	1.2×10^{-4}	1.6×10^{-4}	-	a/lm
With blue light source[g,h]	5×10^{-8}	-	-	a
With red light source[j,k]	3×10^{-7}	-	-	a
Current Amplification. . .	-	3.1×10^{4}	-	
Equivalent Anode-Dark Current Input at a luminous sensitivity of 12 a/lm[m]	-	4×10^{-10}	1×10^{-9}	lm

a Corning No.0080 made by Corning Glass Works, Corning, New York, or equivalent.

b Made by Cinch Manufacturing Company, 1026 South Homan Avenue, Chicago 24, Illinois.

c Magnetic shielding material in the form of foil or tape as available from the Magnetic Shield Division, Perfection Mica Company, 1322 North Elston, Chicago 24, Illinois, or equivalent.

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 1 microlumen is used.

f 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.

g 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 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected as anode.

h 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.

j 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 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected as anode.

k See *Spectral Characteristic of 2870° K Light Source and Spectral Characteristic of Light from 2870° K Source after passing through Indicated Red Filter* at front of this Section.

m At a tube temperature of 25° C. Dark current may be reduced by use of a refrigerant.

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.

OPERATING CONSIDERATIONS

It is recommended that the average anode current be well below the maximum-rated value of 1 milliampere when stability of operation is important. When maximum stability is required, the average anode current should not exceed 10 microamperes.

Electrostatic and/or *magnetic shielding* of the 4464 may be necessary.

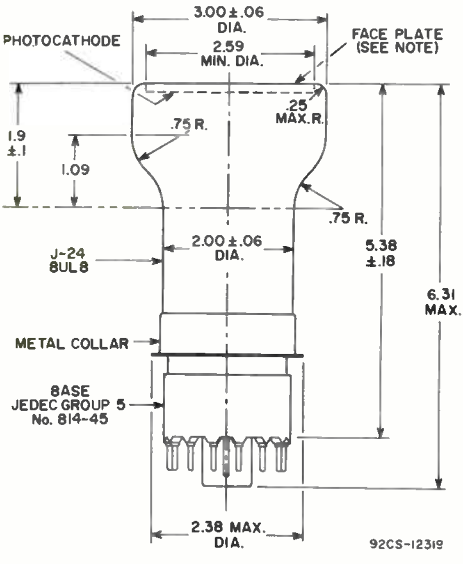
World Radio History

Adequate *shielding* should be provided to prevent extraneous radiation from reaching any part of 4464.

The *operating stability* of the 4464 is dependent on the magnitude of the anode current and its duration. When the 4464 is operated at high average values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depencs on the severity of the operating conditions. After a period of idleness, the 4464 usually recovers a substantial percentage of such loss in sensitivity.

SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOSENSITIVE DEVICE HAVING S-20 RESPONSE
is shown at the front of this Section

TYPICAL VOLTAGE-DIVIDER ARRANGEMENT
shown under Type 4463 also applies to Type 4464



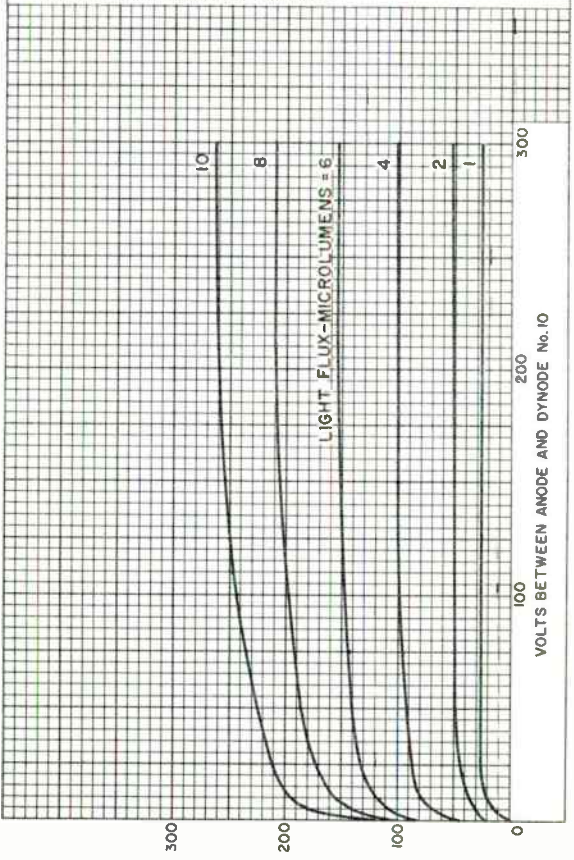
DIMENSIONS IN INCHES

Center line of bulb will not deviate more than 2° in any direction from the perpendicular erected at the center of bottom of the base.

NOTE: Within 2.59" diameter, deviation from flatness of external surface of faceplate will not exceed 0.010" from peak to valley.

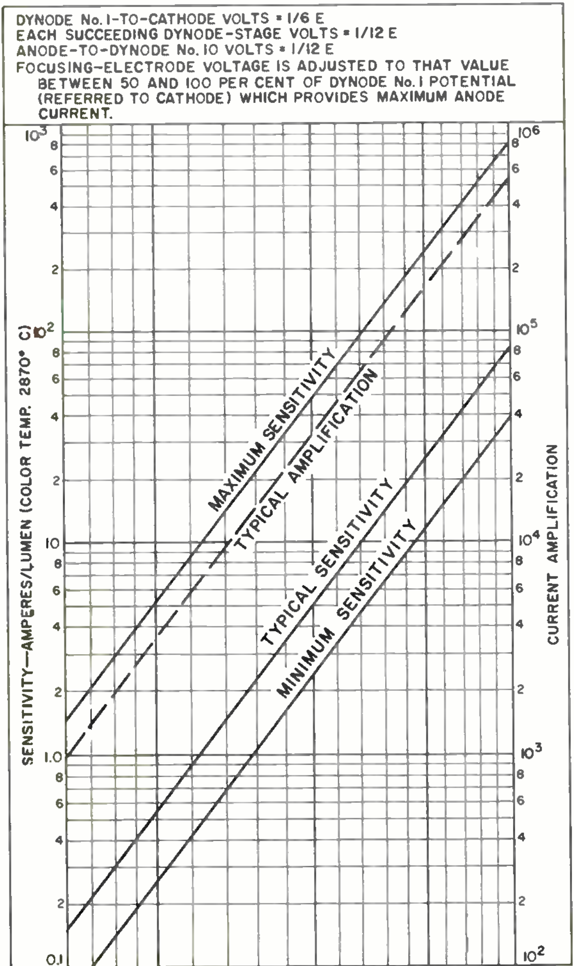
TYPICAL ANODE CHARACTERISTICS

DYNODE No.1-TO-CATHODE VOLTS = 250
EACH SUCCEEDING DYNODE-STAGE VOLTS = 125
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 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.



92CM-12310

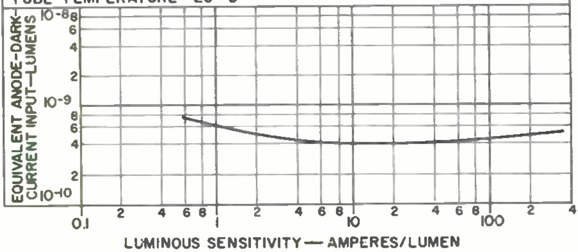
SENSITIVITY AND CURRENT AMPLIFICATION CHARACTERISTICS



World Radio History

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

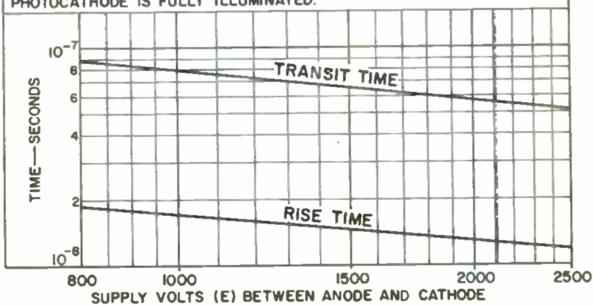
LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E).
DYNODE No. 1-TO-CATHODE VOLTS = 1/6 E
EACH SUCCEEDING DYNODE-STAGE VOLTS = 1/12 E
ANODE-TO-DYNODE No. 10 VOLTS = 1/12 E
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No. 1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.
TUBE TEMPERATURE = 25° C



92CS-12311

TYPICAL TIME RESOLUTION CHARACTERISTICS

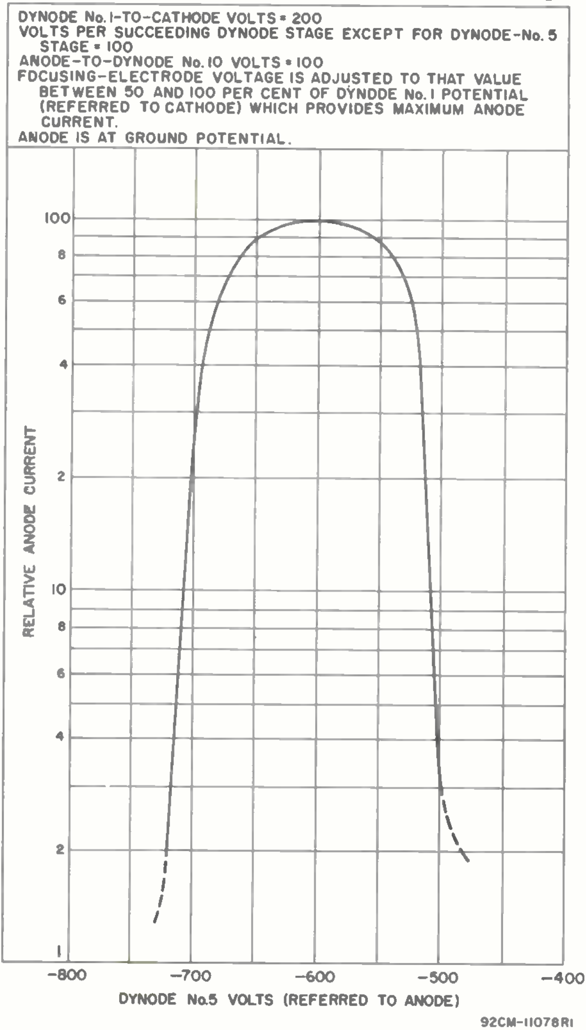
DYNODE No. 1-TO-CATHODE VOLTS = 1/6 E
EACH SUCCEEDING DYNODE-STAGE VOLTS = 1/12 E
ANODE-TO-DYNODE No. 10 VOLTS = 1/12 E
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No. 1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.
PHOTOCATHODE IS FULLY ILLUMINATED.



92CS-12314

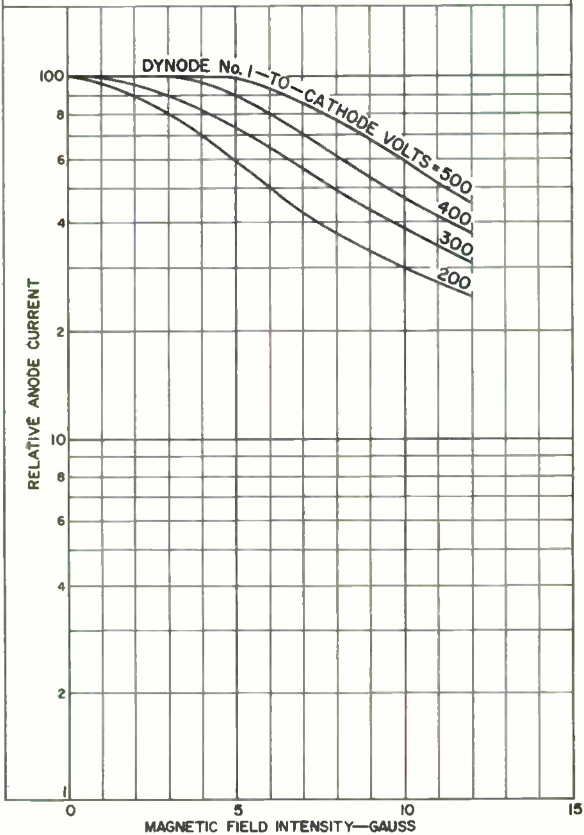
World Radio History

TYPICAL CHARACTERISTIC OF OUTPUT CURRENT AS A FUNCTION OF DYNODE-No.5 VOLTS



TYPICAL EFFECT OF MAGNETIC FIELD ON ANODE CURRENT

DYNODE No.1-TO-CATHODE VOLTS=AS INDICATED
EACH SUCCEEDING DYNODE-STAGE VOLTS=125
ANODE-TO-DYNODE No.10 VOLTS=125
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No.1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.
PHOTOCATHODE FULLY ILLUMINATED BY A POINT LIGHT SOURCE POSITIONED APPROX. 1 FOOT FROM CENTER OF TUBE FACE.
MAGNETIC FIELD PARALLEL TO MAJOR AXIS OF TUBE.

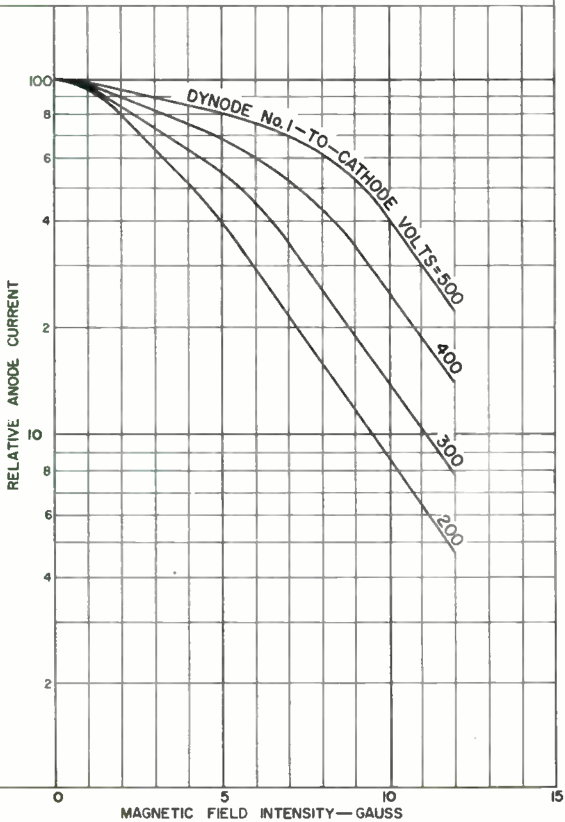


92CM-11084R2

World Radio History

TYPICAL EFFECT OF MAGNETIC FIELD ON ANODE CURRENT

DYNODE No.1-TO-CATHODE VOLTS=AS INDICATED
EACH SUCCEEDING DYNODE-STAGE VOLTS=125
ANODE-TO-DYNODE No.10 VOLTS=125
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No.1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.
PHOTOCATHODE FULLY ILLUMINATED BY A POINT LIGHT SOURCE POSITIONED APPROX. 1 FOOT FROM CENTER OF TUBE FACE.
MAGNETIC FIELD PERPENDICULAR TO MAJOR AXIS OF TUBE.



92CM-11085R2

World Radio History

Multiplier Phototube

S-20 RESPONSE

10-STAGE, HEAD-ON FLAT-FACEPLATE TYPE

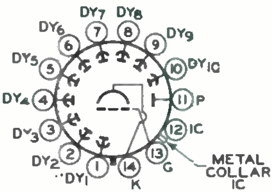
VENETIAN-BLIND-TYPE DYNODE STRUCTURE

For Photometry, Flying-Spot Scanning, and Scintillation-Counter Equipment Requiring Low-Dark Current and High Sensitivity Over a Wide Spectrum (Blue Visible Well into Near Infrared).

General:

Spectral Response	S-20
Wavelength of Maximum Response	4200 ± 500 angstroms
Cathode, Semitransparent	K-Na-Cs-Sb (Multialkali)
Shape	Flat, Circular
Minimum area	15.1 sq.in.
Minimum diameter	4.38 in.
Window	Lime Glass[a]
Index of refraction at 5893 angstroms	1.51
Dynode Material	Copper-Beryllium
Direct Interelectrode Capacitances (Approx.):	
Anode to dynode No.10	7 pf
Anode to all other electrodes	8.5 pf
Maximum Overall Length	7.69"
Seated Length	6.75" ± 0.19"
Maximum Diameter	5.31"
Operating Position	Any
Weight (Approx.)	1 lb 7 oz
Bulb	J42
Socket	Cinch[b] No.3M14, or equivalent
Magnetic Shield	Perfection Mica Co.[c], or equivalent
Base	Small-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-45), Non-hygroscopic
Basing Designation for BOTTOM VIEW	14AM

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
Metal Collar – Do Not Use



DIRECTION OF LIGHT: INTO END OF BULB

World Radio History

Maximum Ratings, ***Absolute-Maximum Values:***

DC Supply Voltage:		
Between anode and cathode.	2500 max.	volts
Between anode and dynode No.10	300 max.	volts
Between consecutive dynodes.	300 max.	volts
Between dynode No.1 and cathode.	600 max.	volts
Between focusing electrode and cathode .	600 max.	volts
Average Anode Current[d]	1 max.	ma
Ambient Temperature.	85 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 50 and 100 per cent of dynode-No.1 potential (referred to cathode) which provides maximum anode current.

With E = 2000 volts (Except as noted)

	Min.	*Typ.*	*Max.*	
Sensitivity:				
Radiant, at 4200 angstroms.	-	1.1×10^{4}	-	a/w
Cathode radiant, at 4200 angstroms. .	-	6.8×10^{-2}	-	a/w
Luminous, at 0 cps[e]. .	12	25	240	a/lm
Cathode luminous:				
With tungsten light source[f]. . .	1.2×10^{-4}	1.6×10^{-4}	-	a/lm
With blue light source[g,h].	5×10^{-8}	-	-	a
With red light source[j,k].	3×10^{-7}	-		a
Current Amplification. .	-	1.6×10^{5}	-	
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 12 a/lm[m].	-	4×10^{-10}	1×10^{-9}	lm
Equivalent Noise Input .	-	-	3.8×10^{-12}	lm
Anode-Pulse Rise Time[n] .	-	1.65×10^{-8}	-	sec
Electron Transit Time[p] .	-	9.3×10^{-8}	-	sec

With E = 1500 volts (Except as noted)

	Min.	*Typ.*	*Max.*	
Sensitivity:				
Radiant, at 4200 angstroms.	-	2.1×10^{3}	-	a/w
Cathode radiant, at 4200 angstroms. . .	-	6.8×10^{-2}	-	a/w
Luminous, at 0 cps[e]. . .	-	5	-	a/lm

World Radio History

	Min.	Typ.	Max.	
Cathode luminous:				
With tungsten light source[f]	1.2×10^{-4}	1.6×10^{-4}	-	a/lm
With blue light source[g,h]	5×10^{-8}	-	-	a
With red light source[j,k]	3×10^{-7}	-	-	a
Current Amplification	-	3.1×10^{4}	-	
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 12 a/lm[m]	-	4×10^{-10}	1×10^{-9}	lm

[a] Corning No.0080 made by Corning Glass Works, Corning, New York, or equivalent.

[b] Made by Cinch Manufacturing Company, 1026 South Homan Avenue, Chicago 24, Illinois.

[c] Magnetic shielding material in the form of foil or tape as available from the Magnetic Shield Division, Perfection Mica Company, 1322 North Elston, Chicago 24, Illinois, or equivalent.

[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 1 microlumen is used.

[f] 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.

[g] 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 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected as anode.

[h] 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.

[j] 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 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected as anode.

[k] See *Spectral Characteristic of 2870° K Light Source and Spectral Characteristic of Light from 2870° K Source after passing through Indicated Red Filter* at front of this Section.

[m] At a tube temperature of 25° C. Dark current may be reduced by use of a refrigerant.

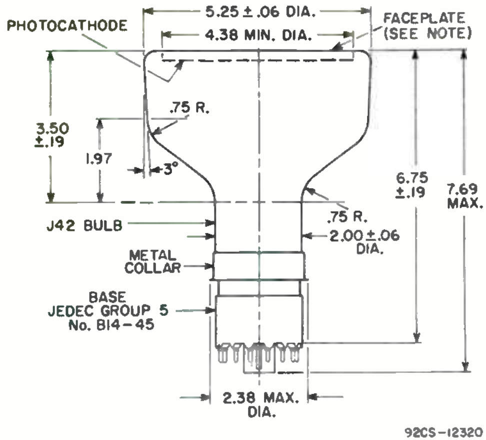
[n] Measured between 10 per cent and 90 per cent of maximum anode-pulse height. This anode-pulse rise time is primarily a function of transit-time variation and is measured under conditions with the incident light fully illuminating the photocathode.

[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-20 RESPONSE is shown at the front of this Section

TYPICAL VOLTAGE-DIVIDER ARRANGEMENT shown under Type 4463 also applies to Type 4465

World Radio History



DIMENSIONS IN INCHES

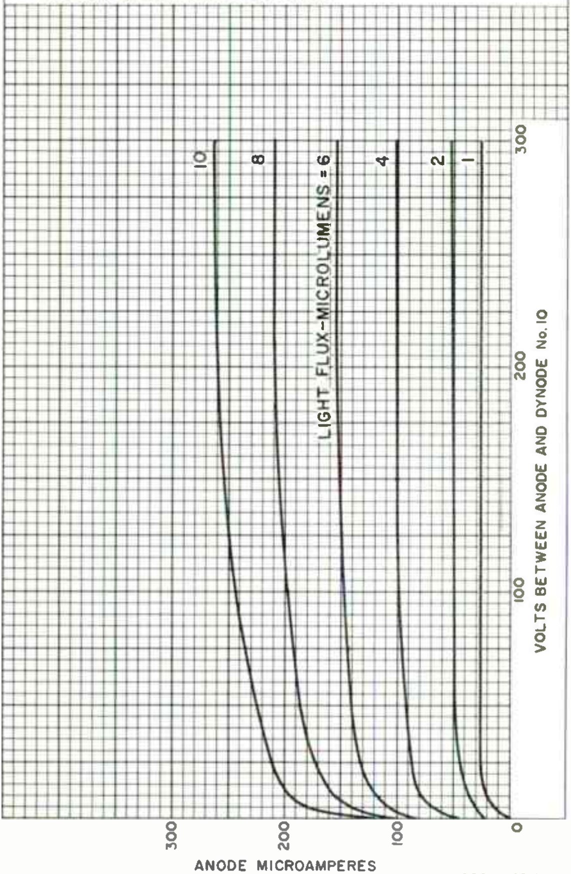
Center line of bulb will not deviate more than 2° in any direction from the perpendicular erected at the center of bottom of the base.

NOTE: Within 4.38" diameter, deviation from flatness of external surface of faceplate will not exceed 0.010" from peak to valley.

World Radio History

TYPICAL ANODE CHARACTERISTICS

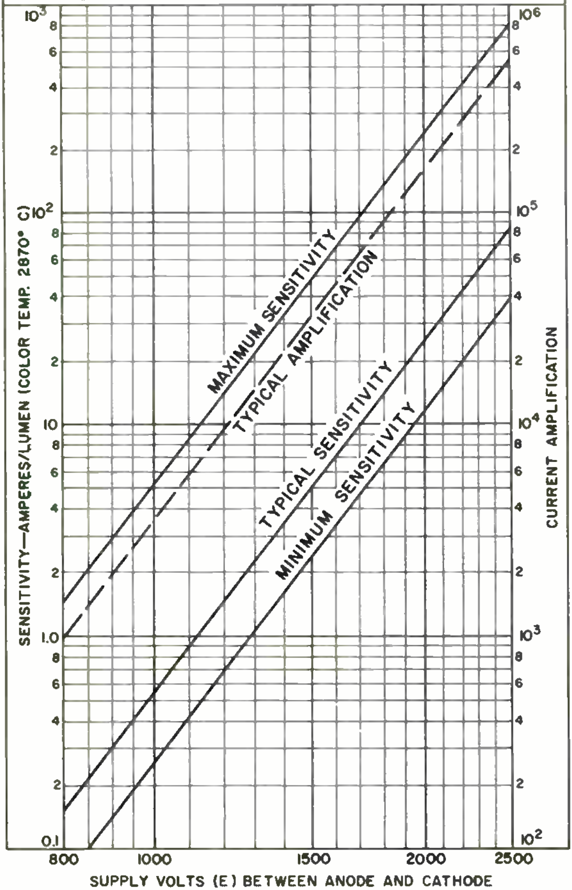
DYNODE No.1-TO-CATHODE VOLTS = 250
EACH SUCCEEDING DYNODE-STAGE VOLTS = 125
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No.1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.



92CM-12310

SENSITIVITY AND CURRENT AMPLIFICATION CHARACTERISTICS

DYNODE No. 1-TO-CATHODE VOLTS = 1/6 E
EACH SUCCEEDING DYNODE-STAGE VOLTS = 1/12 E
ANODE-TO-DYNODE No. 10 VOLTS = 1/12 E
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No. 1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.

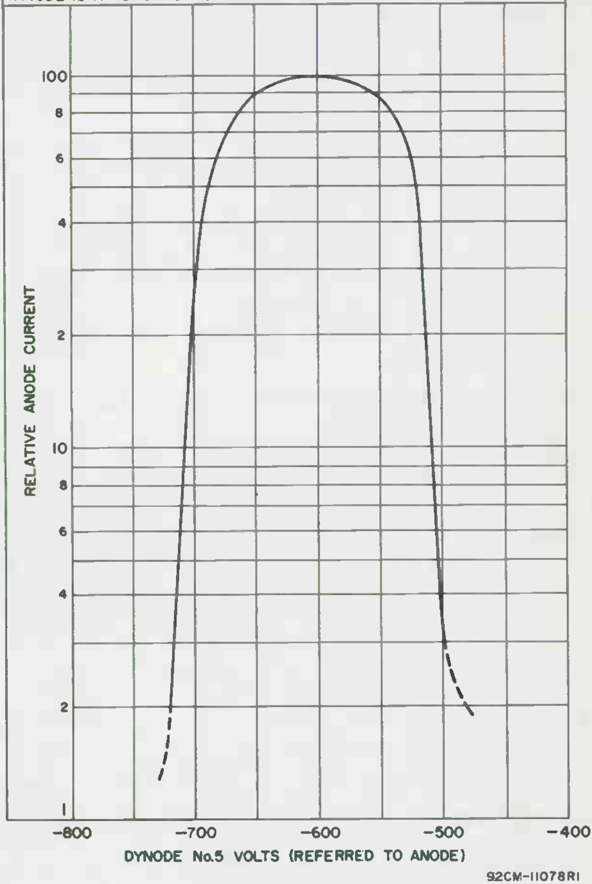


92CM-12312

World Radio History

TYPICAL OUTPUT CURRENT AS A FUNCTION OF DYNODE-No.5 VOLTS CHARACTERISTIC

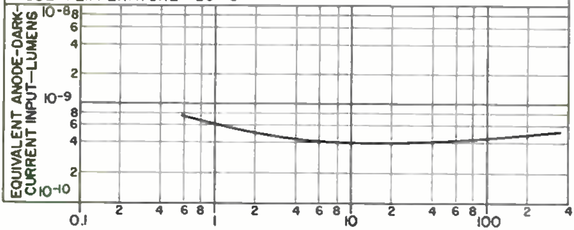
DYNODE No.1-TO-CATHODE VOLTS = 200
VOLTS PER SUCCEEDING DYNODE STAGE EXCEPT FOR DYNODE-No. 5 STAGE = 100
ANODE-TO-DYNODE No.10 VOLTS = 100
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No.1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.
ANODE IS AT GROUND POTENTIAL.



World Radio History

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

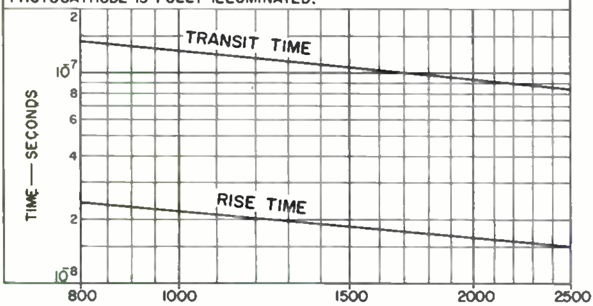
LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E).
DYNODE No. 1-TO-CATHODE VOLTS = 1/6 E
EACH SUCCEEDING DYNODE-STAGE VOLTS = 1/12 E
ANODE-TO-DYNODE No. 10 VOLTS = 1/12 E
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No. 1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.
TUBE TEMPERATURE = 25° C



92CS-12311

TYPICAL TIME RESOLUTION CHARACTERISTICS

DYNODE No.1-TO-CATHODE VOLTS = 1/6 E
EACH SUCCEEDING DYNODE-STAGE VOLTS = 1/12 E
ANODE-TO-DYNODE No.10 VOLTS = 1/12 E
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No.1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.
PHOTOCATHODE IS FULLY ILLUMINATED.



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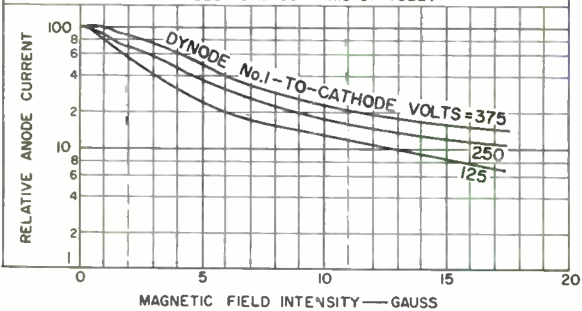
World Radio History

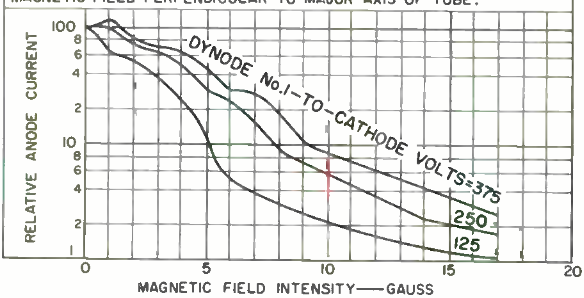
TYPICAL EFFECT OF MAGNETIC FIELD ON ANODE CURRENT CHARACTERISTIC

DYNODE No.1-TO-CATHODE VOLTS = AS INDICATED
EACH SUCCEEDING DYNODE-STAGE VOLTS = 125
ANODE-TO-DYNODE No.10 VOLTS = 125
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No.1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.
PHOTOCATHODE FULLY ILLUMINATED BY A POINT LIGHT SOURCE POSITIONED APPROX. 1 FOOT FROM CENTER OF TUBE FACE.
MAGNETIC FIELD PARALLEL TO MAJOR AXIS OF TUBE.



92CS-11187R2

DYNODE No.1-TO-CATHODE VOLTS = AS INDICATED
EACH SUCCEEDING DYNODE-STAGE VOLTS = 125
ANODE-TO-DYNODE No.10 VOLTS = 125
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No.1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.
PHOTOCATHODE FULLY ILLUMINATED BY A POINT LIGHT SOURCE POSITIONED APPROX. 1 FOOT FROM CENTER OF TUBE FACE.
MAGNETIC FIELD PERPENDICULAR TO MAJOR AXIS OF TUBE.



92CS-11188R2

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Image-Intensifier Orthicon

COMBINED IMAGE-CONVERTER & IMAGE ORTHICON SECTIONS
THIN FILM SEMICONDUCTIVE TARGET

For Extremely Low-Light Level Television Cameras

GENERAL

Maximum Overall Length . . . . 22.44 in
Greatest Diameter. . . . . 5.016 in
Operating Position . . . The tube should never be operated in a vertical position with the diheptal-base end up nor in any other position where the axis of the tube with the base up makes an angle of less than 20° with the vertical.
Weight (Approx.) . . . . 4 lbs 14 oz

Image-Converter Section

Spectral Response. S-20
Wavelength of Maximum Response . . . . . 4200 ± 500 angstroms
First Photocathode. Semitransparent
Useful size of . . . . 2 inches max diagonal
Focusing Method. . . . . Electrostatic

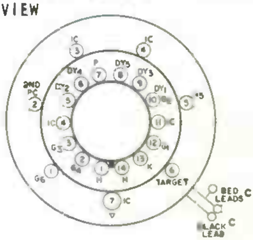
Image-Orthicon Section

Heater, for Unipotential Cathode
Voltage (AC or DC) . . . . 6.3 ± 10% V
Current at 6.3 V . . . . 0.6 A
Direct Interelectrode Capacitance
Anode to all other electrodes. . . . . 12 pF
Focusing Method. . . . . Magnetic
Deflection Method. . . . . Magnetic
Socket . . . . Cinch Part No.3M14,[a] or equivalent
Minimum Deflection-Coil Inside Diameter. . . . . . 2-3/8 in
Deflecting Coil. . . . .Cleveland Electronics, Part No.OY-1,[b] or equivalent
Deflection-Coil Length . . . . 5 in
Focusing Coil. . . . . .Cleveland Electronics, Part No.OF-2,[b] or equivalent
Focusing-Coil Length . . . . 10 in
Alignment Coil . . . . .Cleveland Electronics, Part No.OA-3,[b] or equivalent
Alignment-Coil Length. . . . . 15/16 in

BASING DIAGRAM — BOTTOM VIEW

Shoulder Base: Keyed Jumbo Annular 7-Pin

- Pin 1 – Grid No.6
- Pin 2 – Second Photocathode
- Pin 3 – Do Not Use
- Pin 4 – Do Not Use
- Pin 5 – Grid No.5
- Pin 6 – Target
- Pin 7 – Do Not Use



Direction of Light: Perpendicular to Large End of Tube

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End Base: Small-Shell Diheptal 14-Pin (JEDEC No.B14-45)

Pin 1 - Heater
Pin 2 - Grid No.4
Pin 3 - Grid No.3
Pin 4 - Do Not Use
Pin 5 - Dynode No.2
Pin 6 - Dynode No.4
Pin 7 - Anode
Pin 8 - Dynode No.5
Pin 9 - Dynode No.3
Pin 10 - Dynode No.1, Grid No.2
Pin 11 - Do Not Use
Pin 12 - Grid No.1
Pin 13 - Cathode
Pin 14 - Heater

MAXIMUM RATINGS, ABSOLUTE-MAXIMUM VALUES

Maximum Continuous Operating Photocathode Illumination	1×10^{-6}	fc
Storage-Temperature Range	0 to 50	°C
Image-Converter Section		
Supply Voltage[d]	-14000 to -20000	V
Image-Orthicon Section		
Second Photocathode Voltage	-550	V
Grid-No.6 Voltage	-550	V
Target Voltage		
Positive Value	10	V
Negative Value	10	V
Grid-No.5 Voltage	150	V
Grid-No.4 Voltage	300	V
Grid-No.3 Voltage	400	V
Grid-No.2 & Dynode-No.1 Voltage	350	V
Grid-No.1 Voltage		
Negative bias value	125	V
Positive bias value	0	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	125	V
Heater positive with respect to cathode	10	V
Anode-Supply Voltage[e]	1350	V
Voltage Per Multiplier Stage	350	V
Operating Temperature		
Of any part of bulb	50	°C
At 3"-diameter end of tube (target section)	20 min	°C
Temperature Difference		
Between target section and any part hotter than image-orthicon target section	5	°C

TYPICAL OPERATING VALUES

Image-Converter Section		
Supply Voltage[d]	-14000 to -20000	V
Image-Orthicon Section		
Second Photocathode Voltage	-400 to -540	V
Grid-No.6 Voltage (Approx. 75% of Second Photocathode Voltage)	-300 to -405	V
Target-Cutoff Voltage[f]	-3 to +1	V
Grid-No.5 Voltage (Decelerator)	0 to 125	V
Grid-No.4 Voltage (Beam Focus)	160 to 220	V
Grid-No.3 Voltage[g]	225 to 330	V
Grid-No.2 & Dynode-No.1 Voltage	300	V
Grid-No.1 Voltage for Picture Cutoff	-45 to -115	V

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Dynode-No.2 Voltage.	600	V
Dynode-No.3 Voltage.	800	V
Dynode-No.4 Voltage.	1000	V
Dynode-No.5 Voltage.	1200	V
Anode Voltage.	1250	V
Target-Temperature Range	35 to 45	°C
Minimum Peak-to-Peak Blanking Voltage. . .	5	V
Field Strength at Center of Focusing Coil[h]	75	G
Field Strength of Alignment Coil	0 to 3	G

[a] Made by Cinch Manufacturing Co., 1026 South Homan Ave., Chicago 24, Illinois.

[b] Made by Cleveland Electronics Inc., 1974 East 61st Street, Cleveland, Ohio.

[c] Image-Converter Power-Supply Connector Assembly (Three Leads) - 1. Short Red Lead — To ground of image-orthicon-section power supply. 2. Long Black Lead — To negative high-voltage terminal of image-converter-section power supply and fitted with Alden Part No.8111M or equivalent. 3. Long Red Lead — To positive (ground) high-voltage terminal of image-connector-section power supply and fitted with Alden Part No.8111M, or equivalent.

[d] An optimum value of image-converter-section supply voltage is supplied with each individual 4470.

[e] Dynode voltage values are shown under *Typical Operating Values*.

[f] Normal setting of target voltage is +2 V from target cutoff. The target supply voltage should be adjustable from -3 to +5 V.

[g] Adjust to give the most uniformly shaded picture near maximum signal.

[h] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with indicator located outside of and at the image end of the focusing coil.

OPERATING CONSIDERATIONS

When the beam current is adjusted to just discharge the highlights of the scene being televised, the amount of signal current produced is nearly directly proportional to the light level intensity. Noise, on the other hand, varies as the square root of the scanning-beam current employed. The 4470, therefore, may be operated over a wide range of signal current, or scene illumination levels, without a change in signal-to-noise ratio of the video signal that is in direct proportion. However, attention must be paid to those parameters affecting the amount of beam current used during tube operation.

When the 4470 is used in image-orthicon cameras the following instructions and camera modifications should be followed:

1. The camera should be of good electrical and mechanical design.

2. A high-voltage source must be provided to supply the necessary voltage for the image-converter section of the 4470. The positive terminal of this voltage supply should be grounded and be adjustable from -4kV to -20kV for optimum operation of the tube. The image-converter section presents a load of approximately 20,000 megohms to the power supply.

3. A spherical corrective lens system, such as "Super-Farron F/0.87", - manufactured by the Farrand Optical Co., Inc., Bronx Blvd., and East 238th St., New York 70, N.Y. - or equivalent, should be employed with the first photo-cathode (image-converter section) to minimize "pin cushioning" effects.

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4. The video signal should be passed through a 2 megacycle low-pass filter to obtain optimum signal-to-noise ratio at threshold light levels.

5. Support for the image-converter section of the 4470 must be provided. Such support may be provided by any convenient method that does not introduce undue pressure to the "potting" material and thereby reduces its voltage-isolation properties. In addition, the mounting arrangement should not introduce torsion or forces that are perpendicular to the major axis of the tube. Any tube retaining plug or lens housing placed at the image-converter section (front end) of tube should be made of high-grade insulating material.

SET-UP PROCEDURE

Follow carefully the set-up procedure to obtain optimum performance from the 4470. *Care must be exercised at all times to prevent the inadvertent exposure of the 4470 to direct illumination from the sun or other bright light sources.* The maximum first photocathode illumination level should not exceed 1×10^{-6} footcandle.

Insert the 4470 in its socket with all camera voltages in the "off" position. Before applying the heater voltage make sure that no light is incident on the photocathode, i.e., make sure that all camera doors and light shields are closed and that the camera lens is capped. Allow warm-up for 2 minutes with only heater voltage applied.

Check the camera lens system for the proper combination of neutral-density filter and lens aperture that limits the illumination on the first photocathode to 1×10^{-6} footcandle from a test chart or set-up scene. After the lens system has been so adjusted, uncap the lens. Apply specified image-converter voltage to that section.

Apply scanning and image-orthicon-section voltage as indicated under *Typical Operating Values*. The image-orthicon beam control (grid No. 1) should be in its most negative position and that the target-voltage control adjusted to -3 volts, or its most negative position. Adjust deflecting circuits for maximum output to assure overscanning of the target.

Grid No. 5 is used to control the beam landing on the target and consequently the uniformity of signal output. Adjust grid-No. 5 voltage control to produce a picture that has most uniform shading from center to edge with the lens iris adjusted to permit operation at the highest light level involved in the application. Grid-No. 5 voltage should be as high as possible consistent with uniform shading. Grid No. 3 facilitates a more complete collection by dynode No. 2 of the secondaries from dynode No. 1. Adjust grid-No. 3 voltage control to produce maximum signal output and uniformity.

With a test pattern consisting of a straight line centered on the face of the 4470, adjust grid-No. 6 and photocathode voltage to produce a sharply focused straight line on the monitor. Improper adjustment of the grid-No. 6 voltage control will result in the straight-line pattern having a slight S-shape.

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Electronic Components and Devices Harrison, N. J.

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Scanning may be adjusted until the target just fills the monitor picture.

The above adjustments constitute a rough setup of the 4470. Final adjustments include realignment of the beam with the lens capped. Beam alignment is necessary after each change of the grid-No.5 voltage control and sometimes after each adjustment of the grid-No.3 voltage control.

With the camera operating at the desired illumination level, slowly decrease the beam current by adjusting the grid-No.1 voltage control to the point where the beam is just sufficient to discharge the highlights of the picture. Each change of scene illumination should be accompanied by appropriate changes in the beam current and amplifier gain to obtain the best contrast and signal-to-noise ratio for each new scene condition.

For stand-by operation, adjust scanning for over-scan, cap camera lens, turn off image-converter voltage, and keep the beam and target voltage on.

To turn the 4470 off, put the camera in the standby operation described above, set the target voltage to -3 volts, or its most negative position, turn the beam control (grid No.1) to its most negative position and immediately thereafter turn off all other image-orthicon voltages. To turn tube on again, repeat the set-up procedure.

SPECTRAL-SENSITIVITY CHARACTERISTIC

OF PHOTOSENSITIVE DEVICE HAVING S-20 RESPONSE

is shown at front of this section

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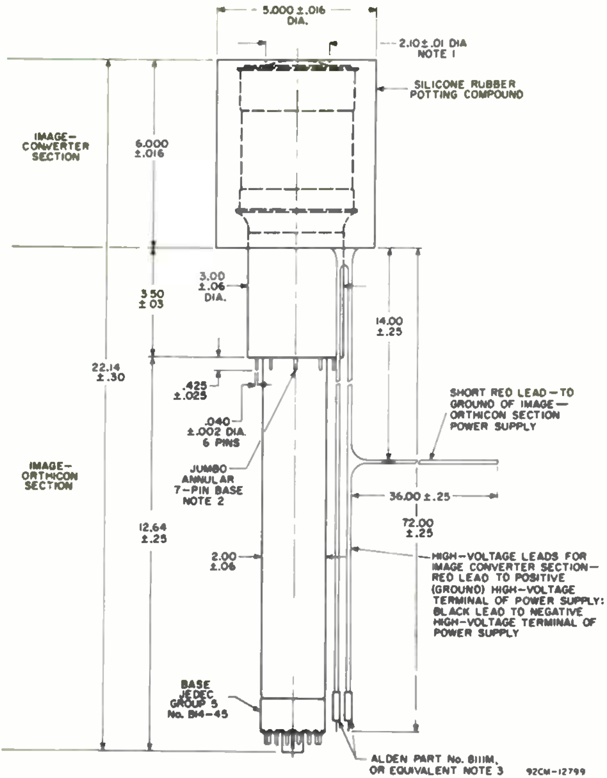
DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Note 1: The window area of the first photocathode is concentric with the image-converter section cylinder, and the image-orthicon section cylinders within 0.100" of the major axis of the tube.

Note 2: The index of the annular base and the key of the diheptal base are aligned within ± 7° with reference to the annular index pin.

Note 3: Alden Products Company, 9140 North Main Street, Brockton 64, Mass.

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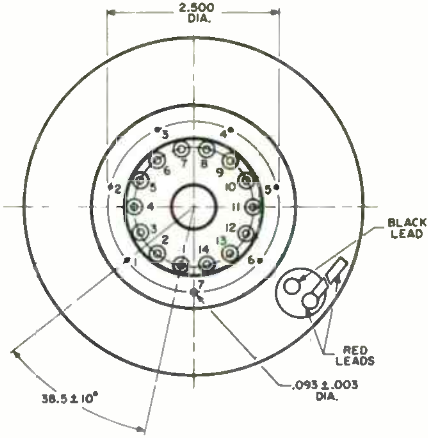
ENLARGED-BOTTOM VIEW

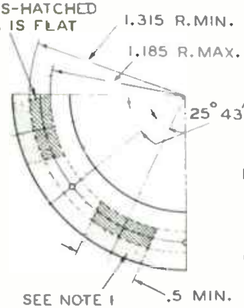


DIMENSIONS IN INCHES

ANNULAR-BASE GAUGE

Annular variations between pins as well as eccentricity of neck cylinder with respect to photocathode cylinder are held to tolerances such that pins and neck cylinder will fit flat-plate gauge with:

Detail of Bottom View
of Jumbo Annular Base



DIMENSIONS IN INCHES

Note 1: Dotted area is flat or extends toward diheptal-base end of tube by 0.060" max.

a. Six holes having diameter of 0.065" ± 0.001" and one hole having diameter of 0.150" ± 0.001". All holes have depth of 0.265" ± 0.001". The six 0.065" holes are enlarged by 45° taper to depth of 0.047". All holes are spaced at angles of 51°26′ ± 5′ on circle diameter of 2.500" ± 0.001".

b. Seven stops having height of 0.187" ± 0.001", centered between pin holes, to bear against flat areas of base.

c. Rim extending out a minimum of 0.125" from 2.812" diameter and having height of 0.126" ± 0.001".

d. Neck-cylinder clearance hole having diameter of 2.200" ± 0.001".

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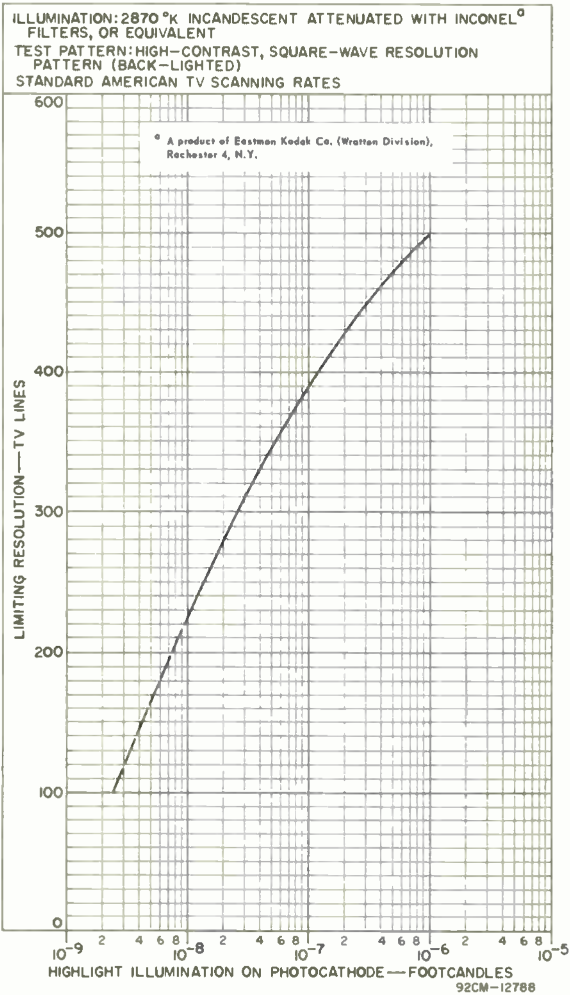
Typical Limiting Resolution Characteristic



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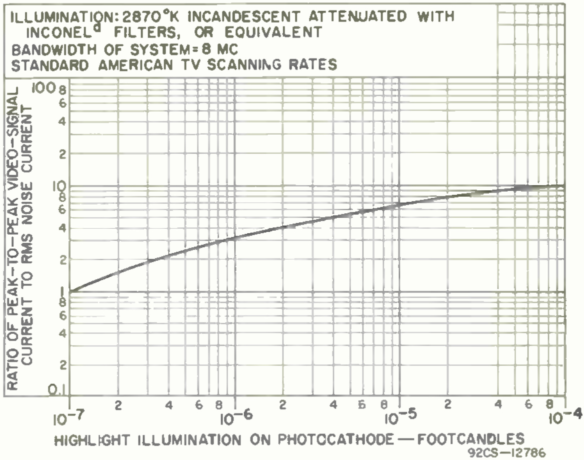
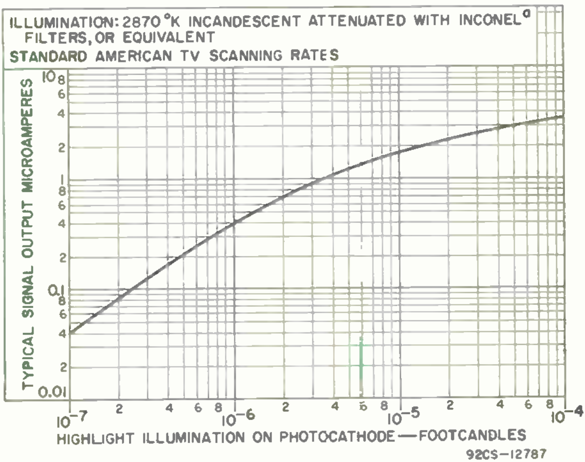
Typical Signal-To-Noise Characteristic



Typical Light Transfer Characteristic



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Photomultiplier Tubes[a]

9-STAGE, SIDE-ON TYPES **S-4 RESPONSE**

CONTROLLED SENSITIVITY ABOVE WAVELENGTH OF 5800Å

The **4471** and **4472** are the same as the **931A** except for the following items:

Characteristics Range Values:

With E = 1000 volts

	Min.	Typ.	Max.	
Sensitivity:				
Luminous, at 0 cps[b]	10	100	600	a/lm
"Red-to-White" Ratio:				
4471	5	–	–	%
4472	7	–	–	%

[a] Alternate designation for Multiplier Phototube.
[b] 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.

OPERATING CONSIDERATIONS

The luminous-sensitivity ratings of the 4471 and 4472 are higher, and their sensitivities above the wavelength of 5800 angstroms are controlled. This control is important in applications where a high level of sensitivity in the red region of the spectral-response characteristic is required. The degree of this controlled sensitivity in the red region is specified by a "red-to-white" ratio of anode currents. Anode current is measured first using a tungsten-lamp source, and then measured with a red filter interposed between the light source and the phototube. The "red-to-white" ratio is greater than 5% for the 4471, and greater than 7% for the 4472.

The anode current comprising the "white" portion of this ratio is measured with a light input of 10 microlumens. The light source is a tungsten-filament lamp having a lime-glass envelope. It is operated at a color temperature of 2870° K.

The anode current comprising the "red" portion of the ratio is measured under conditions identical with the "white" measurement except that the light input of 10 microlumens is transmitted through a red filter (Corning C.S. No. 2-112--manufactured by the Corning Glass Works, Corning, N.Y., or equivalent) which has the following characteristics: the transmittance of all wavelengths from 3000 to 5790 angstroms is less than 0.5%; the 37% transmittance point lies between 6030 and 6070 angstroms; the transmittance from 6400 to 7000 angstroms is greater than 80%; and the difference between the wavelengths where transmittance is 15% and 60% is not greater than 150 angstroms.

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Photomultiplier Tube[a]

9-STAGE, SIDE-ON TYPE **S-4 RESPONSE**

CONTROLLED SENSITIVITY ABOVE WAVELENGTH OF 5800Å

The **4473** is the same as the **1P21** except for the following items:

Characteristics Range Values:

With E = 1000 volts

	Min.	Typ.	Max.	
Sensitivity:				
Luminous, at 0 cps[b]	40	100	800	a/lm
"Red-to-White" Ratio	7	–	–	%

[a] Alternate designation for Multiplier Phototube.

[b] 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.

OPERATING CONSIDERATIONS

Sensitivity of the 4473 above the wavelength of 5800 angstroms is controlled. This control is important in applications where a high-level of sensitivity in the red region of the spectral-response characteristic is required. The degree of this controlled sensitivity in the red region is specified by a "red-to-white" ratio of anode currents. Anode current is measured first using a tungsten-lamp source, and then measured with a red filter interposed between the light source and phototube. The "red-to-white" ratio is greater than 7% for the 4473.

The anode current comprising the "white" portion of this ratio is measured with a light input of 10 microlumens. The light source is a tungsten-filament lamp having a lime-glass envelope. It is operated at a color temperature of 2870° K.

The anode current comprising the "red" portion of the ratio is measured under conditions identical with the "white" measurement except that the light input of 10 microlumens is transmitted through a red filter (Corning C.S. No. 2-112—manufactured by the Corning Glass Works, Corning, N.Y., or equivalent) which has the following characteristics: the transmittance of all wavelengths from 3000 to 5700 angstroms is less than 0.5%; the 37% transmittance point lies between 6030 and 6070 angstroms; the transmittance from 6400 to 7000 angstroms is greater than 80%; and the difference between the wavelengths where transmittance is 15% and 60% is not greater than 150 angstroms.

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Vidicons

MAGNETIC FOCUS | 1"-DIAMETER | MAGNETIC DEFLECTION

For Televising Live Scenes in Educational, Industrial, and Other Closed-Circuit TV Applications Where Broadcast-Quality Scene Reproduction is Not Essential

The 4478 and 4488 are the same as the 7735B except for the following items:

GENERAL

Photoconductive Layer (4478)
Maximum useful diagonal of rectangular image (4x3 aspect ratio)[a]

TYPICAL OPERATION AND PERFORMANCE DATA

	4478	4488	
Grid-No.1 Voltage for Picture Cutoff[b]	-45 to -110	-45 to -100	V
Limiting Resolution[c] at Center of Picture			
Typical value	700	700	TV lines
Minimum value	600	625	TV lines

Average-sensitivity operation — 1.0 footcandle on faceplate

	4478	4488	
Faceplate Illumination (Highlight)	1.0	1.0	fc
Target Voltage[d,e]	10 to 70	12 to 53	V
Dark Current[f]	0.035	0.030	μA
Signal-Output Current[g]			
Typical	0.265	0.270	μA
Minimum	0.240	0.250	μA

[a] Orientation of quality rectangle — Proper orientation is obtained when the horizontal scan is essentially parallel to the plane passing through the tube axis and short pin.

[b] With no blanking voltage on grid No.1.

[c] Amplitude response values will be correspondingly lower than those of type 7735B.

[d] The target voltage for each tube must be adjusted to that value which gives the desired operating signal current.

[e] Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

[f] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

[g] Defined as the component of the highlight target current after the dark-current component has been subtracted.

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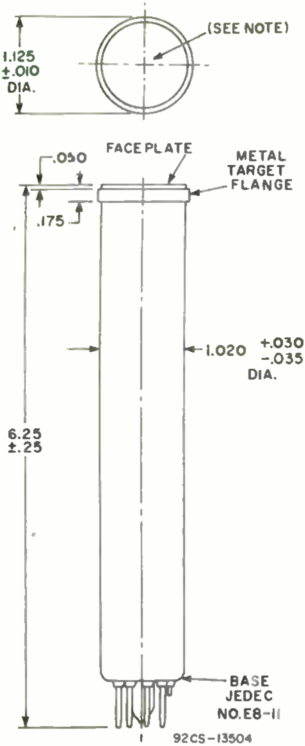
DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Note: Type 4488 has portion of face masked similar to type 7735B.

SPURIOUS SIGNAL TEST

4478

For scanned area of 1/2" x 3/8"

Equivalent Number of Raster Lines	Zone 1 Allowed Spots	Zone 2 Allowed Spots
over 6	0	0
6 but not including 4	0	2
4 but not including 1	3	4
1 or less	footnote h	footnote h

4488

For scanned area of 1/2" x 3/8"

Equivalent Number of Raster Lines	Zone 1 Allowed Spots	Zone 2 Allowed Spots
over 4	0	0
4 but not including 3	0	1
3 but not including 1	2	3
1 or less	footnote h	footnote h

Minimum separation between any 2 spots greater than 1 raster line is limited to 16 raster lines.

[h] Spots of this size are allowed unless concentration causes a smudged appearance.

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Electronic Components and Devices Harrison, N. J.

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Gas Phototube

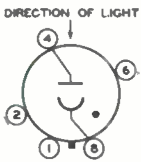
SIDE-ON TYPE HAVING S-4 RESPONSE

DATA

General:

Spectral Response. S-4
Wavelength of Maximum Response . . . . . 4000 ± 500 angstroms
Cathode:
  Shape. . . . . .Semicylindrical
  Minimum projected length[a]. . . . . 13/16"
  Minimum projected width[a] . . . . 5/8"
Direct Interelectrode Capacitance (Approx.) . . . . . . 2.6 μμf
Maximum Overall Length . . . . 3-1/16"
Maximum Seated Length. . . . . 2-1/2"
Seated Length to Center of Cathode . . . . . . 1-5/8" ± 3/32"
Maximum Diameter . . . . 1-9/32" ←
Operating Position . . . . Any
Weight (Approx.) . . . . 0.9 oz ←
Bulb T9
Socket . . . . .Cinch No.8JM-1, or equivalent ←
Base . . . . . . .Intermediate-Shell Octal 5-Pin Arrangement 1, ←
(JEDEC No.B5-10)
  Basing Designation for BOTTOM VIEW . . . . 3J ←

Pin 1 - No Connection
Pin 2 - No Connection
Pin 4 - Anode



Pin 6 - No Connection
Pin 8 - Photocathode

Maximum Ratings, ***Absolute-Maximum Values:*** ←

	Rating I	Rating II	
ANODE-SUPPLY VOLTAGE (DC or Peak AC).	80 max.	100 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[b]	60 max.	30 max.	μa/sq. in.
AVERAGE CATHODE CURRENT[b] . .	6 max.	3 max.	μa
AMBIENT TEMPERATURE.	75 max.	75 max.	°C

Characteristics: ←

With an anode-supply voltage of 90 volts unless otherwise specified

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4000 angstroms.	-	0.13	-	amp/watt
Luminous:[c]				
At 0 cps	75	135	205	μa/lumen
At 5000 cps.	-	124	-	μa/lumen
At 10000 cps	-	108	-	μa/lumen

← Indicates a change

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	Min.	Median	Max.	
Gas Amplification Factor[d] . . .	–	–	5.5	
Anode Dark Current	–	–	0.05	μa

Minimum Circuit Values:

With an anode-supply voltage of	*80 or less*	*100*	*volts*
DC Load Resistance:			
For dc currents above 3 μa	0.1 min.	–	megohm
For dc currents below 3 μa	0 min.	–	megohms
For dc currents above 1 μa	–	2.5 min.	megohms
For dc currents below 1 μa	–	0.1 min.	megohm

[a] On plane perpendicular to indicated direction of incident light.

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

[c] For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A dc anode supply voltage of 90 volts and a 1-megohm load resistor are used. For the 0-cycle measurement, a light input of 0.1 lumen is used. For the 5000- and 10,000-cycle measurements, the light input is varied sinusoidally about a mean value of 0.015 lumen from zero to a maximum of twice the mean value.

[d] The ratio of luminous sensitivity at an anode supply voltage of 90 volts to luminous sensitivity at an anode supply voltage of 25 volts. In each case, sensitivity is obtained under conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K, the light input is 0.1 lumen, and the load resistor has a value of 1 megohm.

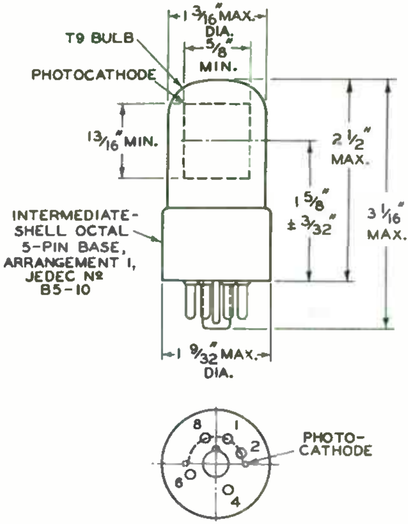
SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-4 RESPONSE

and

FREQUENCY-RESPONSE CHARACTERISTICS OF GAS PHOTOTUBES

are shown at the front of this section

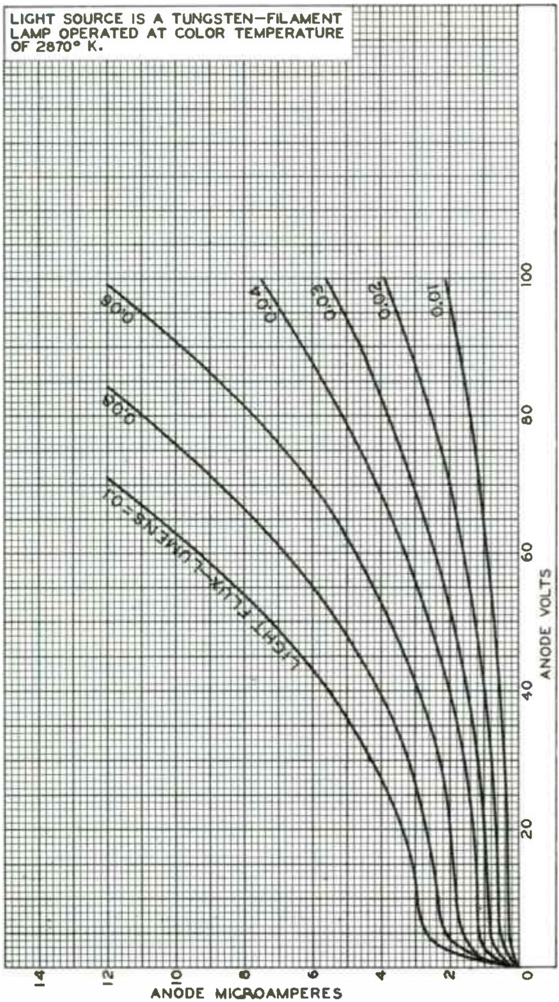
World Radio History



92CM-6137R3

World Radio History

AVERAGE ANODE CHARACTERISTICS



92CM-6822R1

World Radio History

5582

GAS PHOTOTUBE

CARTRIDGE TYPE WITH S-4 RESPONSE

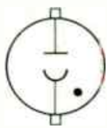
For sound reproduction involving a dye-image sound track in conjunction with an incandescent light source

DATA

General:

Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 angstroms
Cathode:	
Shape	Semicylindrical
Minimum projected length*	5/8"
Minimum projected width*	1/2"
Direct Interelectrode Capacitance	1 μμf
Overall Length	1-21/32" ± 1/16"
Seated Length	1-13/32" ± 1/32" ←
Length from Center of Useful Cathode Area to Plane A-A' *(See Dimensional Outline)*	11/16" ± 1/16"
Maximum Diameter	0.890"
Weight (Approx.)	0.4 oz ←
Mounting Position	Any
Terminals: ←	
Recessed cap	JETEC No.J1-23
Protruding cap	JETEC No.J1-24
Basing Designation	2AQ ←

Recessed Cap } Anode



Protruding Cap } Cathode

DIRECTION OF LIGHT: INTO CONCAVE SIDE OF CATHODE

Maximum Ratings, ***Absolute Values:***

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	100 max.	volts
AVERAGE CATHODE-CURRENT DENSITY°	20 max.	μamp/sq. in. ←
AVERAGE CATHODE CURRENT°	2 max.	μamp
AMBIENT TEMPERATURE	75 max.	°C

Characteristics, ***At 90 Volts on Anode:***

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4000 angstroms	-	0.12	-	μamp/μwatt ←
Luminous:▲				
At 0 cps	80	120	175	μamp/lumen
At 5000 cps	-	110	-	μamp/lumen
At 10000 cps	-	96	-	μamp/lumen
Gas Amplification Factor	-	-	5.5	
Anode Dark Current at 25°C	-	-	0.05	μamp

* On plane perpendicular to indicated direction of incident light.

°,▲: See next page.

← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

5582

GAS PHOTOTUBE

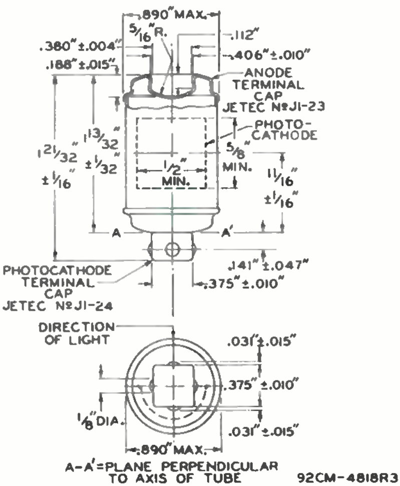
Minimum Circuit Values:

With anode-supply voltage of	*80 or less*	*100*	*volts*
DC Load Resistance:			
For dc currents above 3 µamp	0.1 min.	–	megohm
For dc currents below 3 µamp	0 min.	–	megohm
For dc currents above 1 µamp	–	2.5 min.	megohms
For dc currents below 1 µamp	–	0.1 min.	megohm

○ Averaged over any interval of 30 seconds maximum. This value may be doubled when anode-supply voltage is limited to 80 volts.

▲ For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A dc anode supply of 90 volts and a 1-megohm load resistor are used. For the 0-cycle measurements, a light input of 0.1 lumen is used. For the 5000- and 10000-cycle measurements, the light input is varied sinusoidally about a mean value of 0.015 lumen from zero to a maximum of twice the mean.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-4 Response
and
FREQUENCY-RESPONSE CHARACTERISTICS
of Gas Phototubes
are shown at the front of this Section



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

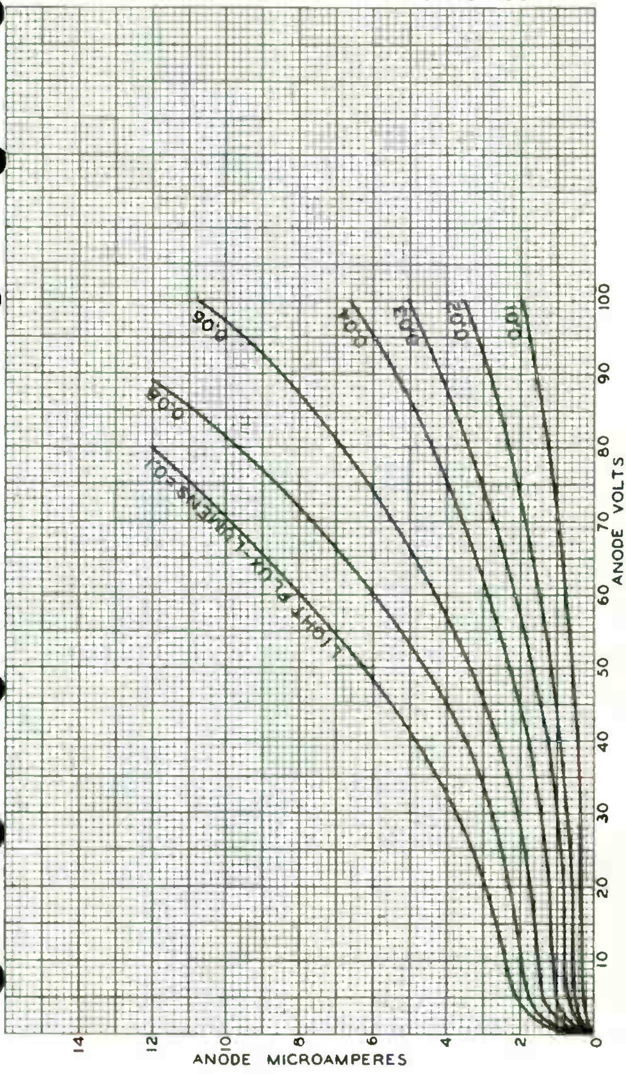
World Radio History

RCA

5582

5582

AVERAGE ANODE CHARACTERISTICS



DEC. 27, 1946

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-6823

World Radio History

World Radio History

Gas Phototube

SIDE-ON TYPE HAVING S-4 RESPONSE

DATA

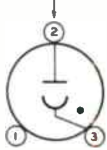
General:

Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 angstroms
Cathode:	
Shape	Semicylindrical
Minimum projected length[a]	11/16"
Minimum projected width[a]	7/16"
Direct Interelectrode Capacitance (Approx.)	2 μμf
Maximum Overall Length	2-13/32"
Maximum Seated Length	1-15/16"
Seated Length to Center of Cathode	1-1/4" ± 3/32"
Maximum Diameter	0.669"
Operating Position	Any
Weight (Approx.)	0.3 oz ←
Bulb	T5-1/4
Socket	Amphenol No. 78S3S-T, or equivalent ←
Base	Small-Shell Peewee 3-Pin (JEDEC No. A3-1) ←
Basing Designation for BOTTOM VIEW	2F

DIRECTION OF LIGHT

Pin 1 – No Connection

Pin 2 – Anode



Pin 3 – Photocathode

Maximum Ratings, ***Absolute-Maximum Values:*** ←

	Rating I	*Rating II*	
ANODE-SUPPLY VOLTAGE (DC or Peak AC)	80 max.	100 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[b]	40 max.	20 max.	μa/sq. in.
AVERAGE CATHODE CURRENT[b]	4 max.	2 max.	μa
AMBIENT TEMPERATURE	75 max.	75 max.	°C

Characteristics: ←

With an anode-supply voltage of 90 volts unless otherwise specified

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4000 angstroms	–	0.13	–	amp/watt
Luminous:[c]				
At 0 cps	75	135	205	μa/lumen
At 5000 cps	–	124	–	μa/lumen
At 10000 cps	–	108	–	μa/lumen

← Indicates a change.

World Radio History

	Min.	Median	Max.	
Gas Amplification Factor[d] . . .	-	-	5.5	
Anode Dark Current at 25° C. .	-	-	0.05	μa

Minimum Circuit Values:

With an anode-supply voltage of	*80 or less*	*100*	*volts*
DC Load Resistance:			
For dc currents above 3 μa.	0.1 min.	-	megohm
For dc currents below 3 μa.	0 min.	-	megohms
For dc currents above 1 μa.	-	2.5 min.	megohms
For dc currents below 1 μa.	-	0.1 min.	megohm

[a] On plane perpendicular to indicated direction of incident light.

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

[c] For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A dc anode supply voltage of 90 volts and a 1-megohm load resistor are used. For the 0-cycle measurement, a light input of 0.1 lumen is used. For the 5000- and 10,000-cycle measurements, the light input is varied sinusoidally about a mean value of 0.015 lumen from zero to a maximum of twice the mean value.

[d] The ratio of luminous sensitivity at an anode supply voltage of 90 volts to luminous sensitivity at an anode supply voltage of 25 volts. In each case, sensitivity is obtained under conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K, the light input is 0.1 lumen, and the load resistor has a value of 1 megohm.

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

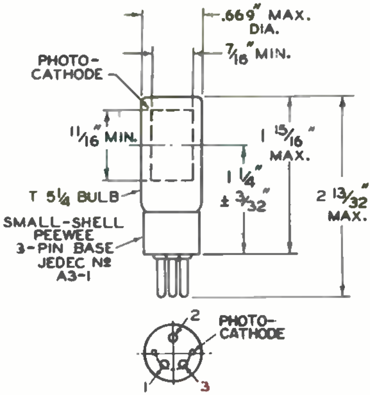
and

FREQUENCY-RESPONSE CHARACTERISTICS OF GAS PHOTOTUBES

are shown at the front of this section

AVERAGE-ANODE-CHARACTERISTICS CURVE shown under Type 5581 also applies to the 5583

World Radio History



92CM-6053R5

World Radio History

World Radio History

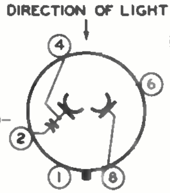
Vacuum Phototube

COMPOSITE-ANODE-CATHODE, SIDE-ON TYPE HAVING S-4 RESPONSE

DATA

General:

Spectral Response S-4
Wavelength of Maximum Response. . . . . 4000 ± 500 angstroms
Cathode:
  Shape . . . . Flat
  Minimum projected length[a] . . . . 19/32"
  Minimum projected width[a]. . . . . 1/4"
Direct Interelectrode Capacitances (Approx.):
  Between base pins 4 and 8 (C_1). . . . . 1 μμf
  Balancing capacitance (C_2)[b] . . . . 1 μμf
Capacitance Difference between C_1 and C_2. . . . 0.3 max. μμf
Maximum Overall Length. . . . . 2-7/8"
Maximum Seated Length . . . . 2-5/16"
Seated Length to Center of Cathode. . . . . . . 1-5/8" ± 3/32"
Maximum Diameter. . . . . 1-9/32"
Operating Position. . . . . Any
Weight (Approx.). . . . . 1 oz
Bulb. T9
Socket. . . . . Cinch No. 8JM-1, or equivalent
Base. . . . . . . Intermediate-Shell Octal 5-Pin, Arrangement 1 (JEDEC Group 1, No. B5-10) Non-hygroscopic
  Basing Designation for BOTTOM VIEW. 2AB



Pin 1 – No Internal Connection
Pin 2 – Balancing Capacitance
Pin 4 – Anode or Photocathode
Pin 6 – No Internal Connection
Pin 8 – Anode or Photocathode

Maximum Ratings, ***Absolute-Maximum Values:***

ANODE-SUPPLY VOLTAGE (DC or Peak AC). . . .	250 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[c].	30 max.	μa/sq.in.
AVERAGE CATHODE CURRENT[c].	4 max.	μa
AMBIENT TEMPERATURE	75 max.	°C

Characteristics:

With an anode-supply voltage of 250 volts

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4400 angstroms. .	–	0.044	–	amp/watt
Luminous[d]	19	45	70	μa/lumen
Ratio of Cathode Luminous Sensitivities	0.42	1.0	2.4	
Anode Dark Current at 25° C . .	–	–	0.01	μa

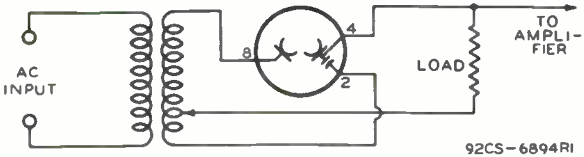
← Indicates a change.

World Radio History

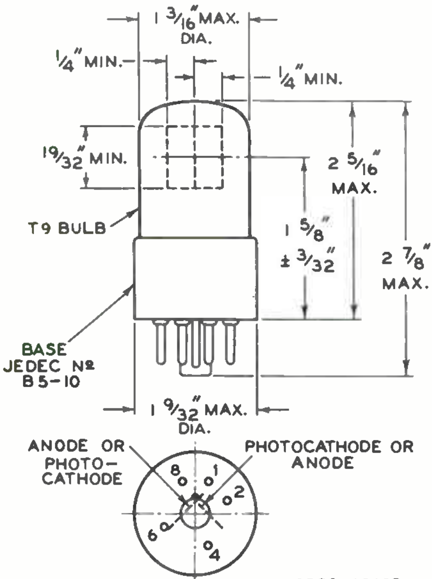
[a] On plane perpendicular to indicated direction of incident light.
[b] Measured between pins 2 and 4.
[c] Averaged over any interval of 30 seconds maximum.
[d] For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A 1-megohm load resistor and a light input of 0.02 lumen are used.

SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOSENSITIVE DEVICE HAVING S-4 RESPONSE
is shown at the front of this section

TYPICAL CIRCUIT



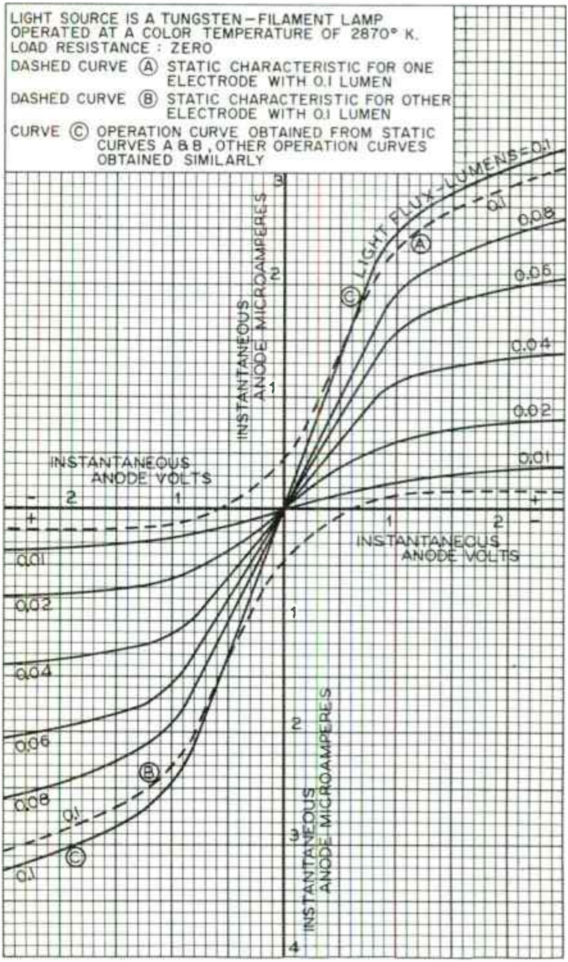
92CS-6894R1



92CS-6869R1

World Radio History

TYPICAL OPERATION CHARACTERISTICS
With AC Voltage Applied Between the Two Electrodes



92CM-6895R1

World Radio History

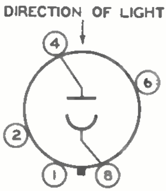
Vacuum Phototube

SIDE-ON TYPE HAVING S-4 RESPONSE

DATA

General:

Spectral Response S-4
Wavelength of Maximum Response. . . . . 4000 ± 500 angstroms
Cathode:
  Shape . . . . Semicylindrical
  Minimum projected length[a] . . . . 13/16"
  Minimum projected width[a]. . . . . 5/8"
Direct Interelectrode Capacitance (Approx.) . . . . . . 2.6 μμf
Maximum Overall Length. . . . . 3-1/16"
Maximum Seated Length . . . . 2-1/2"
Seated Length to Center of Cathode. . . . . . . 1-5/8" ± 3/32"
Maximum Diameter. . . . . 1-9/32"
Operating Position. . . . . Any
Weight (Approx.). . . . . 0.9 oz ←
Bulb. T9
Socket. . . . . Cinch No.8JM-1, or equivalent ←
Base. . . . . . . Intermediate-Shell Octal 5-Pin, Arrangement 1 (JEDEC Group 1, No.B5-10)
  Basing Designation for BOTTOM VIEW. 3J



Pin 1 - No Internal Connection
Pin 2 - No Internal Connection
Pin 4 - Anode
Pin 6 - No Internal Connection
Pin 8 - Photocathode

Maximum Ratings, ***Absolute-Maximum Values:*** ←

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	250 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[b]. . .	25 max.	μa/sq. in.
AVERAGE CATHODE CURRENT[b].	5 max.	μa
AMBIENT TEMPERATURE	75 max.	°C

Characteristics: ←

With an anode-supply voltage of 250 volts

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4000 angstroms. .	-	0.044	-	amp/watt
Luminous[c]	20	45	100	μa/lumen
Anode Dark Current at 25° C . .	-	-	0.25	μa

← Indicates a change.

World Radio History

[a] On plane perpendicular to indicated direction of incident light.
[b] Averaged over any interval of 30 seconds maximum.
[c] For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A 1-megohm load resistor and a light input of 0.1 lumen are used.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-4 RESPONSE
is shown at front of this section

DIMENSIONAL OUTLINE
shown under Type 5581 also applies to the 5653

AVERAGE-ANODE-CHARACTERISTICS CURVE
shown under Type 929 also applies to the 5653

World Radio History

Multiplier Phototube

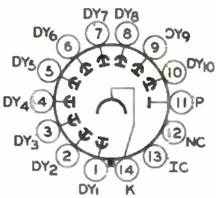
10-STAGE, HEAD-ON, CURVED-FACEPLATE TYPE — S-11 RESPONSE

1-11/16" Minimum Diameter Curved Photocathode. For Detection and Measurement of Nuclear Radiation and Other Low-Level Light Sources in Scintillation Counters.

General:

Spectral Response	S-11
Wavelength of Maximum Response	4400 ± 500 angstroms
Cathode, Semitransparent	Cesium-Antimony
Shape	Curved, Circular
Minimum area	2.2 sq.in.
Minimum diameter	1-11/16 in.
Window	Lime Glass[a]
Index of refraction	1.51
Dynode Material	Cesium-Antimony
Direct Interelectrode Capacitances (Approx.):	
Anode to dynode No.10	4.2 pf
Anode to all other electrodes	6.5 pf
Maximum Overall Length	5-13/16"
Seated Length	4-7/8" ± 3/16"
Maximum Diameter	2-5/16"
Operating Position	Any
Weight (Approx.)	5.2 oz
Bulb	T16
Socket	Eby[b] No.9709-7, or equivalent
Magnetic Shield	Perfection Mica Co.,[c] No.P-100-3, or equivalent
Base	Medium-Shell Diheptal 14-Pin, (JEDEC Group 5, No.B14-38), Non-hygroscopic
Basing Designation for BOTTOM VIEW	14M

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 - No Internal Connection
Pin 13 - Do Not Use
Pin 14 - Photocathode



DIRECTION OF RADIATION INTO END OF BULB

Maximum Ratings, ***Absolute-Maximum Values:***

Supply Voltage Between Anode and Cathode (DC or Peak AC)	1250 max.	volts
Supply Voltage Between Dynode No.10 and Anode (DC or Peak AC)	250 max.	volts

← Indicates a change.

World Radio History

Supply Voltage Between Dynode No.1 and Cathode (DC or Peak AC)	300 max.	volts
Average Anode Current[d]	0.75 max.	ma
Ambient Temperature	75 max.	^{o}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.

With E = 1000 volts (Except as noted)

	Min.	*Typ.*	*Max.*	
Sensitivity:				
Radiant, at 4400 angstroms	–	8×10^4	–	a/w
Cathode radiant, at 4400 angstroms	–	0.04	–	a/w
Luminous:				
At 0 cps[e]	10	100	300	a/lm
With dynode No.10 as output electrode[f]	–	60	–	a/lm
Cathode luminous:				
With tungsten light source[g]	4×10^{-5}	5×10^{-5}	–	a/lm
With blue light source[h]	4×10^{-8}	–	–	a
Current Amplification	–	2×10^6	–	
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 20 a/lm[j,k]	–	3×10^{-10}	2×10^{-9}	lm
Equivalent Noise Input[m]	–	7×10^{-12}	2.6×10^{-11}	lm
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	–	8×10^3	–	a/w
Cathode radiant, at 4400 angstroms	–	0.04	–	a/w
Luminous:				
At 0 cps[e]	–	10	–	a/lm
With dynode No.10 as output electrode[f]	–	6	–	a/lm
Cathode luminous:				
With tungsten light source[g]	4×10^{-5}	5×10^{-5}	–	a/lm
With blue light source[h]	4×10^{-8}	–	–	a
Current Amplification	–	2×10^5	–	

→ indicates a change.

World Radio History

[a] Corning No.0080, made by Corning Glass Works, Corning, New York, or equivalent.

[b] Made by Hugh H. Eby Company, 4701 Germantown Avenue, Philadelphia 44, Pennsylvania.

[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. For best stability, the average anode current value should not exceed 100 microamperes.

[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 curves shown in *Typical Anode Characteristics* do 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 167 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 167 volts are applied between cathode and all other electrodes connected as anode. ←

[j] At a tube temperature of 25° C. Dark current may be reduced by use of a refrigerant.

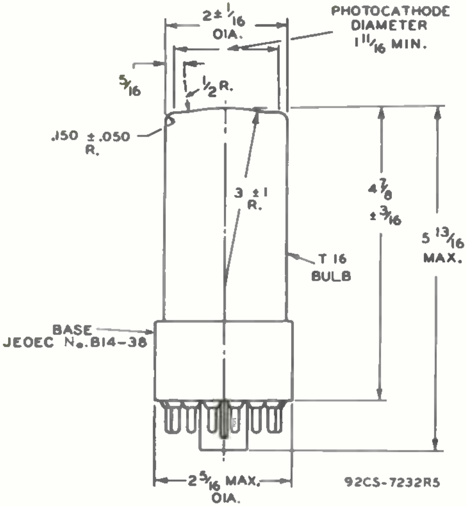
[k] For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1000 volts is recommended.

[m] 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.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Photosensitive Device Having S-11 Response
is shown at the front of this Section

← Indicates a change.

World Radio History

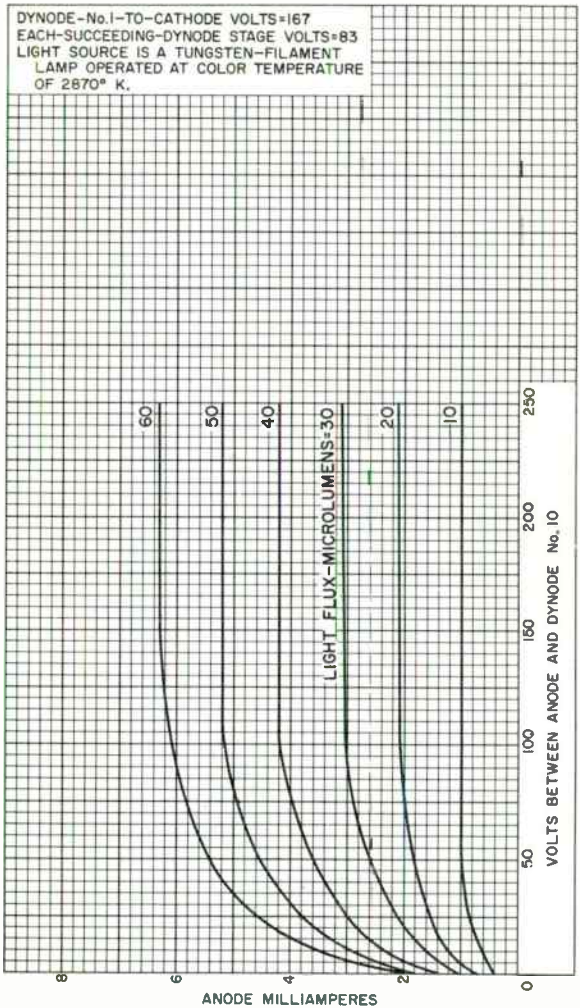


DIMENSIONS IN INCHES

CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

World Radio History

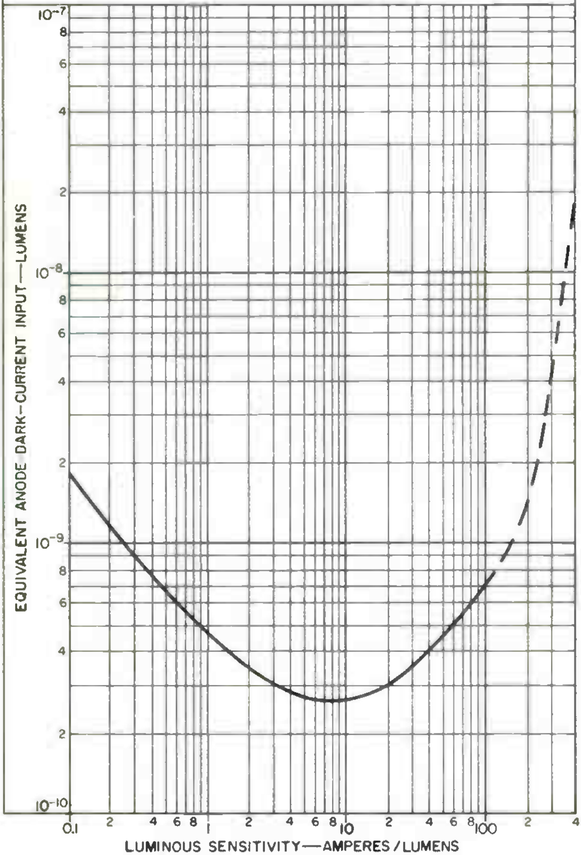
TYPICAL ANODE CHARACTERISTICS



92CM-8823R1

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

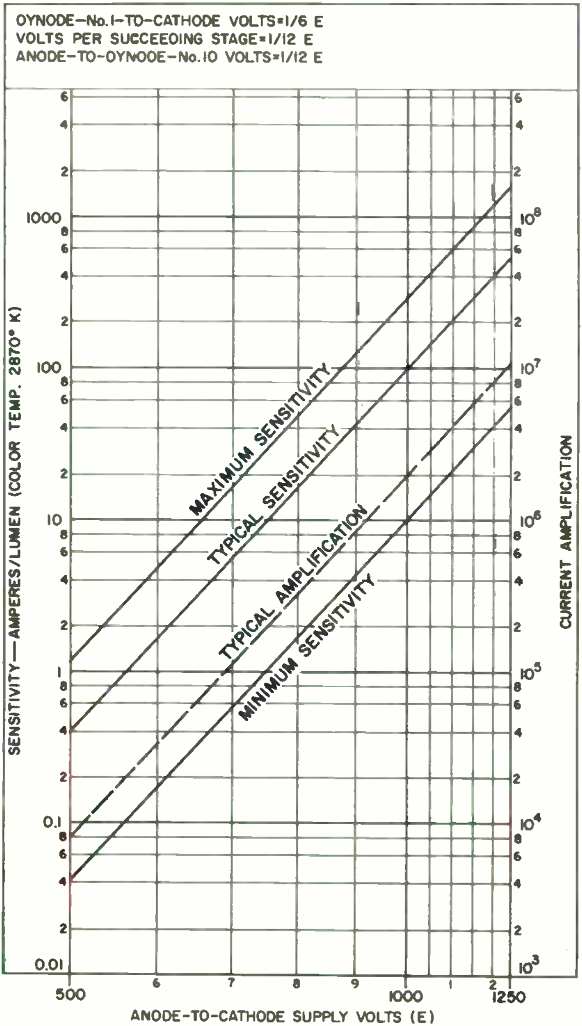
LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES 1/6 OF E BETWEEN CATHODE AND DYNODE No.1; 1/12 OF E FOR EACH SUCCEEDING STAGE; AND 1/12 OF E BETWEEN DYNODE No.10 AND ANODE.
DASHED PORTION INDICATES INSTABILITY.
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.
TUBE TEMPERATURE = 25° C



92CM-7920R3

World Radio History

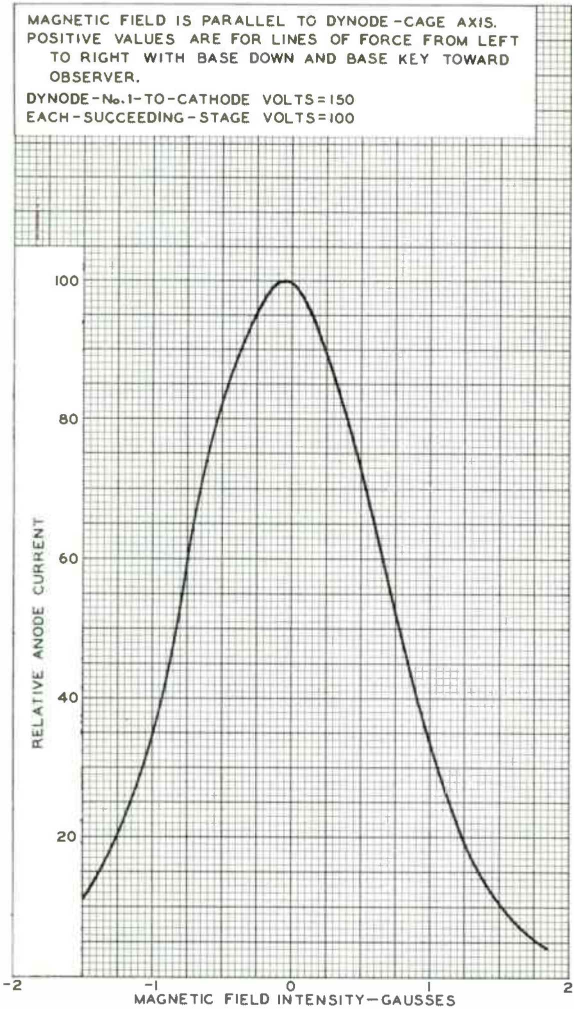
SENSITIVITY AND CURRENT AMPLIFICATION CHARACTERISTICS



92CM-7258R5

World Radio History

EFFECT OF MAGNETIC FIELD ON ANODE CURRENT



92CM-7839

World Radio History

Image Orthicon

MAGNETIC FOCUS MAGNETIC DEFLECTION

For Outdoor and Studio Pickup. The 5820A is Unilaterally Interchangeable with Type 5820.

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:		
Anode to all other electrodes	12	μμf
Spectral Response		S-10
Wavelength of Maximum Response	4500 ± 300	angstroms
Photocathode, Semitransparent:		
Rectangular image (4 x 3 aspect ratio):		
Useful size of	1.8" max.	diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

Orientation of. . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	15.20" ± 0.25"
Greatest Diameter of Bulb	3.00" ± 0.06"
Minimum Deflecting-Coil Inside Diameter	2-3/8"
Deflecting-Coil Length	5"
Focusing-Coil Length	10"
Alignment-Coil Length	15/16"
Photocathode Distance Inside End of Focusing Coil	1/2"

Operating Position. . . The tube should never be operated in a vertical position with the Diheptal-base end up nor in any other position where the axis of the tube with the base up makes an angle of less than 20° with the vertical.

Weight (Approx.)	1 lb 6 oz
Shoulder Base	Keyed Jumbo Annular 7-Pin

BOTTOM VIEW[a]

Pin 1 - Grid No.6
Pin 2 - Photocathode
Pin 3 - Internal Connection—Do Not Use
Pin 4 - Internal Connection—Do Not Use
Pin 5 - Grid No.5
Pin 6 - Target
Pin 7 - Internal Connection—Do Not Use

[a] See basing diagram on next page.

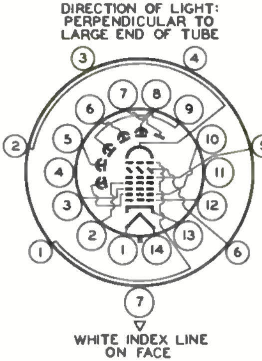
World Radio History

5820A

End Base. . . . . Small-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-45)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.4
Pin 3 - Grid No.3
Pin 4 - Internal Connection—Do Not Use
Pin 5 - Dynode No.2
Pin 6 - Dynode No.4
Pin 7 - Anode
Pin 8 - Dynode No.5
Pin 9 - Dynode No.3
Pin 10 - Dynode No.1, Grid No.2
Pin 11 - Internal Connection—Do Not Use
Pin 12 - Grid No.1
Pin 13 - Cathode
Pin 14 - Heater



Maximum and Minimum Ratings, ***Absolute-Maximum Values:***

PHOTOCATHODE:		
Voltage	-550 max.	volts
Illumination.	50 max.	fc
OPERATING TEMPERATURE:		
Of any part of bulb	50 max.	°C
Of bulb at large end of tube (Target section).	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between target section and any part of bulb hotter than target section. . .	5 max.	°C
GRID-No.6 VOLTAGE	-550 max.	volts
TARGET VOLTAGE:		
Positive value.	10 max.	volts
Negative value.	10 max.	volts
GRID-No.5 VOLTAGE	150 max.	volts
GRID-No.4 VOLTAGE	300 max.	volts
GRID-No.3 VOLTAGE	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value	125 max.	volts
Positive-bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	10 max.	volts
ANODE SUPPLY VOLTAGE[b]	1350 max.	volts
VOLTAGE PER MULTIPLIER STAGE.	350 max.	volts

Typical Operation:

Photocathode Voltage (Image Focus). . . .	-400 to -540	volts
Grid-No.6 Voltage (Accelerator)— Approx. 75% of photocathode voltage . .	-300 to -405	volts

World Radio History

Target-Cutoff Voltage[c]	-3 to +1	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam Focus)	140 to 180	volts
Grid-No.3 Voltage[d]	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil[e]	75	gausses
Field Strength of Alignment Coil	0 to 3	gausses

Performance Data:[f]

With conditions shown under Typical Operation and with camera lens set to bring the picture highlights one stop above the "knee" of the light transfer characteristic

	Min.	*Average*	*Max.*	
Cathode Radiant Sensitivity at 4500 angstroms	–	0.03	–	µa/µw
Luminous Sensitivity	30	60	–	µa/lumen
Anode Current (DC)	–	30	–	µa
Signal-Output Current (Peak-to-peak)	3	8	24	µa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc	35:1	40:1	–	
Photocathode Illumination at 2870° K Required to Bring Picture Highlights One Stop Above "Knee" of Light Transfer Characteristic	–	0.02	0.04	fc
Peak-to-Peak Response to Square-Wave Test Pattern at 400 TV Lines per Picture Height (Per cent of large-area black to large-area white)[g]	35	45	–	%
Uniformity:				
Ratio of Shading (Background) Signal to Highlight Signal	–	0.12	0.15	
Variation of Highlight Signal (Per cent of maximum highlight signal)[h]	–	20	25	%

[b] Dynode-voltage values are shown under *Typical Operation*.

[c] Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from -3 to +5 volts.

[d] Adjust to give the most uniformly shaded picture near maximum signal.

World Radio History

[e] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

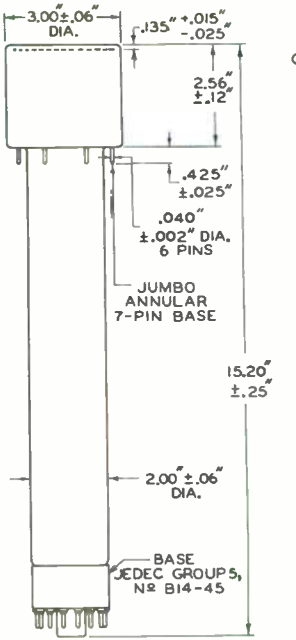
[f] With 5820A operated in properly adjusted RCA TK-31 camera.

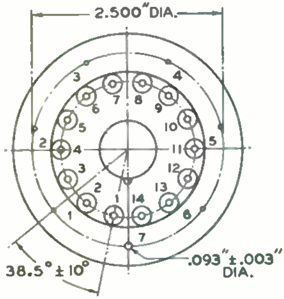
[g] Measured with amplifier having flat frequency response.

[h] Variation of response over scanned area.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-10 RESPONSE is shown at front of this Section

World Radio History

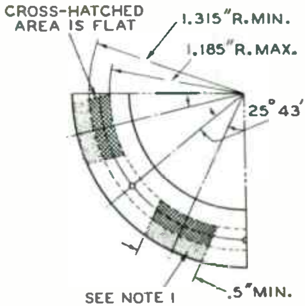




ENLARGED BOTTOM VIEW

92CM-8293R3

DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR-BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

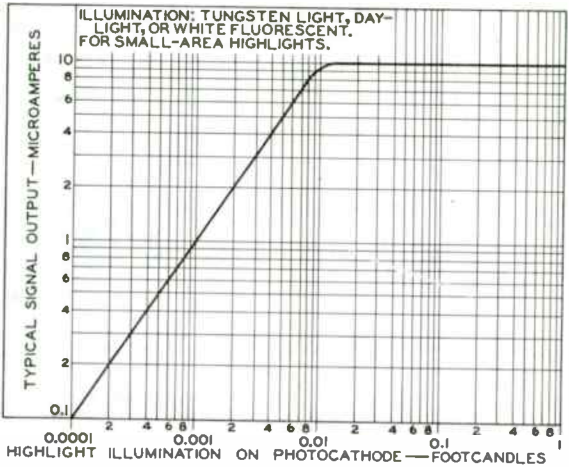
b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

World Radio History

BASIC LIGHT-TRANSFER CHARACTERISTIC



92CS-7296R2

World Radio History

Image Orthicon

LONG-LIFE NON-DETERIORATING TARGET

MAGNETIC FOCUS — MAGNETIC DEFLECTION

For Outdoor and Studio Pickup with Black-and-White TV Cameras. The 5820A/L is Directly Interchangeable with the 5820 and 5820A in All Cameras.

The 5820A/L is the same as the 5820A except it utilizes a longer-life non-deteriorating glass target.

The sturdy, long-life, non-deteriorating, glass target of type 5820A/L is characterized by high gain, resistance to "burn-in", and the absence of any granular structure. Because charge transportation through this target material is electronic rather than ionic as in ordinary glass targets, the electrical characteristics of the target, such as secondary emission and resistivity, are essentially constant and sensitivity of the 5820A/L is stable throughout life.

Other important advantages of this target are that the undesirable characteristics of scene retention or "sticking picture" and raster "burn-in" due to underscanning are significantly reduced. The resistance of the 5820A/L to image "burn-in" provides a highly desirable operational feature because it is not necessary to use an orbiter or continually move the camera when focused on a stationary scene.

OPERATING CONSIDERATIONS

Dos and Don'ts on Use of RCA-5820A/L

Dos

1. Allow the 5820A/L to warm up prior to operation.
2. Hold temperature of the 5820A/L within operating range.
3. Make sure alignment coil is properly adjusted.
4. Adjust beam-focus control for best usable resolution.
5. Condition spare 5820A/L's by operating several hours once each month.
6. Determine proper operating point with target voltage adjusted to exactly 2 volts above target cutoff.
7. Cap lens during standby operation.

Don'ts

1. Don't force the 5820A/L into its shoulder socket.
2. Don't operate the 5820A/L without scanning.
3. Don't operate a 5820A/L having an ion spot.
4. Don't use more beam current than necessary to discharge the highlights of the scene.
5. Don't turn off beam while voltages are applied to photocathode, grid No.6, target, dynodes, and anode during warm-up or standby operation.

World Radio History

World Radio History

6032

6032
IMAGE-CONVERTER TUBE

For use, in combination with suitable optical systems, in viewing a scene with infrared radiation

DATA

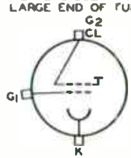
General:

Spectral Response. S-1
Wavelength of Maximum Response . . . . 8000 ± 1000 angstroms
Photocathode, Semitransparent:
  Shape. . . . . Circular
  Minimum window area. . . . . 1 sq. in.
  Minimum window diameter. . . . . 1-1/8"
  Minimum quality-circle diameter within window. . . . . . . 1"
Phosphor (For curves, see front of Cathode-Ray Tube Section. *See also Operating Considerations)*. P20
  Fluorescence . . . . Yellow-Green
  Phosphorescence. . . . . Yellow-Green
    Persistence. . . . . Medium-Short
Fluorescent Screen:
  Shape. . . . . Circular
  Minimum diameter . . . . 5/8"
Focusing Method. . . . . .Electrostatic
Overall Length . . . . 4-15/32" ± 1/16"
Maximum Diameter . . . . 2-3/32" ± 1/32"
Weight (Approx.) . . . . 3.6 oz
Operating Position . . . . .Any
Terminal Connections *(See Dimensional Outline)*:

DIRECTION OF LIGHT: PERPENDICULAR TO LARGE END OF TUBE

CL - Collector

G_1 - Grid No.1



G_2 - Grid No.2

K - Photocathode

Maximum Ratings, *Absolute Values:*

GRID-No.2* VOLTAGE (DC or Peak AC)□. .	20000 max.	volts
GRID-No.1 VOLTAGE□	2700 max.	volts
AVERAGE PHOTOCATHODE CURRENT (Continuous Operation)	1 max.	μa
AMBIENT TEMPERATURE.	75 max.	°C

Characteristics:

Grid-No.2* Voltage . . .	16000	20000	volts
Grid-No.1 (Focusing-Electrode) Voltage—10.75% to 13.25% of grid-No.2 voltage. . .	1720 to 2120	2150 to 2650	volts
Maximum Grid-No.1 Current	0.4	0.5	μa

*,□: See next page.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

6032

IMAGE-CONVERTER TUBE

Paraxial Magnification Factor♦ .	0.5	0.5	
Sensitivity:			
Radiant, at 8000 angstroms . .	0.0038	0.0038	μa/μwatt
Infrared●	5	5	μa/lumen
Minimum Conversion Index†● . . .	8	10	
Minimum Resolution (In central area of photocathode)▲●	18	18	line-pairs per mm

* Grid No.2 serves the dual function of high-voltage electrode for accelerating the electron beam and of collector through which the electrons leave the tube after their energy has been transformed within the tube.

□ Referred to photocathode.

● Under the following conditions: 2870° K tungsten light source; light flux of 0.1 lumen incident on Corning No.2540 Infrared Filter (Melt 1613, 2.61-mm thick, or equivalent); irradiated area of photocathode is 3/4" in diameter.

† Ratio of light flux from fluorescent screen to the product of the light flux incident on the infrared filter multiplied by the filter factor.

▲ The resolution, both horizontally and vertically, in a 0.3"-diameter circle centered on the photocathode is determined with a pattern consisting of alternate black and white lines of equal width. Any two adjacent lines are designated as a "line-pair."

♦ Magnification is defined as the ratio of the distance from the tube axis of an image point on the fluorescent screen to the distance from the tube axis of an object point on the photocathode. Paraxial magnification is the magnification observed along the tube axis.

OPERATING CONSIDERATIONS

The curves giving the *spectral-energy emission characteristic* and the *persistence characteristics* of phosphor P20 are located in the front of the Cathode-Ray Tube Section. Only persistence-characteristic curve A applies to the 6032.

Subjecting the 6032 to intense incident-radiation levels may temporarily decrease the tube's sensitivity even though there is no voltage applied. The magnitude and duration of this decrease depend on the length of exposure. Permanent damage to the tube may result if it is exposed to radiant energy so great as to cause excessive heating of the photocathode.

The *sensitivity values* for the 6032 are *average* values. The average values are representative of this type when operated with low values of photocathode current. At high values of photocathode current, a drop in sensitivity below the values shown may be expected. The extent of the drop is affected by the nature and severity of the operating conditions to which the 6032 is subjected. After a period of idleness, the 6032 usually recovers a substantial percentage of such loss in sensitivity.

Support for the 6032 may be provided at the photocathode end by a cushioned arrangement and at the screen end by a suitable fixture which will exert adequate but not excessive pressure to hold the tube firmly against the cushioned arrangement.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
World Radio History

6032

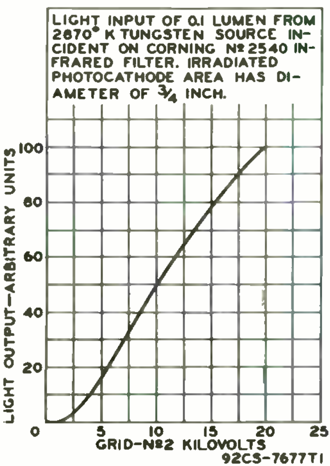
IMAGE-CONVERTER TUBE

Shielding of the 6032 is required to minimize the effects of extraneous fields on tube performance. If an iron or steel case is used, care should be taken in its construction to insure that the case is completely demagnetized. The shielding case may be designed, if desired, to include an annular end piece to position the tube properly in the optical system. The circular opening of the end piece should have a diameter less than 1-1/2" in order to bear on the rim of the tube face *(See Dimensional Outline)*.

Connections to the respective terminals of the tube, indicated on the *Dimensional Outline*, should not be soldered to the terminals. They should be made by flexible metal bands fastened firmly around the tube in the contact areas shown on the *Dimensional Outline*. The bands should be fastened only tight enough to insure good contact. If the bands are too tight, the metal-glass seals may be damaged.

The curve showing the Spectral-Sensitivity Characteristic of Phototube having S-1 Response located at the front of this Section also applies to the 6032

AVERAGE CHARACTERISTIC



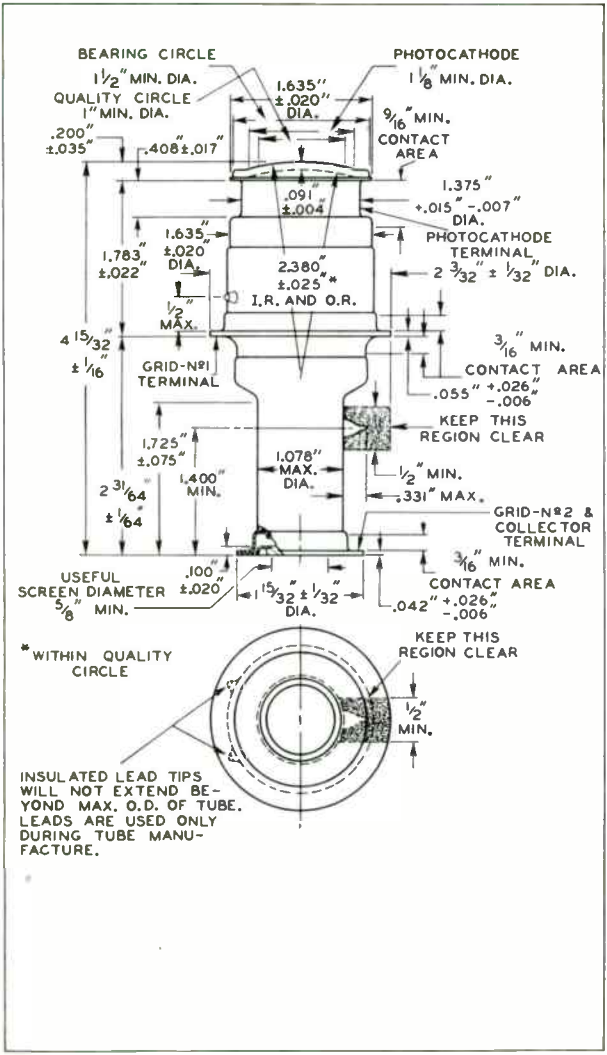
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

6032

IMAGE-CONVERTER TUBE



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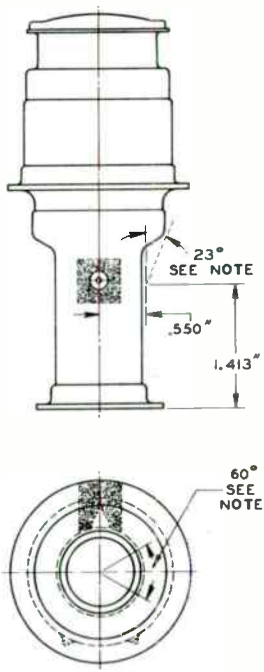
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

6032

6032

IMAGE-CONVERTER TUBE



NOTE: THE CONTOUR OF THE FLARED GLASS NECK WILL BE WITHIN THE DOTTED LINE OVER A 60° SECTION AS SHOWN ON END VIEW.

92CL-7617R2

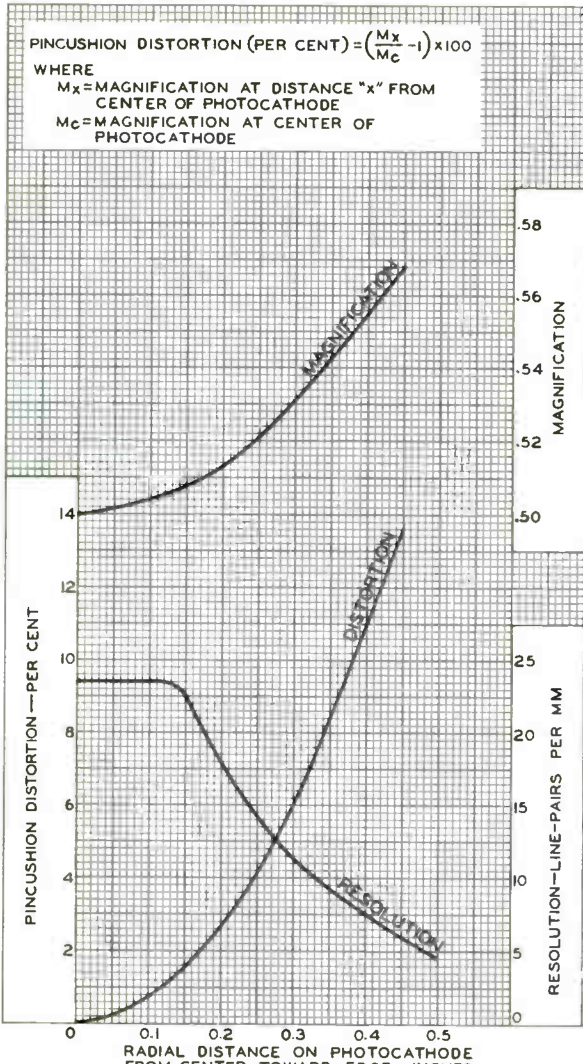
World Radio History

6032

RCA

6032

AVERAGE CHARACTERISTICS



ELECTRON TUBE DIVISION

92CM-8624

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

6032-A

6032-A

IMAGE-CONVERTER TUBE

For use, in combination with suitable optical systems, in viewing a scene with infrared radiation

The 6032-A is unilaterally interchangeable with the 6032.

The 6032-A is like the 6032 except that it is processed and tested to meet the following special-performance test:

Maximum luminous equivalent of infrared radiation for threshold visibility* . . 4.1×10^{-11} lumen

* Radiation from a tungsten lamp operating at a color temperature of 2870° K is passed through a Corning No.2540 Infrared Filter and focused to a point on the photocathode. The resulting image on the fluorescent screen is viewed by a dark-adapted eye through a 10-power ocular. The amount of infrared radiation for threshold visibility is determined by reducing the incident radiation until the image on the screen can just be discerned. The luminous equivalent of this amount of infrared radiation is the value of luminous flux from a 2870° K source which produces a response equal to that produced by the infrared radiation when both are measured with a receiver having S-1 spectral response.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

World Radio History

Photomultiplier Tube

10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE HAVING S-11 RESPONSE
1.24" MINIMUM DIAMETER FLAT PHOTOCATHODE

For Detection and Measurement of Nuclear Radiation and Other Low-Level Light Sources in Portable Scintillation Counters

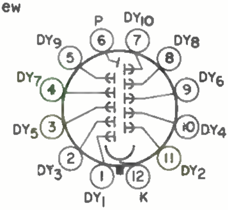
GENERAL

Spectral Response	S-11
Wavelength of Maximum Response	4400 ± 500 angstroms
Cathode, Semitransparent	Cs-Sb ←
Shape	Flat, Circular ←
Minimum area	1.2 sq in
Minimum diameter	1.24 in
Window	Lime Glass, Corning[a] No.0080, or equivalent ←
Index of refraction	1.51
Direct Interelectrode Capacitances (Approx.)	
Anode to dynode No.10	4.0 pF
Anode to all other electrodes	7.0 pF
Maximum Overall Length	4.57 in
Seated Length	3.88 ± 0.19 in
Maximum Diameter	1.56 in
Operating Position	Any
Weight (Approx.)	2.2 oz
Envelope	JEDEC T12
Base	Small-Shell Duodecal 12-Pin, (JEDEC No.B12-43), Non-hygroscopic
Socket	Eby[b] No.9058, or equivalent ←
Magnetic Shield	Perfection Mica Co.,[c] No.P-104-1, or equivalent ←

BASING DIAGRAM

Basing Designation for Bottom View

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



DIRECTION OF RADIATION: INTO END OF BULB

ABSOLUTE-MAXIMUM RATINGS

Supply Voltage (DC or Peak AC)		
Between Anode and Cathode	1250	V
Between Dynode No.10 and Anode	250	V
Between Consecutive Dynodes	200	V ←
Between Dynode No.1 and Cathode	300	V
Average Anode Current[d]	0.75	mA
Ambient Temperature	75	°C

← Indicates a change.

World Radio History

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.

With E = 1000 V (except as noted)

	Min	*Typ*	*Max*	
Sensitivity				
Radiant at 4400 angstroms .	-	2.2×10^4	-	A/W
Cathode radiant at 4400 angstroms	-	0.036	-	A/W
Luminous:				
At 0 c/s[e].	10	27	300	A/lm
With dynode No.10 as output electrode[f] . . .	-	16	-	A/lm
Cathode luminous:				
With tungsten light source[g]	3×10^{-5}	4.5×10^{-5}	-	A/lm
With blue light source[h] . .	2.8×10^{-8}	-	-	A
Current Amplification. . . .	-	6×10^5	-	
Equivalent Anode-Dark-Current Input	-	8×10^{-10}	2.5×10^{-9}	lm
At luminous sensitivity of 20 A/lm[j,k]				
→ **Equivalent Noise Input[m]. . .**	-	4×10^{-12}	1.7×10^{-11}	lm
Dark Current to any Electrode.	-	-	7.5×10^{-7}	A
At 25°C and does not include anode				

With E = 750 V (except as noted)

	Min	*Typ*	*Max*	
Sensitivity				
Radiant at 4400 angstroms. .	-	2.2×10^3	-	A/W
Cathode radiant at 4400 angstroms	-	0.036	-	A/W
Luminous:				
At 0 c/s[e]	-	2.7	-	A/lm
With dynode No.10 as output electrode. . . .	-	1.6	-	A/lm
Cathode luminous:				
With tungsten light source[g]	3×10^{-5}	4.5×10^{-5}	-	A/lm
With blue light source[h] . .	2.8×10^{-8}	-	-	A
Current Amplification. . . .	-	6×10^4	-	

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

[b] Made by Hugh H. Eby Company, 4701 Germantown Avenue, Philadelphia 44, Pennsylvania.

[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. For best stability, the average anode current value should not exceed 100 microamperes.

[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.

→ Indicates a change.

World Radio History

[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 curves shown in *Typical Anode Characteristics* do 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 167 volts are applied between cathode and all other electrodes connected as anode.

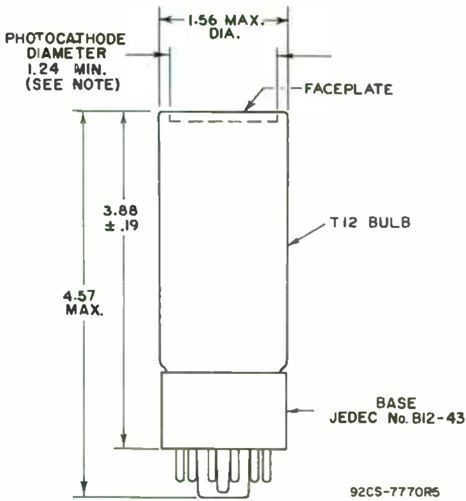
[h] Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning C.S. No. 5-58, Glass Code No. 5113 polished to 1/2 stock thickness—Manufactured by the Corning Glass Works, Corning, New York) from a tungsten-filament lamp operated at a color temperature of 2870°K. The value of light flux incident on the filter is 0.01 lumen and 167 volts are applied between cathode and all other electrodes connected as anode.

[j] At a tube temperature of 25°C. Dark current may be reduced by use of a refrigerant.

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

[m] 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.

DIMENSIONAL OUTLINE



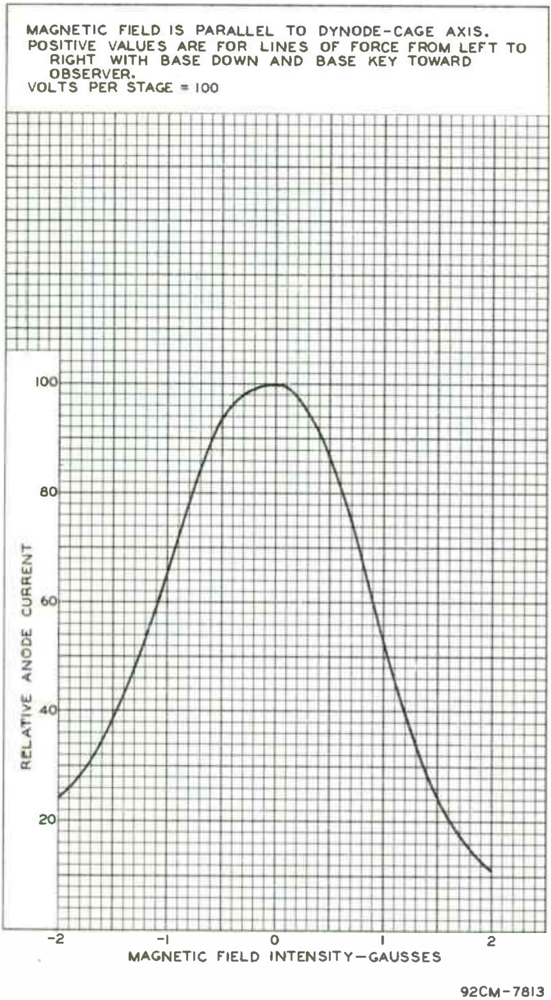
DIMENSIONS IN INCHES

Note: Deviation from flatness within 1.24"-diameter area will not exceed 0.010" from peak to valley.

Center line of bulb will not deviate more than 2° in any direction from the perpendicular erected at the center of bottom of the base.

World Radio History

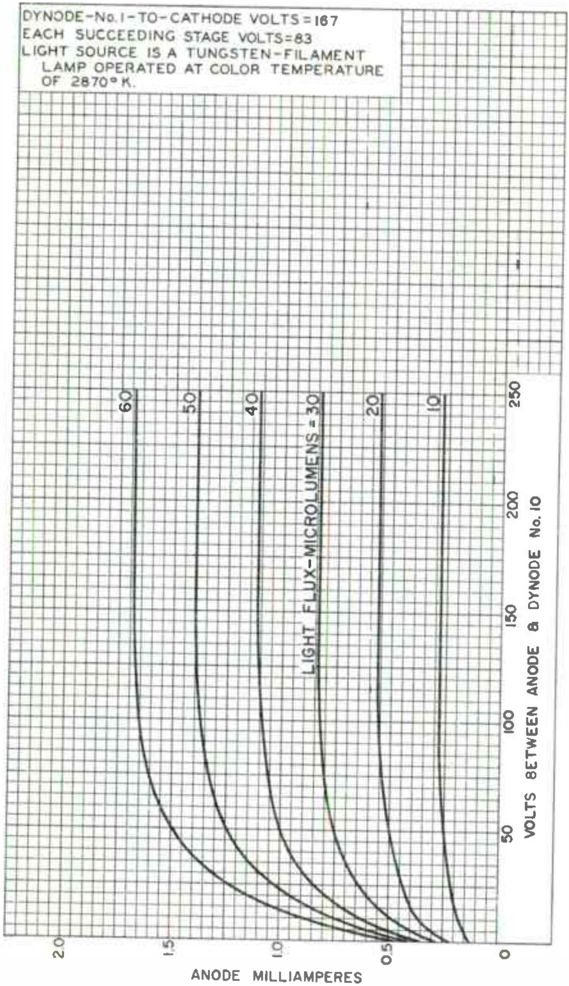
Effect of Magnetic Field on Anode Current



RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

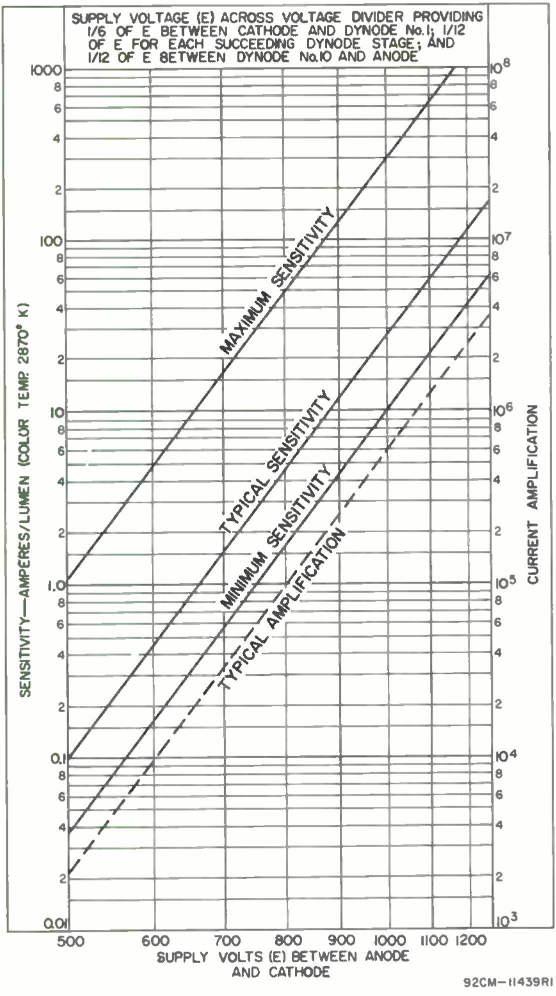
World Radio History

Typical Anode Characteristics



92CM-7255R6

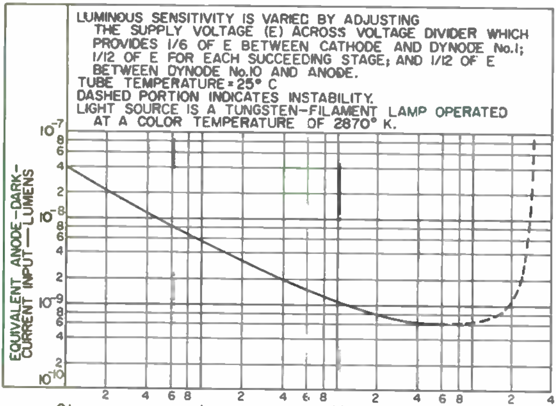
Typical Sensitivity and Current Amplification Characteristics



RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

World Radio History

Typical Anode-Dark Current Characteristic



World Radio History

Photomultiplier Tube

10-STAGE, CURVED-FACEPLATE TYPE HAVING S-10 RESPONSE

1-11/16 INCH MINIMUM DIAMETER CURVED PHOTOCATHODE

GENERAL

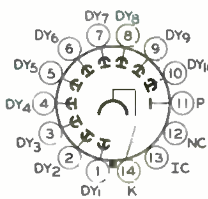
Spectral Response	S-10
Wavelength of Maximum Response	4500 ± 300 angstroms
Cathode, Semitransparent	Ag-Bi-O-Cs
Shape	Curved, Circular ←
Minimum area	2.2 sq in
Minimum diameter	1-11/16 in
Window	Lime Glass (Corning[a] No.0080), or equivalent ←
Index of refraction	1.51
Dynode Material	Cs-Sb ←
Direct Interelectrode Capacitances (Approx.)	
Anode to dynode No.10	4.2 pF
Anode to all other electrodes	6.5 pF
Maximum Overall Length	5.81 in
Seated Length	4.87 ± 0.19 in
Maximum Diameter	2.31 in
Operating Position	Any
Weight (Approx.)	5.2 oz
Envelope	JEDEC T16
Base	Medium-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-38), Non-hygroscopic
Socket	Eby[b] No.9709-7, or equivalent ←
Magnetic Shield	JAN[c] No.S-2004, or equivalent ←

ABSOLUTE-MAXIMUM RATINGS

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 ←
Average Anode Current[d]	0.75	mA
Ambient Temperature	75	°C

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 – Dynode No.10
Pin 11 – Anode
Pin 12 – No Connection
Pin 13 – Do Not Use
Pin 14 – Photocathode



DIRECTION OF RADIATION: INTO END OF BULB

14M

← Indicates a change.

World Radio History

→ **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

With E = 1000 V (Except as noted)

	Min	*Typ*	*Max*	
Sensitivity				
Radiant, at 4500 angstroms	-	5.1×10^4	-	A/W
Cathode radiant, at 4500 angstroms.	-	0.02	-	A/W
Luminous, at 0 c/s[e] . . .	10	100	300	A/lm
Cathode luminous				
With tungsten light source[f]	2×10^{-5}	4×10^{-5}	-	A/lm
With red-infrared light source[g]	5×10^{-8}	-	-	A
Current Amplification. . .	-	2.5×10^6	-	
Equivalent Anode-Dark-Current Input[h].	-	1.4×10^{-9}	2.5×10^{-8}	lm
At a luminous sensitivity of 20 A/lm				
Equivalent Noise Input[j]. .	-	4×10^{-11}	1.7×10^{-10}	lm
Dark Current	-	-	7.5×10^{-7}	A
To any electrode except anode at 25 °C				

With E = 750 V (Except as noted)

	Min	*Typ*	*Max*	
Sensitivity				
Radiant, at 4500 angstroms. . .	-	5.1×10^3	-	A/W
Cathode radiant, at 4500 angstroms	-	0.02	-	A/W
Luminous, at 0 c/s[e].	-	10	-	A/lm
Cathode luminous				
With tungsten light source[f] .	2×10^{-5}	4×10^{-5}	-	A/lm
With red-infrared light source[g]	5×10^{-8}	-	-	A
Current Amplification.	-	2.5×10^5	-	

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

[b] Made by Hugh H. Eby Company, 4701 Germantown Avenue, Philadelphia 44, Pa.

[c] Made by JAN Hardware Manufacturing Company, 38-01 Queens Blvd., Long Island City 1, New York.

[d] Averaged over any interval of 30 seconds maximum. For best stability, the average anode current value should not exceed 100 microamperes.

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

[g] Under the following conditions: Light incident on the cathode is transmitted through a red-infrared filter (Combination of Corning C.S. Nos. 3-67 and 7-59, Glass Code No. 3482 and 5850, respectively—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

→ Indicates a change.

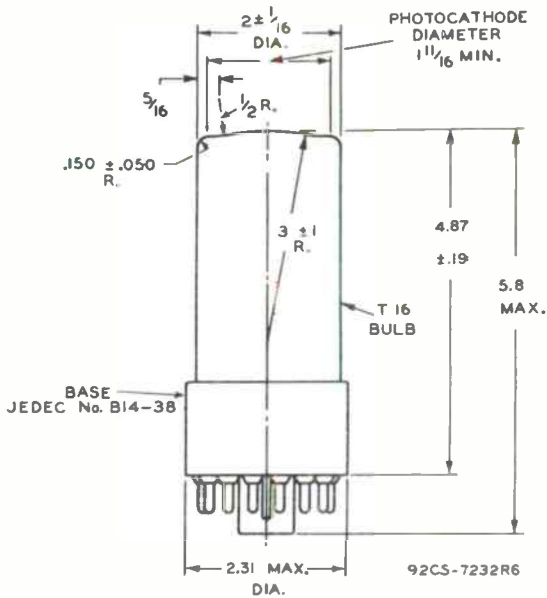
World Radio History

incident on the filter is 0.01 lumen and 167 volts are applied between cathode and all other electrodes connected at anode.

h At a tube temperature of 25°C. Prior to measurement, tube is stored in dark for a period of 30 minutes. Dark current may be reduced by use of a refrigerant.

j 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.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

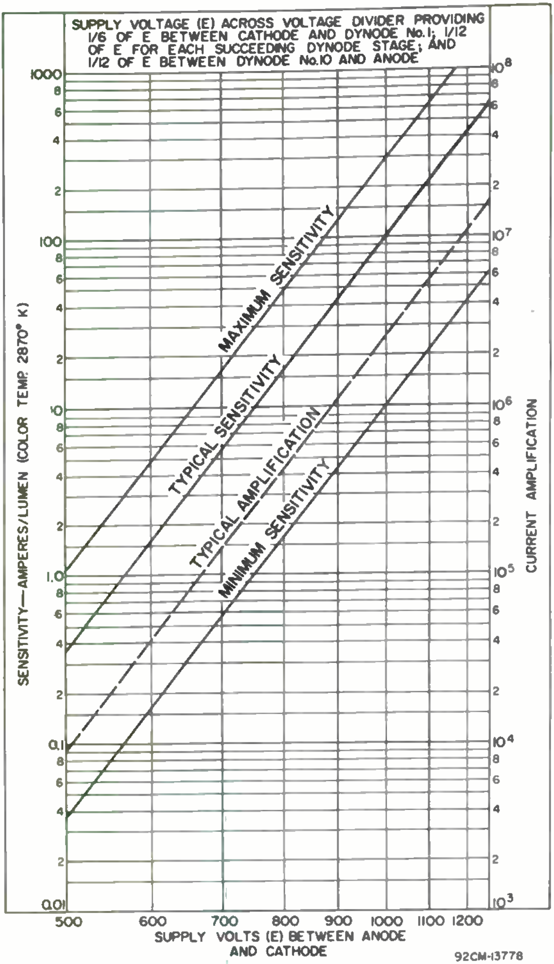
Center line of bulb will not deviate more than 2° in any direction from perpendicular erected at the center of bottom of the base.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-10 Response
is shown at the front of this Section

TYPICAL ANODE CHARACTERISTICS
are the same as those shown for Type 6199

World Radio History

Typical Sensitivity and Current Amplification Characteristics



92CM-13778

World Radio History

RCA

6323

MULTIPLIER PHOTOTUBE

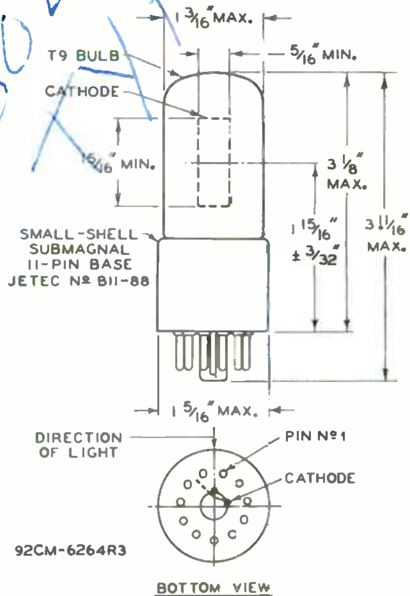
9-STAGE TYPE WITH S-4 RESPONSE

For Headlight-Control Service

The 6323 is the same as the 6328 except for the following items:

General:

Direct Interelectrode Capacitances (Approx.):		
Anode to dynode No.9	4.4	μμf
Anode to all other electrodes	6	μμf
Maximum Overall Length	3-11/16"	
Maximum Seated Length	3-1/8"	
Length from Base Seat to Center of Useful Cathode Area	1-15/16" ± 3/32"	
Weight (Approx.)	1.6 oz	
Base	Small-Shell Submagnal 11-Pin (JETEC No.B11-88), Non-hygroscopic	



℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

NOTE: THE MAXIMUM ANGULAR VARIATION BETWEEN THE PLANE THROUGH PINS No. 1 AND No. 11 AND THE PLANE OF THE GRILL WILL NOT EXCEED 6°.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

World Radio History

RCA

6326
VIDICON

600-LINE RESOLUTION

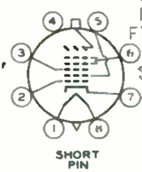
For film pickup
with color or black-and-white TV cameras

DATA

General:

Heater, for Unipotential Cathode:
Voltage . . . . 6.3 ± 10% . . . .ac or dc volts
Current . . . . 0.6 . . . . amp
Direct Interelectrode Capacitance:♦
Target (Signal electrode) to all
other electrodes. . . . . 4.5 μμf
Spectral Response . . . .*See curves*
Photoconductive Layer:
Maximum useful diagonal of rectangular
image (4 x 3 aspect ratio). . . . . 0.62"
Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the plane passing through the tube axis and short index pin.
Focusing Method . . . . .Magnetic
Deflection Method . . . . .Magnetic
Overall Length. . . . . 6.25" ± 0.25"
Greatest Diameter (Excluding side tip). . . . 1.125" ± 0.010"
Maximum Radius (Including side tip) . . . . 0.805"
Weight (Approx.). . . . . 2 oz
Operating Position. . . . Approx. horizontal, or faceplate up
Bulb. T8
Base Connector. . . . . .Cinch No.54A18088, or equivalent
Base. . . . . . . .Small-Button Ditetrar 8-Pin (JETEC No.E8-11)
Basing Designation for BOTTOM VIEW. . . . . 8HL ←

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.3
Pin 4 – Internal Connection—Do Not Use
Pin 5 – Grid No.2
Pin 6 – Grid No.4, Grid No.5



DIRECTION OF LIGHT: INTO FACE END OF TUBE

Pin 7 – Cathode
Pin 8 – Heater
Flange – Target (Signal Electrode)
Short Index Pin—Internal Connection—Do Not Use

Maximum Ratings, ***Absolute Values:*** ←

For scanned area of 1/2" x 3/8"

GRID-No.5 & GRID-No.4 VOLTAGE . . . . . . 350 max. volts
GRID-No.3 VOLTAGE . . . . 350 max. volts
GRID-No.2 VOLTAGE . . . . 350 max. volts

♦: See next page.

← Indicates a change.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

6326
VIDICON

GRID-No.1 VOLTAGE:		
Negative bias value.	125 max.	volts
Positive bias value.	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	10 max.	volts
DARK CURRENT	0.025 max.	μa
PEAK TARGET (SIGNAL-ELECTRODE) CURRENT . .	0.5 max.	μa
FACEPLATE:		
Illumination	1000 max.	ft-c
Temperature.	60 max.	°C

→ **Typical Operation:**

Grid No.3 connected to grids No.4 and No.5; scanned area of 1/2" x 3/8"; faceplate temperature of 30° to 35° C

Faceplate Illumination:		
Average highlight▲, for pickup from film.	50 to 300	ft-c
Constant highlight, for pickup from live scenes	20	ft-c
Maximum Target (Signal-Electrode) Voltage required to produce dark current of 0.02 μa in any tube**	100	volts
Target (Signal-Electrode) Voltage:†		
For pickup from film	20 to 40	volts
For pickup from live scenes. . . .	40 to 70	volts
Grid-No.5 (Decelerator) and Grids-No.4 & No.3 (Beam-Focus-Electrodes*) Voltage	250⊕ to 300	volts
Grid-No.2 (Accelerator) Voltage. . .	300	volts
Grid-No.1 Voltage for picture cutoff●	-45 to -100	volts
Signal-Output Current:#		
Peak	0.3 to 0.4	μa
Average.	0.1 to 0.2	μa
Dark Current:		
For pickup from film	0.004	μa
For pickup from live scenes. . . .	0.02	μa
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μa and 0.2 μa	0.65	
Visual Equivalent Signal-to-Noise Ratio (Approx.)°	300:1	
Minimum Peak-to-Peak Blanking Voltage:		
When applied to grid No.1.	40	volts
When applied to cathode.	10	volts
Field Strength at Center of Focusing Coil (Approx.).	40	gausses
Field Strength of Adjustable Alignment Coil□.	0 to 4	gausses

♦,▲,**,†,*,⊕,●,#,o,□: See next page. → Indicates a change.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

6326
VIDICON

ǂ This capacitance, which effectively is the output impedance of the 6326, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms.

▲ Averaged over the time of one TV frame.

** The target (signal-electrode) voltage for each 6326 must be adjusted to that value which gives the desired operating dark current.

† Indicated range for each type of service serves only to illustrate the operating target- (signal-electrode-) voltage range normally encountered.

* Beam focus is obtained by combined effect of grids-No.4 & No.3 voltage which should be adjustable over indicated range, and a focusing coil having an average field strength of 40 gausses. If desired, grid No.3 may be operated separately to permit vernier control of focus. Under such conditions, the instantaneous grid-No.3 voltage must always be equal to or greater than the grid-No.4 voltage.

⊕ Definition, focus uniformity, and picture quality decrease with decreasing grids-No.5 & No.4 & No.3 voltage. In general, grids No.5 & No.4 & No.3 should not be operated below 250 volts.

● With no blanking voltage on grid No.1.

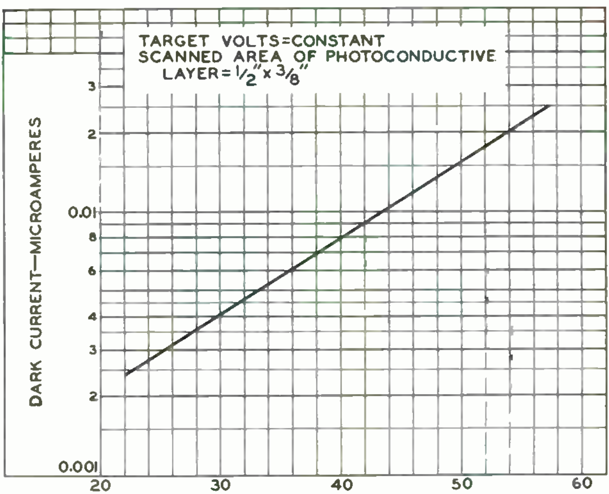
Defined as the component of the target (signal-electrode) current after the dark-current component has been subtracted.

○ Measured with high-gain, low-noise, cascode-type amplifier having bandwidth of 5 Mc. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of highlight video-signal current to rms noise current, multiplied by a factor of 3.

□ The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

DATA 2

TYPICAL CHARACTERISTIC

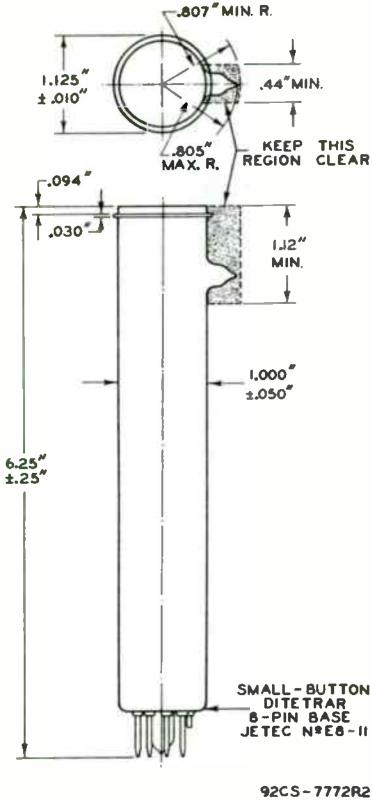


World Radio History

RCA

6326

VIDICON

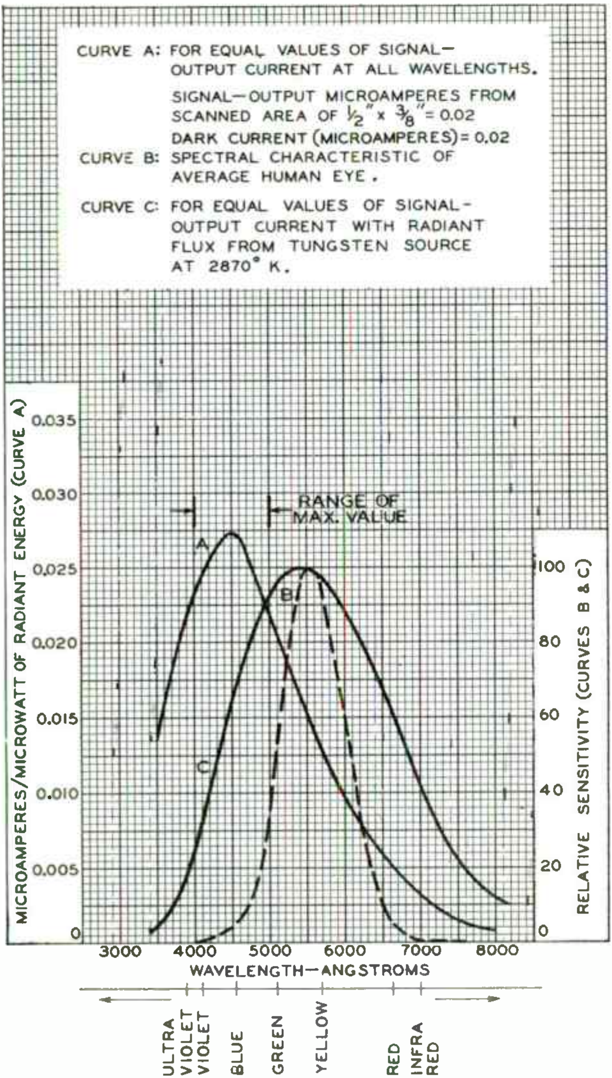


ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

6326

SPECTRAL-SENSITIVITY CHARACTERISTICS



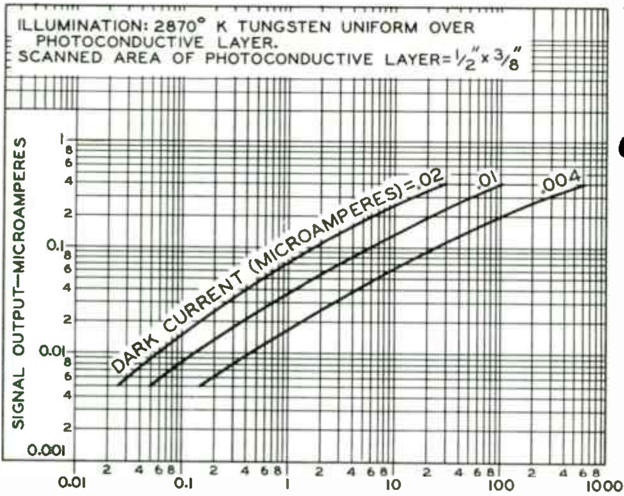
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7783R2

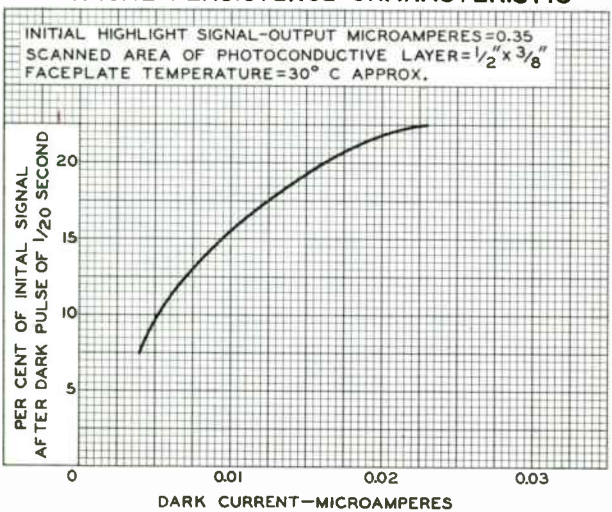
RCA

6326

TYPICAL LIGHT-TRANSFER CHARACTERISTICS



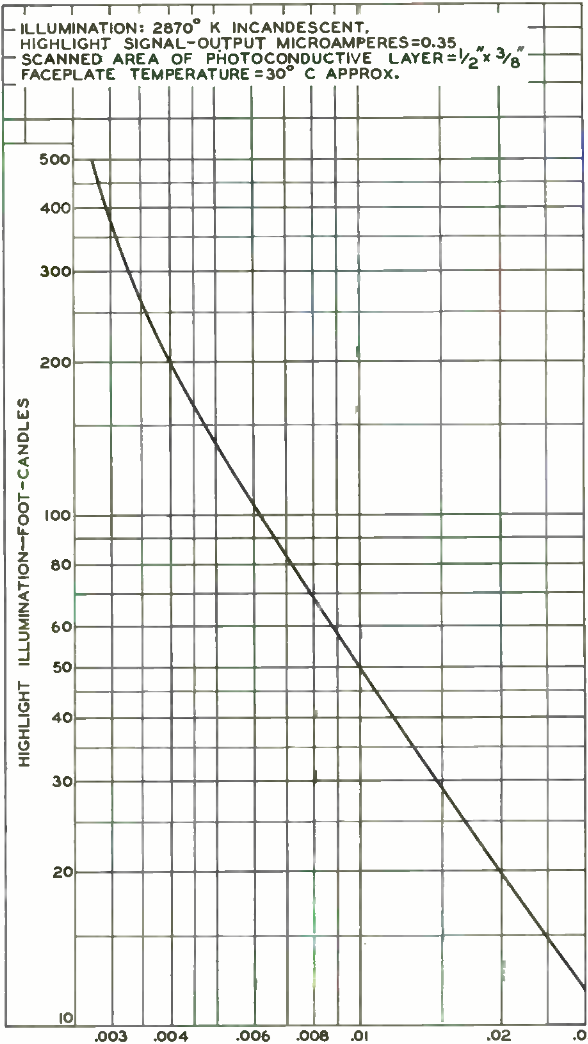
TYPICAL PERSISTENCE CHARACTERISTIC



6326

6326

TYPICAL CHARACTERISTIC



ELECTRON TUBE DIVISION

92CM-9545

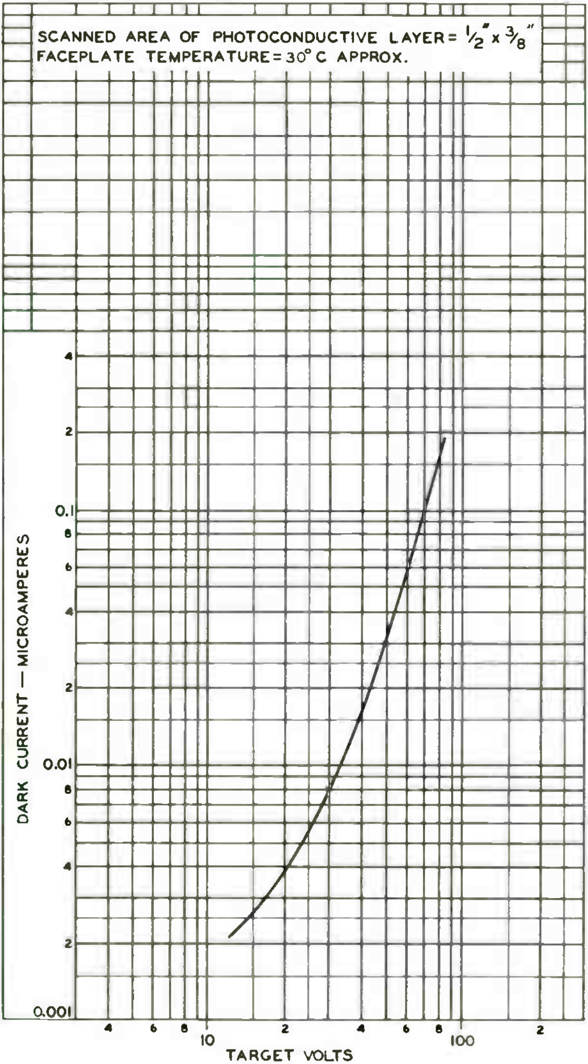
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

6326

6326

TYPICAL DARK-CURRENT CHARACTERISTIC



92CM-9541

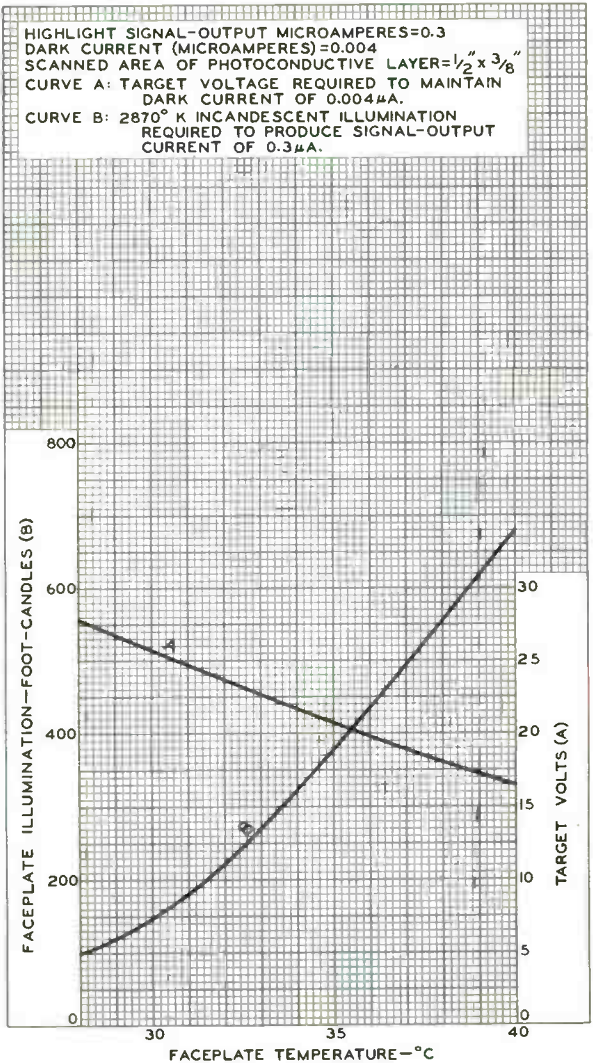
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

6326

6326

TYPICAL CHARACTERISTICS



ELECTRON TUBE DIVISION

92CM-9543

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

World Radio History

Photomultiplier Tube

9-STAGE, SIDE-ON TYPE HAVING S-4 RESPONSE

For AC-Operated Control Applications Such as Automobile-Headlight Control

GENERAL

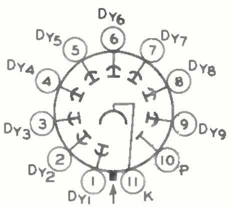
Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 angstroms
Cathode, Opaque	Cs-Sb ←
Minimum projected length[a]	0.93 in
Minimum projected width	0.31 in
Window	Lime Glass, (Corning[b] No.0080), or equivalent ←
Dynode Material	Cs-Sb
Direct Interelectrode Capacitances (Approx.)	
Anode to dynode No.9	4.2 pF
Anode to all other electrodes	5.5 pF
Maximum Overall Length	3.12 in
Maximum Seated Length	2.69 in
Length	1.56 ± 0.09 in
From base seat to center of useful cathode area	
Maximum Diameter	1.31 in
Operating Position	Any
Weight (Approx.)	1.6 oz
Envelope	JEDEC T9
Base	Small-Shell Neosubmagnal 11-Pin (JEDEC No.B11-104), Non-hygroscopic
Socket	Amphenol[c] No.78S11T, or equivalent ←
Magnetic Shield	Millen[d] No.80801B, or equivalent ←

ABSOLUTE-MAXIMUM RATINGS

Peak AC Supply Voltage			
Between anode and cathode	1400	V	←
Between dynode No.9 and anode	250	V	←
Between consecutive dynodes	250	V	←
Between dynode No.1 and cathode	250	V	←
Average Anode Current[e]	0.1	mA	
Ambient-Temperature	75	°C	

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 – Photocathode



DIRECTION OF RADIATION

← Indicates a change.

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 V dc

	Min	Typ	Max	
Sensitivity				
→ Radiant, at 4000 angstroms	-	3.4×10^4	-	A/W
Luminous, at 0 c/s[f] . . .	-	35	-	A/lm
Dark Current to Any Electrode At 25°C	-	-	7.5×10^{-7}	A

→ **With E = Adjustable 60 c/s ac Voltage**

	Min	Typ	Max	
Anode-to-Cathode Voltage[g] . . . . RMS values	525	750	990	V
Anode Dark Current[h] . . . . At 25°C	-	-	1×10^{-7}	A

[a] On plane perpendicular to the indicated direction of incident light and passing through the major axis of the tube.

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

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

[d] Made by James Millen Manufacturing Company, 150 Exchange Street, Malden 48, Massachusetts.

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

[f] 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.

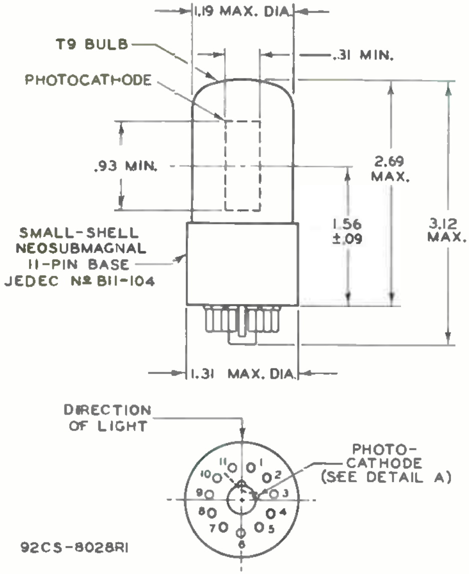
[g] Under the following conditions: Light incident on the cathode is transmitted through a filter (Corning C.S. No. 2-62, Glass Code No. 2418 which has an effective transmission of luminous flux of 5%—Manufactured by the Corning Glass Works, Corning, New York) from a tungsten-filament lamp operated at a color temperature of 2870°K. The value of light flux incident on the filter is 10 microlumens. Supply voltage (E) is adjusted to give an anode current of 8 microamperes.

[h] For conditions same as (g) except no radiant flux on photocathode.

→ Indicates a change.

World Radio History

DIMENSIONAL OUTLINE



92CS-8028R1

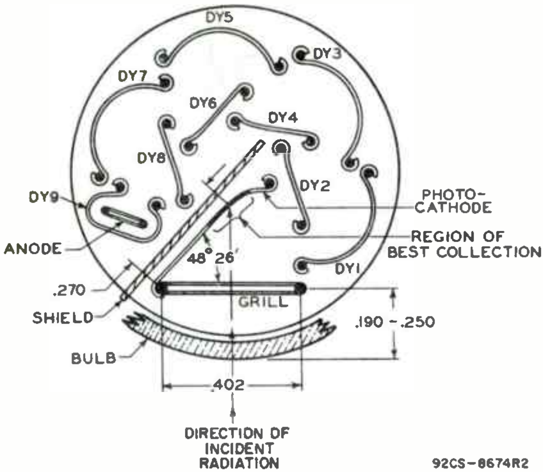
Center line of bulb will not deviate more than 2° in any direction from the perpendicular erected at the center of bottom of the base.

Note: The maximum angular variation between the planes through pins 1 and 11 and the plane of the grill will not exceed 6°.

DIMENSIONS IN INCHES

World Radio History

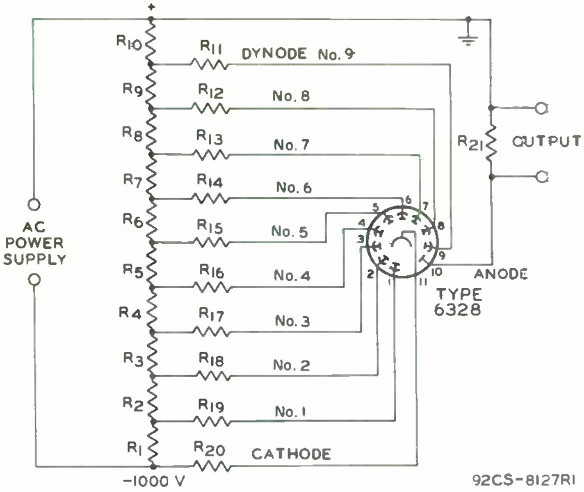
DETAIL A



92CS-8674R2

World Radio History

RECOMMENDED VOLTAGE-DIVIDER NETWORK FOR USE
WITH TYPE 6328 IN HEADLIGHT-CONTROL SERVICE



R1 R2 R3 R4 R5
R6 R7 R8 R9 R10: 1 megohm, 1/2 watt

R11: 2 megohms, 1/2 watt

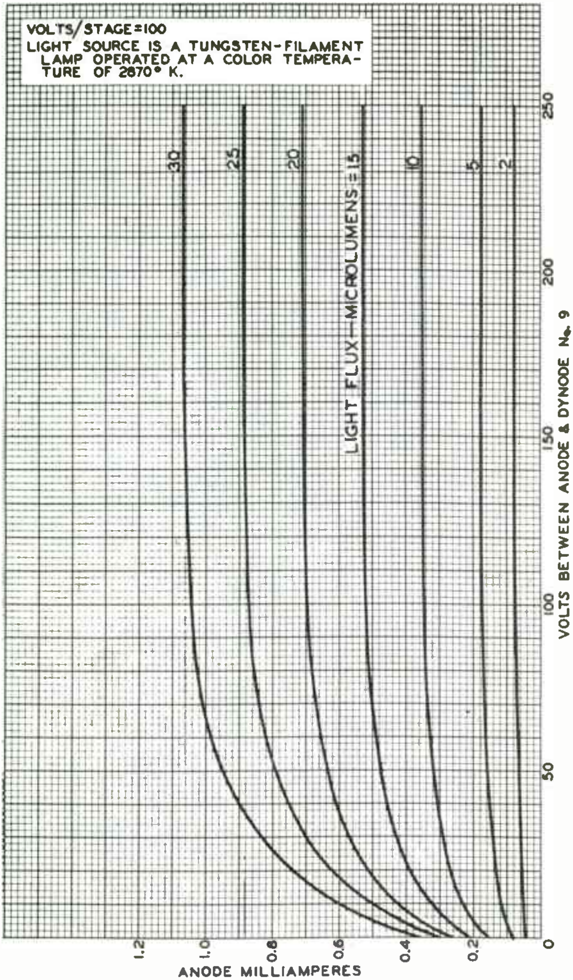
R12: 5.1 megohms, 1/2 watt

R13 R14 R15 R16
R17 R18 R19 R20: 8.2 megohms, 1/2 watt

R21: 820,000 ohms, 1/2 watt

World Radio History

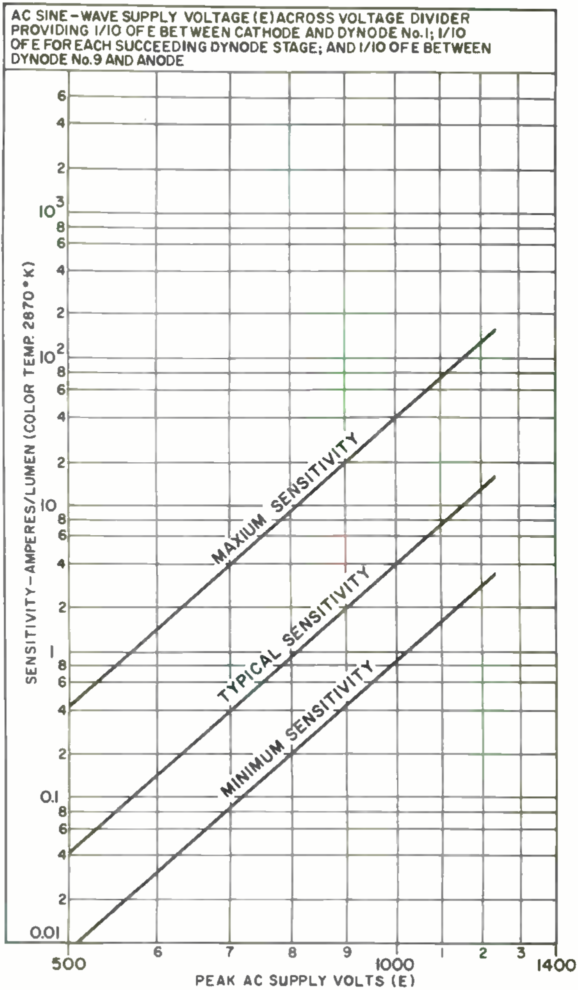
Typical Anode Characteristics



92CM-8029R2

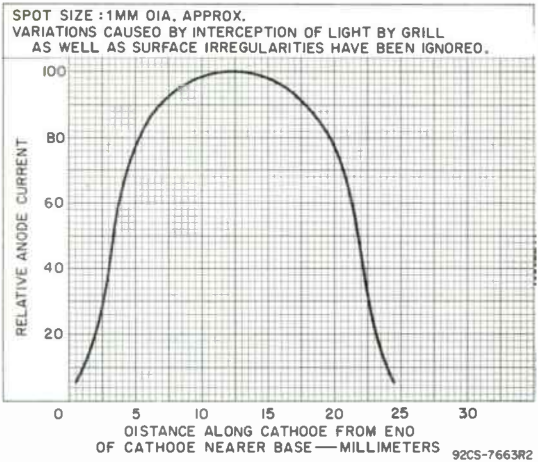
World Radio History

Sensitivity Characteristics

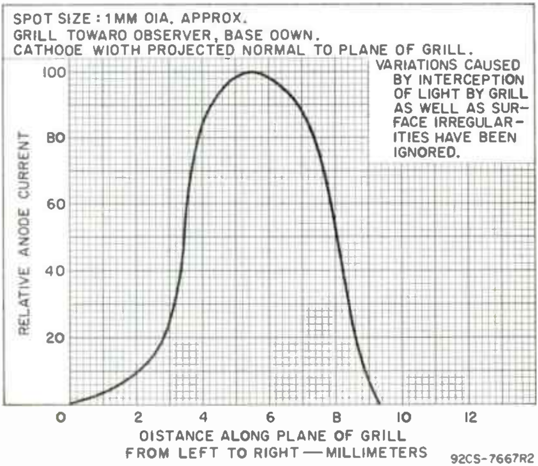


92CM-9571RIT

Variation in Photocathode Sensitivity Along Its Length



Variation in Photocathode Sensitivity Across Its Projected Width in Plane of Grill



RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

Multiplier Phototube

10-STAGE, HEAD-ON, FLAT-FACEPLATE

ELECTROSTATICALLY FOCUSED DYNODE STAGES

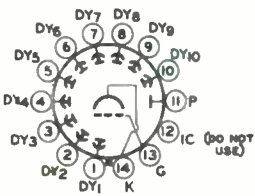
For Detection and Measurement of Nuclear Radiation and other Low-Level Light Sources in Scintillation Counters

DATA

General:

Spectral Response	S-11
Wavelength of Maximum Response	4400 ± 500 angstroms
Cathode, Semitransparent	Cesium-Antimony
Shape	Curved, Circular
Minimum area	2.2 sq. in.
Minimum diameter	1.68 in.
Window	Lime Glass (Corning[a] No.0080), or equivalent
Index of refraction	1.51
Dynode Material	Copper-Beryllium
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"
Seated Length	4.87" ± 0.19"
Maximum Diameter	2.31"
Operating Position	Any
Weight (Approx.)	5.2 oz
Bulb	T16
Socket	Loranger[b] No.2274, or equivalent
Magnetic Shield	Millen[c] No.80802B, 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

World Radio History

Maximum Ratings, ***Absolute-Maximum Values***

SUPPLY VOLTAGE BETWEEN ANODE AND CATHODE (DC or Peak AC)	1500 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE (DC or Peak AC)	250 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.1 AND CATHODE (DC or Peak AC)	400 max.	volts
SUPPLY VOLTAGE BETWEEN FOCUSING ELECTRODE AND CATHODE (DC or Peak AC)	400 max.	volts
AVERAGE ANODE CURRENT[d]	2 max.	ma
AMBIENT TEMPERATURE	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.*	
Sensitivity:				
Radiant, at 4400 angstroms	-	2.5×10^4	-	a/w
Cathode radiant at 4400 angstroms	-	0.064	-	a/w
Luminous:				
At 0 cps[e]	15	31	200	a/lm
With dynode No.10 as output electrode[f]	-	22	-	a/lm
Cathode Luminous:				
With tungsten light source[g]	5×10^{-5}	8×10^{-5}	-	a/lm
With blue light source[h,s]	5×10^{-8}	-	-	a
Current Amplification	-	3.9×10^5	-	
Equivalent Anode-Dark-Current Input[j]	-	2×10^{-10}[k]	2×10^{-9}[k]	lm
	-	2.5×10^{-13}[m]	2.5×10^{-12}[m]	w
Equivalent Noise Input[n]	-	7×10^{-12}	1.7×10^{-11}	lm
	-	8.7×10^{-15}[p]	2.1×10^{-14}[p]	w
Anode-Pulse Rise Time[q]	-	3×10^{-9}	-	sec
Greatest Delay Between Anode Pulses:				
Due to position from which electrons are simultaneously released within a circle centered on tube face having a diameter of —				

→ Indicates a change.

World Radio History

	Min.	Typical	Max.	
1-1/8"	-	1.3×10^{-9} [r]	-	sec
1-9/16"	-	4×10^{-9} [r]	-	sec

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

[b] Made by Loranger Manufacturing Corporation, 36 Clark Street, Warren, Pennsylvania.

[c] Made by James Millen Manufacturing Company, 150 Exchange Street, Malden 48, Massachusetts.

[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 a collector. The curves under *Typical Anode Characteristics* do 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 1250 volts is recommended.

[k] Measured at a tube temperature of 25° C and with a 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] Determined under the same conditions shown under (p) except that use is made of a monochromatic source having radiation at 4400 angstroms.

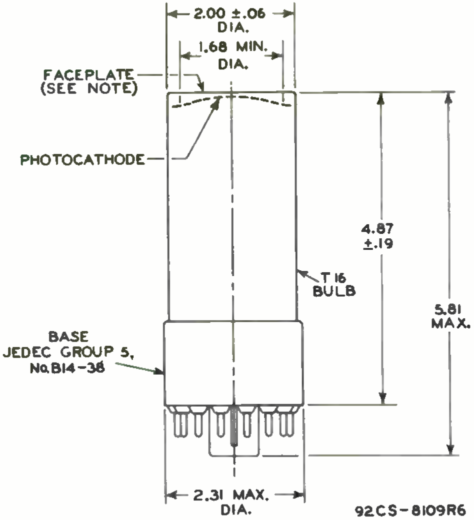
[q] Measured between 10 per cent and 90 per cent of maximum anode-pulse height. This anode-pulse rise time is primarily a function of transit-time variations in the multiplier stages and is measured under conditions with an incident-light spot approximately 1 millimeter in diameter centered on the photocathode.

[r] These values also represent the difference in time of transit between the photocathode and dynode No.1 for electrons simultaneously released from the center and from the periphery of the specified areas.

[s] 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-11 RESPONSE
is shown at the front of this Section

World Radio History



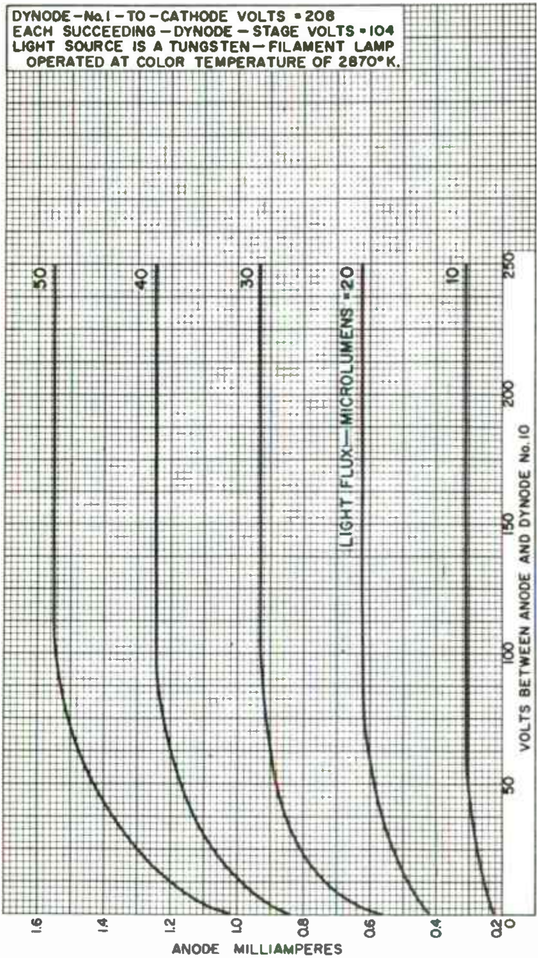
ALL DIMENSIONS IN INCHES

CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

NOTE: WITHIN 1.68" DIAMETER, DEVIATION FROM FLATNESS OF EXTERNAL SURFACE OF FACEPLATE WILL NOT EXCEED 0.010" FROM PEAK TO VALLEY.

World Radio History

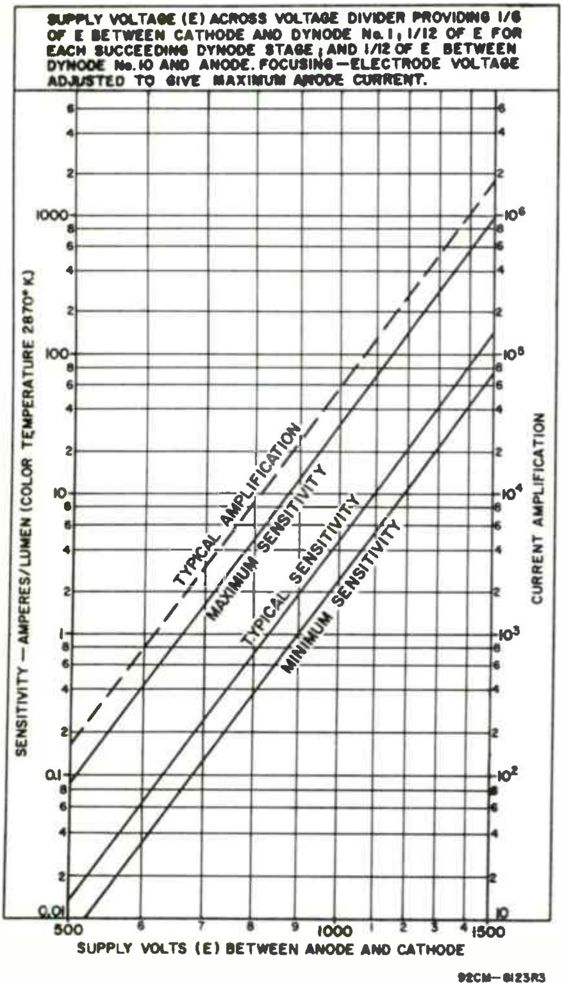
TYPICAL ANODE CHARACTERISTICS



92CM-8125R4

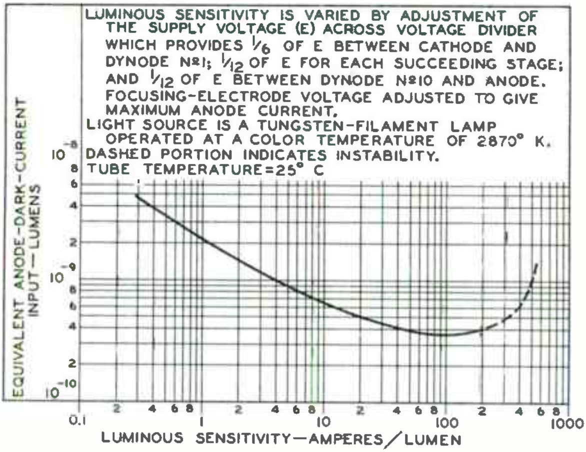
World Radio History

CHARACTERISTICS



World Radio History

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



World Radio History

Gas Phototube

SIDE-ON TYPE **S-1 RESPONSE**

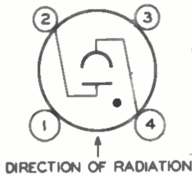
For Industrial Applications Critical as to Microphonics and Sensitivity Gradient

DATA

General:

Spectral Response S-1
Wavelength of Maximum Response. . . . . 8000 ± 1000 angstroms
Cathode:
  Shape . . . . Semicylindrical
  Minimum projected length[a] . . . . 1-1/4"
  Minimum projected width[a]. . . . . 5/8"
Direct Interelectrode Capacitance (Approx.) . . . . . . 2.6 pf
Maximum Overall Length. . . . . 4-7/16"
Maximum Seated Length . . . . 3-13/16"
Seated Length to Center of Cathode. . . . . . . 2-1/8" ± 3/32"
Maximum Diameter. . . . . 1-1/8"
Operating Position. . . . . Any
Weight (Approx.). . . . . 1.3 oz
Bulb. T8
Socket. . . . . Amphenol No.77-MIP-4-T, or equivalent
Base. . . . . Dwarf-Shell Small 4-Pin (JEDEC No.A4-26) Non-hygroscopic
  Basing Designation for BOTTOM VIEW. 2K

Pin 1 - No Internal Connection
Pin 2 - Anode



Pin 3 - No Internal Connection
Pin 4 - Photocathode

Maximum Ratings, *Absolute-Maximum Values:*

	Rating I	Rating II	
ANODE SUPPLY VOLTAGE (DC or Peak AC)	70 max.	90 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[b].	50 max.	25 max.	μa/sq.in.
AVERAGE CATHODE CURRENT[b]. . . .	10 max.	5 max.	μa
AMBIENT TEMPERATURE	100 max.	100 max.	°C

Characteristics:

With an anode-supply voltage of 50 volts unless otherwise specified

	Min.	Typical	Max.	
Sensitivity:				
Radiant, at 8000 angstroms. . .	-	0.0033	-	a/w ←

← indicates a change.

World Radio History

	Min.	*Typical*	*Max.*	
Luminous:[c]				
At 0 cps.	17.5	35	70	μa/lumen
At 5000 cps	-	30	-	μa/lumen
At 10000 cps.	-	26	-	μa/lumen
Sensitivity Difference between highest value and lowest value along cathode length[d] .	-	-	1.1	μa/lumen
Gas amplification Factor [e]. . .	-	-	2.5	
Anode Dark Current at 25° C . .	-	-	0.1	μa

Minimum Circuit Values:

With an anode-supply voltage of	*70 or less*	*90*	*volts*
DC Load Resistance:			
For dc currents above 5 μa.	0.1 min.	-	megohm
For dc currents below 5 μa.	0 min.	-	megohm
For dc currents above 3 μa.	-	2.5 min.	megohms
For dc currents below 3 μa.	-	0.1 min.	megohm

[a] On plane perpendicular to indicated direction of incident radiation.

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

[c] For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A dc anode supply of 50 volts and a 1-megohm load resistor are used. For the 0-cycle measurement, a light input of 0.1 lumen is used. For the 5000- and 10000-cycle measurements, the light input is varied sinusoidally about a mean value of 0.015 lumen from zero to a maximum of twice the mean value.

[d] Measured under the same conditions as indicated under "c" with light input of 0.1 lumen and a rectangular light spot having a width of 0.315 inch and a length sufficient to cover the length of the cathode.

[e] The ratio of luminous sensitivity at an anode-supply voltage of 50 volts to luminous sensitivity at an anode-supply voltage of 25 volts. In each case, sensitivity is obtained under conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K, the light input is 0.1 lumen, and the load resistor has a value of 1 megohm.

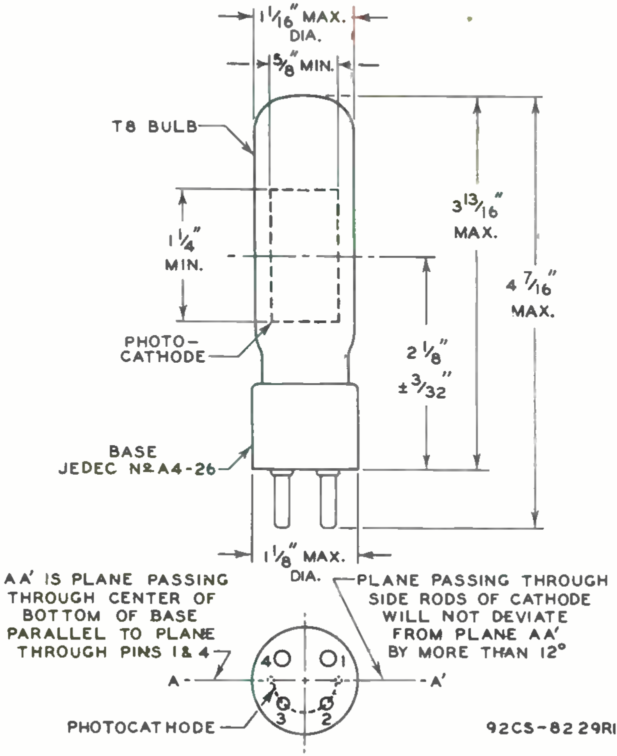
SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-1 RESPONSE

and

FREQUENCY-RESPONSE CHARACTERISTICS OF GAS PHOTOTUBES

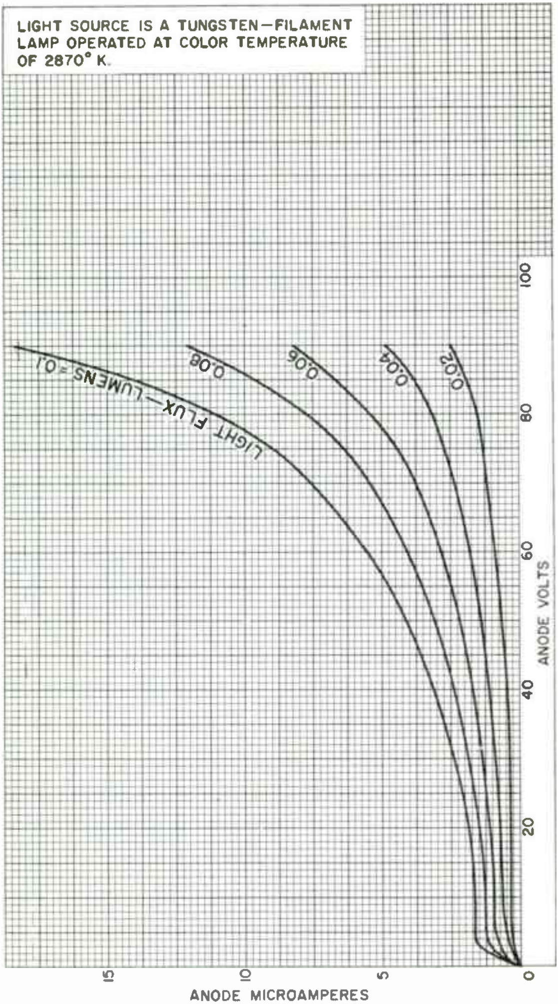
are shown at the front of this section

World Radio History



World Radio History

AVERAGE ANODE CHARACTERISTICS



92CM—8227RI

World Radio History

Photomultiplier Tube

S-4 RESPONSE

FLEXIBLE LEADS

SIDE-ON, 9-STAGE TYPE

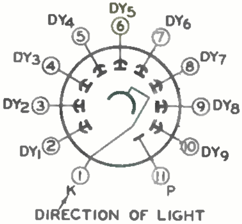
For AC- or DC-Operated Control Applications Which Require High Luminous Sensitivity

GENERAL

Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 angstroms
Cathode, Opaque	Cs-Sb ←
Minimum projected length[a]	15/16 in
Minimum projected width[a]	5/16 in
Window	Lime Glass, (Corning[b] No.0080), or equivalent ←
Dynode Material	Cs-Sb ←
Direct Interelectrode Capacitances (Approx.)	
Anode-to-dynode No.9	3.8 pF
Anode to all other electrodes	4.8 pF
Maximum Overall Length	2-3/4 in
Excluding semiflexible leads	
Maximum Envelope Length	2-1/4 in
Excluding tip	
Length	1-1/4 ± 3/32 in
From envelope seal to center of useful cathode area	
Maximum Diameter	1-3/16 in
Operating Position	Any
Weight (Approx.)	2 oz
Envelope	JEDEC T9
Magnetic Shield	Perfection Mica Co.,[c] No.P-107, or equivalent

TERMINAL DIAGRAM (Bottom View)

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



ABSOLUTE-MAXIMUM RATINGS

DC or Peak AC Supply Voltage	
Between anode and cathode	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[d]	0.1 mA
Ambient Temperature	75 °C ←

← Indicates a change.

World Radio History

CHARACTERISTICS RANGE VALUES

Under conditions with 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 V dc

	Min	Typ	Max	
Sensitivity				
Radiant, at 4000 angstroms. .	-	3.4×10^{4}	-	A/W
Luminous, at 0 c/s[e]	5	35	250	A/lm
Dark Current to any Electrode .	-	-	7.5×10^{-7}	A
At 25°C				

With E = Adjustable 60 c/s ac voltage

	Min	Typ	Max	
→ **Anode-to-Cathode Voltage**[f] . . .				
RMS Values	535	775	1000	V
Anode Dark Current[g]	-	-	2.5×10^{-7}	A
At 25°C				

[a] On plane perpendicular to the indicated direction of incident light and passing through the major axis of the tube.

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

[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.

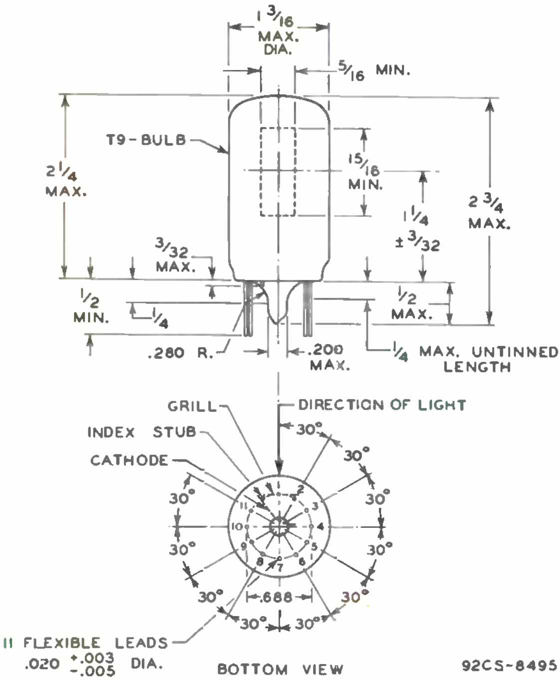
[f] Under the following conditions: The light source is a tungsten-filament lamp having a lime-glass envelope. It is operated at a color temperature of 2870° K and a light input of 1 microlumen is used. Supply Voltage (E) is adjusted to give an anode current of 7.5 microamperes.

[g] For conditions same as (f) except no radiant flux on photocathode.

→ Indicates a change.

World Radio History

DIMENSIONAL OUTLINE



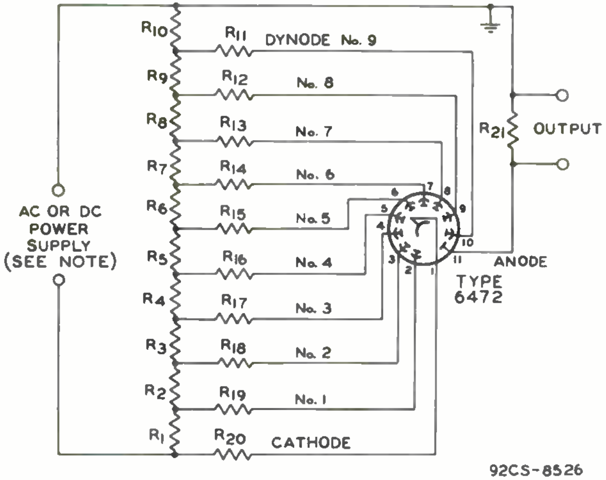
DIMENSIONS IN INCHES

The angular variation between the plane through Lead No.1 and tube axis and the plane perpendicular to the plane of the grill will not exceed 20°.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-4 Response
is shown at front of this section

World Radio History

RECOMMENDED VOLTAGE-DIVIDER NETWORK FOR USE WITH TYPE 6472 IN HEADLIGHT-DIMMING SERVICE



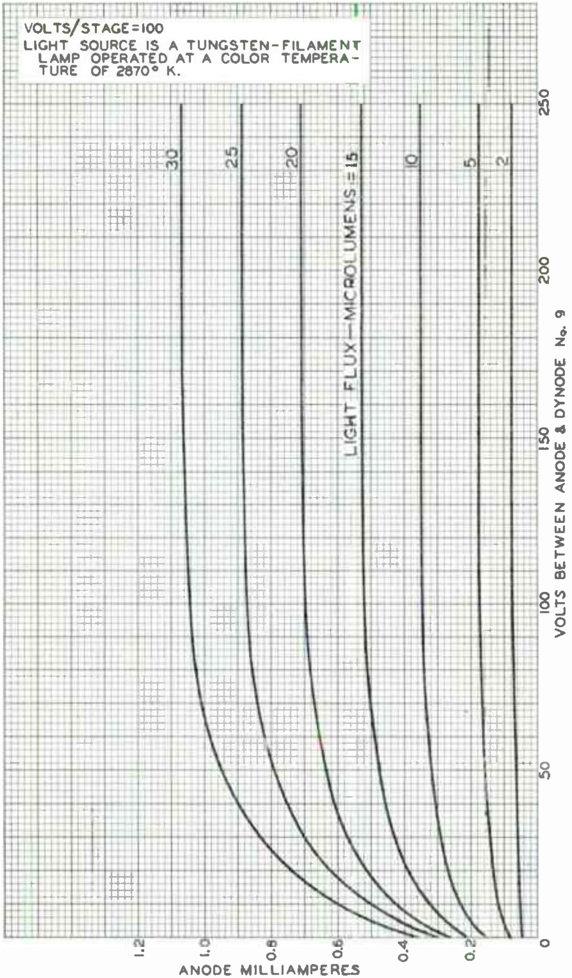
R1 R2 R3 R4 R5
R6 R7 R8 R9 R10: 1 megohm, 1/2 watt
R11: 2 megohms, 1/2 watt
R12: 5.1 megohms, 1/2 watt
R13 R14 R15 R16
R17 R18 R19 R20: 8.2 megohms, 1/2 watt
R21: 820,000 ohms, 1/2 watt

Note: Adjustable between approximately 500 and 1000 volts dc or peak ac.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

World Radio History

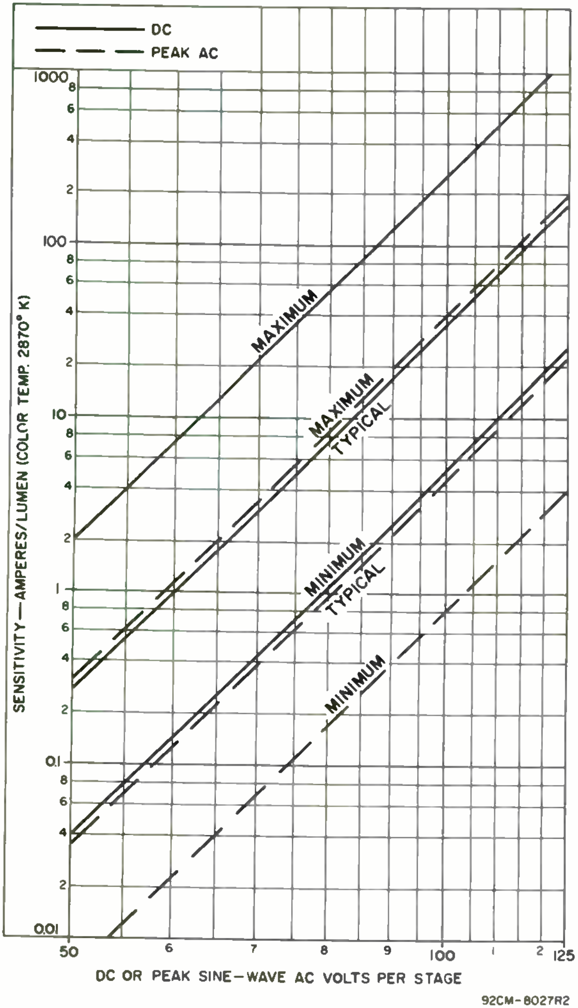
Typical Anode Characteristics



92CM-8029R2

World Radio History

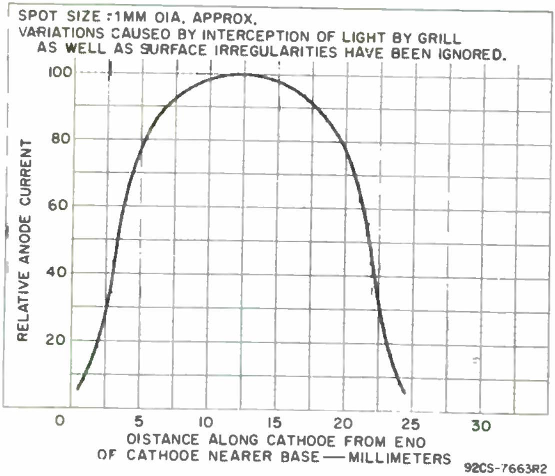
Range of Luminous Sensitivity



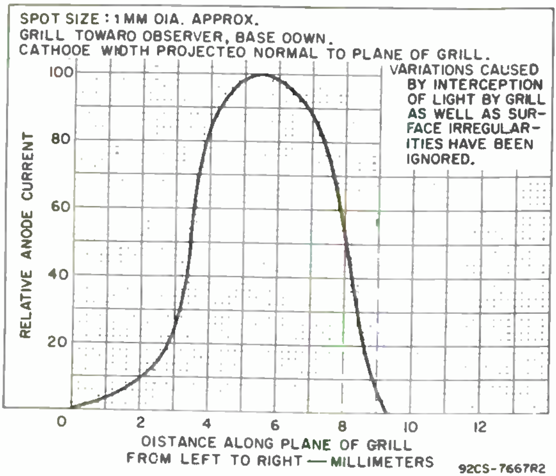
RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

World Radio History

Variation in Photocathode Sensitivity Along Its Length



Variation in Photocathode Sensitivity Across Its Projected Width in Plane of Grill



World Radio History

World Radio History

RCA

6474/1854
IMAGE ORTHICON

FOR SIMULTANEOUS COLOR PICKUP

MAGNETIC FOCUS — MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:
- Voltage . . . . 6.3 ± 10% . . . ac or dc volts
- Current . . . . 0.6 . . . . ampere

Direct Interelectrode Capacitance:
- Anode to all other electrodes . . . . 20 μμf

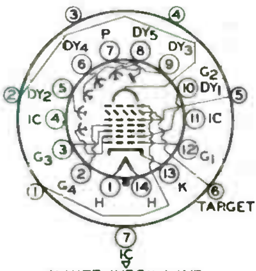
Photocathode, Semitransparent:
- Response . . . See accompanying Spectral Sensitivity curve
- Rectangular image (4 x 3 aspect ratio):
  - Useful size of . . . . 1.6" max. Diagonal
  - Orientation of . . . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin No.7 of the shoulder base.

Focusing Method . . . . Magnetic
Deflection Method . . . . Magnetic
Overall Length . . . . 15-3/16" ± 1/4"
Greatest Diameter of Bulb . . . . 3" ± 1/16"
Minimum Deflecting-Coil Inside Diameter . . . . 2-3/8"
Deflecting-Coil Length . . . . 5"
Focusing-Coil Length . . . . 10"
Alignment-Coil Length . . . . 15/16"
Photocathode Distance Inside End of Focusing Coil . . . 1/2"
Operating Position: Any except with diheptal base up and tube axis at angle of less than 20° from vertical
Weight (Approx.) . . . . 1 lb 6 oz
End Base . . . . Small-Shell Diheptal 14-Pin Base (JETEC No.B14-45)

- Pin 1 - Heater
- Pin 2 - Grid No.4
- Pin 3 - Grid No.3
- Pin 4 - Internal Connection—Do Not Use
- Pin 5 - Dynode No.2
- Pin 6 - Dynode No.4
- Pin 7 - Anode
- Pin 8 - Dynode No.5
- Pin 9 - Dynode No.3
- Pin 10 - Dynode No.1, Grid No.2
- Pin 11 - Internal Connection—Do Not Use
- Pin 12 - Grid No.1
- Pin 13 - Cathode
- Pin 14 - Heater

BOTTOM VIEW

DIRECTION OF LIGHT: PERPENDICULAR TO LARGE END OF TUBE



(Continued on next page)

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

6474

IMAGE ORTHICON

Shoulder Base . . . . Keyed Jumbo Annular 7-Pin

Pin 1 - Grid No.6	Pin 5 - Grid No.5
Pin 2 - Photocathode	
Pin 3 - Internal Connection—Do Not Use	Pin 6 - Target
Pin 4 - Internal Connection—Do Not Use	Pin 7 - Internal Connection—Do Not Use

Maximum Ratings, ***Absolute Values:***

PHOTOCATHODE:		
Voltage	-550 max.	volts
Illumination	50 max.	ft-c
OPERATING TEMPERATURE:		
Of any part of bulb	50 max.	°C
Of bulb at large end of tube (target section)	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between target section and any part of bulb hotter than target section . .	5 max.	°C
GRID-No.6 VOLTAGE	-550 max.	volts
TARGET VOLTAGE:		
Positive value	10 max.	volts
Negative value	10 max.	volts
GRID-No.5 VOLTAGE	150 max.	volts
GRID-No.4 VOLTAGE	300 max.	volts
GRID-No.3 VOLTAGE	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	125 max.	volts
Positive bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode .	125 max.	volts
Heater positive with respect to cathode .	10 max.	volts
ANODE-SUPPLY VOLTAGE*	1350 max.	volts
VOLTAGE PER MULTIPLIER STAGE	350 max.	volts

Typical Operation and Characteristics:

Photocathode Voltage (Image Focus) . .	-300 to -500	volts
Grid-No.6 Voltage (Accelerator)—75% of photocathode voltage	-225 to -375	volts
Target Voltage°	0 to 3	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam Focus)	160 to 220	volts
Grid-No.3 Voltage#	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff ..	-45 to -115	volts

* Ratio of dynode voltages is shown under *Typical Operation*.
° Adjustable from -3 to +5 volts with blanking voltage off.
\# Adjust to give the most uniformly shaded picture near maximum signal.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

6474

IMAGE ORTHICON

Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Anode Current (DC)	30	μamp
Signal-Output Current (Peak to peak) . .	3 to 20	μamp
Target Temperature Range	35 to 45	°C
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current (Approx.)	60	
Minimum Peak-to-Peak Blanking Voltage . .	5	volts
Field Strength at Center of Focusing Coil▲	75	gausses
Field Strength of Alignment Coil (Approx.)	0 to 3	gausses

▲ Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

OPERATING CONSIDERATIONS

When the equipment design or operating conditions are such that the *maximum temperature rating* or *maximum temperature difference* as given under *Maximum Ratings* will be exceeded, provision should be made to direct a blast of cooling air from the diheptal-base end of the tube along the entire length of the bulb surface, i.e., through the space between the bulb surface and the surrounding deflecting-coil assembly and its extension. Any attempt to effect cooling of the tube by circulating even a large amount of air around the focusing coil will do little good, but a small amount of air directly in contact with the bulb surface will effectively drop the bulb temperature. For this purpose, a small blower is satisfactory, but it should be run at low speed to prevent vibration of the 6474 and the associated amplifier equipment. Unless vibration is prevented, distortion of the picture may occur.

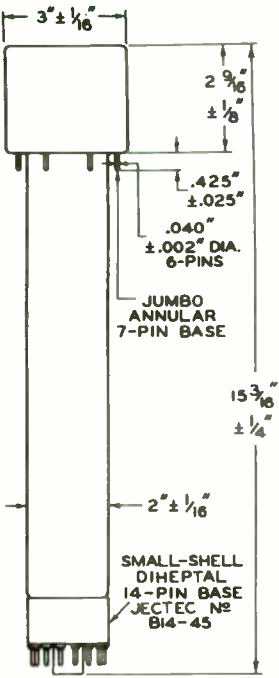
To keep the operating temperature of the large end of the tube from falling below 35°C, some form of controlled heating should be employed. Ordinarily, adequate heat will be supplied by the focusing coil, deflecting coils, and associated amplifier tubes so that the temperature can be controlled by the amount of cooling air directed along the bulb surface. If, in special cases, a target heater is required, it should fit between the focusing coil and the bulb near the shoulder of the tube, and be non-inductively wound.

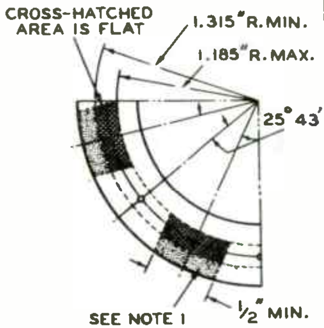
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6474

RCA 6474

IMAGE ORTHICON





NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR BASE GAUGE

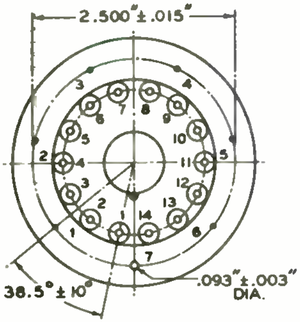
ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.015".

b. SIX STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 1/8" FROM 2-13/16" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".



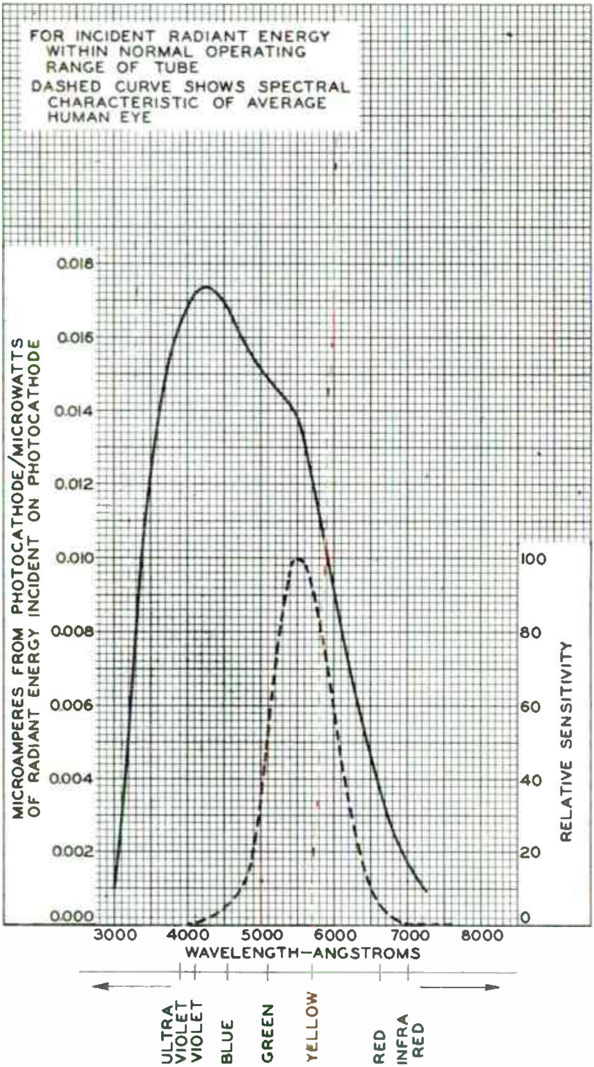
ENLARGED BOTTOM VIEW

92CM-8293

RCA

6474

SPECTRAL SENSITIVITY CHARACTERISTIC



MAR. 15, 1954

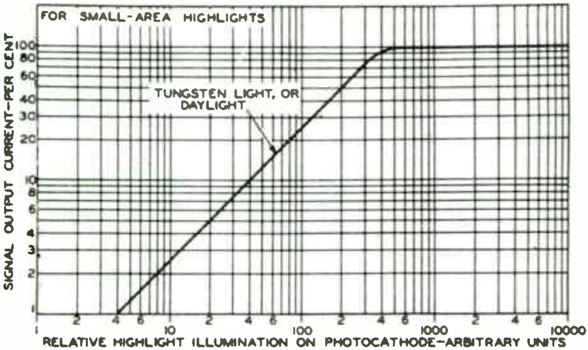
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8274R1

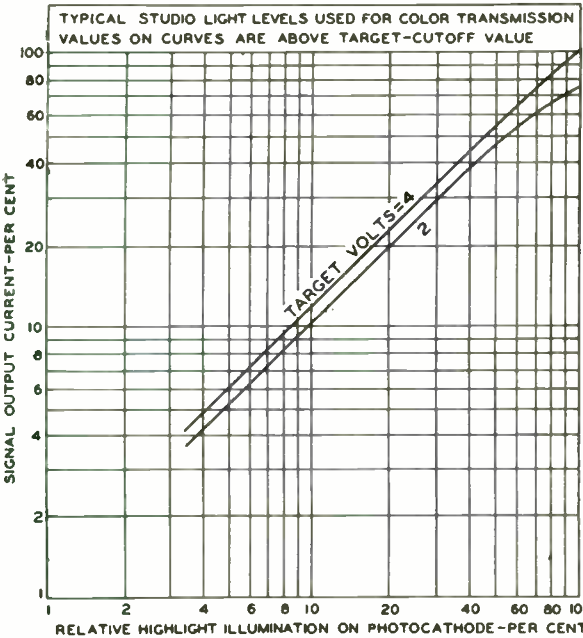
RCA

6474

LIGHT TRANSFER CHARACTERISTICS



92CM-8283



92CS-8273

JUNE 14, 1954

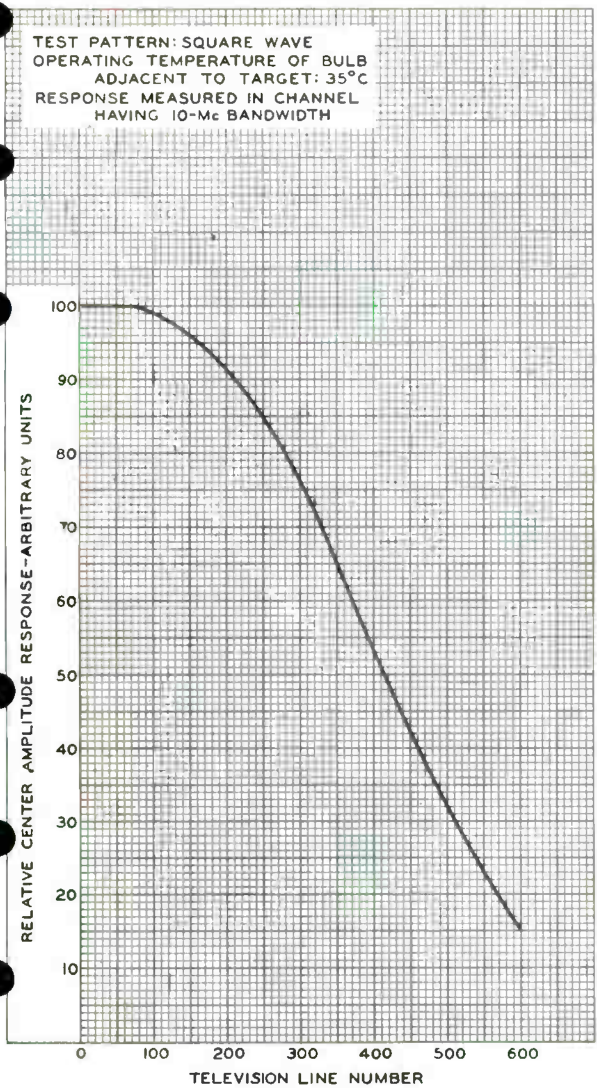
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-8283
-8273

RCA

6474

AMPLITUDE RESPONSE CHARACTERISTIC



MAR. 15, 1954

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8271

World Radio History

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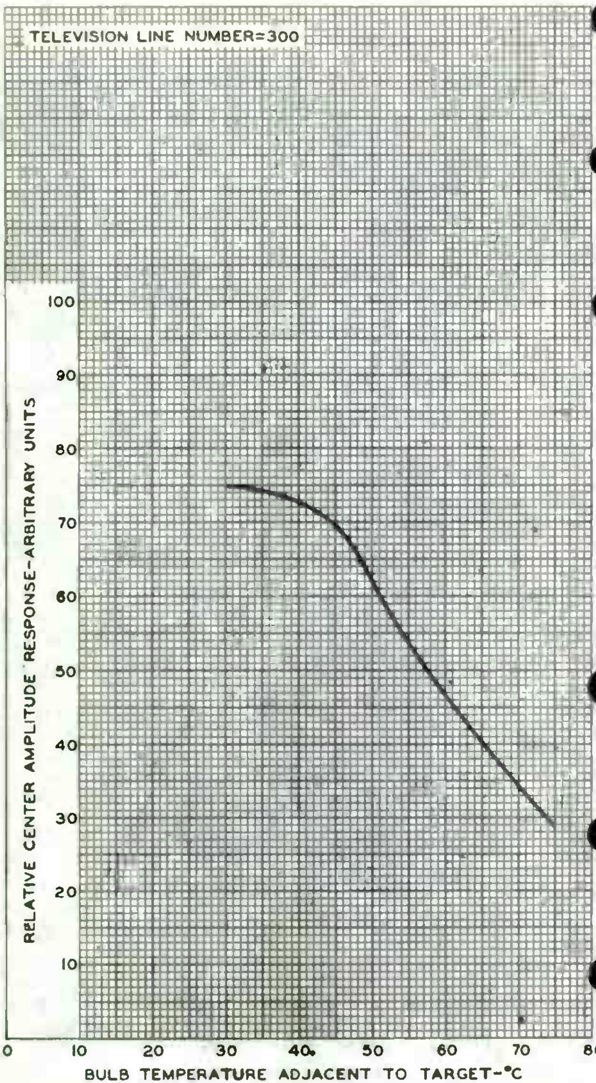
TEMPERATURE EFFECT ON AMPLITUDE RESPONSE



MAR.15,1954 TUBE DIVISION 92CM-8272

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6570

6570
VACUUM PHOTOTUBE

LOW-MICROPHONIC TYPE WITH S-1 RESPONSE

DATA

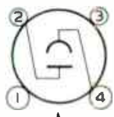
General:

Spectral Response S-1
Wavelength of Maximum Response. . . . . 8000 ± 1000 angstroms
Cathode:
  Shape . . . . Semicylindrical
  Minimum projected length* . . . . 1-1/4"
  Minimum projected width*. . . . . 5/8"
Direct Interelectrode Capacitance . . . . 3 μμf
Overall Length. . . . . 4-5/16" ± 1/8"
Seated Length . . . . 3-11/16" ± 1/8"
Seated Length to Center of Cathode . . . . 2-1/8" ± 3/32"
Maximum Diameter. . . . . 1-1/8"
Mounting Position . . . . Any
Weight (Approx.). . . . . 1.3 oz
Bulb. T-8
Base. . . . . .Dwarf-Shell Small 4-Pin (JETEC No.A4-26), Non-hygroscopic

BOTTOM VIEW

Pin 1 - No Connection

Pin 2 - Anode



DIRECTION OF LIGHT

Pin 3 - No Connection

Pin 4 - Cathode

Maximum Ratings, *Absolute Values:*

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	500 max.	volts
AVERAGE CATHODE-CURRENT DENSITY° . . .	25 max.	μamp/sq.in.
AVERAGE CATHODE CURRENT°	5 max.	μamp
AMBIENT TEMPERATURE	100 max.	°C

Characteristics at 250 Volts on Anode:

	Min.	*Av.*	*Max.*	
Sensitivity:				
Radiant at 8000 angstroms . . .	-	0.0027	-	μamp/μwatt
Luminous#	20	30	40	μamp/lumen
Sensitivity Difference Between Highest Value and Lowest Value Along Cathode Length▲ . . .	-	-	4.5	μamp/lumen
Anode Dark Current at 25°C. . . .	-	-	0.013	μamp

* On plane perpendicular to indicated direction of incident light.

° Averaged over any interval of 30 seconds maximum.

\# For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A dc anode supply of 250 volts, a 1-megohm load resistor, and a light input of 0.1 lumen are used.

▲ Measured under the same conditions as indicated under (#) with light input of 0.1 lumen and a light spot 1/2 inch in diameter.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

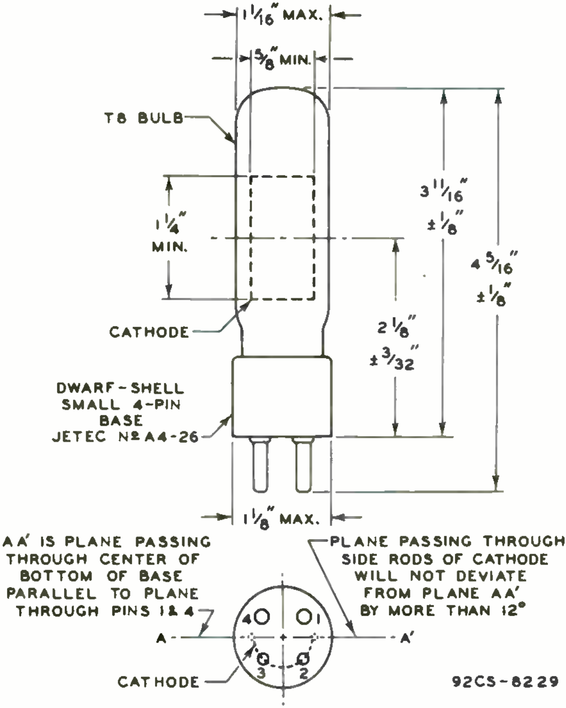
World Radio History

RCA

6570

VACUUM PHOTOTUBE

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-1 Response
is shown at the front of this Section



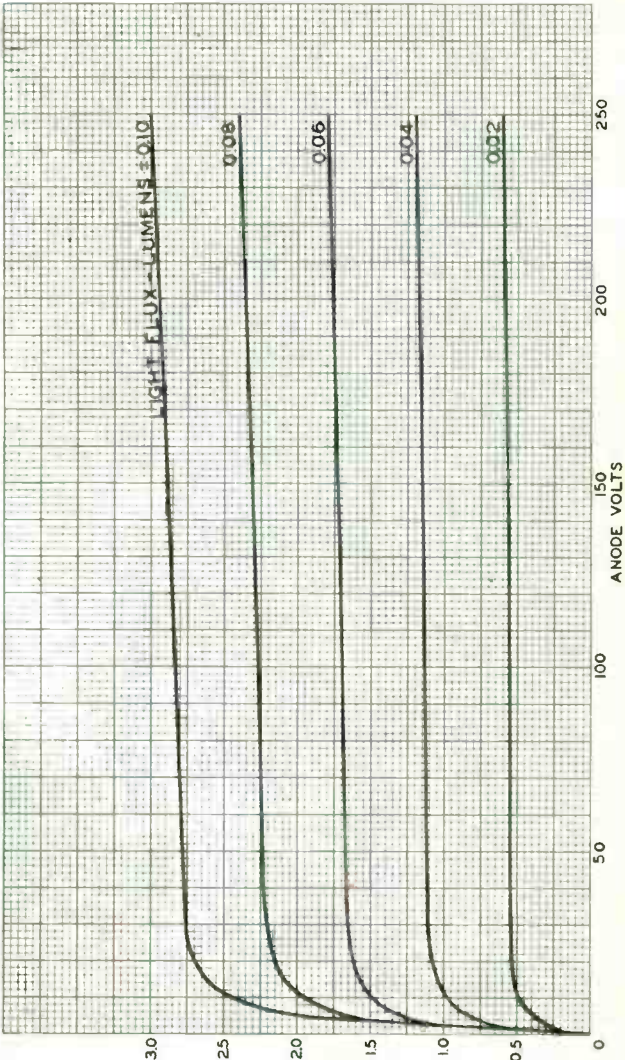
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

6570

6570

AVERAGE ANODE CHARACTERISTICS



DEC. 3, 1954

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8491

World Radio History

World Radio History

6655A

Photomultiplier Tube

10-STAGE. HEAD-ON, FLAT-FACEPLATE TYPE HAVING S-11 RESPONSE
1.68 INCH MINIMUM DIAMETER CURVED PHOTOCATHODE

For Use in Scintillation Counters for the Detection and Measurement of Nuclear Radiation and Other Low-Level Light Sources

GENERAL

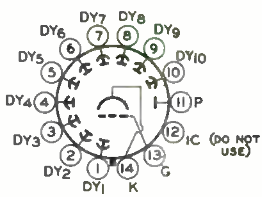
Spectral Response	S-11
Wavelength of Maximum Response	4400 ± 500 angstroms
Cathode, Semitransparent	Cs-Sb ←
Shape	Curved, Circular
Minimum area	2.2 sq in
Minimum diameter	1.68 in
Window	Lime Glass (Corning[a] No.0080), or equivalent ←
Index of refraction	1.51
Dynode Material	Cs-Sb ←
Direct Interelectrode Capacitances (Approx.)	
Anode to dynode No.10	4.4 pF
Anode to all other electrodes	7.0 pF
Maximum Overall Length	5.81 in
Seated Length	4.87 ± 0.19 in
Maximum Diameter	2.31 in
Operating Position	Any
Weight (Approx.)	5.2 oz
Envelope	JEDEC T16
Base	Medium-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-38), Non-hygroscopic
Socket	Loranger[b] No.2274, or equivalent ←
Magnetic Shield	Perfection Mica Co.,[c] No. P-100-4, or equivalent ←

ABSOLUTE-MAXIMUM RATINGS

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

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 – 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

14AA

← Indicates a change.

World Radio History

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 1/10 of E between dynode No.9 and anode

With E = 1000 V dc	Min	Typ	Max	
Sensitivity				
Radiant, at 4400 angstroms	-	7.2×10^{4}	-	A/W
Cathode radiant, at 4400 angstroms.	-	0.044	-	A/W
Luminous:				
At 0 c/s[e].	10	90	300	A/lm
With dynode No.10 as output electrode[f] . .	-	65	-	A/lm
Cathode luminous:				
With tungsten light source[g]	4×10^{-5}	5.5×10^{-5}	-	A/lm
With blue light source[h]	4×10^{-8}	-	-	A
Current Amplification. . .	-	1.6×10^{6}	-	
Equivalent Anode-Dark-Current Input	-	5×10^{-10}	2×10^{-9}	lm
At a luminous sensitivity of 20 A/lm[j,k]				
Equivalent Noise Input[m] . .	-	7×10^{-12}	2.7×10^{-11}	lm
Anode-Pulse Rise Time[n] . .	-	3×10^{-9}	-	s
Greatest Delay Between Anode Pulses, due to position from which electrons are simultaneously released within a circle centered on tube face having:				
Diameter of 1-1/8 in . .	-	1.5×10^{-9}[p]	-	s
Diameter of 1-9/16 in. .	-	4.5×10^{-9}[p]	-	s

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

b Made by Loranger Manufacturing Corp., 36 Clark St., Warren, Pa.

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 curves shown in *Typical Anode Characteristics* do 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.

→ Indicates a change.

World Radio History

j At a tube temperature of 25°C. Dark current may be reduced by use of a refrigerant.

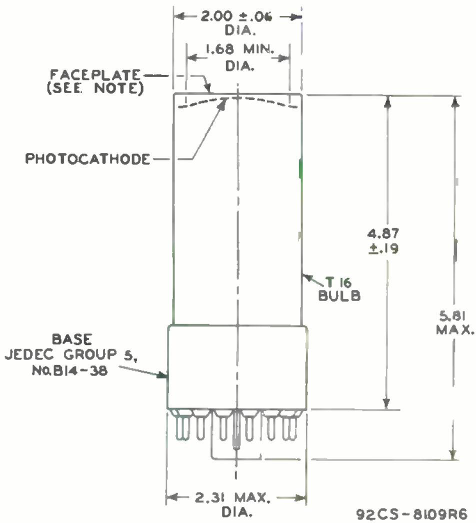
k For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1000 volts is recommended.

m 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.

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 variations in the multiplier stages and is measured under conditions with an incident-light spot approximately 1 millimeter in diameter centered on the photocathode.

p These values also represent the difference in time of transit between the photocathode and dynode No. 1 for electrons simultaneously released from the center and from the periphery of the specified areas.

DIMENSIONAL OUTLINE



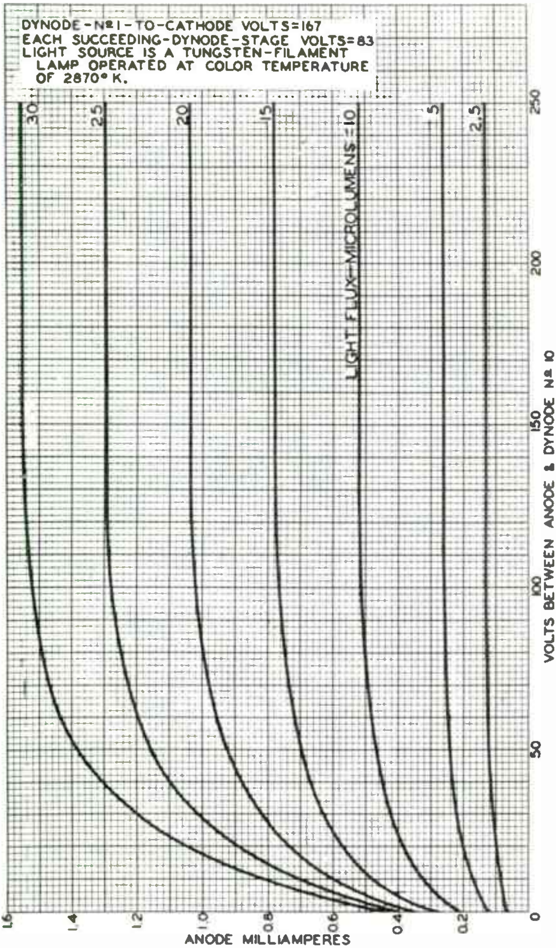
DIMENSIONS IN INCHES

Center line of bulb will not deviate more than 2° in any direction from the perpendicular erected at the center of bottom of the base.

Note: within 1.68 inch diameter, deviation from flatness of external surface of faceplate will not exceed 0.010 inch from peak to valley.

World Radio History

Typical Anode Characteristics

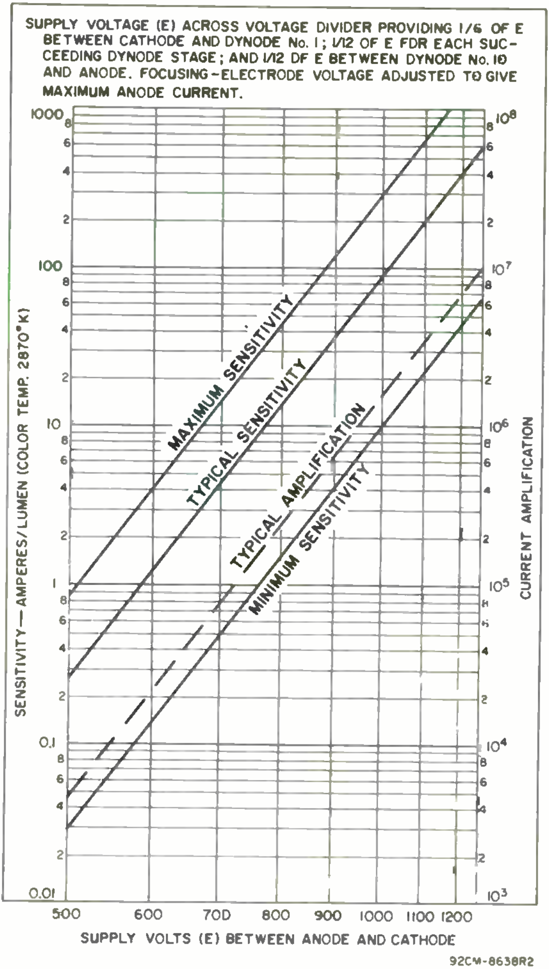


92CM-8603R1

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

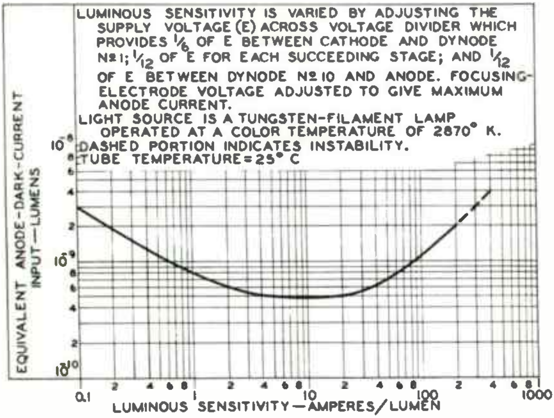
World Radio History

Typical Sensitivity and Current Amplification Characteristics



World Radio History

Typical Anode-Dark-Current Characteristic



92CS-8636R2

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

World Radio History

Photomultiplier Tube

14-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE HAVING S-11 RESPONSE
1.68-INCH MINIMUM DIAMETER CURVED PHOTOCATHODE

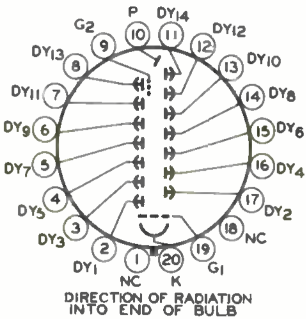
Particularly Useful in Fast Scintillation Counters, in the Detection and Measurement of Nuclear Radiation and Other Low-Level Light Sources

GENERAL

Spectral Response S-11
Wavelength of Maximum Response . . . . . 4400 ± 500 angstroms
Cathode, Semitransparent . . . . Cs-Sb ←
  Shape . . . . Curved, Circular
  Minimum area . . . . 2.2 sq in
  Minimum diameter . . . . 1.68 in
Window . . . . . . .Lime Glass, Corning[a] No.0080, or equivalent ←
  Index of refraction 1.51
Dynode Material . . . . Cu-Be
Direct Interelectrode Capacitances (Approx.)
  Anode to dynode No.14 . . . . 2.8 pF
  Anode to all other electrodes . . . . 6.0 pF
Maximum Overall Length . . . . 7.5 in
Seated Length . . . . 6.69 ± 0.19 in
Maximum Diameter . . . . 2.38 in
Operating Position . . . . Any
Weight (Approx.) . . . . 8 oz
Envelope . . . . JEDEC T16
Base . . . . .Small-Shell Bidecal 20-Pin, (JEDEC No.B20-102), Non-hygroscopic
Socket . . . . Cinch[b] No.20-PM, or equivalent ←
Magnetic Shield . . . . Millen[c] No.80802E, or equivalent ←

TERMINAL DIAGRAM (Bottom View)

Pin 1 – No Connection
Pin 2 – Dynode No.1
Pin 3 – Dynode No.3
Pin 4 – Dynode No.5
Pin 5 – Dynode No.7
Pin 6 – Dynode No.9
Pin 7 – Dynode No.11
Pin 8 – Dynode No.13
Pin 9 – Grid No.2 (Accelerating Electrode)
Pin 10 – Anode
Pin 11 – Dynode No.14
Pin 12 – Dynode No.12
Pin 13 – Dynode No.10
Pin 14 – Dynode No.8
Pin 15 – Dynode No.6
Pin 16 – Dynode No.4
Pin 17 – Dynode No.2
Pin 18 – No Connection
Pin 19 – Grid No.1 (Focusing Electrode)
Pin 20 – Photocathode Metal Collar – No Connection (If used, connect only to photocathode)



20D

World Radio History

VERY-LOW-LIGHT-LEVEL, LOW-NOISE, HIGH-GAIN SERVICE

Absolute-Maximum Ratings

Under conditions with dc supply voltage (E) across a voltage divider providing electrode voltages shown in Table I - Column A. The focusing-electrode and accelerating-electrode voltages are adjusted to those values which provide maximum anode current.

DC Supply Voltage		
Between Anode and Cathode	2400	V
Between Dynode No.14 and Anode	400	V
Between Consecutive Dynodes	500	V
Between Dynode No.1 and Cathode	400	V
Between Focusing Electrode and Cathode	400	V
Between Accelerating Electrode and Dynode No.13	±500	V
Average Anode Current[d]	2	mA
Ambient Temperature	75	°C

Characteristics Range Values

With E = 2000 V (except as noted)

	Min	Typ	Max	
Sensitivity				
Radiant at 4400 angstroms	-	2.4×10^{6}	-	A/W
Cathode radiant at 4400 angstroms	-	0.056	-	A/W
Luminous:				
At 0 c/s[e]	480	3050	2×10^{4}	A/lm
With dynode No.14 as output electrode[f]	-	2.1×10^{3}	-	A/lm
Cathode luminous:				
With tungsten light source[g]	5×10^{-5}	7×10^{-5}	-	A/lm
With blue light source[h]	5×10^{-8}	-	-	A
Current Amplification	-	4.3×10^{7}	-	
Equivalent Anode-Dark-Current Input	-	5×10^{-10}	1.5×10^{-9}	lm
At luminous sensitivity of 2000 A/lm[j,k]				
Equivalent Noise Input[m]	-	3.3×10^{-12}	1.5×10^{-11}	lm
Greatest Delay Between Anode Pulses[n]				
Due to position from which electrons are simultaneously released within a circle centered on tube face having:				
Diameter of 1.12 in	-	1×10^{-9}	-	s
Diameter of 1.56 in	-	3×10^{-9}	-	s

HIGH-OUTPUT-PULSE SERVICE

Absolute-Maximum Ratings

Under conditions with dc supply voltage (E) across a voltage divider providing electrode voltages shown in Table I - Column B. The focusing-electrode and accelerating-electrode voltages are adjusted to those values which provide maximum anode current.

DC Supply Voltage		
Between Anode and Cathode	2800	V

World Radio History

DC Supply Voltage (Cont'd)				
Between Dynode No.14 and Anode			400	V
Between Consecutive Dynodes			500	V
Between Dynode No.1 and Cathode			400	V
Between Focusing Electrode and Cathode			400	V
Between Accelerating Electrode and Dynode No.13			±500	V
Average Anode Current[d]			2	mA
Ambient Temperature			75	°C

Characteristics Range Values

With E = 2400 V (except as noted)

	Min	*Typ*	*Max*	
Sensitivity				
Radiant at 4400 angstroms	-	2.4×10^{6}	-	A/W
Cathode radiant at 4400 angstroms	-	0.056	-	A/W
Luminous:				
At c/s[e]	-	3050	-	A/lm
With dynode No.14 as output electrode[f]	-	2.1×10^{3}	-	A/lm
Cathode luminous:				
With tungsten light source[g]	5×10^{-5}	7×10^{-5}	-	A/lm
With blue light source[h]	5×10^{-8}	-	-	A
Current Amplification	-	4.3×10^{7}	-	
Equivalent Anode-Dark-Current Input	-	1.1×10^{-9}	-	lm
At luminous sensitivity of 2000 A/lm[g,p]				
Equivalent Noise Input[m]	-	4.6×10^{-12}	-	lm

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

[b] Made by Cinch Manufacturing Company, 1026 South Homan Avenue, Chicago 24, Illinois.

[c] Made by James Millen Manufacturing Company, 150 Exchange Street, Malden 48, Massachusetts.

[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 0.1 microlumen is used.

[f] An output current of opposite polarity to that obtained at the anode may be provided by using dynode No.14 as the output electrode. With this arrangement, the load is connected in the dynode-No.14 circuit and the anode serves only as collector. The curves shown under *Typical Anode Characteristics* do not apply when dynode No.14 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 together 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] At a tube temperature of 25° C. Dark current may be reduced by use of a refrigerant.

[k] For maximum signal-to-noise ratio, operation with a supply voltage (E) below 2000 volts is recommended.

→ Indicates a change.

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[m] 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.

[n] These values also represent the difference in time of transit between the photocathode and dynode No. 1 for electrons simultaneously released from the center and from the periphery of the specified areas.

[p] For maximum signal-to-noise ratio, operation with a supply voltage (E) below 2300 volts is recommended.

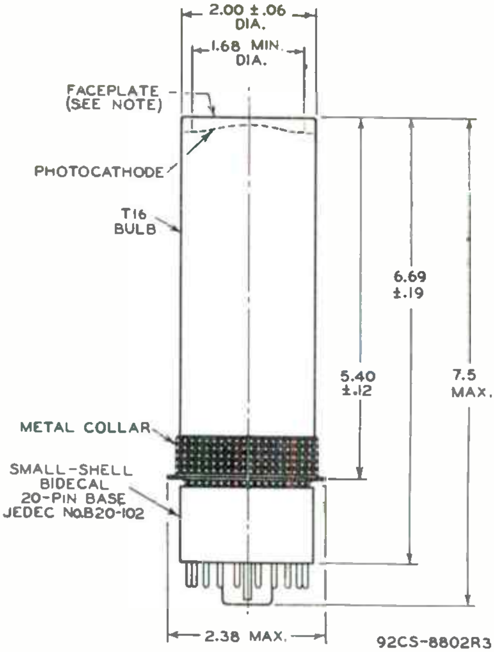
[q] Focusing-electrode voltage is adjusted to that value which provides maximum anode current.

TABLE I		
VOLTAGE TO BE PROVIDED BY DIVIDER		
Between	COLUMN A 5.4% of Supply Voltage (E) multiplied by	COLUMN B 2.75% of Supply Voltage (E) multiplied by
Cathode and Focusing Electrode	See footnote[q]	See footnote[q]
Cathode and Dynode No. 1	2	2
Focusing Electrode and Dynode No. 1	1	1
Dynode No. 1 and Dynode No. 2	1	1
Dynode No. 2 and Dynode No. 3	1	1
Dynode No. 3 and Dynode No. 4	1	1
Dynode No. 4 and Dynode No. 5	1	1
Dynode No. 5 and Dynode No. 6	1	1
Dynode No. 6 and Dynode No. 7	1	1.2
Dynode No. 7 and Dynode No. 8	1	1.5
Dynode No. 8 and Dynode No. 9	1	1.9
Dynode No. 9 and Dynode No. 10	1	2.4
Dynode No. 10 and Dynode No. 11	1	3.0
Dynode No. 11 and Dynode No. 12	1.25	3.8
Dynode No. 12 and Dynode No. 13	1.5	4.8
Dynode No. 13 and Dynode No. 14	1.75	6.0
Dynode No. 14 and Anode	2	4.8
Anode and Cathode	18.5	36.4

OPERATING CONSIDERATIONS

An increase in current amplification may be obtained under conditions with a dc supply voltage (E) across a voltage divider providing 1/8 of E between cathode and dynode No. 1; 1/16 of E for each succeeding dynode stage, and 1/16 of E between dynode No. 14 and anode.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Center line of bulb will not deviate more than 2° in any direction from the perpendicular erected at the center of bottom of the base.

Note: Within 1.68" diameter, deviation from flatness of external surface of faceplate will not exceed 0.005" from peak to valley.

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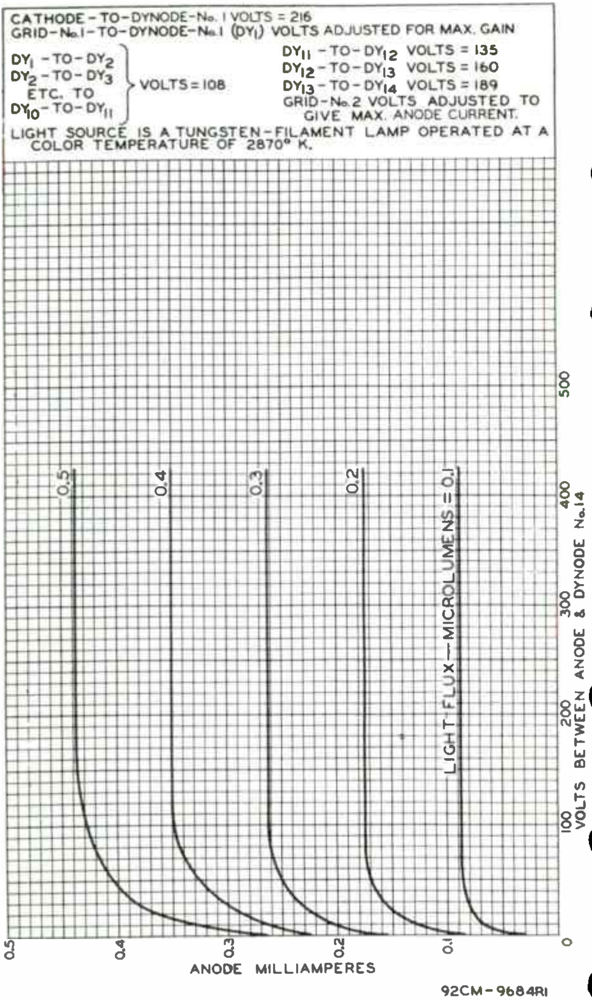
Typical Anode Characteristics



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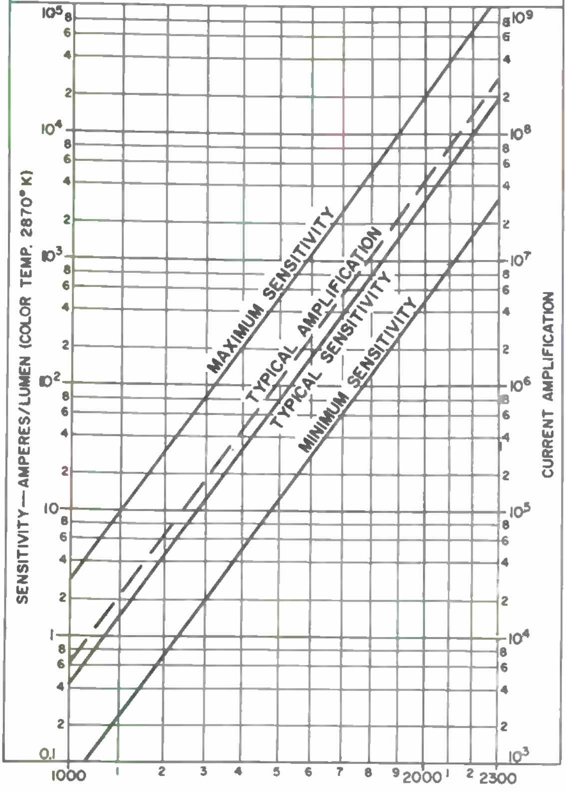
Electronic Components and Devices Harrison, N. J.

Typical Sensitivity and Current Amplification Characteristics

THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	5.4% OF E MULT. BY	BETWEEN	5.4% OF E MULT. BY
CATHODE & GRID No.1	1	DY_{11} & DY_{12}	1.25
GRID No.1 & DYNODE No.1	1	DY_{12} & DY_{13}	1.5
DYNODE No.1 (DY_1) & DY_2 ETC. THRU DY_{10} & DY_{11}	1	DY_{13} & DY_{14}	1.75
		DY_{14} & ANODE	2

GRID-No.2 VOLTS ADJUSTED TO GIVE MAXIMUM GAIN.



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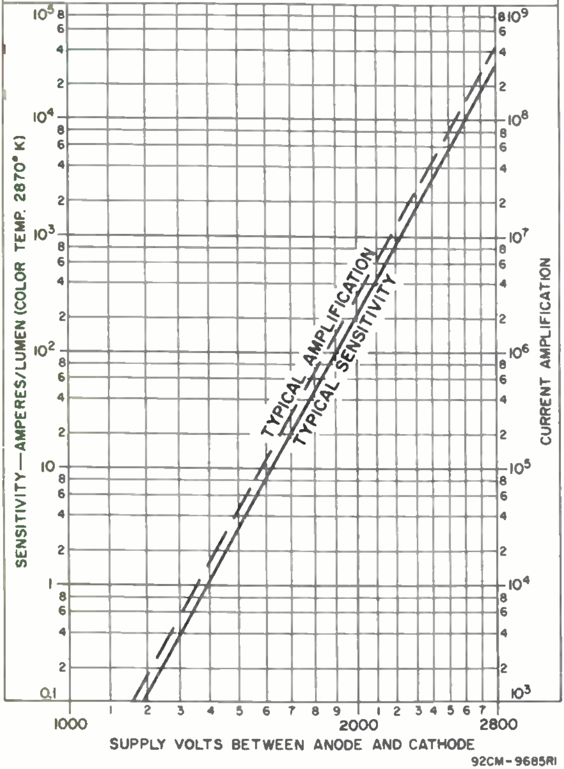
Sensitivity and Current Amplification Characteristics

HIGH-OUTPUT-PULSE SERVICE

THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	2.75 % OF E MULT. BY	BETWEEN	2.75 % OF E MULT. BY
CATHODE & GRID N°1	1	DY_8 & DY_9	1.9
GRID N°1 & DYNODE N°1 (DY_1)	1	DY_9 & DY_{10}	2.4
		DY_{10} & DY_{11}	3
DY_1 & DY_2 ETC. THRU DY_5 & DY_6	1	DY_{11} & DY_{12}	3.8
		DY_{12} & DY_{13}	4.8
DY_6 & DY_7	1.2	DY_{13} & DY_{14}	6
DY_7 & DY_8	1.5	DY_{14} & ANODE	4.8

GRID-N°2 VOLTS ADJUSTED TO GIVE MAX. ANODE CURRENT.



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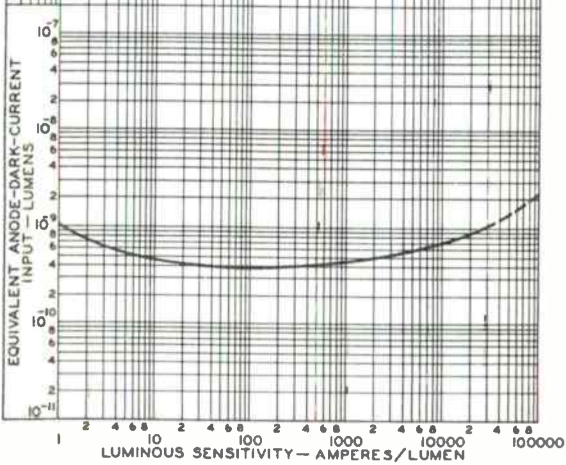
Typical Anode-Dark-Current Characteristic

VERY-LOW-LIGHT-LEVEL, LOW-NOISE, HIGH-GAIN SERVICE

LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	5.4 % OF E MULTIPLIED BY
CATHODE & GRID Nº1	1
GRID Nº1 & DYNODE Nº1 (DY_1)	1
CATHODE & DYNODE Nº1 (DY_1)	2
DY_1 & DY_2	1
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1
DY_7 & DY_8	1
DY_8 & DY_9	1
DY_9 & DY_{10}	1
DY_{10} & DY_{11}	1
DY_{11} & DY_{12}	1.25
DY_{12} & DY_{13}	1.5
DY_{13} & DY_{14}	1.75
DY_{14} & ANODE	2.
ANODE & CATHODE	18.5

GRID-Nº2 VOLTS ADJUSTED TO GIVE MAX. ANODE CURRENT
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.
TUBE TEMPERATURE = 25° C
DASHED PORTION INDICATES INSTABILITY.



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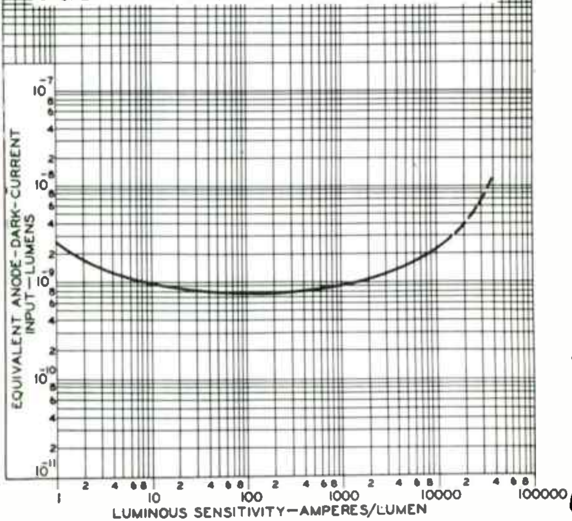
Typical-Anode-Dark-Current Characteristic

HIGH-OUTPUT-PULSE SERVICE

LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	2.75 % OF E MULTIPLIED BY
CATHODE & GRID Nº 1	1
GRID Nº 1 & DYNODE Nº 1 (DY_1)	1
CATHODE & DYNODE Nº 1 (DY_1)	2
DY_1 & DY_2	1
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1.2
DY_7 & DY_8	1.5
DY_8 & DY_9	1.9
DY_9 & DY_{10}	2.4
DY_{10} & DY_{11}	3
DY_{11} & DY_{12}	3.8
DY_{12} & DY_{13}	4.8
DY_{13} & DY_{14}	6
DY_{14} & ANODE	4.8
ANODE & CATHODE	36.4

GRID-Nº 2 VOLTS ADJUSTED TO GIVE MAX. ANODE CURRENT
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.
TUBE TEMPERATURE = 25° C
DASHED PORTION INDICATES INSTABILITY.



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Photomultiplier Tube[a]

S-13 RESPONSE

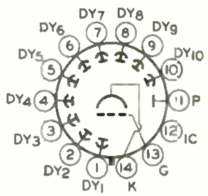
10-STAGE, HEAD-ON, FLAT-FACEPLATE — ELECTROSTATICALLY FOCUSED DYNODE STAGES

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]	4×10^{-5}	6×10^{-5}	-	A/lm
With blue light source[h]	4×10^{-8}	-	-	A
Current Amplification . . .	-	1.3×10^{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.

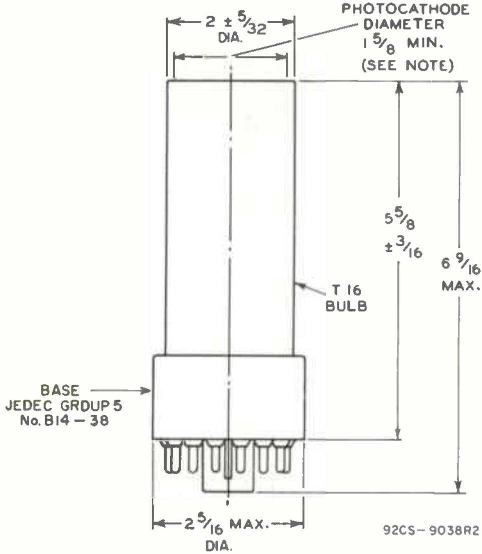
[p] Under the same conditions as shown under (n) except that use is made of a monochromatic source having radiation at 2537 angstroms.

[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

World Radio History

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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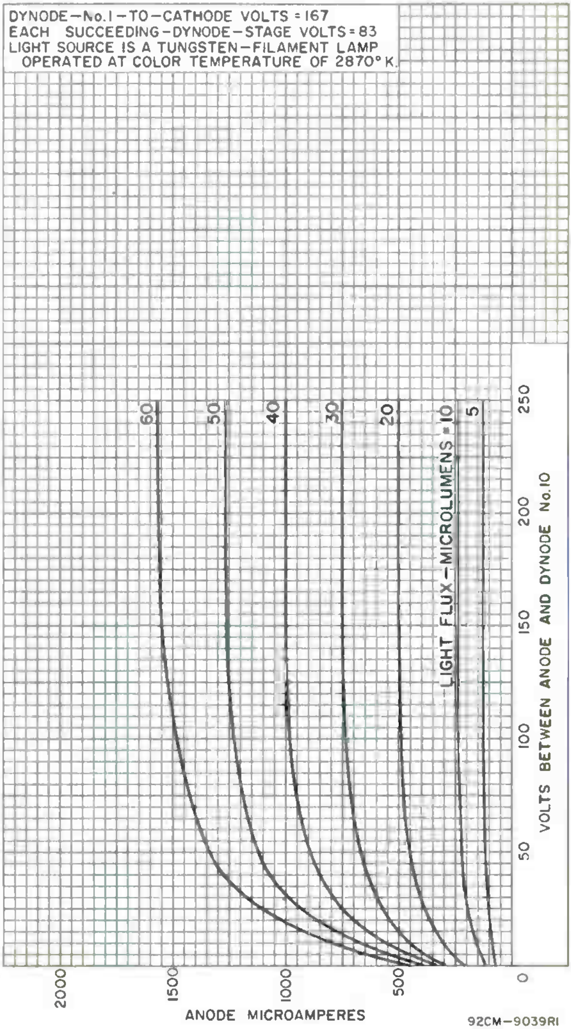
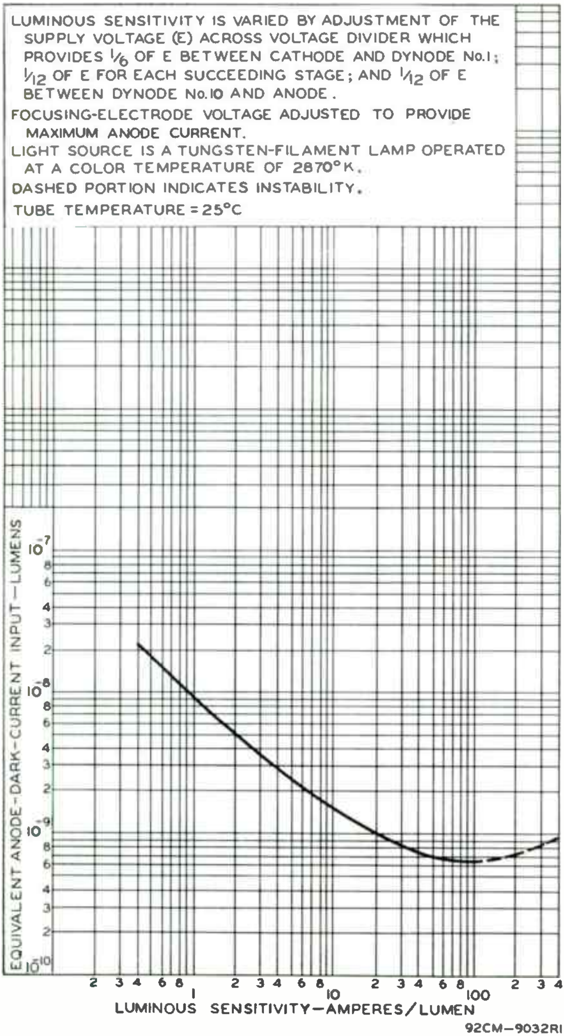
TYPICAL ANODE CHARACTERISTICS



TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



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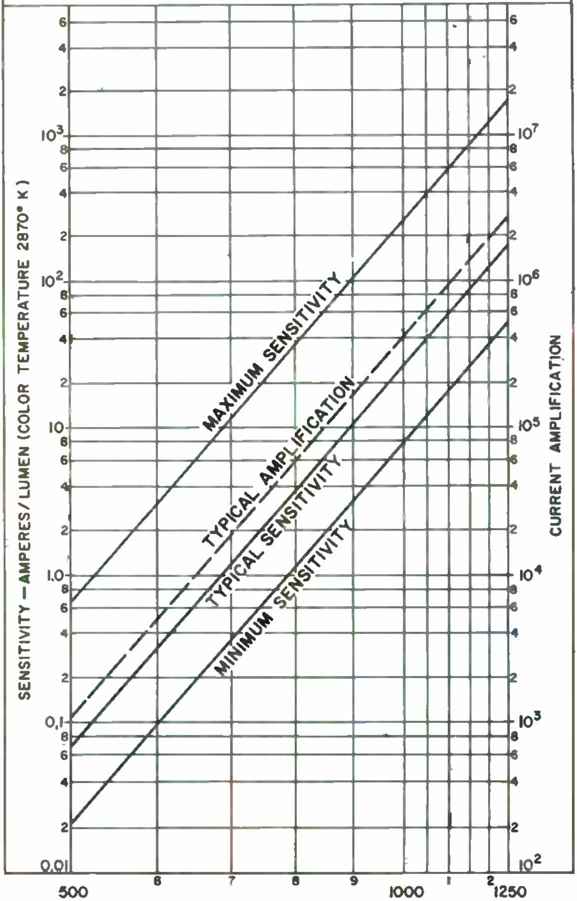
CHARACTERISTICS

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.



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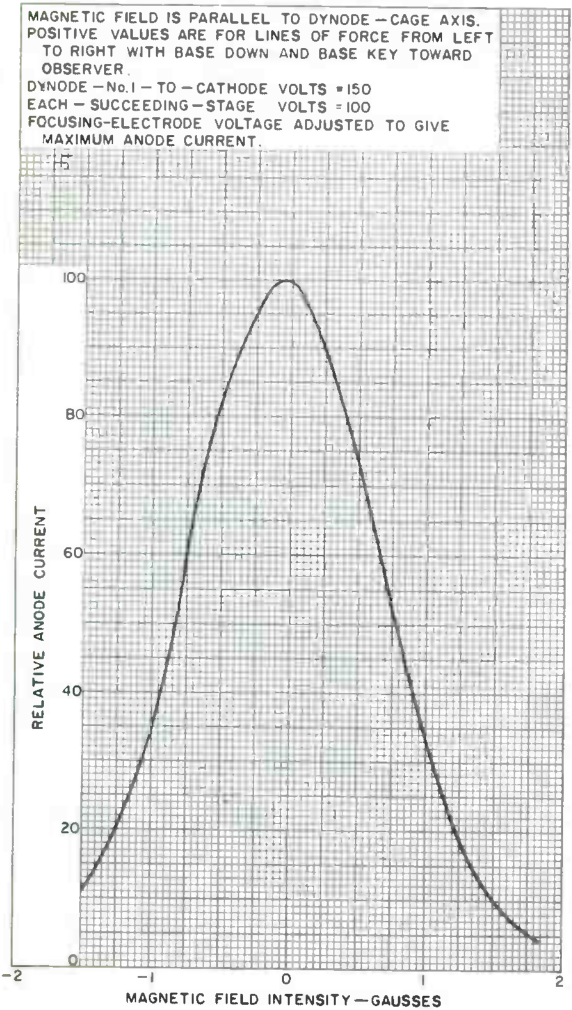
TYPICAL EFFECT OF MAGNETIC FIELD ON ANODE CURRENT



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6914
IMAGE-CONVERTER TUBE

MONOVOLTAGE TYPE HAVING S-1 RESPONSE

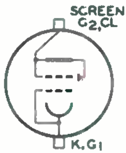
For use, in combination with suitable optical systems, in viewing a scene irradiated with near-infrared radiation

DATA

General:

Spectral Response	S-1
Wavelength of Maximum Response	8000 ± 1000 angstroms
Photocathode, Semitransparent:	
Shape	Circular
Minimum useful diameter	1.00"
Fluorescent Screen:	
Shape	Circular
Minimum useful diameter	0.86"
Phosphor	P20■, Aluminized
Fluorescence	Yellow-Green
Phosphorescence	Yellow-Green
Persistence	Medium-Short
Focusing Method (Self-focusing)	Electrostatic
Overall Length	2.92" ± 0.05"
Greatest Diameter (Excluding side tip)	1.88" ± 0.03"
Maximum Radius (Including side tip)	1.08"
Weight (Approx.)	3 oz
Operating Position	Any

Terminal Connections *(See Dimensional Outline)*:



CL - Collector

G_1 - Grid No.1 (Focusing Electrode)

G_2 - Grid No.2 (Focusing & Accelerating Electrode)

K - Photocathode

Maximum Ratings, ***Absolute-Maximum Values:***

FLUORESCENT-SCREEN VOLTAGE:□		
Peak instantaneous	17000 max.	volts
Average (DC)	16500 max.	volts
AVERAGE PHOTOCATHODE CURRENT (Continuous operation)*	0.35 max.	μa
AMBIENT TEMPERATURE	75 max.	°C

Characteristics:

At Ambient Temperature of 25° C

Fluorescent-Screen Voltage (DC)□	16000	volts
Median Paraxial Magnification Factor●	0.76	
Minimum Conversion Index†	15	
Minimum Resolution▲	25	line-pairs per mm

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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6914

6914

IMAGE-CONVERTER TUBE

Maximum Quotient** of Screen Background by Conversion Index. . . . . . 0.25 µlumen/sq.cm.

■ For Curves, *see front of Cathode-Ray Tube, Storage Tube, & Monoscope Section. See also Operating Considerations.*

□ Referred to photocathode.

* Averaged over any interval of 10 seconds maximum.

♦ Defined as the ratio of the linear size of the image on the fluorescent screen to the linear size of the image on the photocathode. The image on the photocathode consists of two parallel lines 0.08" long, each located 0.08" from the tube axis. Size of the image on the fluorescent screen is determined by measuring the spacing between the two parallel lines.

† Ratio of luminous flux from fluorescent screen to the product of the luminous flux incident on Corning No. 2540 Infrared Filter (Melt No. 1613, 2.61-mm thick), or equivalent, and the filter factor of 11.6 per cent. The light source is a tungsten-filament lamp operated at a color temperature of 2870° K.

▲ The resolution, both horizontally and vertically in a 0.15-inch-diameter circle centered on the photocathode, is determined with a pattern consisting of alternate black and white lines of equal width. Any two adjacent lines are designated as a "line-pair".

** The value of this quotient for any individual tube multiplied by the square of the magnification factor of the tube gives that value of the incident illumination from a 2870° K source required to produce an increase in screen brightness equal to the screen background.

OPERATING CONSIDERATIONS

The curves giving the *spectral-energy emission characteristic* and the *persistence characteristics* of phosphor P20 are located in the front of the Cathode-Ray Tube, Storage Tube, & Monoscope Section. Only persistence-characteristic curve A applies to the 6914.

Subjecting the 6914 to intense incident-radiation levels may temporarily decrease the tube's sensitivity even though there is no voltage applied. The magnitude and duration of this decrease depend on the length of exposure. Permanent damage to the tube may result if it is exposed to radiant energy so great as to cause excessive heating of the photocathode.

Support for the 6914 may be provided at the photocathode end by a cushioned arrangement and at the screen end by a suitable fixture which will exert adequate but not excessive pressure to hold the tube firmly against the cushion.

Connections to the two terminals of the tube, indicated on the *Dimensional Outline*, should not be soldered to the terminals. They may be made by spring fingers engaging the rim or the straight side of each terminal.

Magnetic shielding of the 6914 is required to minimize the effects of extraneous fields on tube performance. It is to be noted that ac magnetic fields are particularly objectionable in that they seriously impair tube resolution. If an iron or steel case is used, care should be taken in its construction to insure that the case is completely demagnetized.

The *high voltage at which the 6914 is operated may be very dangerous*. Great care should be taken in the design of apparatus to prevent the user from coming in contact with

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RCA

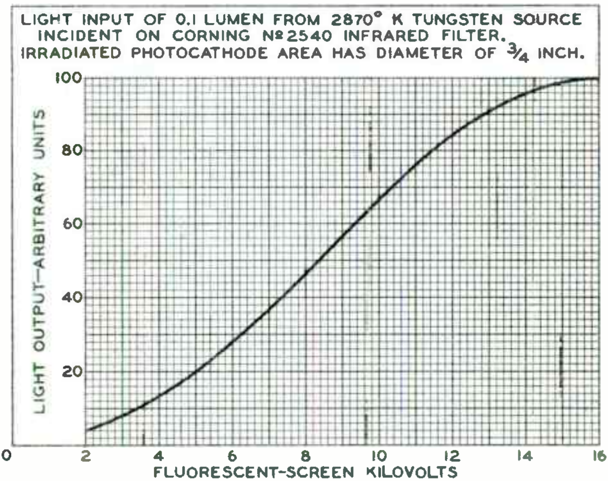
6914

IMAGE-CONVERTER TUBE

the high voltage. Precautions must include safeguards which eliminate all hazards to operating personnel. In the use of high-voltage tubes, such as the 6914, it should always be remembered that high voltage may appear at normally low-potential points in the circuit because of capacitor breakdown or incorrect circuit connections. Before any part of the circuit is touched, the voltage-supply switch should be turned off and both terminals of any capacitors connected to ground.

The curve showing the Spectral-Sensitivity Characteristic of Phototube having S-1 Response located at the front of this Section also applies to the 6914

AVERAGE CHARACTERISTIC



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ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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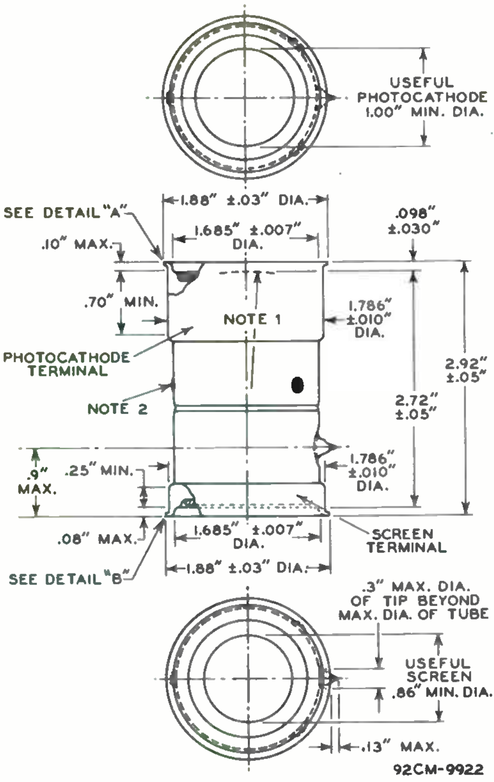
6914

IMAGE-CONVERTER TUBE



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

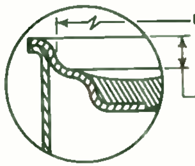
World Radio History

6914

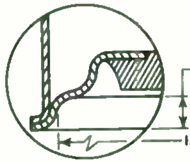
6914

IMAGE-CONVERTER TUBE

DETAIL A



DETAIL B



NOTE 1: RADIUS OF CURVATURE OF FACEPLATE IS 2.380" ± 0.005"; FACEPLATE THICKNESS AT CENTER IS 0.065" ± 0.004".

NOTE 2: THREE INSULATED LEAD TIPS WILL NOT EXTEND BEYOND MAXIMUM OUTSIDE DIAMETER OF TUBE. LEADS ARE USED ONLY DURING TUBE MANUFACTURE.

NOTE 3: DEPTH IS MEASURED TO TANGENT OF THE TWO RADII.

NOTE 4: DIAMETER IS MEASURED TO TANGENT OF THE TWO RADII.

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RCA

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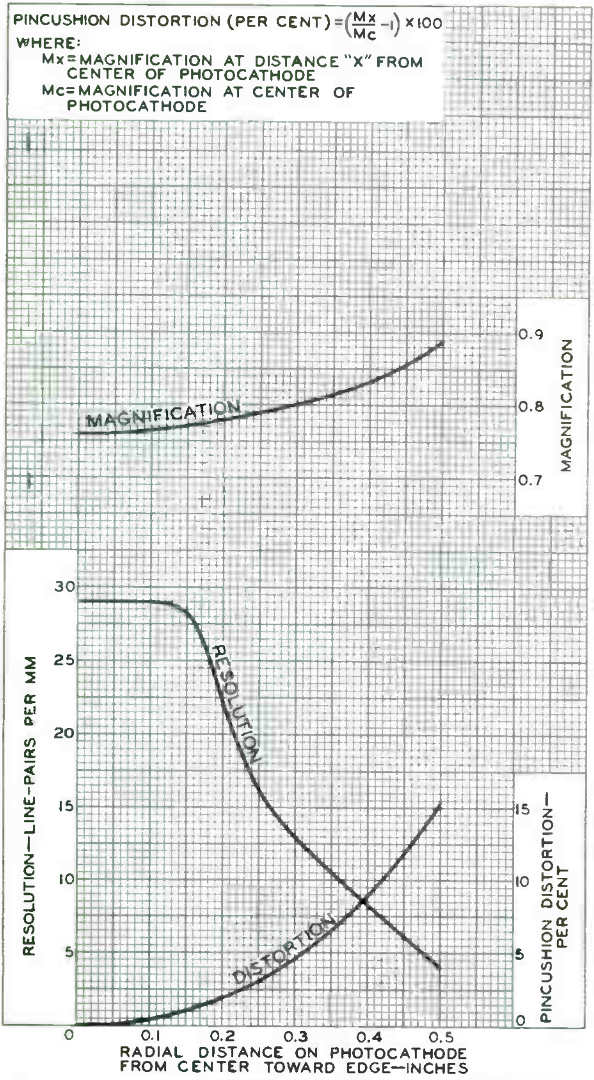
AVERAGE CHARACTERISTICS



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92CM-9920

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6914-A

IMAGE-CONVERTER TUBE

MONOVOLTAGE TYPE HAVING S-1 RESPONSE

For use, in combination with suitable optical systems, in viewing a scene irradiated with near-infrared radiation

The 6914-A is unilaterally interchangeable with the 6914.

The 6914-A is like the 6914 except that it is processed and tested to meet the following special-performance test:

Maximum luminous equivalent of infrared radiation for threshold visibility*. . 4.1×10^{-11} lumen

* Radiation from a tungsten lamp operating at a color temperature of 2870° K is passed through a Corning No.2540 Infrared Filter and focused to a point on the photocathode. The resulting image on the fluorescent screen is viewed by a dark-adapted eye through a 10-power ocular. The amount of infrared radiation for threshold visibility is determined by reducing the incident radiation until the image on the screen can just be discerned. The luminous equivalent of this amount of infrared radiation is the value of luminous flux from a 2870° K source which produces a response equal to that produced by the infrared radiation when both are measured with a receiver having S-1 spectral response.

World Radio History

World Radio History

Image-Converter Tube

SELF-FOCUSING, MONOVOLTAGE TYPE HAVING S-1 RESPONSE

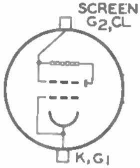
For Use, in Combination with Suitable Optical Systems, in Viewing a Scene Irradiated with Near-Infrared Radiation

GENERAL

Spectral Response	S-1
Wavelength of Maximum Response	8000 ± 1000 angstroms
Photocathode, Semitransparent	
Shape	Convexo-Concave
Minimum useful diameter	0.75 in
Flourescent Screen	
Shape	Plano-Plano
Minimum useful diameter	0.57 in
Phosphor	P20[a], Aluminized
Fluorescence	Yellow-Green
Phosphorescence	Yellow-Green
Persistence	Medium-Short
Focusing Method	Electrostatic
Overall Length	2.285 ± 0.050 in
Greatest Diameter	1.350 ± 0.025 in
Operating Position	Any
Weight (Approx.)	1.5 oz

TERMINAL DIAGRAM (See *Dimensional Outline*)

CL - Collector
G1 - Grid No.1 (Focusing Electrode)
G2 - Grid No.2 (Focusing & Accelerating Electrode)
K - Photocathode



DIRECTION OF INCIDENT RADIATION PERPENDICULAR TO PHOTOCATHODE END OF TUBE

MAXIMUM RATINGS, ABSOLUTE-MAXIMUM VALUES

Fluorescent-Screen Voltage[b]		
Peak instantaneous	13000	V
Average (DC)	12500	V
Average Photocathode Current		
Continuous operation[c]	0.35	μA
Ambient Temperature	75	°C

CHARACTERISTICS

At Ambient Temperature = 25° C

Fluorescent-Screen Voltage (DC)[b]	12000	V
Median Paraxial Magnification Factor[d]	0.75	
Minimum Conversion Index[e]	10	
Minimum Resolution[f]	25	line-pairs/mm
Maximum Quotient[g] of Screen Background by Conversion Index	0.33	μlm/sq cm

← Indicates a change.

World Radio History

[a] For curves, see front of Cathode-Ray Tube, Storage Tube, & Monoscope Section. See also *Operating Considerations*.

[b] Referred to photocathode.

[c] Averaged over any interval of 10 seconds maximum.

[d] Defined as the ratio of the linear size of the image on the fluorescent screen to the linear size of the image on the photocathode. The image on the photocathode consists of two parallel lines 0.08 inch long, each located 0.08 inch from the tube axis. Size of the image on the fluorescent screen is determined by measuring the spacing between the two parallel lines.

[e] Ratio of luminous flux from fluorescent screen to the product of the luminous flux incident on Corning No. 2540 Infrared Filter (Melt No. 1613, 2.61-mm thick), or equivalent, and the filter factor of 11.6 per cent. The light source is a tungsten filament lamp operated at a color temperature of 2870° K.

[f] The resolution, both horizontally and vertically in a 0.15-inch-diameter circle centered on the photocathode, is determined with a pattern consisting of alternate black and white lines of equal width. Any two adjacent lines are designated as a "line-pair".

[g] The value of this quotient for any individual tube multiplied by the square of the magnification factor of the tube gives that value of the incident illumination from a 2870° K source required to produce an increase in screen brightness equal to the screen background.

OPERATING CONSIDERATIONS

The curves giving the *spectral-energy emission characteristic* and the *persistence characteristics* of phosphor P20 are located in the front of the Cathode-Ray Tube, Storage Tube, & Monoscope Section. Only persistence-characteristic curve A applies to the 6929.

Subjecting the 6929 to intense incident-radiation levels may temporarily decrease the tube's sensitivity even though there is no voltage applied. The magnitude and duration of this decrease depend on the length of exposure. Permanent damage to the tube may result if it is exposed to radiant energy so great as to cause excessive heating of the photocathode.

Support for the 6929 may be provided at the photocathode end by a cushioned arrangement and at the screen end by a suitable fixture which will exert adequate but not excessive pressure to hold the tube firmly against the cushion.

Connections to the two terminals of the tube, indicated on the *Dimensional Outline*, should not be soldered to the terminals. They may be made by spring fingers engaging the rim or the straight side of each terminal.

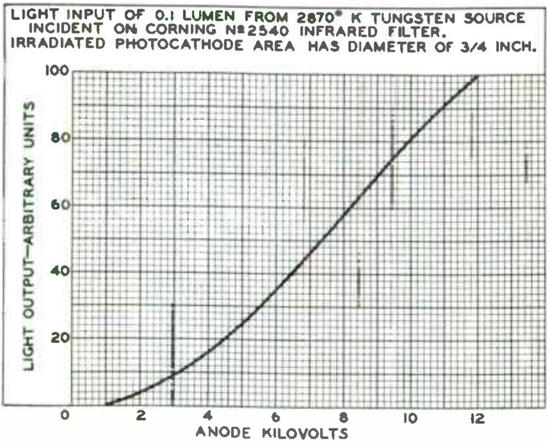
Magnetic shielding of the 6929 is required to minimize the effects of extraneous fields on tube performance. It is to be noted that ac magnetic fields are particularly objectionable in that they seriously impair tube resolution. If an iron or steel case is used, care should be taken in its construction to insure that the case is completely demagnetized.

World Radio History

The *high voltage at which the 6929 is operated may be very dangerous.* Great care should be taken in the design of apparatus to prevent the user from coming in contact with the high voltage. Precautions must include safeguards which eliminate all hazards to operating personnel. In the use of high-voltage tubes, such as the 6929, it should always be remembered that high voltage may appear at normally low-potential points in the circuit because of capacitor breakdown or incorrect circuit connections. Before any part of the circuit is touched, the voltage-supply switch should be turned off and both terminals of any capacitor connected to ground.

The curve showing the Spectral-Sensitivity Characteristic of Phototube having S-1 Response located at the front of this section also applies to the 6929

Average Characteristic



92CS-9981R1

World Radio History

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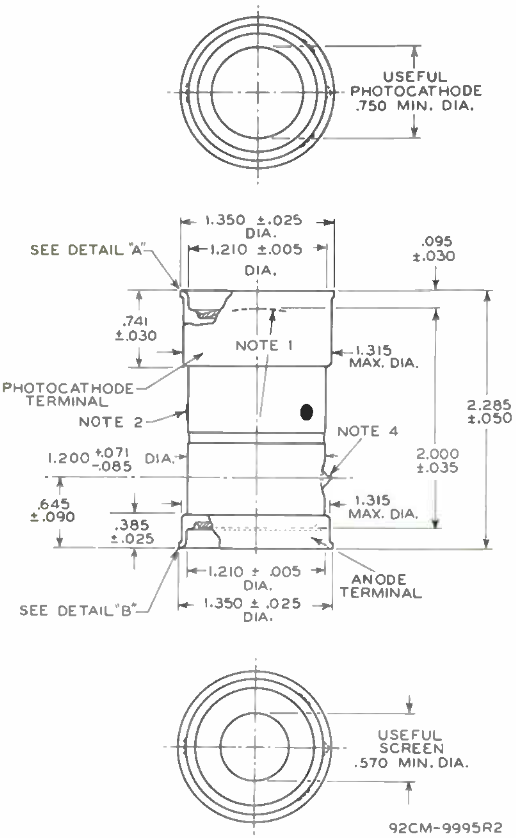
DIMENSIONAL OUTLINE



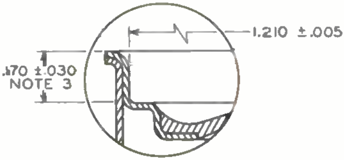
DIMENSIONS IN INCHES

→ Indicates a change.

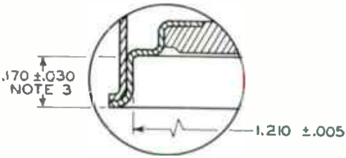
RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

World Radio History

DETAIL A



DETAIL B



DIMENSIONS IN INCHES

Note 1: Radius of curvature of faceplate is 1.230" ± 0.005"; faceplate thickness at center is 0.060" ± 0.004".

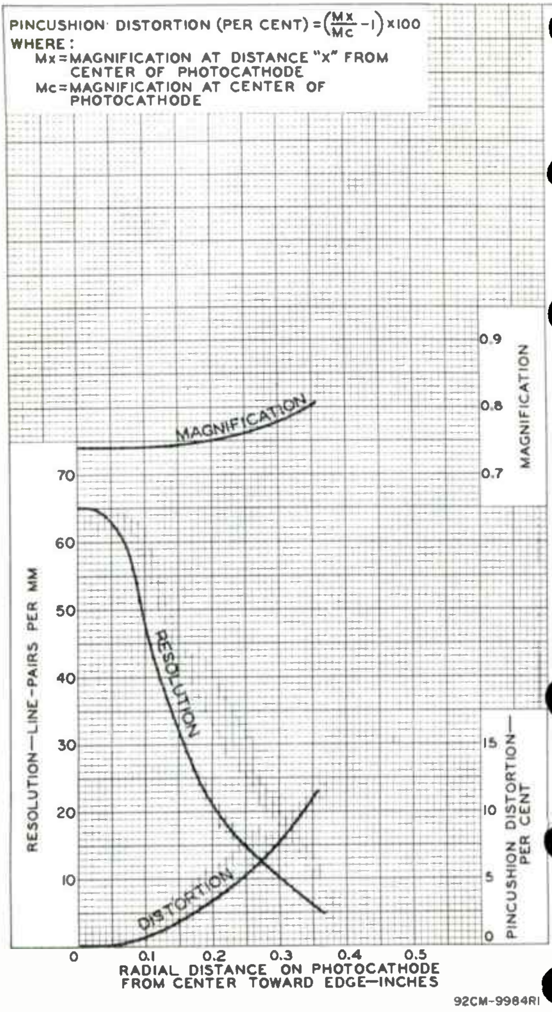
Note 2: Three insulated lead tips will not extend beyond maximum outside diameter of tube. Leads are used only during tube manufacture.

Note 3: Depth is measured to tangent of the two radii.

Note 4: Tip will not extend beyond maximum outside diameter of tube.

World Radio History

Average Characteristics



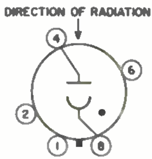
Gas Phototube

SIDE-ON TYPE HAVING UNOBSTRUCTED PHOTOCATHODE AREA AND S-1 RESPONSE

DATA

General:

Spectral Response	S-1
Wavelength of Maximum Response	8000 ± 1000 angstroms
Cathode:	
Shape	Semicylindrical
Minimum unobstructed projected length[a]	23/32"
Minimum unobstructed projected width[a]	9/16"
Direct Interelectrode Capacitance (Approx.)	3 μμf
Maximum Overall Length	3-1/16"
Maximum Seated Length	2-1/2"
Seated Length to Center of Cathode	1-5/8" ± 3/32"
Maximum Diameter	1-9/32"
Operating Position	Any
Weight (Approx.)	0.9 oz
Bulb	T9
Socket	Cinch No.8JM-1, or equivalent ←
Base	Intermediate-Shell Octal 5-Pin Arrangement 1, (JEDEC No.B5-10)
Basing Designation for BOTTOM VIEW	3J



Pin 1 - No Connection
Pin 2 - No Connection
Pin 4 - Anode
Pin 6 - No Connection
Pin 8 - Photocathode

Maximum Ratings, *Absolute-Maximum Values:*

	Rating I	*Rating II*	
ANODE-SUPPLY VOLTAGE (DC or Peak AC)	70 max.	90 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[b]	60 max.	30 max.	μa/sq. in.
AVERAGE CATHODE CURRENT[b]	6 max.	3 max.	μa
AMBIENT TEMPERATURE	100 max.	100 max.	°C

Characteristics: ←

With an anode-supply voltage of 90 volts unless otherwise specified

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 8000 angstroms	–	0.019	–	amp/watt

← Indicates a change.

World Radio History

	Min.	Median	Max.	
Luminous:[c]				
At 0 cps.	140	200	330	μa/lumen
At 5000 cps	–	165	–	μa/lumen
At 10000 cps.	–	150	–	μa/lumen
Gas Amplification Factor[d] . . .	–	–	10	
Anode Dark Current at 25° C . .	–	–	0.1	μa

Minimum Circuit Values:

With an anode-supply voltage of	*70 or less*	*90*	*volts*
DC Load Resistance:			
For dc currents above 3 μa.	0.1 min.	–	megohm
For dc currents below 3 μa.	0 min.	–	megohms
For dc currents above 2 μa.	–	2.5 min.	megohms
For dc currents below 2 μa.	–	1 min.	megohm

[a] On plane perpendicular to indicated direction of incident radiation.

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

[c] For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A dc anode supply voltage of 90 volts and a 1-megohm load resistor are used. For the 0-cycle measurement, a light input of 0.1 lumen is used. For the 5000- and 10,000-cycle measurements, the light input is varied sinusoidally about a mean value of 0.015 lumen from zero to a maximum of twice the mean value.

[d] The ratio of luminous sensitivity at an anode supply voltage of 90 volts to luminous sensitivity at an anode supply voltage of 25 volts. In each case, sensitivity is obtained under conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K, the light input is 0.1 lumen, and the load resistor has a value of 1 megohm.

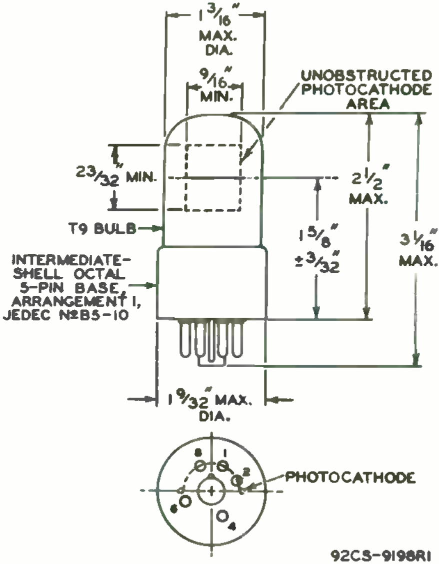
SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOSENSITIVE DEVICE HAVING S-1 RESPONSE

and

FREQUENCY-RESPONSE CHARACTERISTICS
OF GAS PHOTOTUBES

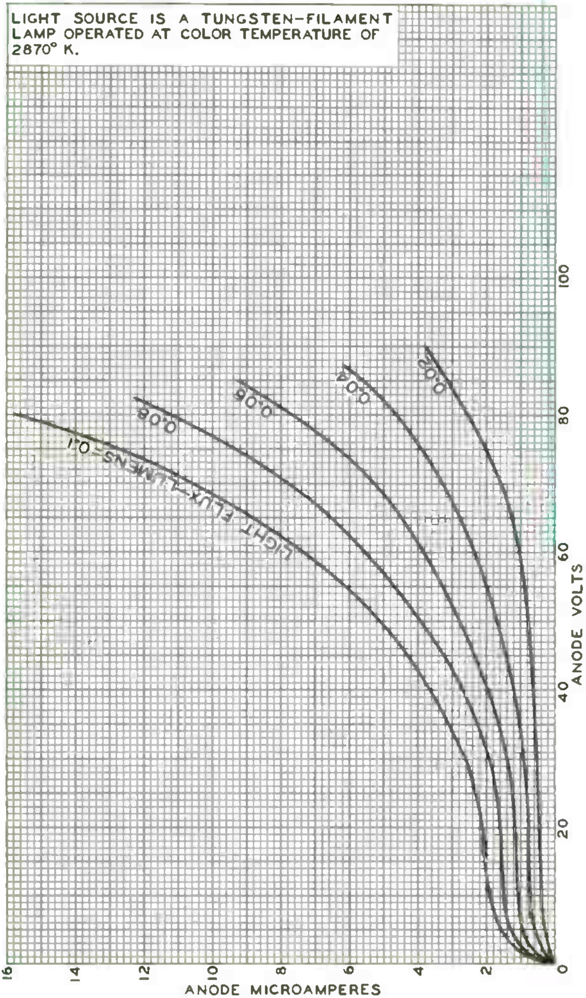
are shown at the front of this section

World Radio History



World Radio History

AVERAGE ANODE CHARACTERISTICS



92CM-9226

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Vidicon

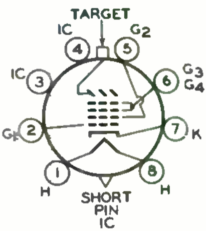
MAGNETIC FOCUS | **1" Diameter** | **MAGNETIC DEFLECTION**

For Live and Film Pickup With Color or Black-and-White TV Cameras

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at heater volts = 6.3	0.6	amp
Direct Interelectrode Capacitance:[a]		
Target to all other electrodes	4.6	pf
Spectral Response	See Accompanying *Curves*	
Photoconductive Layer:		
Maximum useful diagonal of rectangular image (4 x 3 aspect ratio)[b]	0.62"	
Focusing Method	Magnetic	
Deflection Method	Magnetic	
Overall Length	6.25" ± 0.25"	
Greatest Diameter	1.125" ± 0.010"	
Operating Position	Any	
Weight (Approx.)	2 oz	
Bulb	T8	
Focusing Coil	Cleveland Electronics[c,d] No.VF-115-5, or equivalent	
Deflecting Yoke	Cleveland Electronics[c,d] No.VY-111-3, or equivalent	
Alignment Coil	Cleveland Electronics[c,d] No.VA-118, or equivalent	
Socket	Cinch[e] No.54A18088, or equivalent	
Base	Small-Button Ditetrar 8-Pin (JEDEC No.E8-11)	
Basing Designation for BOTTOM VIEW	8HM	

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Do Not Use
Pin 4 – Do Not Use
Pin 5 – Grid No.2
Pin 6 – Grid No.3 & No.4
Pin 7 – Cathode
Pin 8 – Heater
Flange – Target
Short Pin – Do Not Use



DIRECTION OF LIGHT: INTO FACE END OF TUBE

Maximum Ratings, ***Absolute-Maximum Values:***

For scanned area of 1/2" x 3/8"

Grid-No.3 & Grid-No.4 Voltage	750 max.	volts
Grid-No.2 Voltage	750 max.	volts
Grid-No.1 Voltage:		
Negative-bias value	300 max.	volts ←
Positive-bias value	0 max.	volts

← Indicates a change.

World Radio History

Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	10 max.	volts
Dark Current	0.25 max.	μa
Peak Target Current	0.55 max.	μa
Faceplate:		
Illumination	1000 max.	fc
➔ Temperature	71 max.	°C

Typical Operation:

For scanned area of 1/2" x 3/8" and faceplate temperature of 30° to 35° C

Grid-No.4 (Decelerator) & Grid-No.3 (Beam-Focus Electrode[f]) Voltage	250[g] to 300	volts
Grid-No.2 (Accelerator) Voltage	300	volts
Grid-No.1 Voltage for picture cutoff[h]	-45 to -100	volts
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μa and 0.2 μa	0.65	
Visual Equivalent Signal-to-Noise Ratio (Approx.)[j]	300:1	
Minimum Peak-to-Peak Blanking Voltage:		
When applied to grid No.1	75	volts
When applied to cathode	20	volts
Field Strength at Center of Focusing Coil (Approx.)	40	gauss
Field Strength of Adjustable Alignment Coil[k]	0 to 4	gauss

Maximum-Sensitivity Operation for Live-Scene Pickup

Faceplate Illumination (Highlight)	2	fc
Maximum Target Voltage required to produce dark current of 0.2 μa in any tube[m]	110	volts
Target Voltage[n]	60 to 100	volts
Dark Current[p]	0.2	μa
Target Current (Highlight)[q]	0.4 to 0.5	μa
Signal-Putput Current:[r]		
Peak	0.2 to 0.3	μa
Average	0.08 to 0.1	μa

Average-Sensitivity Operation for Live-Scene Pickup

Faceplate Illumination (Highlight)	15	fc
Maximum Target Voltage required to produce dark current of 0.02 μa in any tube[m]	60	volts
Target Voltage[n]	30 to 50	volts
Dark Current	0.02	μa
Target Current (Highlight)[q]	0.3 to 0.4	μa
Signal-Output Current:[r]		
Peak	0.3 to 0.4	μa
Average	0.1 to 0.2	μa

➔ Indicates a change.

Minimum-Lag Operation for Film Pickup

Faceplate Illumination (Highlight). . . .	100	fc
Maximum Target Voltage required to produce dark current of 0.004 μa in any tube[m].	30	volts
Target Voltage[n]	15 to 25	volts
Dark Current.	0.004	μa
Target Current (Highlight)[q]	0.3 to 0.4	μa
Signal-Output Current:[r]		
Peak.	0.3 to 0.4	μa
Average	0.1 to 0.2	μa

[a] This capacitance, which effectively is the output impedance of the 7038, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms.

[b] Proper orientation of quality rectangle is obtained when the horizontal scan is essentially parallel to the straight sides of the masked portions of the faceplate. The straight sides are parallel to the plane passing through the tube axis and short pin. The masking is for orientation only and does not define the proper scanned area of photoconductive layer.

[c] Cleveland Electronics Inc., 1974 East 61st St., Cleveland, Ohio.

[d] These components are chosen to provide tube operation with minimum beam-landing error.

[e] Cinch Manufacturing Corp., 1026 South Homan Avenue, Chicago 24, Ill.

[f] Beam focus is obtained by combined effect of grid-No.3 voltage which should be adjustable over indicated range, and a focusing coil having an average field strength of 40 gauss.

[g] Definition, focus uniformity, and picture quality decrease with decreasing grid-No.4 and grid-No.3 voltage. In general, grid No.4 and grid No.3 should be operated above 250 volts.

[h] With no blanking voltage on grid No.1.

[j] Measured with high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of highlight video-signal current to rms noise current, multiplied by a factor of 3.

[k] The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

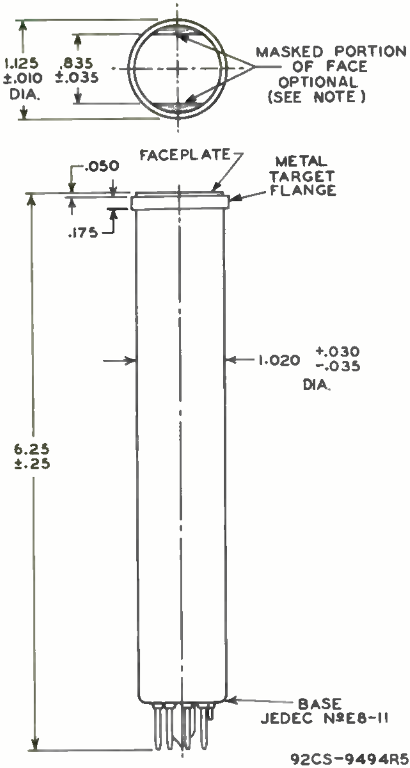
[m] The target voltage for each 7038 must be adjusted to that value which gives the desired operating dark current.

[n] Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

[p] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

[q] Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

[r] Defined as the component of the target current after the dark-current component has been substracted.

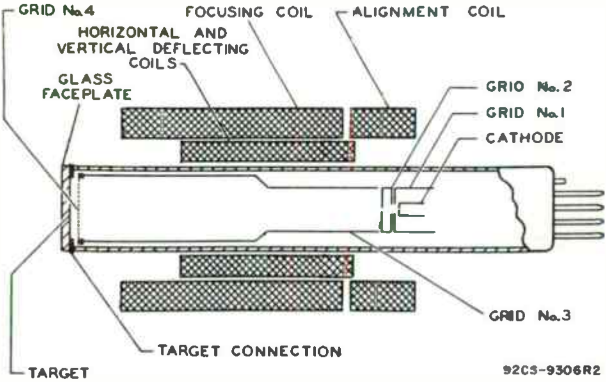


DIMENSIONS IN INCHES

Note: Straight sides of masked portions are parallel to the plate passing through tube axis and short pin.

→ Indicates a change.

SCHEMATIC ARRANGEMENT

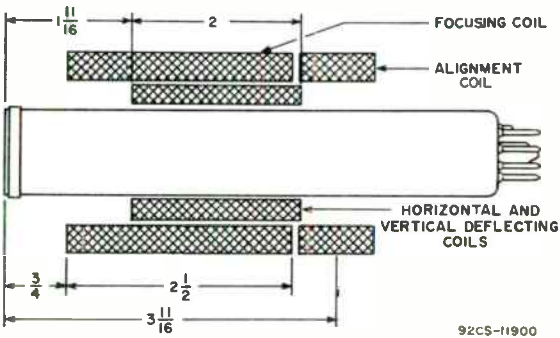


Alignment of the beam is accomplished by a transverse magnetic field produced by external coils located at the base end of the focusing coil.

Deflection of the beam is accomplished by transverse magnetic fields produced by external deflecting coils.

RECOMMENDED LOCATION AND LENGTH OF DEFLECTING, FOCUSING, AND ALIGNMENT COMPONENTS

For Minimum Beam-Landing Error

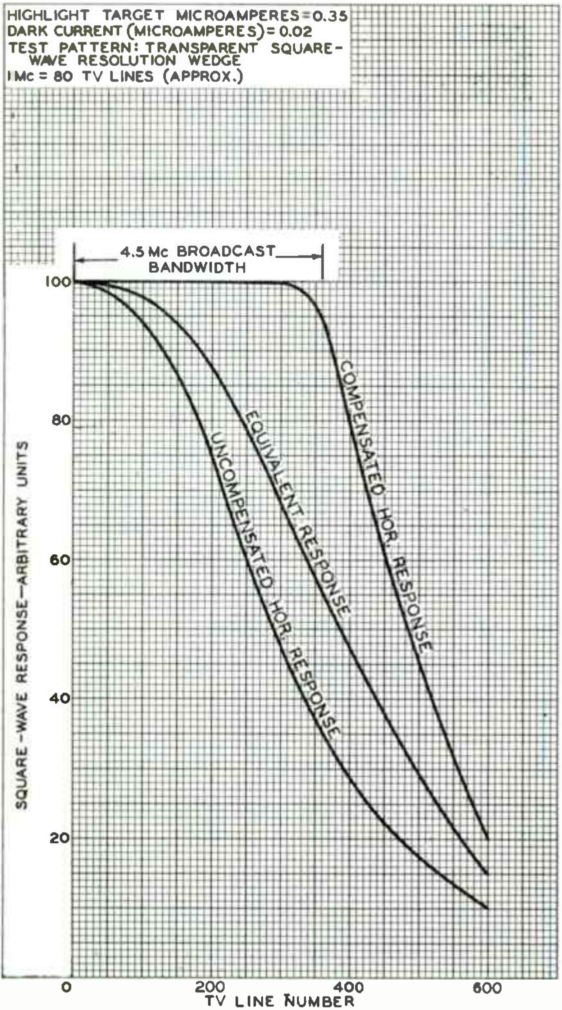


DIMENSIONS IN INCHES

The *deflecting yoke and focusing coil* used with the 7038 are designed to cause the scanning beam to land perpendicularly to the target at all points of the scanned area with minimum beam-landing error and resultant superior uniformity of sensitivity and focus over the scanned area.

World Radio History

HORIZONTAL & EQUIVALENT SQUARE-WAVE RESPONSE CHARACTERISTICS



92CM-8117R1

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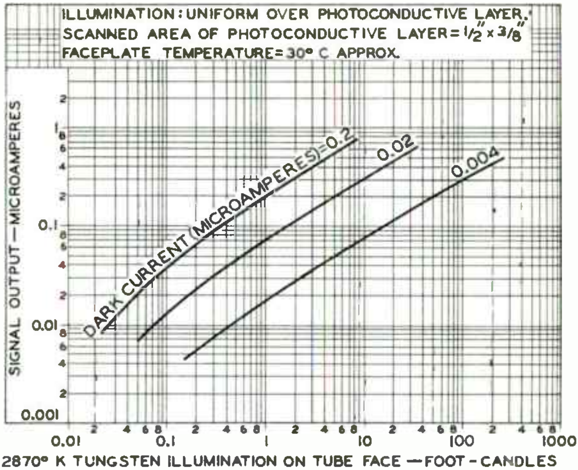
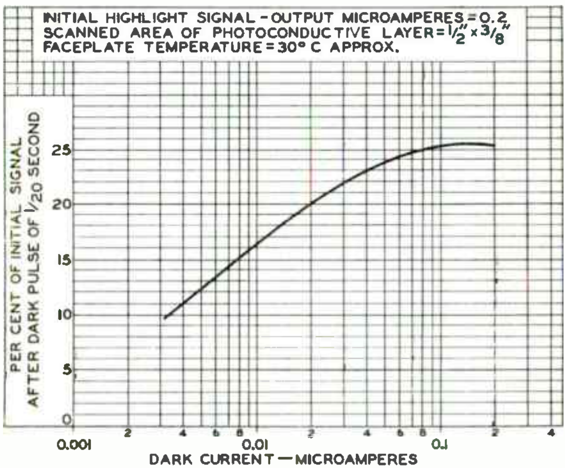
TYPICAL LIGHT-TRANSFER CHARACTERISTICS



92CS-9495

TYPICAL PERSISTENCE CHARACTERISTIC



92CS-9504R1

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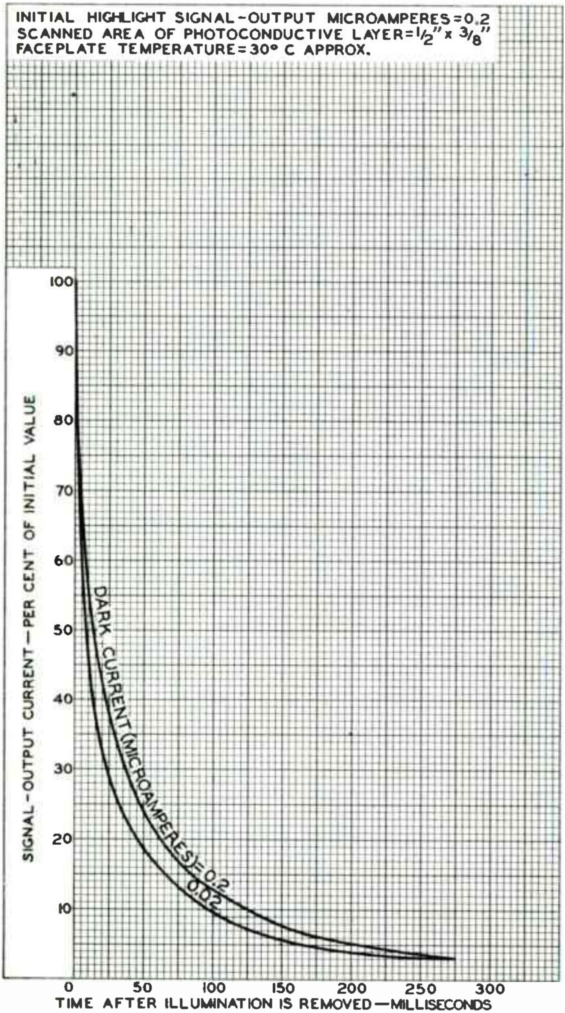
TYPICAL PERSISTENCE CHARACTERISTICS



92CM-9505R1

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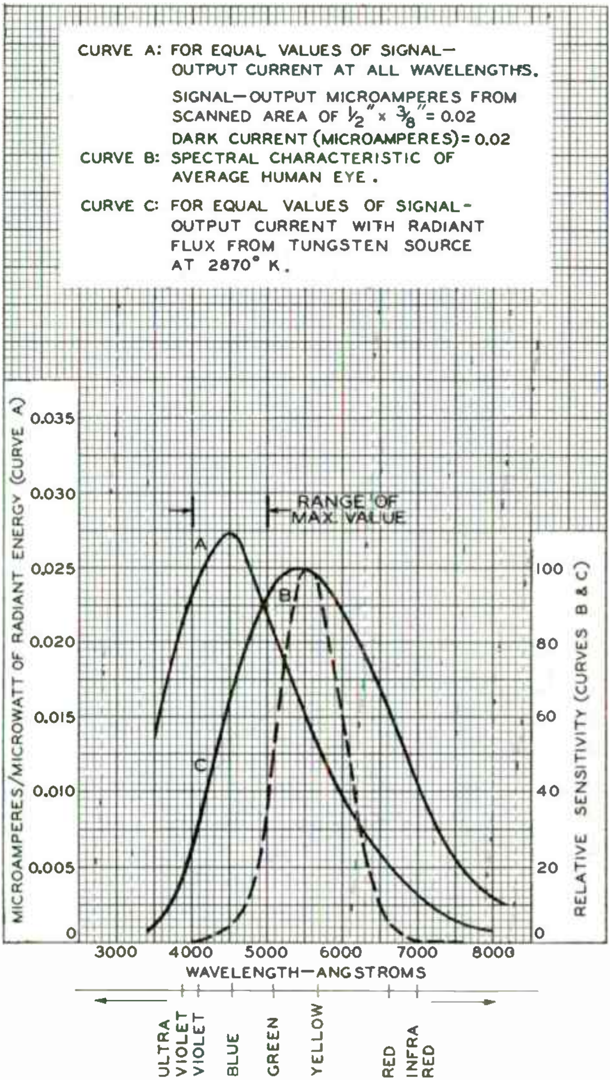
7038

SPECTRAL-SENSITIVITY CHARACTERISTICS



ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7783R2

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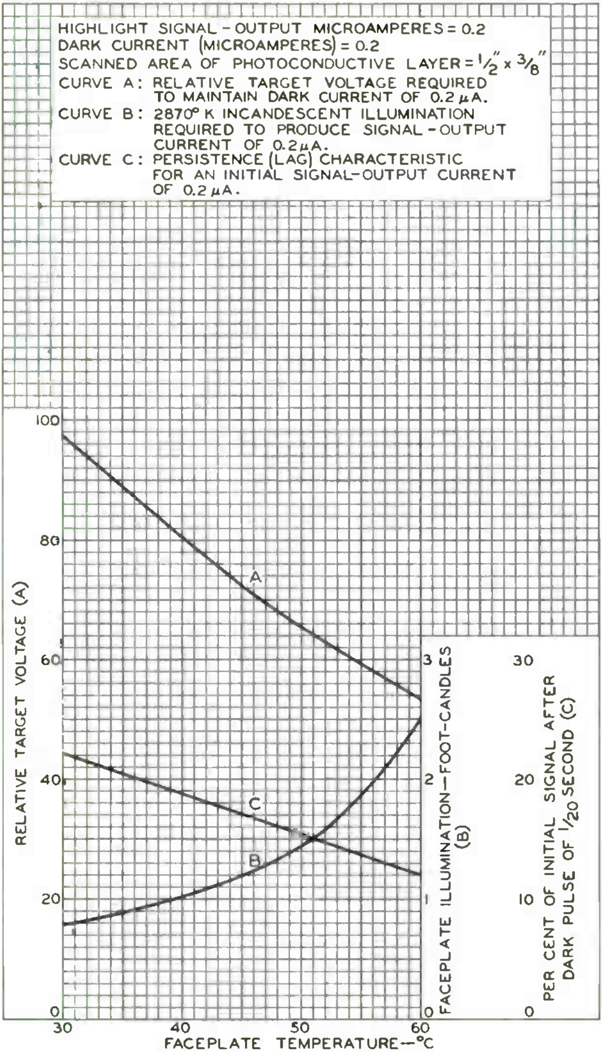
TYPICAL CHARACTERISTICS



ELECTRON TUBE DIVISION 92CM-9499

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7038

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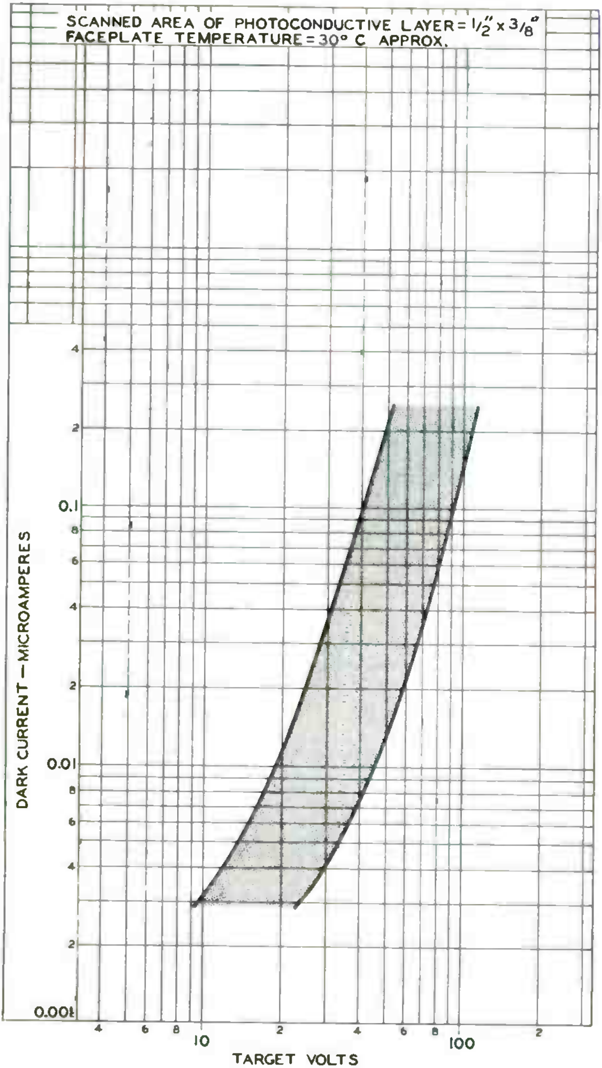
7038

DARK-CURRENT RANGE



ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

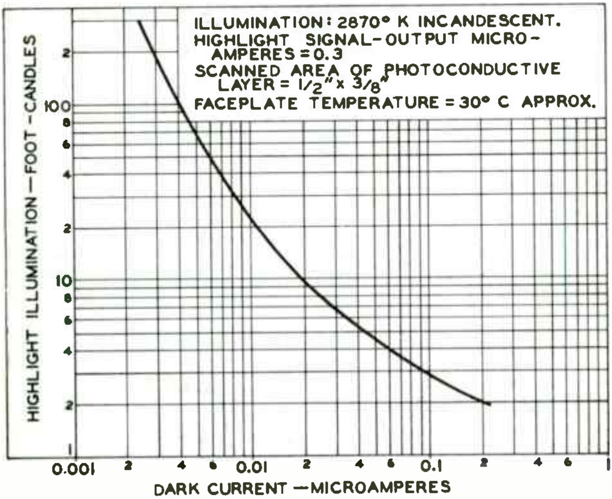
92CM-9497

World Radio History

7038

7038

TYPICAL CHARACTERISTIC



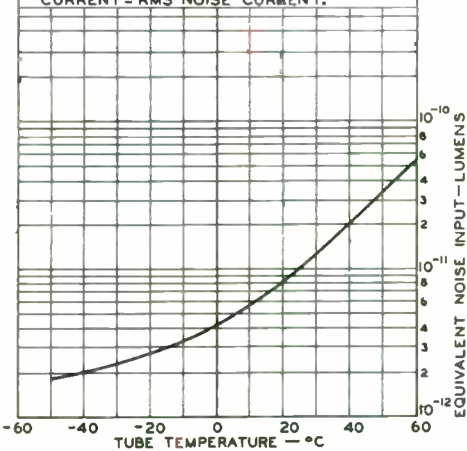
92CS-9493

World Radio History

7046

EQUIVALENT-NOISE-INPUT CHARACTERISTIC

CATHODE-TO-GRID-No2 VOLTS=1215
GRID-No2-TO-DYNODE-No2 (DY_2) VOLTS=212
DY_1-TO-DY_2, DY_2-TO-DY_3, ETC. THRU DY_{14}-TO-ANODE VOLTS=106
GRID-No1 VOLTAGE, GRID-No3 VOLTAGE, AND DY_1 VOLTAGE ADJUSTED FOR MAXIMUM ANODE CURRENT.
BANDWIDTH (CPS) = 1
LIGHT SOURCE: TUNGSTEN AT 2870° K INTERRUPTED AT 90 CPS TO PRODUCE PULSES ALTERNATING BETWEEN ZERO AND FLUX VALUE SHOWN FOR ANY GIVEN TUBE TEMPERATURE; "ON" PERIOD OF PULSE EQUAL TO "OFF" PERIOD; RMS SIGNAL CURRENT = RMS NOISE CURRENT.



92CS-9376

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

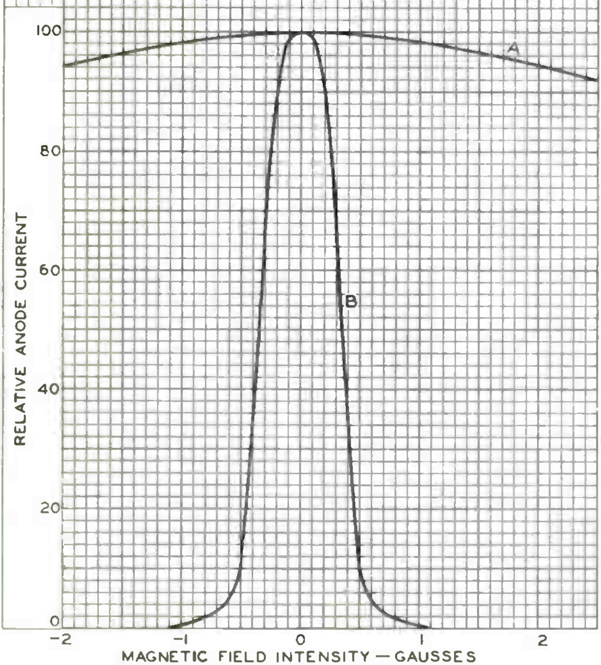
7046

7046

EFFECT OF MAGNETIC FIELD ON ANODE CURRENT

CATHODE-TO-GRID-Nº2 VOLTS=1215
GRID-Nº2-TO-DYNODE-Nº2 (DY_2) VOLTS=212
DY_1-TO-DY_2, DY_2-TO-DY_3, ETC. THRU DY_{14}-TO-ANODE VOLTS=106
GRID-Nº1 VOLTAGE, GRID-Nº3 VOLTAGE, AND DY_1 VOLTAGE ADJUSTED FOR MAXIMUM ANODE CURRENT.
MAGNETIC FIELD IS PERPENDICULAR TO DYNODE SPACERS AND IS CENTERED BETWEEN CATHODE & DYNODE Nº1.
POSITIVE VALUES ARE FOR LINES OF FORCE FROM RIGHT TO LEFT WITH INDEX PIN OF BASE TOWARD RIGHT OF OBSERVER.

CURVE	CONDITION
A	WITH EXTERNAL SHIELD MILLEN Nº80805P, OR EQUIVALENT.
B	WITHOUT EXTERNAL SHIELD.



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9379R1

World Radio History

7102

7102

MULTIPLIER PHOTOTUBE

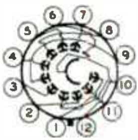
10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE WITH
1.24"-DIAMETER FLAT, SEMITRANSPARENT CATHODE AND S-1 RESPONSE
CAPABLE OF VERY SHORT TIME-RESOLUTION

DATA

General:

Spectral Response	S-1
Wavelength of Maximum Response	8000 ± 1000 angstroms
Cathode, Semitransparent:	
Shape	Flat Circular
Window:	
Area	1.2 sq. in.
Minimum diameter	1.24 in.
Index of refraction	1.51
Direct Interelectrode Capacitances (Approx.):	
Anode to dynode No.10	4 μμf
Anode to all other electrodes	7 μμf
Maximum Overall Length	4.57"
Seated Length	3.88" ± 0.19"
Maximum Diameter	1.56"
Operating Position	Any
Weight (Approx.)	2 oz
Bulb	T12
Socket	Eby No.9058, or equivalent
Base	Small-Shell Duodecal 12-Pin (JETEC No.B12-43), Non-hygroscopic
Basing Designation for BOTTOM VIEW	12AE

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 - Cathode

DIRECTION OF INCIDENT RADIATION: INTO END OF BULB

Maximum Ratings, *Absolute Values:*

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	1500 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE (DC or Peak AC)	250 max.	volts
SUPPLY VOLTAGE BETWEEN CATHODE AND DYNODE No.1 (DC or Peak AC)	400 max.	volts
AVERAGE ANODE CURRENT•	10 max.	μa
AMBIENT TEMPERATURE	75 max.	°C

•: See next page.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

7102

MULTIPLIER PHOTOTUBE

Characteristics Range Values for Equipment Design:

Under conditions with 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

With E = 1250 volts (except as noted)

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 8000 angstroms . .	–	400	–	μa/μw
Cathode radiant, at 8000 angstroms . .	–	0.0027	–	μa/μw
Luminous:♦				
At 0 cps	1	4.5	30	amp/lumen
With dynode No.10 as output electrode* . . .	–	2.7	–	amp/lumen
Cathode luminous:				
With tungsten light source▲. .	10	30	–	μa/lumen
With infrared source⊛⧫	0.012	0.036	–	μa
Current Amplification.	–	150000	–	
Equivalent Anode-Dark-Current Input✱.	–	3×10^{-7}	5×10^{-6}	lumen
	–	3.3×10^{-9}†	5.5×10^{-8}†	watt
Equivalent Noise Input★	–	1.5×10^{-10}	7.5×10^{-10}	lumen
	–	1.7×10^{-12}†	8.4×10^{-12}†	watt

With E = 1500 volts (except as noted)

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 8000 angstroms . .	–	1250	–	μa/μw
Cathode radiant, at 8000 angstroms . .	–	0.0027	–	μa/μw
Luminous:♦				
At 0 cps	–	14	–	amp/lumen
With dynode No.10 as output electrode*	–	8.4	–	amp/lumen
Cathode Luminous:				
With tungsten light source▲. .	10	30	–	μa/lumen
With infrared source⊛⧫	0.012	0.036	–	μa
Current Amplification.	–	465000	–	

● Averaged over any interval of 30 seconds maximum.

♦,*,▲,⊛,⧫,✱,★,†: See next page.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

7102

MULTIPLIER PHOTOTUBE

● For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A light input of 10 microlumens is used. The load resistance has a value of 0.01 megohm.

* 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.

▲ For conditions the same as shown under (●) except that the value of light flux is 0.01 lumen and 150 volts are applied between cathode and all other electrodes connected together as anode.

⊕ Under the following conditions: 2870° K tungsten light source; light flux of 0.01 lumen incident on Corning No.2540 Infrared Filter (Melt 1613, 2.61 mm thick, or equivalent); irradiated area of photocathode is 1.24 inch in diameter.

◆ For spectral characteristic of this source, see sheet SPECTRAL CHARACTERISTIC OF 2870° K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870° K SOURCE AFTER PASSING THROUGH INDICATED INFRARED FILTER at front of this section.

✺ Measured at a tube temperature of 25° C and with the supply voltage (E) adjusted to give a luminous sensitivity of 4 amperes per lumen. Dark current caused by thermionic emission and ion feedback may be reduced by the use of a refrigerant.

★ Under the following conditions: Supply voltage (E) 1250 volts, 25° C tube temperature, ac-amplifier bandwidth of 1 cycle per second, tungsten light source at 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. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

† Measured at 8000 angstroms.

OPERATING CONSIDERATIONS

The 7102 is capable of very short time-resolution. For an input pulse having a duration of 1 millimicrosecond or less, the time spread of the pulse at the anode is about 5 millimicroseconds measured at 50 per cent of the maximum pulse height. This time spread corresponds to an electron transit-time spread of about 4 millimicroseconds. The transit-time spread can be reduced to about 2 millimicroseconds by irradiating only a small central area of the photocathode.

When stability of operation is important, the use of an average anode current well below the maximum rated value of 10 microamperes is recommended. This maximum rating should never be exceeded because operation at higher average output currents may cause a permanent decrease in infrared sensitivity and a consequent decrease in tube life.

A small temporary loss of infrared sensitivity may be observed after long periods of operation. The sensitivity recovers during idle periods but only very slowly at temperatures below 25° C.

Electrostatic and/or magnetic shielding of the 7102 may be necessary.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-1 Response
is shown at front of this Section

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

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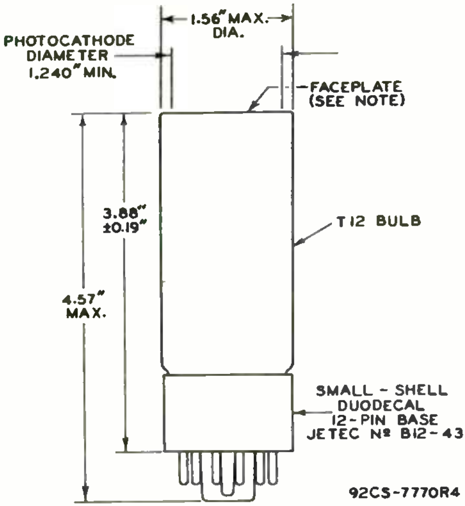
7102

MULTIPLIER PHOTOTUBE



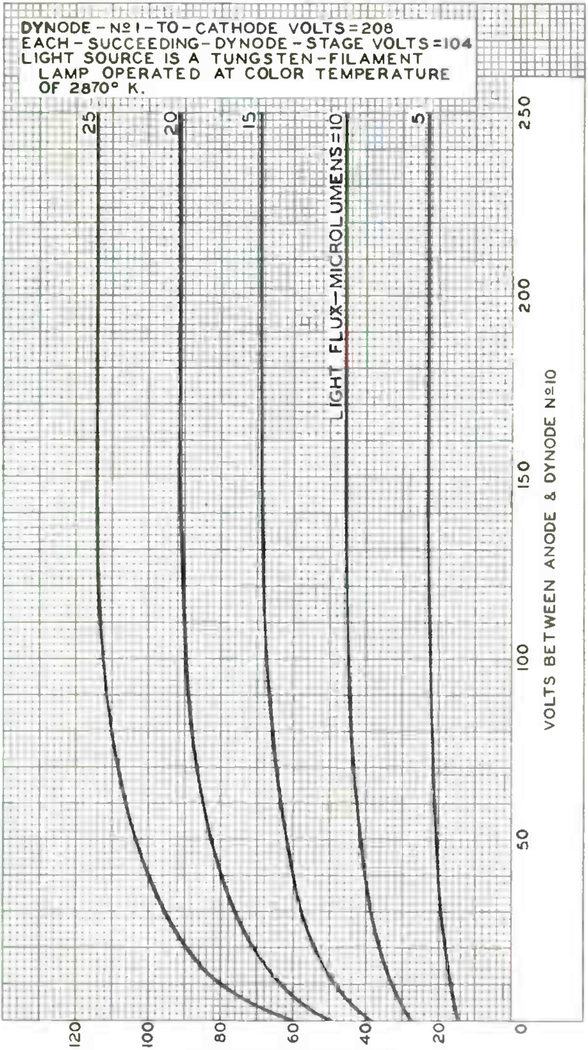
NOTE: WITHIN 1.24" DIAMETER, DEVIATION FROM FLATNESS OF EXTERNAL SURFACE OF FACEPLATE WILL NOT EXCEED 0.010" FROM PEAK TO VALLEY.

℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

World Radio History

7102

AVERAGE ANODE CHARACTERISTICS



ELECTRON TUBE DIVISION

92CM-9460R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

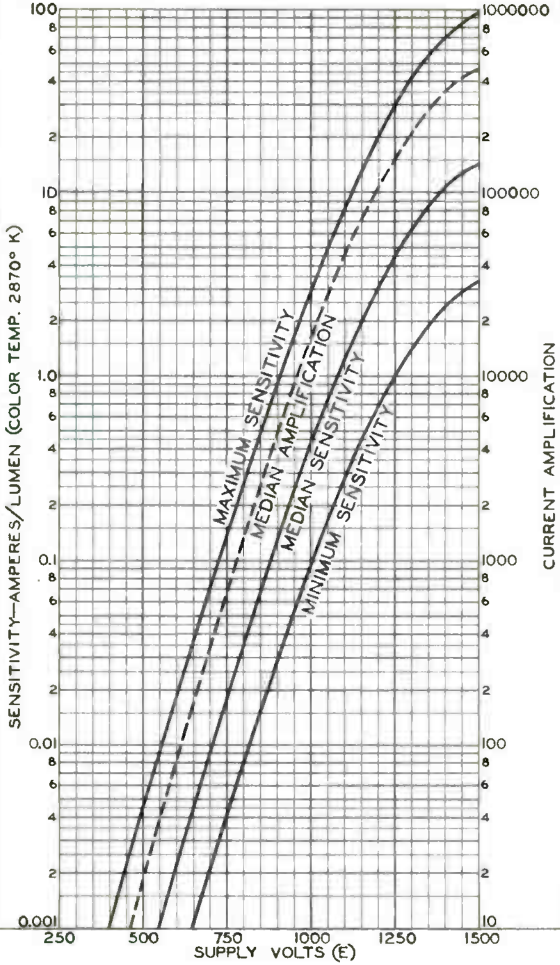
World Radio History

RCA

7102

CHARACTERISTICS

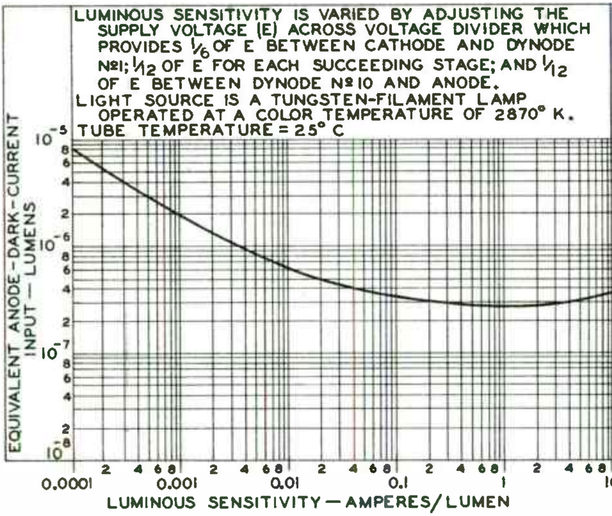
SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER PROVIDING 1/6 OF E BETWEEN CATHODE AND DYNODE No 1; 1/12 OF E FOR EACH SUCCEEDING DYNODE STAGE; AND 1/12 OF E BETWEEN DYNODE No 10 AND ANODE.



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

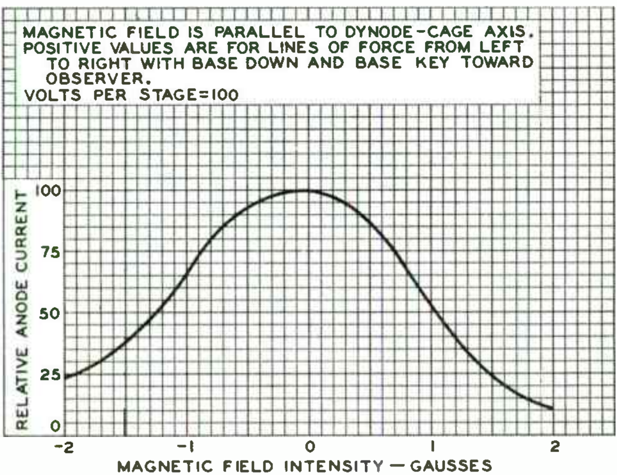
92CL-9455

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



92CS-9459

EFFECT OF MAGNETIC FIELD ON ANODE CURRENT



92CS-7813V

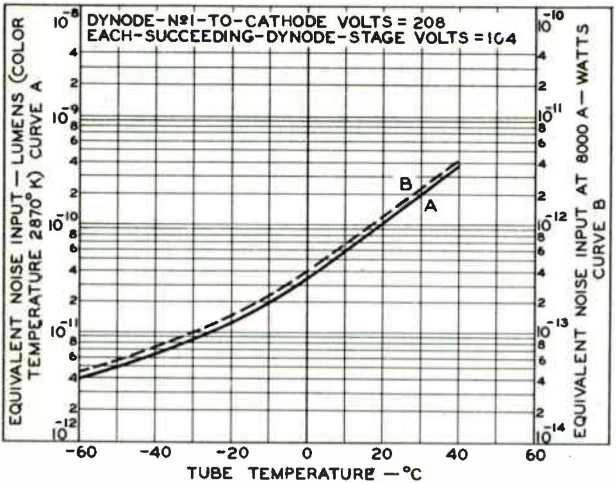
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

7102

EQUIVALENT-NOISE-INPUT CHARACTERISTICS



92CS-9462

World Radio History

Photomultiplier Tube

9-STAGE, SIDE-ON TYPE HAVING S-4 RESPONSE

For DC-Operated Control Applications Such as Automobile-Headlight Control

GENERAL

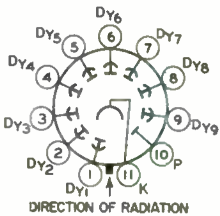
Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 angstroms
Cathode, Opaque	Cs-Sb ←
Minimum projected length[a]	0.93 in
Minimum projected width[a]	0.31 in
Window	Lime Glass, (Corning[b] No.0080), or equivalent ←
Dynode Material	Cs-Sb ←
Direct Interelectrode Capacitances (Approx.)	
Anode to dynode No.9	4.2 pF
Anode to all other electrodes	5.5 pF
Maximum Overall Length	3.12 in
Maximum Seated Length	2.69 in
Length	1.56 ± 0.09 in
From base seat to center of useful cathode area	
Maximum Diameter	1.31 in
Operating Position	Any
Weight (Approx.)	1.6 oz
Envelope	JEDEC T9
Base	Small-Shell Neosubmagnal 11-Pin (JEDEC No.B11-104), Non-hygroscopic
Socket	Amphenol[c] No.78S11T, or equivalent
Magnetic Shield	Millen[d] No.80801B, or equivalent

ABSOLUTE-MAXIMUM RATINGS

DC Supply Voltage	
Between anode and cathode	1250 V
Between dynode No.9 and anode	250 V
Between consecutive dynodes	250 V ←
Between dynode No.1 and cathode	250 V ←
Average Anode Current[e]	0.1 mA
Ambient Temperature	75 °C

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 – Photocathode



11K

← Indicates a change.

World Radio History

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 V (except as noted)

	Min	Typ	Max	
Sensitivity				
→ Radiant, at 4000 angstroms. . .	-	3.4×10^4	-	A/W
Luminous, at 0 c/s[f]	-	34	-	A/lm
→ **Electrode Dark Current**				
At 25°C				
At anode.	-	-	1×10^{-7}	A
At any other electrode. . . .	-	-	7.5×10^{-7}	A

With E = Adjustable dc voltage

	Min	Typ	Max	
Anode-to-Cathode Voltage[g]	630	900	1100	V
DC values				

[a] On plane perpendicular to the indicated direction of incident light and passing through the major axis of the tube.

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

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

[d] Made by James Millen Manufacturing Company, 150 Exchange Street, Malden 48, Massachusetts.

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

[f] 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.

[g] Under the following conditions: Light incident on the cathode is transmitted through a filter (Corning C.S. No. 3-67, Glass Code No. 3482—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 10 microlumens. Supply voltage (E) is adjusted to give an anode current of 50 microamperes.

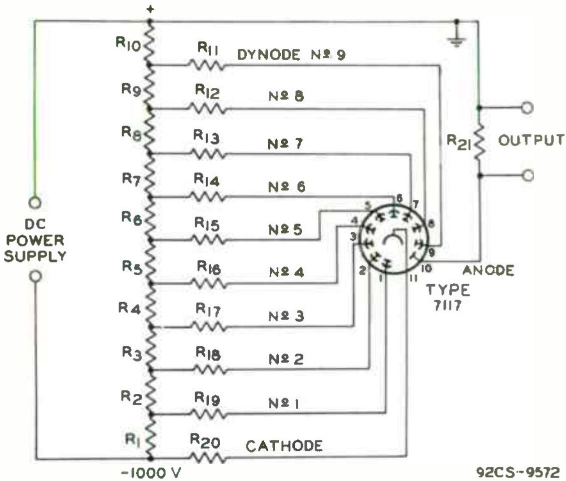
**SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-4 Response
is shown at the front of this Section**

**DIMENSIONAL OUTLINE
and
AVERAGE-ANODE-CHARACTERISTICS and
VARIATION-IN-SENSITIVITY-OF-PHOTOCATHODE
Curves shown under Type 6328
also apply to the 7117**

→ Indicates a change.

World Radio History

RECOMMENDED VOLTAGE-DIVIDER NETWORK FOR USE WITH TYPE 7117 IN HEADLIGHT-CONTROL SERVICE



R1 R2 R3 R4 R5
R6 R7 R8 R9 R10: 1 megohm, 1/2 watt

R11: 2 megohms, 1/2 watt

R12: 5.1 megohms, 1/2 watt

R13 R14 R15 R16
R17 R18 R19 R20: 8.2 megohms, 1/2 watt

R21: 820,000 ohms, 1/2 watt

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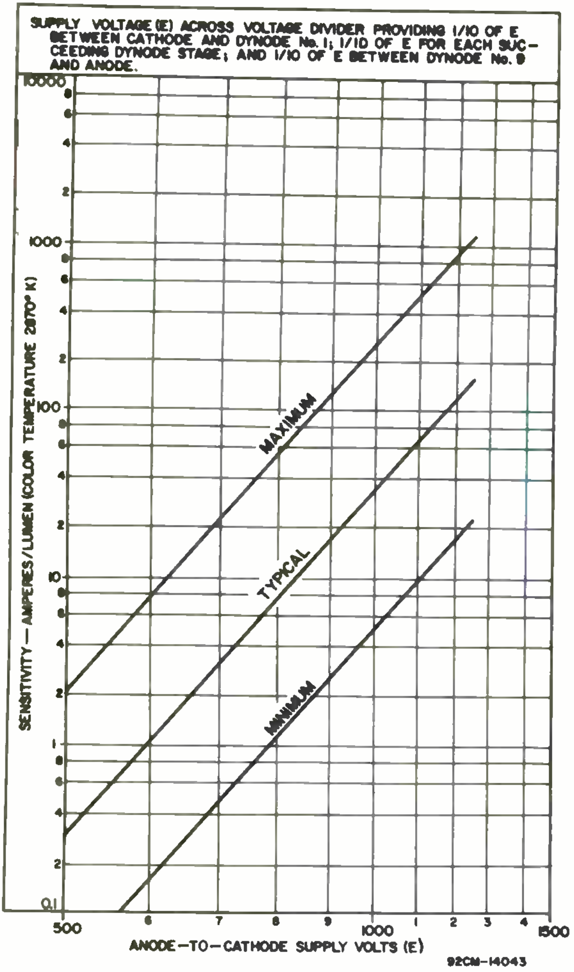
World Radio History

Sensitivity Characteristics



RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.

World Radio History

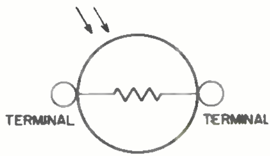
Photoconductive Cell

CADMIUM-SULFIDE, HEAD-ON TYPE

DATA

General:

Spectral Response	S-15
Wavelength of Maximum Response	5800 ± 500 angstroms
Sensitive Surface, Including Metallic Strips:	
Shape	Rectangular
Length (Minimum)	0.65 in.
Width (Minimum)	0.54 in.
Area (Minimum)	0.35 sq. in.
Maximum Overall Length	0.9"
Greatest Diameter	1.24" ± 0.02"
Seated Length	0.28" ± 0.06"
Maximum Axial Distance from External Surface of Window to Sensitive Surface	0.15"
Case	Metal
Envelope Seals	Hermetic
Operating Position	Any
Weight (Approx.)	0.4 oz
Base	JEDEC No.E2-47



DIRECTION OF LIGHT:
INTO FACE OF CELL

indicates that the primary characteristic of the element within the envelope symbol is designed to vary under the influence of light.

Maximum Ratings, *Absolute-Maximum Values:*

VOLTAGE BETWEEN TERMINALS (DC or Peak AC)	250 max.	volts
POWER DISSIPATION:		
Sensitive surface fully illuminated:		
Continuous service	0.3 max.	watt
Demand service[a]	0.5 max.	watt
Sensitive surface partially illuminated:		
Continuous service	0.85 max.	watt/sq. in.
Demand service[a]	1.42 max.	watt/sq. in.
PHOTOCURRENT	50 max.	ma
AMBIENT-TEMPERATURE RANGE	-75 to +60	°C

← Indicates a change.

World Radio History

Characteristics:

Under conditions with ac voltage (rms) of 50 volts, 60 cps between terminals and ambient temperature of 25° C

	Min.	Median	Max.	
Sensitivity:				
Radiant[b], at 5800 angstroms.	-	290	-	amp/watt
Luminous[c], at 0 cps.	-	0.82	-	amp/lumen
Illumination[d,e].	1	2	3	ma/fc
Decay Current[d,f]	-	-	40	μa
Photocurrent:				
Rise	See accompanying *Curve*			
Decay.	See accompanying *Curve*			

[a] The demand rating may be utilized twice every 24 hours for a period of 20 minutes each time provided the interval between demand periods is not less than 4 hours.

[b] For conditions where the incident power is 6.9 μwatt.

[c] For conditions where light flux from a tungsten-filament lamp operated at 2870° K is transmitted through a filter (Corning No.C.S. 1-62, Glass No.5900 which has an effective transmission of luminous flux of 13.3 per cent) onto the sensitive surface. The value of illumination incident on the sensitive surface is 7.5 footcandles measured before positioning the filter between the lamp and the cell. Area of illuminated sensitive surface is approx. 0.35 sq. in.

[d] This characteristic is determined after the 7163 has been exposed to 500 footcandle illumination (white fluorescent light) for a period of 16 to 24 hours.

[e] For conditions where light flux from a tungsten-filament lamp operated at 2870° K is transmitted through a filter (Corning No.C.S. 1-62, Glass No.5900 which has an effective transmission of luminous flux of 13.3 per cent) onto the sensitive surface. The value of illumination incident on the sensitive surface is 7.5 footcandles measured before positioning the filter between the lamp and the cell. The sensitive surface of the cell is fully illuminated.

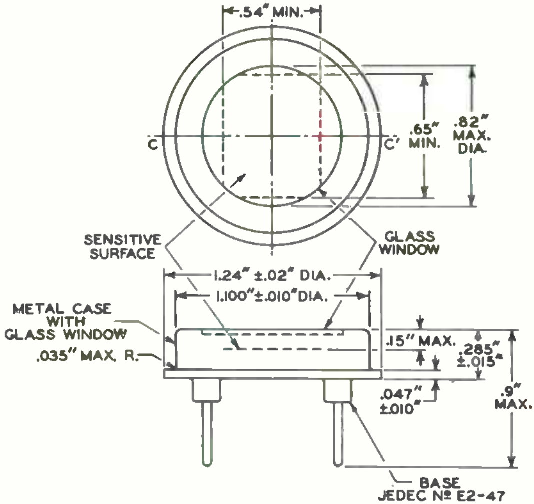
[f] Measured 10 seconds after removal of incident-illumination level as established in (e).

OPERATING CONSIDERATIONS

Electrical connection can be made to the base pins of the 7163 by soldering directly to the pins. Soldering of connections to the pins may be made close to the pin seals provided care is taken to conduct excessive heat away from the pin seal. Otherwise, the heat of the soldering operation will crack the glass seals of the pins and damage the cell. Connection can also be made to the base pins by use of insulated clips.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-15 RESPONSE is shown at front of this section

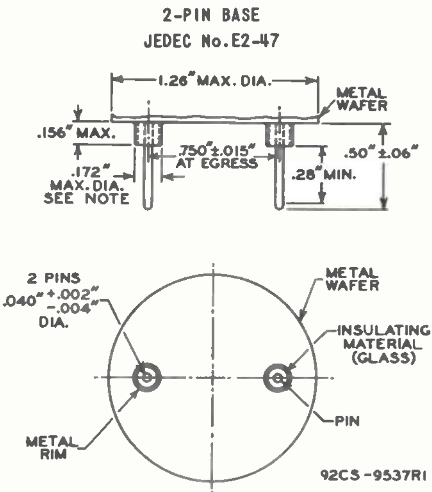
World Radio History



92CS-9536R3

PLANE THROUGH MINOR AXIS (CC') OF SENSITIVE SURFACE AND THE CELL AXIS MAY VARY FROM PLANE THROUGH CELL AXIS AND THE TWO PINS BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE CELL AXIS) OF ± 10°.

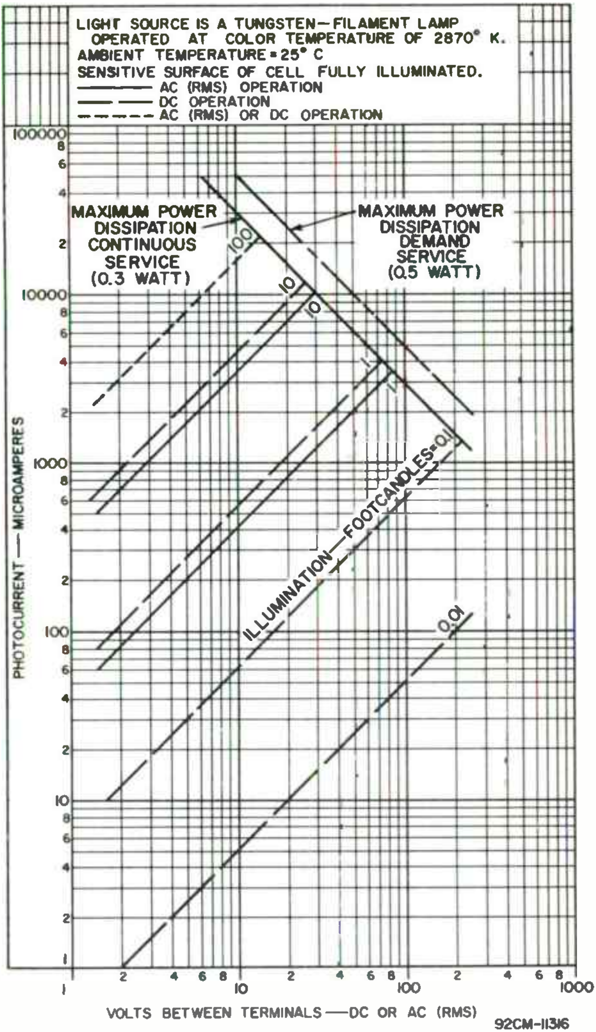
World Radio History



NOTE: FOR SOCKET DESIGN, PROVIDE CLEARANCE HOLE HAVING MINIMUM DIAMETER OF 0.188".

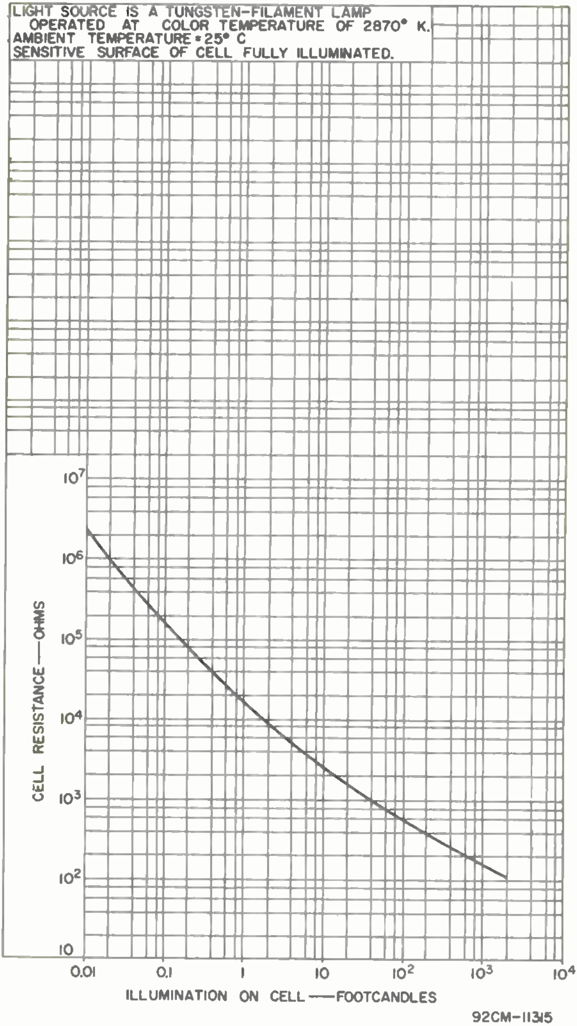
World Radio History

AVERAGE CHARACTERISTICS

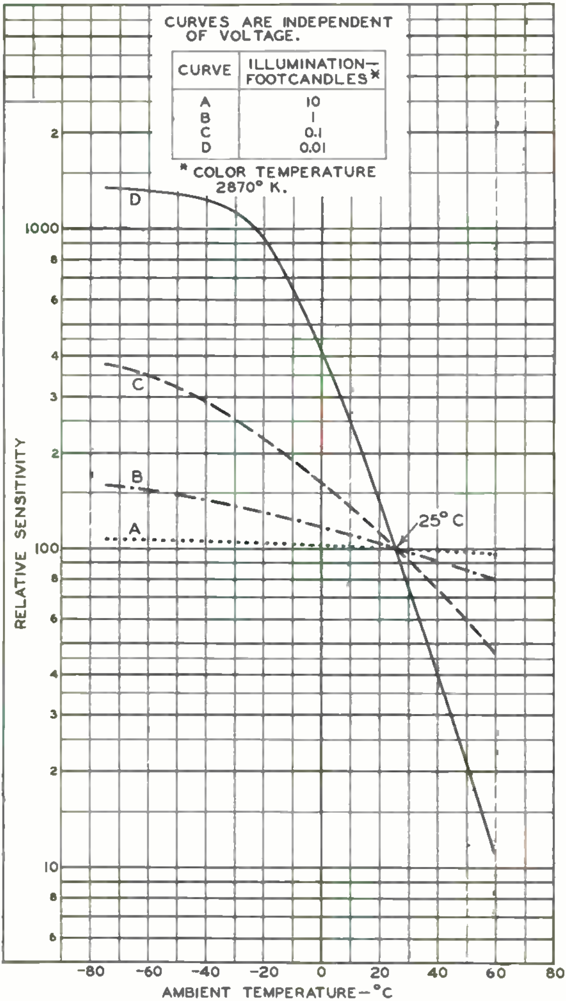


World Radio History

AVERAGE CELL RESISTANCE (DC)



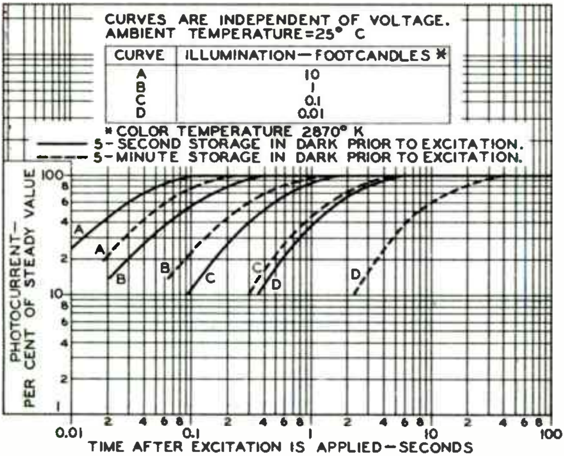
TYPICAL CHARACTERISTICS



92CM-9538

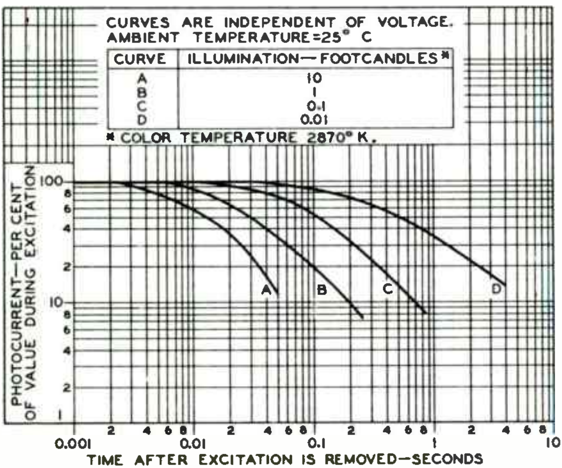
World Radio History

TYPICAL RISE CHARACTERISTICS



92CS-9532

TYPICAL DECAY CHARACTERISTICS



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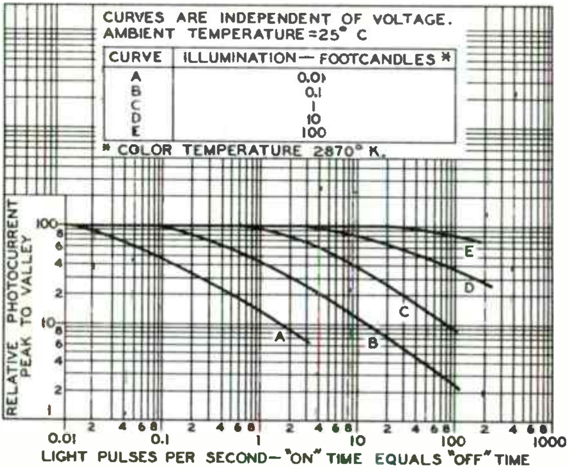
World Radio History

RESPONSE CHARACTERISTICS



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World Radio History

World Radio History

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7198

IMAGE ORTHICON

MAGNETIC FOCUS　　　　MAGNETIC DEFLECTION

Shock and vibration resistant
For use under adverse environmental conditions

DATA

General:

Heater, for Unipotential Cathode:

Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts.	0.6	amp

Direct Interelectrode Capacitance:

Anode to all other electrodes . . .	12	μμf
Wavelength of Maximum Response. . . .	4500 ± 300	angstroms

Photocathode, Semitransparent:

Response. S-10

Rectangular image (4 x 3 or 3 x 4 aspect ratio):

Useful size of. . . . . 1.8" max. diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

Orientation of. . Proper orientation is obtained when the vertical or horizontal scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base.

Focusing Method . . . . .Magnetic
Deflection Method . . . . .Magnetic
Overall Length. . . . . 15.20" ± 0.25"
Greatest Diameter of Bulb . . . . 3.00" ± 0.06"
Minimum Deflecting-Coil Inside Diameter . . . . 2.38"
Deflecting-Coil Length. . . . . 5"
Focusing-Coil Length. . . . . 10"
Alignment-Coil Length . . . . 0.94"
Photocathode Distance Inside End of Focusing Coil . . . 0.50"
Operating Position. . . . . *See Operating Considerations*
Weight (Approx.). . . . . 1 lb 6 oz
Shoulder Base . . . . Keyed Jumbo Annular 7-Pin

BOTTOM VIEW■

Pin 1 - Grid No.6
Pin 2 - Photocathode
Pin 3 - Internal Connection—Do Not Use
Pin 4 - Internal Connection—Do Not Use
Pin 5 - Grid No.5
Pin 6 - Target
Pin 7 - Internal Connection—Do Not Use

■ See basing diagram on next page.

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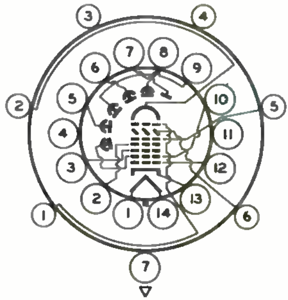
IMAGE ORTHICON

End Base. . . . . Small-Shell Diheptal 14-Pin (JEDEC Group 5, No. B14-45)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No. 4
Pin 3 - Grid No. 3
Pin 4 - Internal Connection—Do Not Use
Pin 5 - Dynode No. 2
Pin 6 - Dynode No. 4
Pin 7 - Anode
Pin 8 - Dynode No. 5
Pin 9 - Dynode No. 3
Pin 10 - Dynode No. 1, Grid No. 2
Pin 11 - Internal Connection—Do Not Use
Pin 12 - Grid No. 1
Pin 13 - Cathode
Pin 14 - Heater

DIRECTION OF LIGHT: PERPENDICULAR TO LARGE END OF TUBE



WHITE INDEX LINE ON FACE

Maximum and Minimum Ratings, ***Absolute-Maximum Values:***

PHOTOCATHODE:		
Voltage	−650 max.	volts
Illumination.	50 max.	fc
OPERATING TEMPERATURE:		
Of any part of bulb	71 max.	°C
Of bulb at large end of tube (Image section)	20 min.	°C
TEMPERATURE DIFFERENCE:		
Between image section and any part of bulb hotter than image section . .	7.5 max.	°C
STORAGE-TEMPERATURE RANGE	−65 to +71	°C
GRID-No.6 VOLTAGE	−650 max.	volts
TARGET VOLTAGE:		
Positive value.	10 max.	volts
Negative value.	10 max.	volts
GRID-No.5 VOLTAGE	150 max.	volts
GRID-No.4 VOLTAGE	300 max.	volts
GRID-No.3 VOLTAGE	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	400 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value	125 max.	volts
Positive-bias value	0 max.	volts
DYNODE-No.2-TO-DYNODE-No.1 VOLTAGE. . . .	350 max.	volts
DYNODE-No.3-TO-DYNODE-No.2 VOLTAGE. . . .	350 max.	volts
DYNODE-No.4-TO-DYNODE-No.3 VOLTAGE. . . .	680 max.	volts
DYNODE-No.5-TO-DYNODE-No.4 VOLTAGE. . . .	350 max.	volts
ANODE-TO-DYNODE-No.5 VOLTAGE.	100 max.	volts
ANODE SUPPLY VOLTAGE*	1850 max.	volts

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IMAGE ORTHICON

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode. .	125 max.	volts
Heater positive with respect to cathode. .	10 max.	volts

Typical Operating Values:

Photocathode Voltage (Image focus) . . .	-400 to -600	volts
Grid-No.6 Voltage (Accelerator)— Approx. 75% of photocathode voltage .	-300 to -450	volts
Target-Cutoff Voltage●	-3 to +1	volts
Grid-No.5 Voltage (Decelerator). . . .	0 to 125	volts
Grid-No.4 Voltage (Beam focus)	130 to 180	volts
Grid-No.3 Voltage▲	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage. . . .	300	volts
Grid-No.1 Voltage for picture cutoff .	-45 to -115	volts
Dynode-No.2 Voltage.	600	volts
Dynode-No.3 Voltage.	800	volts
Dynode-No.4 Voltage.	1000	volts
Dynode-No.5 Voltage.	1200	volts
Anode Voltage.	1250	volts
Target-Temperature Range	35 to 45	°C
Minimum Peak-to-Peak Blanking Voltage.	5	volts
Field Strength at Center of Focusing Coil♦.	75	gausses
Field Strength of Alignment Coil (Approx.)	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operating Values and altitude up to 60,000 feet (unless otherwise noted)

Cathode Radiant Sensitivity at 4500 angstroms.	0.028 μa/μw
Anode Current (DC)—For Highlight Illumination on Photocathode at 0.01 footcandle.	30 μa
Signal-Output Current (Peak to peak)	*See Curve*
Ratio of Peak-to-Peak Video-Signal Current to RMS Noise Current for Bandwidth of 9 Mc.	*See Curve*
Center Square-Wave Amplitude Response**.	*See Curves*

Vibration Tests. These tests are performed on a sample lot of tubes from each production run with highlight illumination on photocathode of 0.003 footcandle. Tubes and their associated components# are vibrated on apparatus providing dynamic conditions similar to those described in MIL-E-5272A□, paragraph 4.7.1.

Resonance. Tubes and associated components# are vibrated (per the method of MIL-E-5272A□, paragraph 4.7.1.1) at 25° C and at vibration accelerations not exceeding 10 g in each of three mutually perpendicular axes for 3 hours or one million cycles, whichever is less. After vibration,

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World Radio History

IMAGE ORTHICON

the center resolution of the tubes will be at least 525 lines as determined with an RETMA Resolution Chart, or equivalent, with not more than 0.003-footcandle highlight illumination on the photocathode.

Cycling. Tubes and associated components* are vibrated (per the method of MIL-E-5272A□, paragraph 4.7.1.2 pertaining to specimen without vibration isolators) in each of three mutually perpendicular axes at 25° C and at vibration accelerations not exceeding 5 g. One survey cycle is made for each axis. The cycle has a duration of one hour during which time the frequency is varied from 5 to 500 and back to 5 cycles per second. During this test, the tubes will maintain center resolution of at least 350 lines as determined with an RETMA Resolution Chart, or equivalent, with not more than 0.003-footcandle highlight illumination on the photocathode. After vibration the center resolution, determined under the same conditions as above, will be at least 525 lines.

Shock Tests. These tests are performed on a sample lot of tubes from each production run with no voltages applied to the tubes. Tubes alone are subjected in these tests (per the method of MIL-E-5272A□, paragraph 4.15.2.1) to 12 impact shocks of 30 g, each shock impulse having a time duration of 11 ± 1 milliseconds. The intensity is within ± 10 per cent as measured with a filter having a bandwidth of 0.2 to 250 cycles per second. The maximum g is reached in approximately 5-1/2 milliseconds. The shock is applied in the following directions: a) vertically, perpendicular to longitudinal axis, 3 shocks in each direction; b) horizontally, perpendicular to longitudinal axis, 3 shocks in each direction. After shock tests, the tubes are operable and will have resolution of at least 525 lines as determined with an RETMA Resolution Chart, or equivalent, with not more than 0.003-footcandle highlight illumination on the photocathode.

Temperature-Humidity Tests. These tests are performed on a sample lot of tubes from each production run and with no voltages applied to the tubes. The tubes are subjected (per MIL-E-005272B(USAF)●, paragraph 4.4.1, Procedure I) to relative humidities up to and including 95 per cent at temperatures up to and including +71° C. Following this test the tubes are operative, and there will be no picture streaking or other evidence of arcing when operated under the following conditions: grid-No.1 voltage adjusted for cutoff; photocathode voltage = -650 volts; grid-No.6 voltage = -650 volts; dynode-No.2 voltage = 700 volts; dynode-No.3 voltage varied from 780 to 1050 volts; dynode-No.4 voltage = 1400 volts; dynode-No.5 voltage = 1750 volts; and anode voltage = 1850 volts. In addition, the leakage resistance

World Radio History

7198

IMAGE ORTHICON

determined separately between each of six specific Diheptal-base pins (pins 5,6,7,8,9, and 10) and the 13 other Diheptal-base pins tied together and grounded will be greater than 500 megohms when a voltage of 350 volts is applied between that specific pin and the others.

* Ratio of dynode voltages is shown under *Typical Operating Values*.

● Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from -3 to +5 volts.

▲ Adjust to produce maximum signal.

♦ Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

** Measured with amplifier having flat frequency response.

\# Tube sockets and components assembly which consists of the deflecting coils, focusing coil, and alignment coil.

□ 1 January 1956.

● 5 June 1957.

OPERATING CONSIDERATIONS

The *operating position* of the 7198 should preferably be such that any loose particles in the neck of the tube will not fall down and strike or become lodged on the target. Therefore, it is recommended that the tube never be operated in a vertical position with the Diheptal-base end up nor in any other position where the axis of the tube with base up makes an angle of less than 20° with the vertical.

Resolution capability of 7198 is in excess of 600 TV lines.

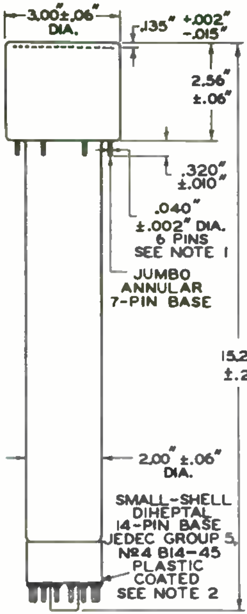
SPECTRAL-SENSITIVITY CHARACTERISTIC of Photosensitive Device having S-10 Response is shown at the front of this Section

World Radio History

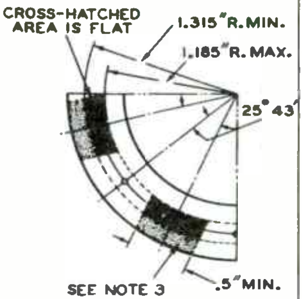
RCA

7198

IMAGE ORTHICON

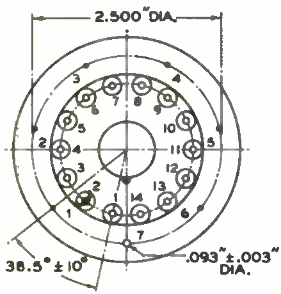


DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



NOTE 2: PLASTIC COATING MAY INCREASE DIAMETER OF BASE SHELL TO 2.08" MAX. AND MAY INCREASE HEIGHT OF BASE SHELL BY 0.03" MAX.

NOTE 3: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.



ENLARGED BOTTOM VIEW

92CM-10289

NOTE 1: ENDS OF PINS CHAMFERED 45°; FLAT ENDS 0.020" ± 0.010".

ANNULAR-BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

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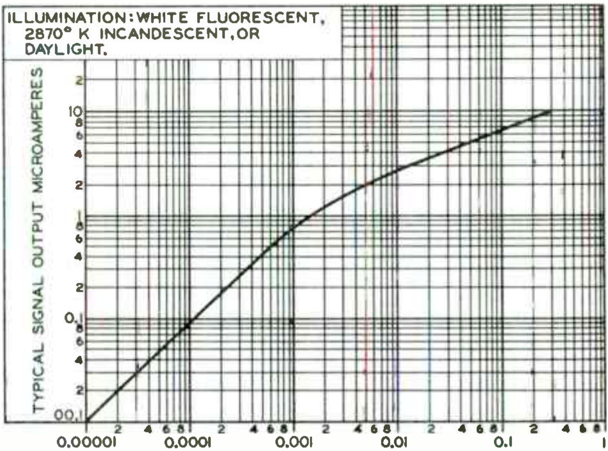
BASIC LIGHT-TRANSFER CHARACTERISTIC



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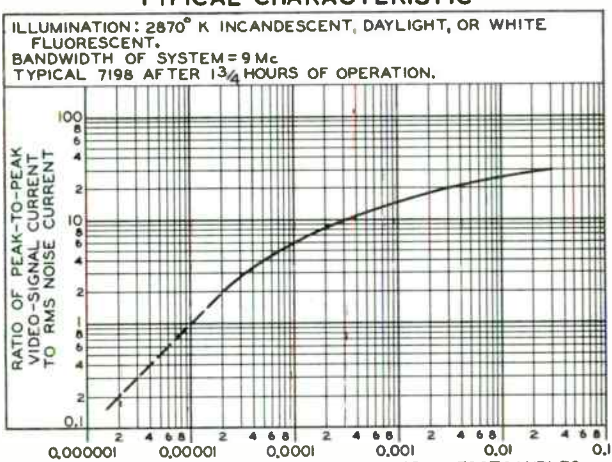
TYPICAL CHARACTERISTIC



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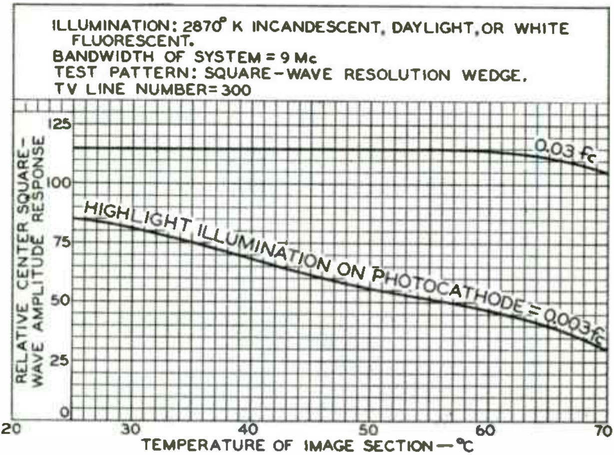
TYPICAL CHARACTERISTICS



92CS-10280

World Radio History

RCA

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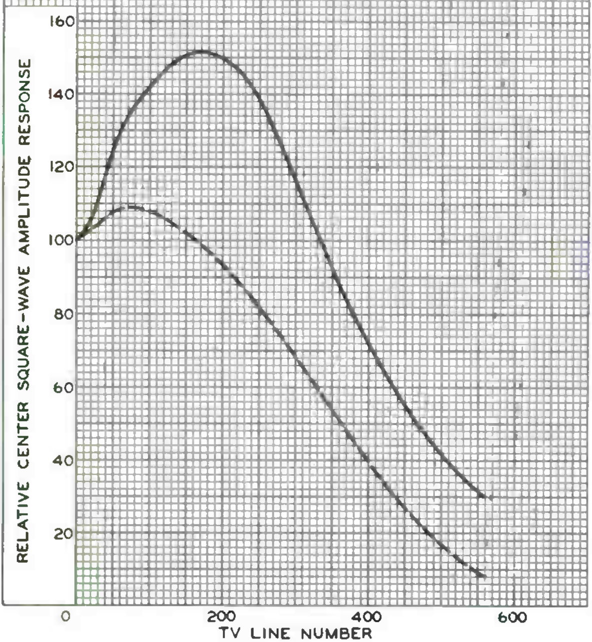
7198

TYPICAL CHARACTERISTICS

ILLUMINATION: 2870° K INCANDESCENT, DAYLIGHT, OR WHITE FLUORESCENT.
BANDWIDTH OF SYSTEM = 9Mc
TEMPERATURE OF IMAGE SECTION = 40° C
TYPICAL 7198 AFTER 1 3/4 HOURS OF OPERATION.

CURVE	HIGHLIGHT ILLUMINATION ON PHOTOCATHODE
———	0.03 FOOTCANDLE
— — —	0.003 FOOTCANDLE



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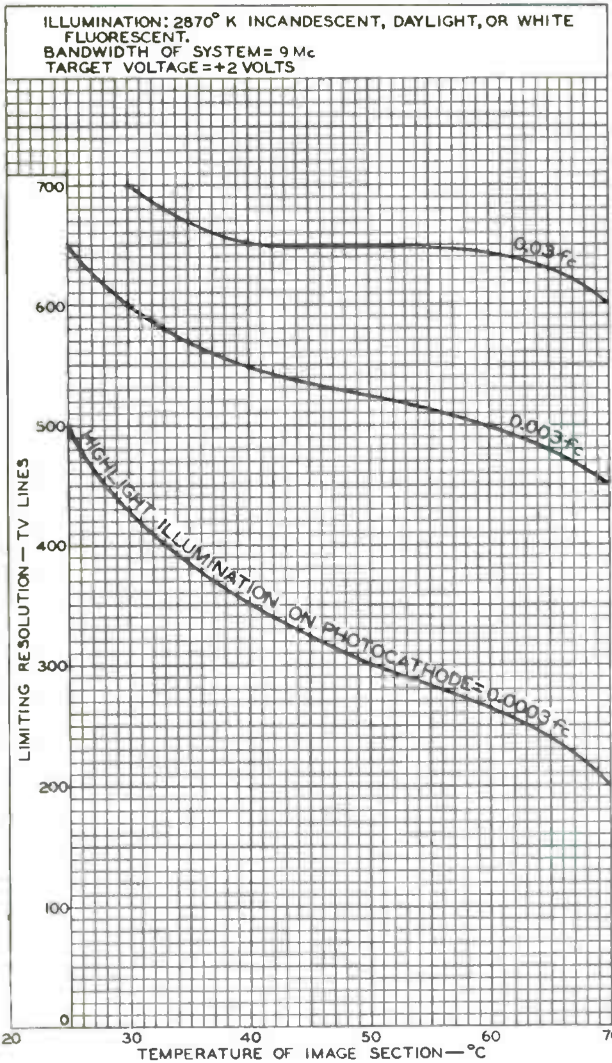
7198

TYPICAL CHARACTERISTICS



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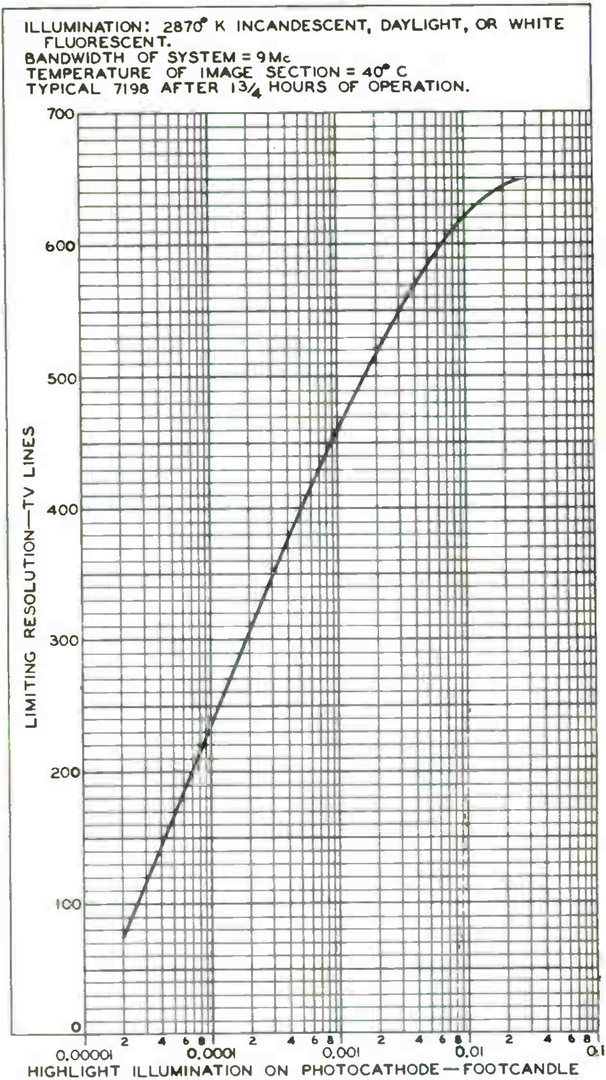
7198

TYPICAL CHARACTERISTIC



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World Radio History

7200

MULTIPLIER PHOTOTUBE

9-STAGE TYPE HAVING S-19 RESPONSE

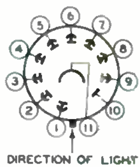
For detection and measurement of ultraviolet radiation

DATA

General:

Spectral Response	S-19
Wavelength of Maximum Response	3300 ± 500 angstroms
Cathode:	
Minimum projected length•	0.94"
Minimum projected width•	0.31"
Direct Interelectrode Capacitances (Approx.):	
Anode to dynode No.9	4.4 μμf
Anode to all other electrodes	6 μμf
Maximum Overall Length	5.69"
Maximum Seated Length	5.12"
Length from Base Seat to Center of Useful Cathode Area	3.94" ± 0.09"
Maximum Diameter	1.31"
Weight (Approx.)	1.8 oz
Operating Position	Any
Bulb	Fused-Silica Section with Graded Seal
Socket	Amphenol Part No.78RS-11T, or equivalent
Base	Small-Shell Submagnal 11-Pin (JETEC No.B11-88), Non-hygroscopic
Basing Designation for BOTTOM VIEW	11K

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 – Photocathode

Maximum Ratings, ***Absolute Values:***

SUPPLY VOLTAGE BETWEEN ANODE AND CATHODE (DC or Peak AC)	1250 max.	volts
SUPPLY VOLTAGE BETWEEN ANODE AND DYNODE No.9 (DC or Peak AC)	250 max.	volts
AVERAGE ANODE CURRENT*	0.5 max.	ma
AMBIENT-TEMPERATURE RANGE	-80 to +75	°C

•,*: See next page.

World Radio History

7200

7200
MULTIPLIER PHOTOTUBE

Characteristics:

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 dc (except as noted)

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at				
3300 angstroms. .	-	65000	-	µa/µw
Cathode radiant, at				
3300 angstroms. .	-	0.065	-	µa/µw
Luminous:#				
At 0 cps.	15	40	300	amp/lumen
Cathode luminous♦ .	20	40	-	µa/lumen
Current Amplification	-	1000000	-	
Equivalent Anode-Dark-Current Input▲□ . .	-	2×10^{-10}	2×10^{-9}	lumen
Equivalent Noise Input:				
Luminous★—				
At +25° C	-	7.5×10^{-13}	-	lumen
At -78° C	-	4×10^{-14}	-	lumen
Ultraviolet†—				
At +25° C	-	6.6×10^{-16}	-	watt
At -78° C	-	4×10^{-17}	-	watt

● On plane perpendicular to the indicated direction of incident light.

* Averaged over any interval of 30 seconds maximum.

For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A light input of 10 microlumens is used. The load resistor has a value of 0.01 megohm.

♦ For conditions the same as shown under (#) except that the value of light flux is 0.01 lumen and 100 volts are applied between cathode and all other electrodes connected together as anode.

▲ Supply voltage (E) adjusted to give a luminous sensitivity of 20 amperes per lumen. Dark current caused by thermionic emission and ion feedback may be reduced by the use of a refrigerant.

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

★ Under the following conditions: Supply voltage (E) is 1000 volts, external shield operated at -1000 volts with respect to anode, 25° C tube temperature, ac-amplifier bandwidth of 1 cycle per second, tungsten light source at 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. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

† Determined under the same conditions as shown under (★) except that use is made of monochromatic source having radiation of 2537 angstroms.

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RCA

7200

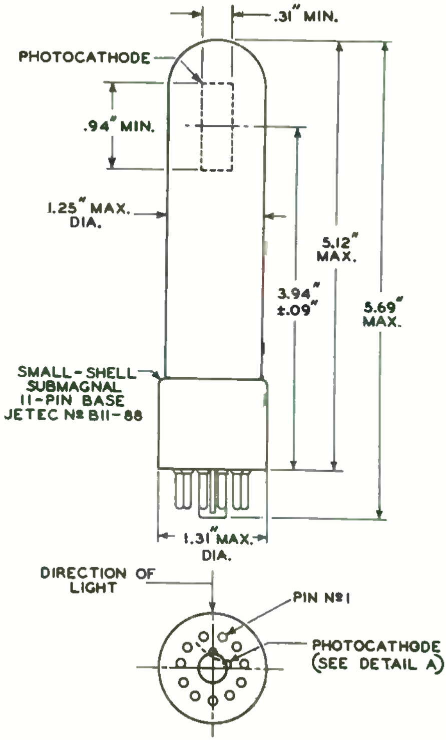
MULTIPLIER PHOTOTUBE

OPERATING CONSIDERATIONS

The use of an *average anode current* well below the maximum rated value of 0.5 milliampere is recommended when stability of operation is important.

Electrostatic and/or *magnetic shielding* of the 7200 may be necessary.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-19 Response is shown at the front of this Section



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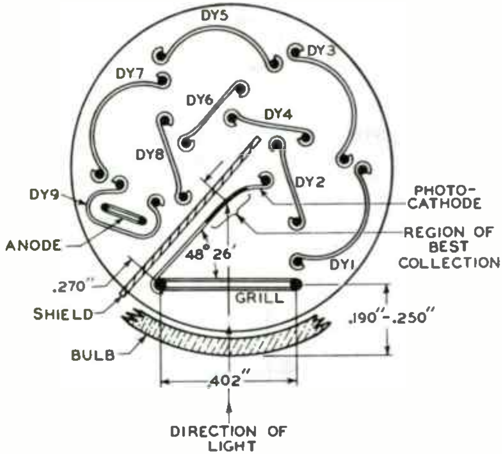
7200
MULTIPLIER PHOTOTUBE

DETAIL A



92CS-8674R1

NOTE 1: CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE.

NOTE 2: THE MAXIMUM ANGULAR VARIATION BETWEEN THE PLANE THROUGH PINS 1 AND 11 AND THE PLANE OF THE GRILL WILL NOT EXCEED 6°.

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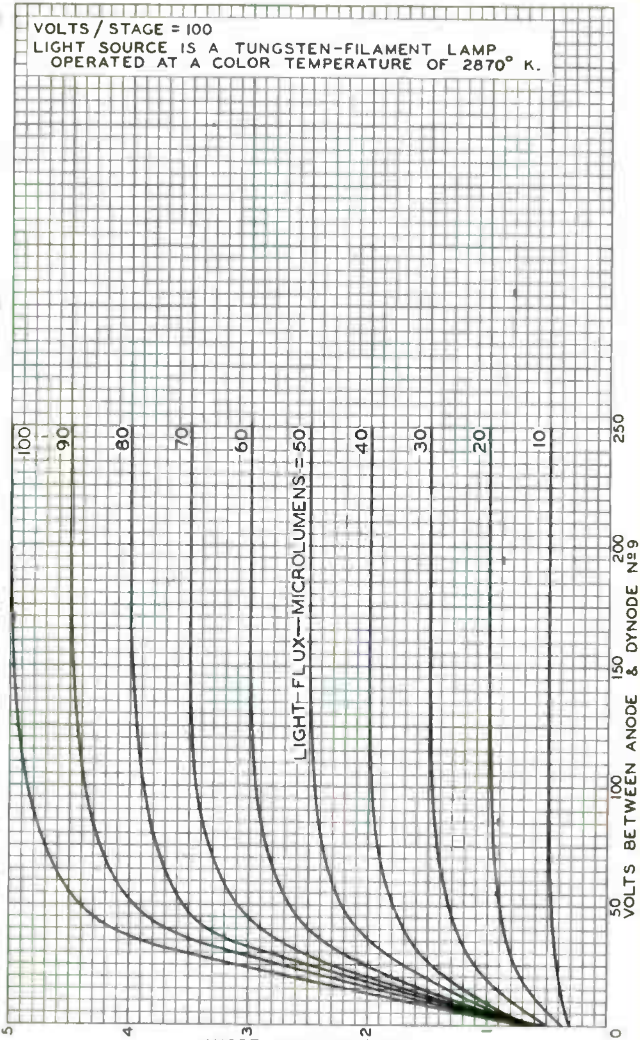
AVERAGE ANODE CHARACTERISTICS



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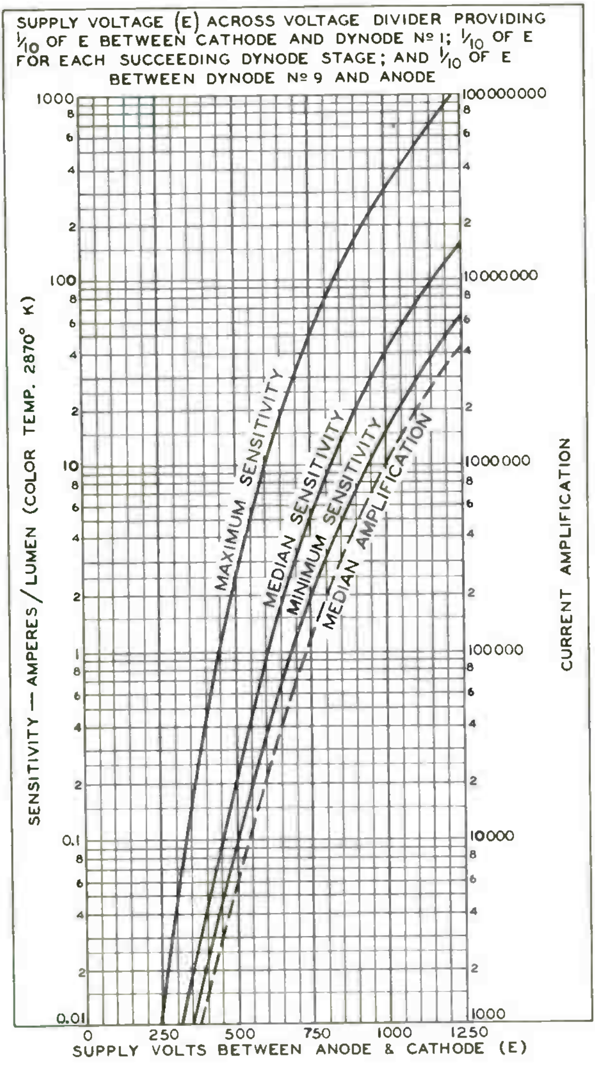
7200

RCA

7200

CHARACTERISTICS



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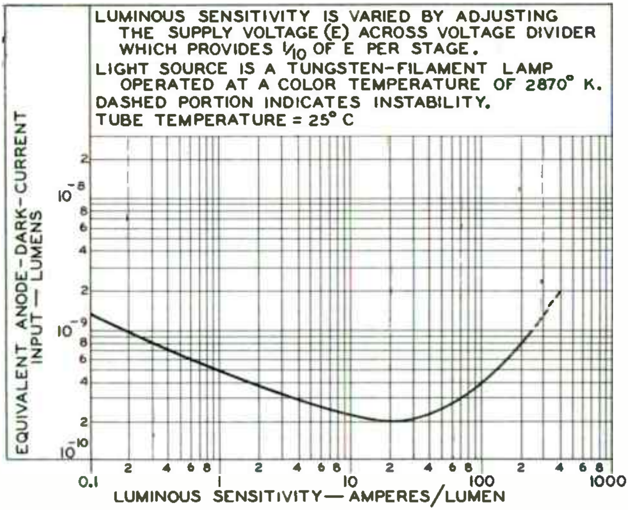
TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



92CS-9586

World Radio History

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RCA

7223

PHOTOJUNCTION CELL

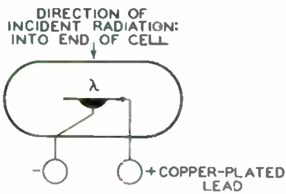
GERMANIUM P-N ALLOY JUNCTION, HEAD-ON TYPE
HAVING S-14 RESPONSE

For computer, punched-tape, punched-card, and sound pickup-from-film applications

DATA

General:

Spectral Response	S-14
Wavelength of Maximum Response	15000 angstroms
Window	Glass
Minimum diameter	0.060"
Length (Excluding flexible leads)	0.520" + 0.060" − 0.100"
Diameter	0.080" ± 0.003"
Envelope Seals	Hermetic
Operating Position	Any
Weight (Approx., avoirdupois)	3 grains
Leads, Flexible	2
Minimum length	1"
Diameter and polarity	*See Dimensional Outline*



λ indicates that the primary characteristic of the element within the envelope symbol is designed to vary under the influence of light.

Maximum Ratings, *Absolute Values:*

POLARIZING VOLTAGE	50 max.	volts
POWER DISSIPATION	0.025 max.	watt
AMBIENT TEMPERATURE	50 max.	°C

Characteristics:

Under conditions with polarizing voltage of 2.5 volts and ambient temperature of 25° C, unless otherwise noted

	Min.	Median	Max.	
Sensitivity:				
Radiant intensity, at 15000 angstroms	–	0.68	–	μa/watt/meter²
Illumination†▲	0.1	0.2	0.5	μa/ft-c
Dark Current:				
At polarizing voltage of 2.5 volts	–	–	14	μa
At polarizing voltage of 50 volts	–	–	35	μa

†,▲: See next page.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

World Radio History

7223

7223

PHOTOJUNCTION CELL

Photocurrent:
Rise . . . . *See Curve*
Decay . . . . *See Curve*

† For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K.

▲ The value of illumination incident on the window is 73 foot-candles.

OPERATING CONSIDERATIONS

The *flexible leads* of the 7223 are usually soldered to the circuit elements. Soldering of the leads may be made close to the seals provided care is taken to conduct excessive heat away from the seals. Otherwise, the heat of soldering will open the seals and damage the cell.

A *clamp* around the metal shell of the cell may be used to hold the cell in position. However, care must be taken in clamping to avoid crushing or otherwise damaging the metal shell, the glass window, or the lead seals. *Do not solder or braze directly to the metal shell* of the cell.

The cell must be *polarized* by connecting the positive voltage to the copper-plated lead.

The use of an optical system to *focus the incident radiation* onto the window is suggested, especially when the level of incident radiation is low.

Exposure of the 7223 to intense radiation, such as focused sunlight, should be avoided under all conditions including the condition when no voltage is applied to the cell. Permanent damage to the cell may result if it is exposed to radiant energy so intense as to cause excessive heating of the cell.

With no radiation on the window of the cell, some *dark current* will flow across the junction. This current can be reduced, as shown in the accompanying curve, by operation of the cell at reduced ambient temperature.

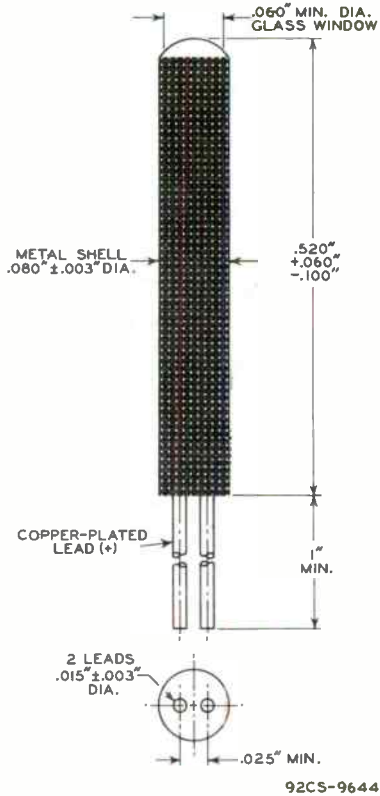
SPECTRAL-SENSITIVITY CHARACTERISTIC of Photojunction Cell having S-14 Response is shown at the front of this Section

World Radio History

RCA

7223

PHOTOJUNCTION CELL



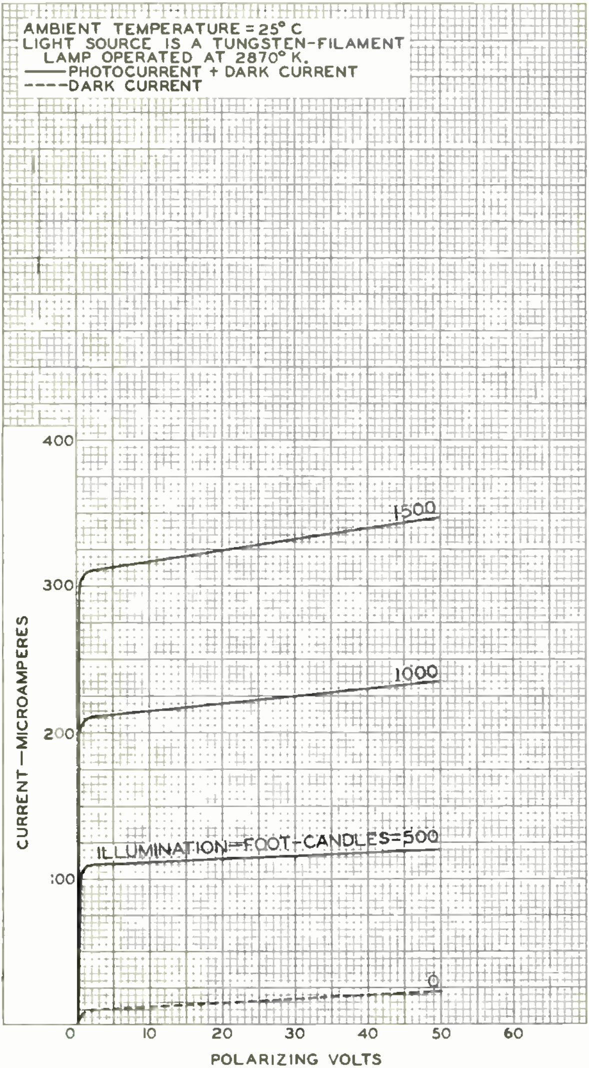
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

7223

7223

AVERAGE CHARACTERISTICS



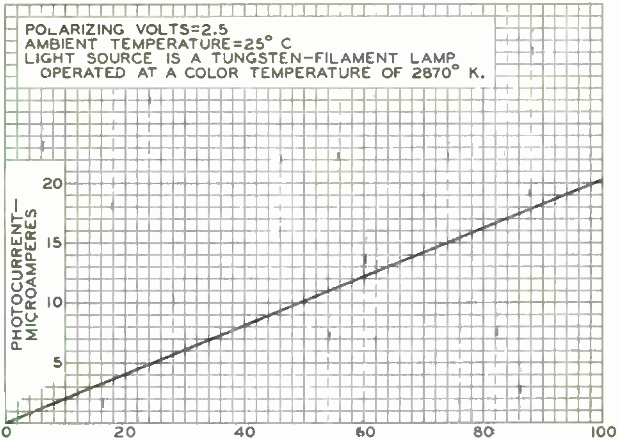
ELECTRON TUBE DIVISION 92CM-9648

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

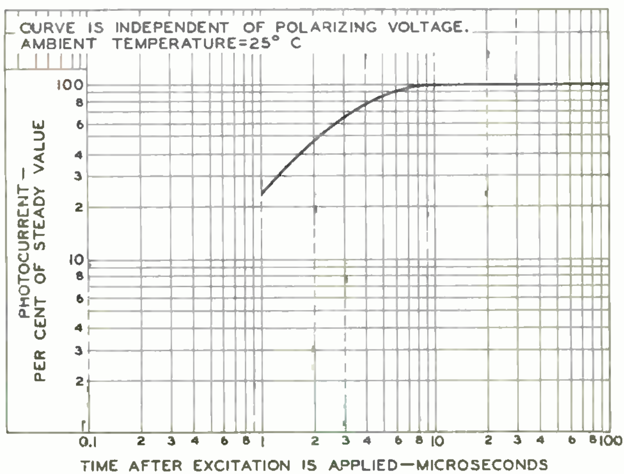
RCA
7223

TYPICAL CHARACTERISTIC



92CS-9650

TYPICAL RISE CHARACTERISTIC

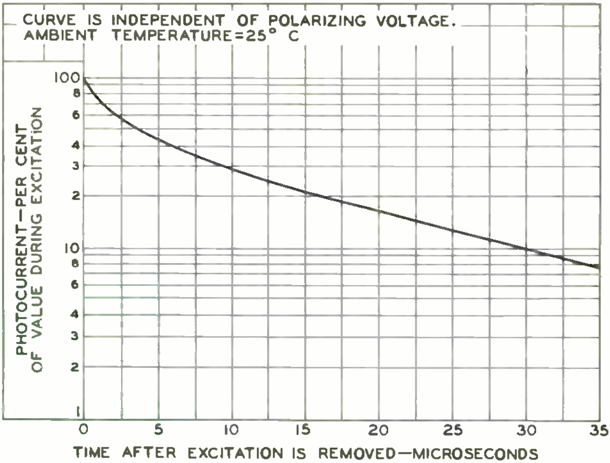


92CS-9654

RCA

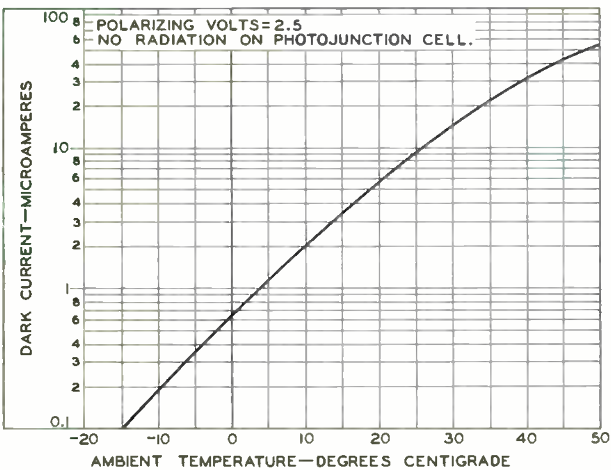
7223

TYPICAL DECAY CHARACTERISTIC



92CS-9655

TYPICAL CHARACTERISTIC



ELECTRON TUBE DIVISION 92CS-9656

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

7262
VIDICON

LOW-POWER (0.6-WATT) HEATER — 600-LINE RESOLUTION

For use in small, compact, transistorized TV cameras

DATA

General:

Heater, for Unipotential Cathode:
- Voltage . . . . 6.3 ± 10% . . . . ac or dc volts
- Current. . . . . 0.095 . . . . .amp

Direct Interelectrode Capacitance:♦
- Target to all other electrodes . . . . 4.6 μμf

Spectral Response. . . . . *See Curves*

Photoconductive Layer:
- Maximum useful diagonal of rectangular image (4 x 3 aspect ratio). 0.62"
- Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the straight sides of the masked portions of the faceplate. The straight sides are parallel to the plane passing through the tube axis and short index pin. The masking is for orientation only and does not define the proper scanned area of the photoconductive layer.

Focusing Method. Magnetic
Deflection Method. . . . . Magnetic
Overall Length . . . . 5.12" ± 0.06"
Greatest Diameter. . . . . 1.125" ± 0.010"
Weight (Approx.) . . . . 2 oz
Operating Position . . . . .Any
Bulb T8
Base Connector . . . . Cinch No.54A18088, or equivalent
Base . . . . Small-Button Ditetrar 8-Pin (JEDEC No.E8-11)
- Basing Designation for BOTTOM VIEW 8HM

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Internal Connection—Do Not Use
Pin 4 - Same as Pin 3
Pin 5 - Grid No.2
Pin 6 - Grid No.4, Grid No.3

DIRECTION OF LIGHT: INTO FACE END OF TUBE

Pin 7 - Cathode
Pin 8 - Heater
Flange - Target
Short Index Pin - Same as Pin 3

Maximum Ratings, ***Absolute Values:***

For scanned area of 1/2" x 3/8"

GRID-No.3 & GRID-No.4 VOLTAGE.	350 max.	volts
GRID-No.2 VOLTAGE.	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value.	125 max.	volts
Positive-bias value.	0 max.	volts

♦: See next page.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

7262

7262

VIDICON

PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	10 max.	volts
DARK CURRENT	0.25 max.	μa
PEAK TARGET CURRENT.	0.55 max.	μa
FACEPLATE:		
Illumination	1000 max.	ft-c
Temperature.	60 max.	°C

Typical Operation:

For scanned area of 1/2" x 3/8" and faceplate temperature of 30° to 35° C

Grid-No.4 (Decelerator) & Grid-No.3 (Beam-focus electrode*) Voltage.	250□ to 300	volts
Grid-No.2 (Accelerator) Voltage. . . .	300	volts
Grid-No.1 Voltage for picture cutoff●.	-45 to -100	volts
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μa and 0.2 μa	0.65	
Visual Equivalent Signal-to-Noise Ratio (Approx.)★	300:1	
Minimum Peak-to-Peak Blanking Voltage:		
When applied to grid No.1.	75	volts
When applied to cathode.	20	volts
Field Strength at Center of Focusing Coil (Approx.).	40	gausses
Field Strength of Adjustable Alignment Coil◉.	0 to 4	gausses

Maximum-Sensitivity Operation for Live-Scene Pickup

Faceplate Illumination (Highlight) . .	2	ft-c
Maximum Target Voltage required to produce dark current of 0.2 μa in any tube**.	110	volts
Target Voltage†.	60 to 100	volts
Dark Current▲.	0.2	μa
Target Current (Highlight)■.	0.4 to 0.5	μa
Signal-Output Current:#		
Peak	0.2 to 0.3	μa
Average.	0.08 to 0.1	μa

Average-Sensitivity Operation for Live-Scene Pickup

Faceplate Illumination (Highlight) . .	15	ft-c
Maximum Target Voltage required to produce dark current of 0.02 μa in any tube**.	60	volts
Target Voltage†.	30 to 50	volts

♦,*,□,●,★,◉,**,†,▲,■,#: See next page.

World Radio History

Dark Current	0.02	μa
Target Current (Highlight)■.	0.3 to 0.4	μa
Signal-Output Current:#		
Peak	0.3 to 0.4	μa
Average.	0.1 to 0.2	μa

Minimum-Lag Operation for Film Pickup

Faceplate Illumination (Highlight) . .	100	ft-c
Maximum Target Voltage required to produce dark current of 0.004 μa in any tube**▲.	30	volts
Target Voltage†.	15 to 25	volts
Dark Current	0.004	μa
Target Current (Highlight)■.	0.3 to 0.4	μa
Signal-Output Current:#		
Peak	0.3 to 0.4	μa
Average.	0.1 to 0.2	μa

♣ This capacitance, which effectively is the output impedance of the 7262, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms.

♠ Beam focus is obtained by combined effect of grid-No.3 voltage which should be adjustable over indicated range, and a focusing coil having an average field strength of 40 gausses.

□ Definition, focus uniformity, and picture quality decrease with decreasing grid-No.4 and grid-No.3 voltage. In general, grid No.4 and grid No.3 should be operated above 250 volts.

● With no blanking voltage on grid No.1.

★ Measured with high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of the highlight video-signal current to rms noise current, multiplied by a factor of 3.

⊕ The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

** The target voltage for each 7262 must be adjusted to that value which gives the desired operating dark current.

† Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

▲ The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

■ Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

Defined as the component of the target current after the dark-current component has been substracted.

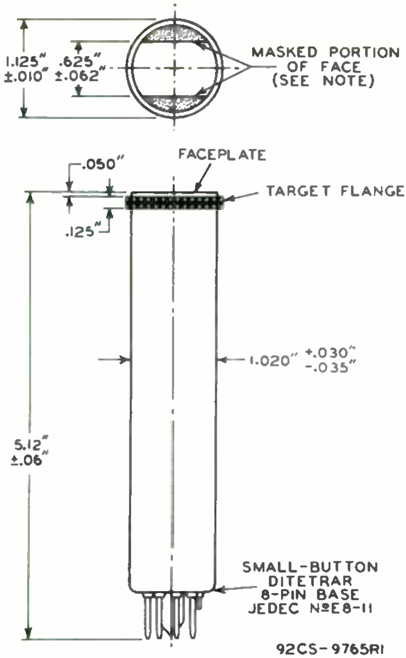
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

7262

VIDICON



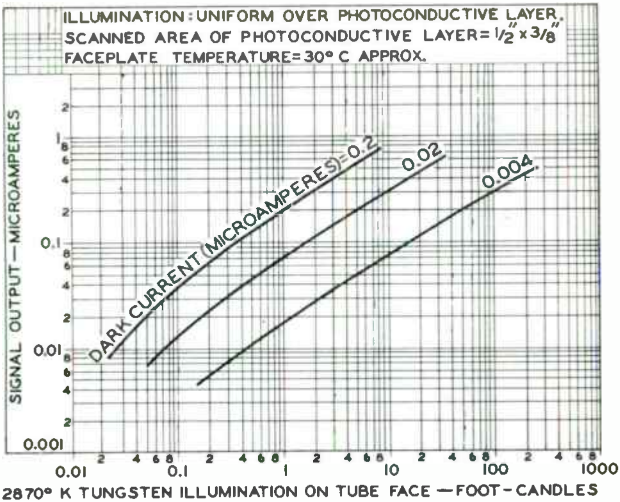
NOTE: STRAIGHT SIDES OF MASKED PORTIONS ARE PARALLEL TO THE PLANE PASSING THROUGH TUBE AXIS AND SHORT INDEX PIN.

World Radio History

RCA

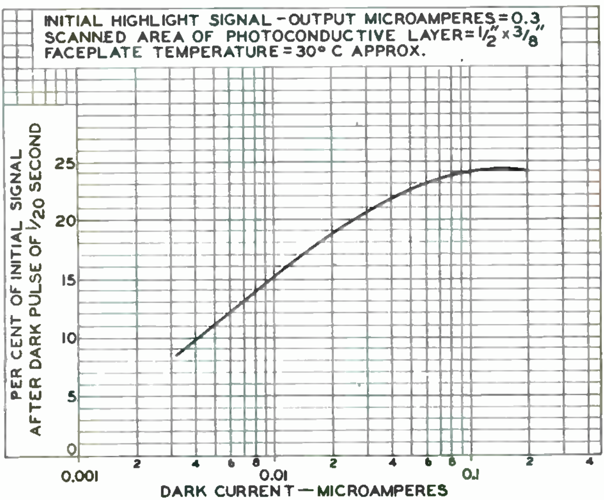
7262

TYPICAL LIGHT-TRANSFER CHARACTERISTICS



92CS-9495

TYPICAL PERSISTENCE CHARACTERISTIC



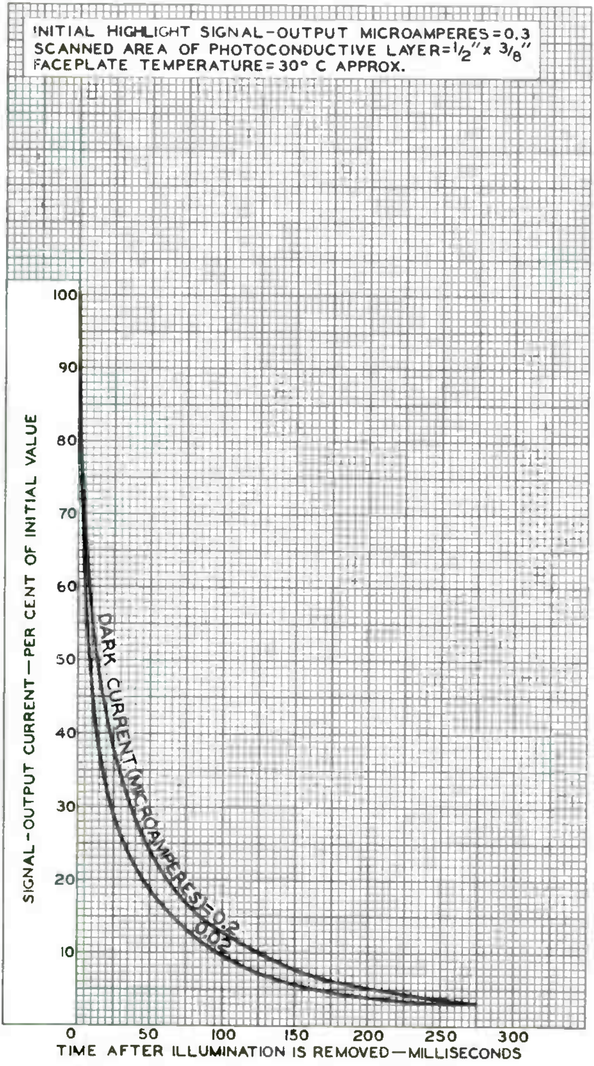
92CS-9504

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

7262

TYPICAL PERSISTENCE CHARACTERISTICS



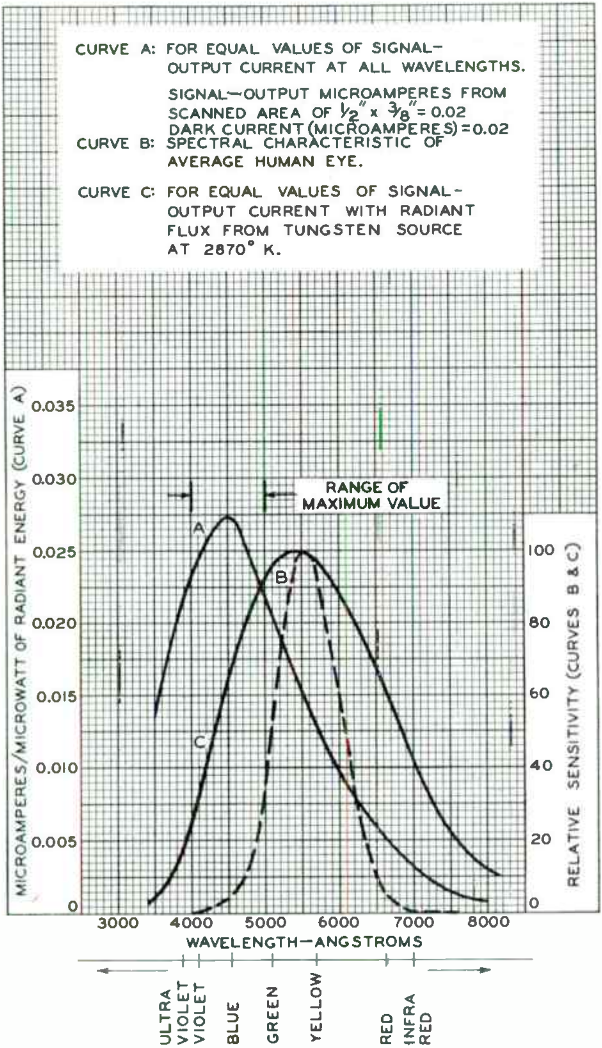
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9505

World Radio History

7262

SPECTRAL-SENSITIVITY CHARACTERISTICS



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7783R2

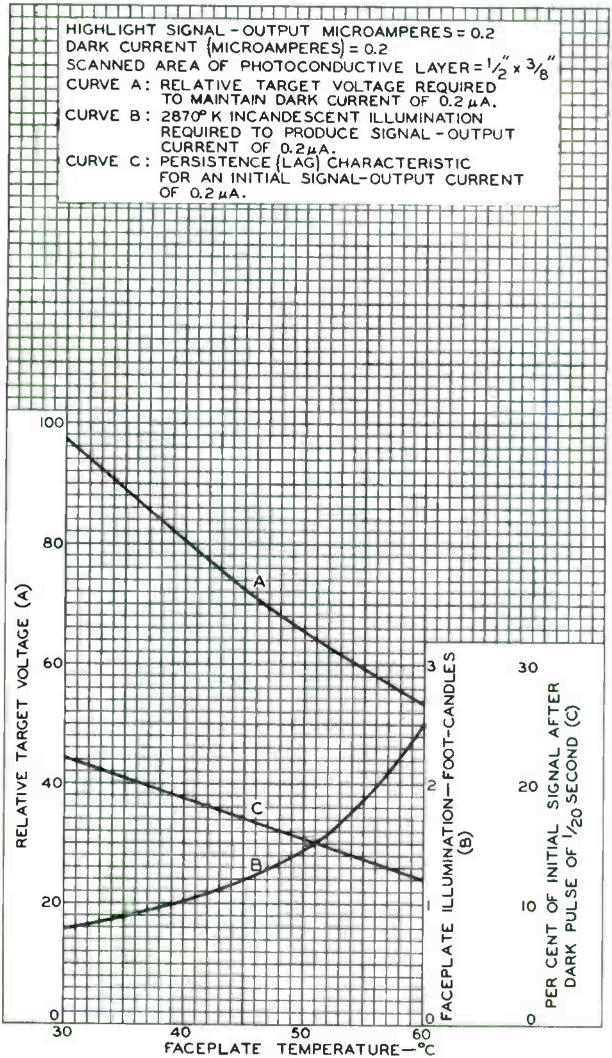
World Radio History

7262

RCA

7262

TYPICAL CHARACTERISTICS



ELECTRON TUBE DIVISION

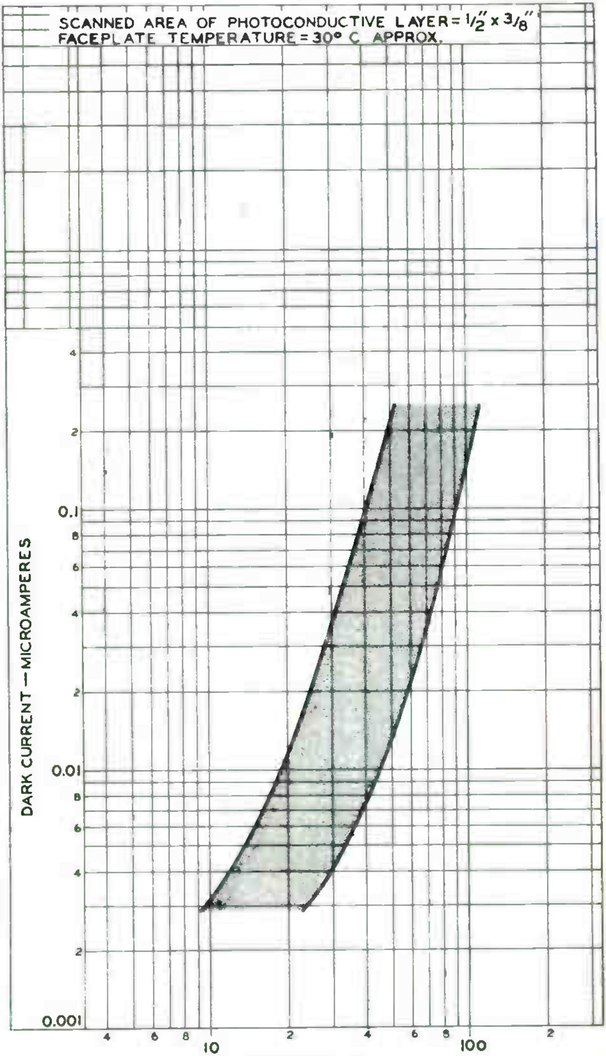
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9499

7262

7262

DARK-CURRENT RANGE



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

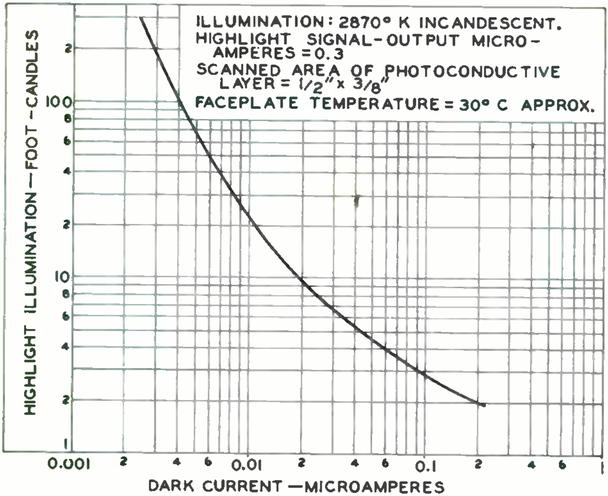
92CM-9497

World Radio History

7262

RCA 7262

TYPICAL CHARACTERISTIC



92CS-9493

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

Vidicon

LOW-POWER (0.6-WATT) HEATER   600-TO-900-LINE RESOLUTION

For Live-Scene Pickup with Compact, Transistorized TV Cameras in Industrial Closed-Circuit Systems. The 7262-A is Unilaterally Interchangeable with Type 7262.

DATA

General:

Heater, for Unipotential Cathode:
  Voltage (AC or DC). . . . . 6.3 ± 10% volts
  Current at 6.3 volts. . . . . 0.095 amp
Direct Interelectrode Capacitance:[▲]
  Target to all other electrodes. . . . . 4.6 $\mu\mu$f
Spectral Response . . . . See *Curve*
Photoconductive Layer:
  Maximum useful diagonal of rectangular image (4 x 3 aspect ratio) . . . . 0.62"
  Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the straight sides of the masked portions of the faceplate. The straight sides are parallel to the plane passing through the tube axis and short index pin. The masking is for orientation only and does not define the proper scanned area of the photoconductive layer.
Focusing Method . . . . .Magnetic
Deflection Method . . . . .Magnetic
Overall Length. . . . . 5.12" ± 0.06"
Greatest Diameter . . . . 1.125" ± 0.010"
Operating Position. . . . . Any
Weight (Approx.). . . . . 2 oz
Bulb. T8
Socket. . . . . .Cinch No.54A18088, or equivalent
Base. . . . . . .Small-Button Ditetrar 8-Pin (JEDEC No.E8-11)
  Basing Designation for BOTTOM VIEW. 8HM

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Internal Connection—Do Not Use
Pin 4 - Same as Pin 3
Pin 5 - Grid No.2
Pin 6 - Grid No.4, Grid No.3

DIRECTION OF LIGHT: INTO FACE END OF TUBE

Pin 7 - Cathode
Pin 8 - Heater
Flange - Target
Short Index Pin - Same as Pin 3

Maximum Ratings, *Absolute-Maximum Values:*

For scanned area of 1/2" x 3/8"

GRID-No.3 & GRID-No.4 VOLTAGE . . . . 750 max. volts
GRID-No.2 VOLTAGE . . . . 750 max. volts

World Radio History

GRID-No.1 VOLTAGE:		
Negative-bias value	300 max.	volts
Positive-bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts
TARGET VOLTAGE	100 max.	volts
DARK CURRENT	0.25 max.	μa
PEAK TARGET CURRENT●	0.55 max.	μa
FACEPLATE:		
Illumination	1000 max.	fc
Temperature	71 max.	°C

Typical Operation:

For scanned area of 1/2" x 3/8" and faceplate temperature of 30° to 35° C

Grid-No.4 (Decelerator) & Grid-No.3 (Beam-Focus-Electrode*) Voltage	250♦ to 300	volts
Grid-No.2 (Accelerator) Voltage	300	volts
Grid-No.1 Voltage for picture cutoff♦	-45 to -100	volts
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μa and 0.2 μa	0.57	
Visual Equivalent Signal-to-Noise Ratio (Approx.)♠	300:1	
Lag:■		
Typical	20	%
Maximum	25	%
Minimum Peak-to-Peak Blanking Voltage:		
When applied to grid No.1	75	volts
When applied to cathode	20	volts
Field Strength at Center of Focusing Coil (Approx.)	40	gausses
Field Strength of Adjustable Alignment Coil♣	0 to 4	gausses

Maximum-sensitivity operation — 0.1 footcandle on faceplate

Faceplate Illumination (Highlight)	0.1	fc
Target Voltage⊕,#	35 to 70	volts
Dark Current*	0.2	μa
Signal-Output Current:♣		
Typical	0.14	μa

Intermediate-sensitivity operation — 0.5 footcandle on faceplate

Faceplate Illumination (Highlight)	0.5	fc
Target Voltage⊕,#	30 to 60	volts
Dark Current*	0.1	μa
Signal-Output Current:♣		
Typical	0.27	μa

World Radio History

Average-sensitivity operation — 1 footcandle on faceplate

Faceplate Illumination (Highlight)	1	fc
Target Voltage⊕,#	20 to 40	volts
Dark Current*	0.02	μa
Signal-Output Current:✤		
Typical	0.2	μa
Minimum	0.15	μa

▲ This capacitance, which effectively is the output impedance of the 7262-A, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms.

● Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

★ Beam focus is obtained by combined effect of grid-No.3 voltage which should be adjustable over indicated range, and a focusing coil having an average field strength of 40 gausses.

♦ Definition, focus uniformity, and picture quality decrease with decreasing grid-No.4 and grid-No.3 voltage. In general, grid No.4 and grid No.3 should be operated above 250 volts.

♁ With no blanking voltage on grid No.1.

♠ Measured with a peak signal-output current of 0.35 microampere using a high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of the highlight video-signal current to rms noise current, multiplied by a factor of 3.

■ Defined as the per cent of initial value of signal-output current 1/20 second after illumination is removed. Values shown are for initial signal-output current of 0.2 microampere and a dark current of 0.02 microampere.

♣ The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

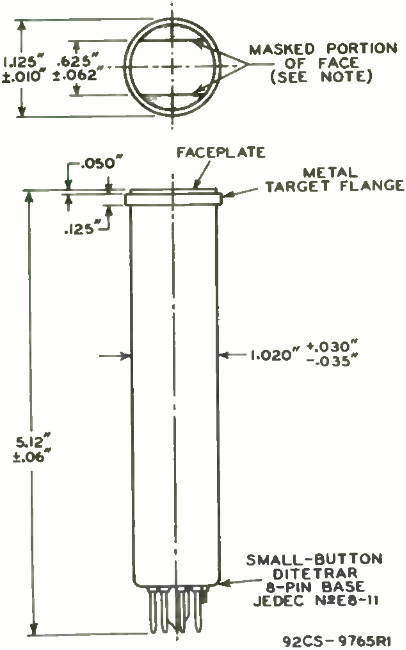
⊕ Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

\# The target voltage for each 7262-A must be adjusted to that value which gives the desired operating dark current.

* The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct porportion to the change in scanning velocity.

✤ Defined as the component of the highlight target current after the dark-current component has been subtracted.

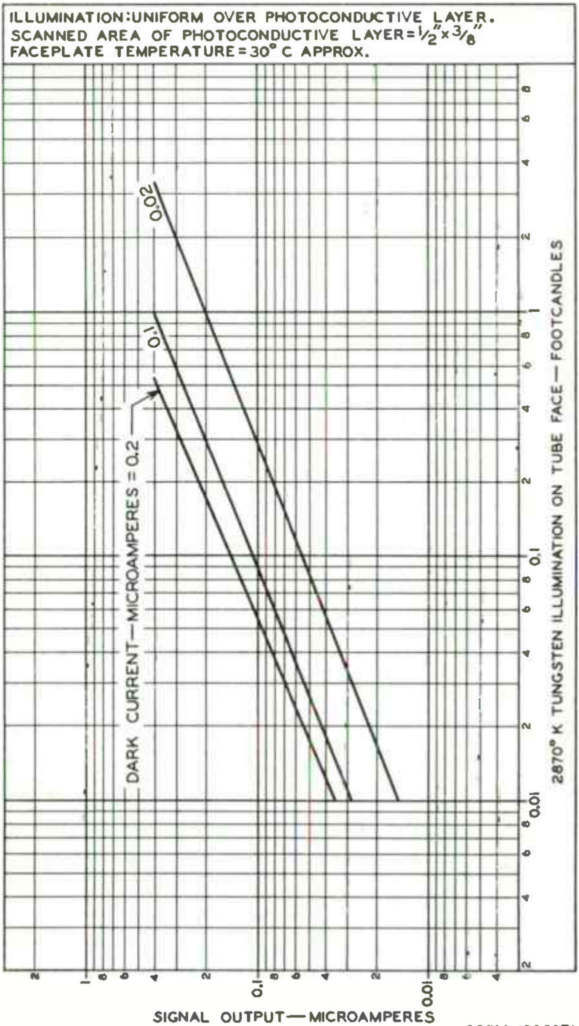
World Radio History



NOTE: STRAIGHT SIDES OF MASKED PORTIONS ARE PARALLEL TO THE PLANE PASSING THROUGH TUBE AXIS AND SHORT INDEX PIN.

World Radio History

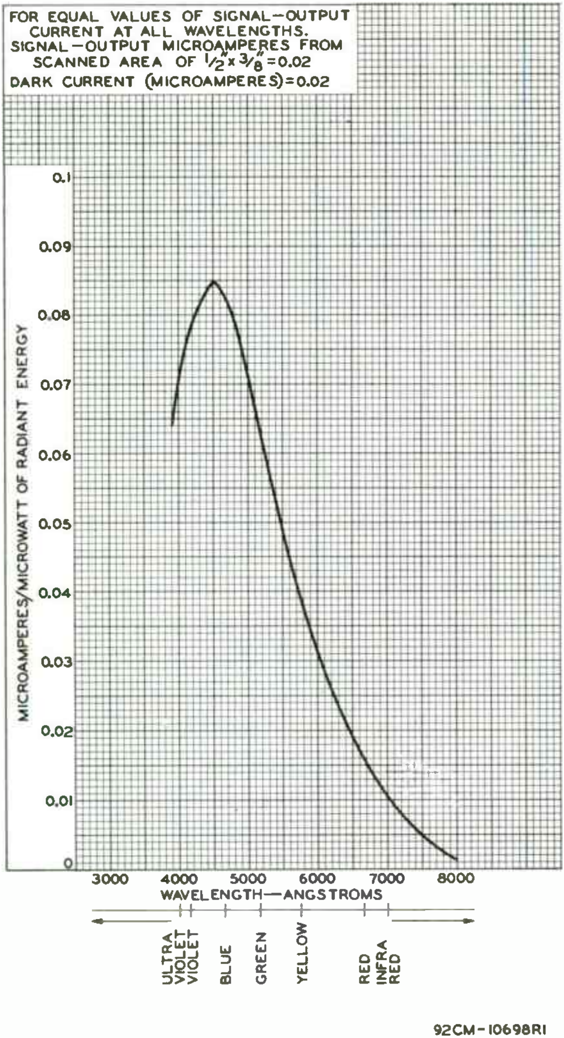
TYPICAL LIGHT-TRANSFER CHARACTERISTICS



92CM-10689R1

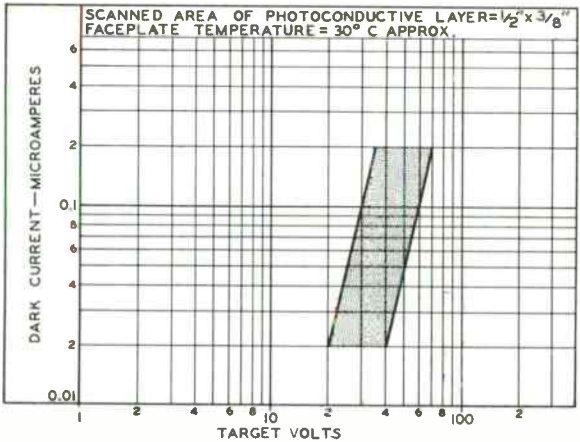
World Radio History

TYPICAL SPECTRAL-SENSITIVITY CHARACTERISTIC



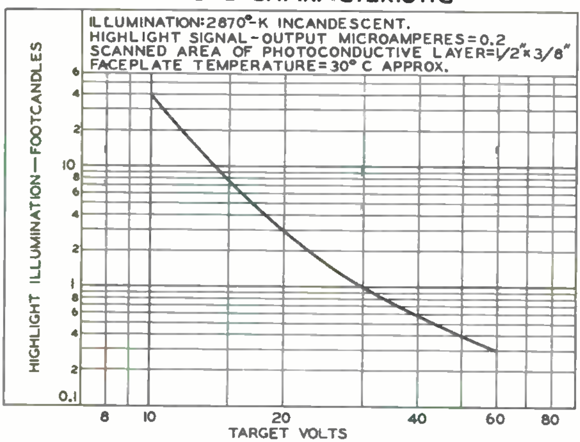
World Radio History

DARK-CURRENT RANGE



92CS-10684R1

TYPICAL CHARACTERISTIC



92CS-10685R1

World Radio History

World Radio History

Vidicon

LOW-POWER (0.6-WATT) HEATER   600-TO-900-LINE RESOLUTION

For Use Under Severe Shock and Vibration, High Humidity, and at Altitudes up to 50,000 Feet in Small, Compact, Transistorized TV Cameras. The 7263-A is Unilaterally Interchangeable with Type 7263.

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.095	amp
Direct Interelectrode Capacitance:♠		
Target to all other electrodes	4.6	μμf
Spectral Response		See *Curve*
Photoconductive Layer:		
Maximum useful diagonal of rectangular image (4 x 3 aspect ratio)		0.62"

Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the plane passing through the tube axis and short index pin.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	5.12" ± 0.06"
Greatest Diameter	1.125" ± 0.010"
Weight (Approx.)	2 oz
Operating Position	Any
Bulb	T8
Socket	Cinch No.54A18088●, or equivalent
Base	Small-Button Ditetrar 8-Pin (JEDEC No.E8-11)
Basing Designation for BOTTOM VIEW	8HM

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Internal Connection— Do Not Use
Pin 4 - Same as Pin 3
Pin 5 - Grid No.2
Pin 6 - Grid No.4, Grid No.3

DIRECTION OF LIGHT: INTO FACE END OF TUBE

Pin 7 - Cathode
Pin 8 - Heater
Flange - Target
Short Index Pin - Same as Pin 3

Maximum Ratings, ***Absolute-Maximum Values:***

For altitudes up to 50,000 feet and scanned area of 1/2" x 3/8"

GRID-No.3 & GRID-No.4 VOLTAGE	750 max.	volts
GRID-No.2 VOLTAGE	750 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value	300 max.	volts
Positive-bias value	0 max.	volts

World Radio History

PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	10 max.	volts
TARGET VOLTAGE.	100 max.	volts
DARK CURRENT.	0.25 max.	μa
PEAK TARGET CURRENT*.	0.55 max.	μa
FACEPLATE:		
Illumination.	1000 max.	fc
Temperature	71 max.	°C

Typical Operation:

For scanned area of 1/2" x 3/8" and faceplate temperature of 30° to 35° C

Grid-No.4 (Decelerator) & Grid-No.3 (Beam-Focus-Electrode♦) Voltage	250♣ to 300	volts
Grid-No.2 (Accelerator) Voltage	300	volts
Grid-No.1 Voltage for picture cutoff♠	-45 to -100	volts
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μa and 0.2 μa.	0.57	
Visual Equivalent Signal-to-Noise Ratio (Approx.)‡.	300:1	
Lag:♣		
Typical	25	%
Maximum	20	%
Minimum Peak-to-Peak Blanking Voltage:		
When applied to grid No.1	75	volts
When applied to cathode	20	volts
Field Strength at center of focusing coil (Approx.)	40	gausses
Field Strength of Adjustable Alignment Coil●	0 to 4	gausses

Maximum-sensitivity operation — 0.1 footcandle on faceplate

Faceplate Illumination (Highlight). . .	0.1	fc
Target Voltage#,*	35 to 70	volts
Dark Current●	0.2	μa
Signal-Output Current:†		
Typical	0.14	μa

Intermediate-sensitivity operation — 0.5 footcandle on faceplate

Faceplate Illumination (Highlight). . .	0.5	fc
Target Voltage#,*	30 to 60	volts
Dark Current●	0.1	μa
Signal-Output Current:†		
Typical	0.27	μa

Average-sensitivity operation — 1 footcandle on faceplate

Faceplate Illumination (Highlight). . .	1	fc
Target Voltage#,*	20 to 40	volts
Dark Current●	0.02	μa

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Signal-Output Current:†

Typical	0.2	μa
Minimum	0.15	μa

▲ This capacitance, which effectively is the output impedance of the 7263-A, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in order of 100 megohms.

● Made by Cinch Manufacturing Corporation, 1026 South Homan Avenue, Chicago 24, Illinois.

★ Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

♦ Beam focus is obtained by combined effect of grid-No.3 voltage which should be adjustable over indicated range, and a focusing coil having an average field strength of 40 gausses.

♠ Definition, focus uniformity, and picture quality decrease with decreasing grid-No.4 and grid-No.3 voltage. In general, grid No.4 and grid No.3 should be operated above 250 volts.

♠ With no blanking voltage on grid No.1.

‡ Measured with high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc and a peak signal-output current of 0.35 microampere. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of the highlight video-signal current to rms noise current, multiplied by a factor of 3.

♣ Defined as the per cent of initial value of signal-output current 1/20 second after illumination is removed. Values shown are for initial signal-output current of 0.2 microampere and a dark current of 0.02 microampere.

⊕ The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

• The target voltage for each 7263-A must be adjusted to that value which gives the desired operating dark current.

✽ The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

† Defined as the component of the highlight target current after the dark-current component has been subtracted.

SPECIAL PERFORMANCE DATA

In connection with the following tests, sample 7263-A's will maintain resolution as determined with a RETMA Resolution Chart, or equivalent, and will faithfully reproduce all resolution wedges and grey scales of the chart.

Vibration Tests:

These tests are performed under conditions for *Average-Sensitivity Operation* on a sample lot of tubes from each production run. Tubes and their associated components§ are vibrated on apparatus providing dynamic conditions similar to those described in MIL-E-5272B□, paragraph 4.7.1.

Resonance. Tubes and associated components□ are vibrated (per the method of MIL-E-5272B□, paragraph 4.7.1) for 1 hour at +25° C, for 15 minutes at 0° C, and for 15 minutes at +55° C.

Cycling. Tubes and associated components§ are vibrated (per the method of MIL-E-5272B□, paragraph 4.7.1.2 pertaining

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to specimen without vibration isolators) for 1 hour at +25° C, for 15 minutes at 0° C, and for 15 minutes at +55° C.

Temperature-Pressure (Altitude) Tests:

Tubes and associated components§ are subjected (per the method of MIL-E-5400◊, paragraph 3.2.20, 3.2.20.1, and 3.2.20.1.1) to the separate and combined effects of varying temperature 0° to +55° C and varying barometric pressure 30 to 3.4 inches of mercury. The pressures correspond to sea level and to an altitude of 50,000 feet, respectively.

Shock Tests:

These tests are performed with no voltages applied and on a sample lot of tubes from each production run. Tubes and their associated components§ are subjected in these tests (per MIL-E-5400◊, paragraph 3.2.21.2.1) to 18 impact shocks of 15 g consisting of 3 shocks in opposite directions along each of three mutually perpendicular axes of the tube. Each shock impulse has a duration of 11 ± 1 milliseconds with a maximum impact acceleration occurring at approximately 5.5 milliseconds. Tube mounting accessories assure the rigid fastening of the tube to the shock-test apparatus.

Temperature-Humidity Tests:

These tests are performed with no voltages applied to the 7263-A. The 7263-A and associated components§ are subjected (per the method of MIL-E-5400◊, paragraph 3.2.20.2B) to relative humidities up to and including 100 per cent at temperatures up to and including +50° C.

§ Tube socket such as Cinch No.54A18088 and RCA Assembly No.200SDU501, or equivalent, which consists of the deflecting coils, focusing coil, alignment coil, shield, and target connector.

□ 5 June 1957, Procedure I of Military Specifications.

◊ 1 January 1956.

OPERATING CONSIDERATIONS

The *target connection* is made by a suitable spring contact bearing against the edge of the metal ring at the face end of the tube. This spring contact may conveniently be provided as part of the focusing-coil design.

Support for the 7263-A should be provided such that, under vibration and shock, the tube will not be displaced with respect to the focusing, deflecting, and alignment fields. Suitable support is provided for the tube and its socket in the RCA Deflection Assembly 200SDU501, or equivalent. Orientation of the 7263-A in its support should be such that the horizontal scan is essentially parallel to the plane passing through the tube axis and short index pin.

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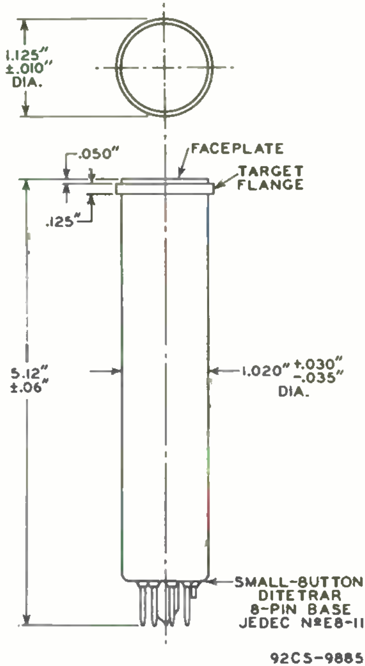

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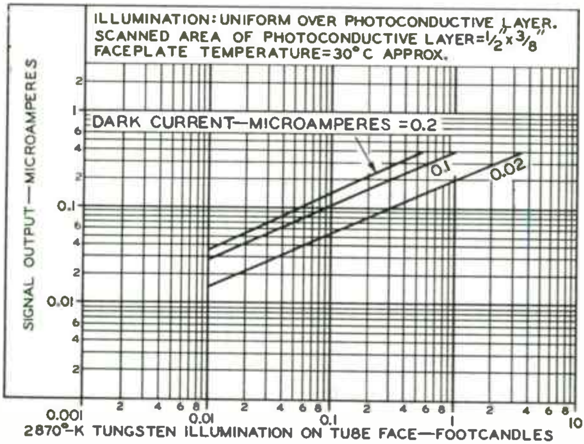
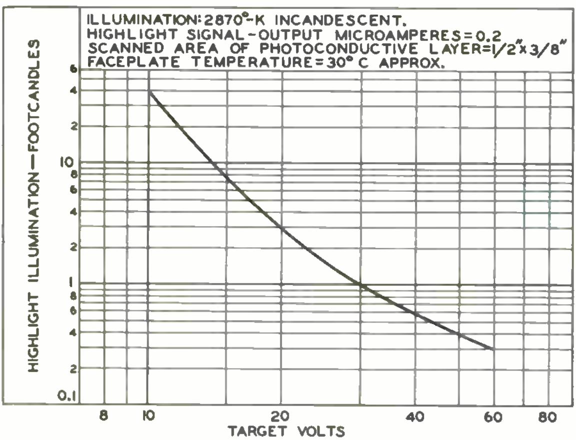
TYPICAL LIGHT-TRANSFER CHARACTERISTICS



92CS-10689R2

TYPICAL CHARACTERISTIC



92CS-10685R1

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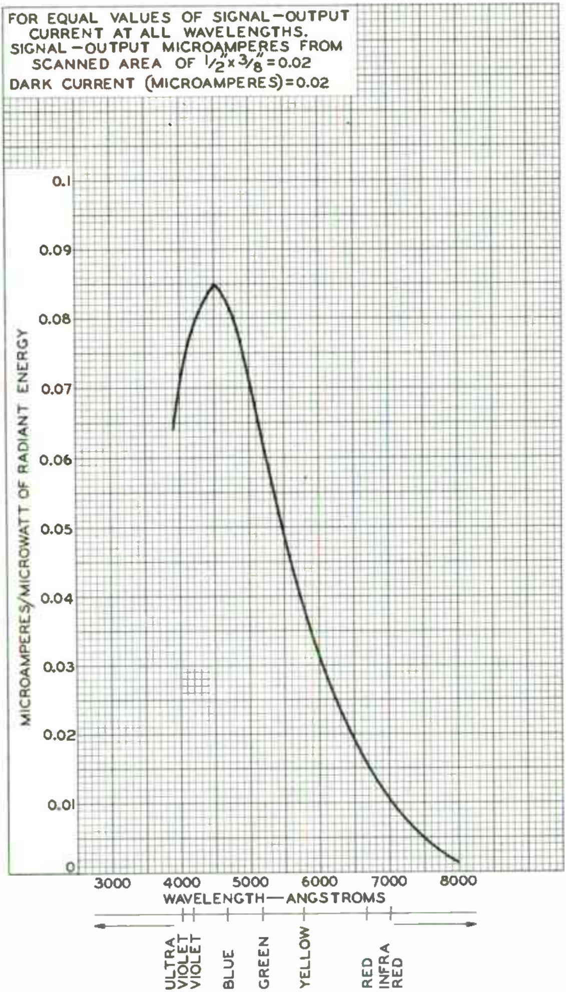
TYPICAL SPECTRAL-SENSITIVITY CHARACTERISTIC



92CM-10698R1

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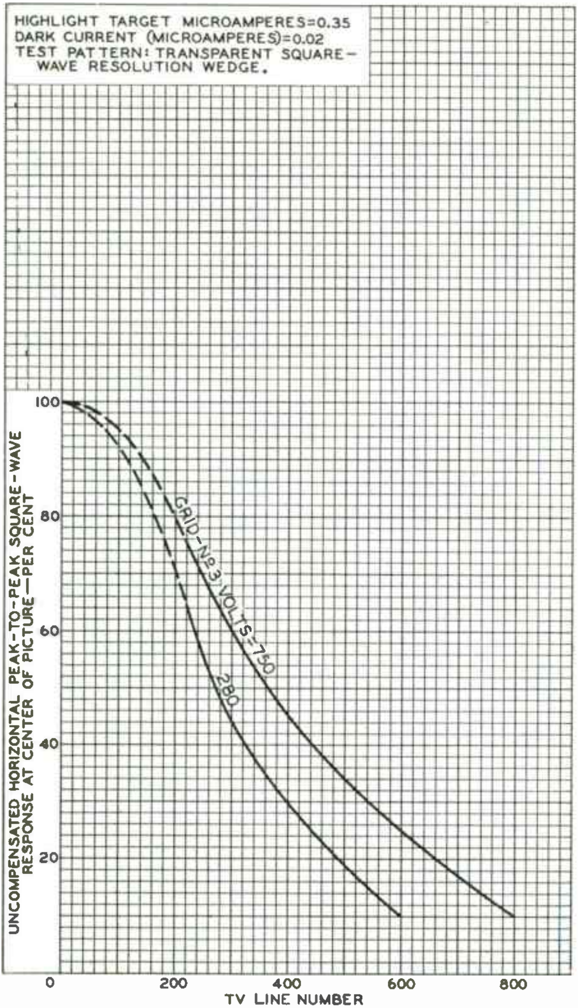
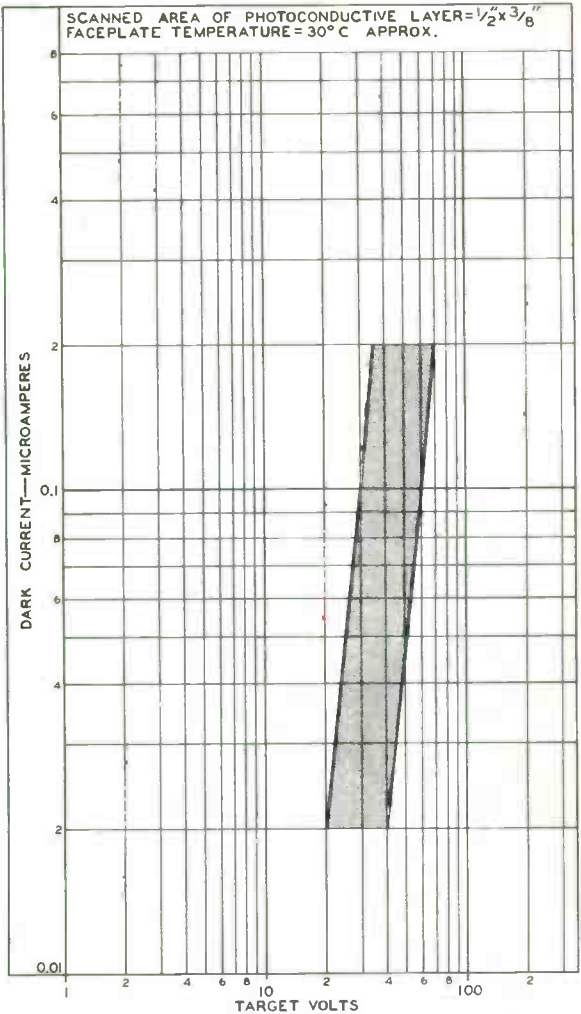
UNCOMPENSATED HORIZONTAL SQUARE-WAVE RESPONSE



92CM-10683R1

DARK-CURRENT RANGE



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MULTIPLIER PHOTOTUBE

14-STAGE, HEAD-ON, SPHERICAL-FACEPLATE TYPE WITH 1.68"-DIA., SPHERICAL, SEMITRANSPARENT PHOTOCATHODE AND S-11 RESPONSE
VERY SHORT TIME-RESOLUTION CAPABILITY

DATA

General:

Spectral Response S-11
Wavelength of Maximum Response . . . . . 4400 ± 500 angstroms
Cathode, Semitransparent:
Shape. . . . . .Spherical
Window:

Area	2.2	sq. in.
Minimum diameter	1.68	in.
Index of refraction.	1.51	

Direct Interelectrode Capacitances (Approx.):

Anode to dynode No.14.	2.4	μμf
Anode to all other electrodes. .	5.5	μμf
Dynode No.14 to all other electrodes	7.5	μμf

Maximum Overall Length . . . . 7.5"
Seated Length. 6.69" ± 0.19"
Maximum Diameter . . . . 2.38"
Operating Position . . . . .Any
Weight (Approx.) . . . . 8 oz
Bulb T16
Socket . . . . Alden No.220FT with 20 contacts, or equivalent
Base . . . . . . .Small-Shell Bidecal 20-Pin (JETEC No.B20-102)
Basing Designation for BOTTOM VIEW 20D

Pin 1 - No Connection
Pin 2 - Dynode No.1
Pin 3 - Dynode No.3
Pin 4 - Dynode No.5
Pin 5 - Dynode No.7
Pin 6 - Dynode No.9
Pin 7 - Dynode No.11
Pin 8 - Dynode No.13
Pin 9 - Grid No.2 (Accelerating Electrode)
Pin 10 - Anode
Pin 11 - Dynode No.14
Pin 12 - Dynode No.12
Pin 13 - Dynode No.10

DIRECTION OF LIGHT: INTO END OF BULB

Pin 14 - Dynode No.8
Pin 15 - Dynode No.6
Pin 16 - Dynode No.4
Pin 17 - Dynode No.2
Pin 18 - No Connection
Pin 19 - Grid No.1 (Focusing Electrode)
Pin 20 - Photocathode
Metal Collar - No Connection (If used, connect only to photocathode)

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MULTIPLIER PHOTOTUBE

VERY-LOW-LIGHT-LEVEL, LOW-NOISE, HIGH-GAIN SERVICE

With supply voltage (E) across voltage divider providing electrode voltages shown in Table I—Column A

Maximum Ratings, *Absolute Values:*

SUPPLY VOLTAGE BETWEEN ANODE AND CATHODE (DC)	2400 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.14 AND ANODE (DC)	400 max.	volts
SUPPLY VOLTAGE BETWEEN CONSECUTIVE DYNODES (DC)	500 max.	volts
SUPPLY VOLTAGE BETWEEN ACCELERATING ELECTRODE AND DYNODE No.13 (DC)	±500 max.	volts
DYNODE-No.1 SUPPLY VOLTAGE (DC)	400 max.	volts
FOCUSING-ELECTRODE SUPPLY VOLTAGE (DC)	400 max.	volts
AVERAGE ANODE CURRENT●	2 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

Characteristics Range Values for Equipment Design:

With E = 2000 volts (except as noted) and focusing-electrode as well as accelerating-electrode voltage adjusted to give maximum gain

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms	–	0.7	–	amp/μw
Cathode radiant, at 4400 angstroms	–	0.056	–	μa/μw
Luminous:#				
At 0 cps.	120	875	4500	amp/lumen
With dynode No.14 as output electrode†	–	612	–	amp/lumen
Cathode luminous:				
With tungsten light source▲	50	70	–	μa/lumen
With blue light source**♦	0.05	–	–	μa
Current Amplification	–	12.5×10^6	–	
Equivalent Anode-Dark-Current Input♣■	–	5×10^{-10}	2×10^{-9}	lumen
Equivalent Noise Input:★				
At +25° C	–	3.3×10^{-12}	1.5×10^{-11}	lumen
At −50° C	–	9×10^{-13}	–	lumen
Anode-Pulse Rise Time□	–	3	–	millimicrosec

●, #, †, ▲, **, ♦, ♣, ■, ★, □: See next page.

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MULTIPLIER PHOTOTUBE

	Min.	Median	Max.	
Greatest Delay Between Anode Pulses:				
Due to position from which electrons are simultaneously released within a circle centered on tube face and having a diameter of—				
1.12"	–	0.5‡	–	milliμsec
1.5".	–	1‡	–	milliμsec

HIGH-OUTPUT-PULSE SERVICE

With supply voltage (E) across voltage divider providing electrode voltages shown in Table I—Column B

Maximum Ratings, *Absolute Values:*

SUPPLY VOLTAGE BETWEEN ANODE AND CATHODE (DC).	2800 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.14 AND ANODE (DC).	400 max.	volts
SUPPLY VOLTAGE BETWEEN CONSECUTIVE DYNODES (DC).	500 max.	volts
SUPPLY VOLTAGE BETWEEN ACCELERATING ELECTRODE AND DYNODE No.13 (DC) . . .	±500 max.	volts
DYNODE-No.1 SUPPLY VOLTAGE (DC)	400 max.	volts
FOCUSING-ELECTRODE SUPPLY VOLTAGE (DC).	400 max.	volts
AVERAGE ANODE CURRENT•.	2 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

Characteristics Range Values for Equipment Design:

With E = 2400 volts (except as noted) and focusing-electrode as well as accelerating-electrode voltage adjusted to give maximum gain

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms. . . .	–	0.7	–	amp/μw
Cathode radiant, at 4400 angstroms. . . .	–	0.056	–	μa/μw
Luminous:#				
At 0 cps.	–	875	–	amp/lumen
With dynode No.14 as output electrode†.	–	612	–	amp/lumen
Cathode luminous:				
With tungsten light source▲ . . .	50	70	–	μa/lumen
With blue light source**♦	0.05	–	–	μa

•,#,†,▲,**,♦,◆,■,★,○,‡: See next page.

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MULTIPLIER PHOTOTUBE

	Min.	Median	Max.	
Current Amplification. . .	-	12.5×10^6	-	
Equivalent Anode-Dark-Current Input●⊕.	-	1.1×10^{-9}	-	lumen
Equivalent Noise Input:**				
At $+25^\circ$ C.	-	4.6×10^{-12}	-	lumen
At -50° C.	-	1.2×10^{-12}	-	lumen

● Averaged over any interval of 30 seconds maximum.

Under the following conditions: The light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A light input of 0.1 microlumen is used. The load resistor has a value of 0.01 megohm.

† An output current of opposite polarity to that obtained at the anode may be provided by using dynode No.14 as the output electrode. With this arrangement, the load is connected in the dynode-No.14 circuit and the anode serves only as collector.

▲ Under the following conditions: The light source is a tungsten-filament lamp 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 together as anode. The load resistor has a value of 0.01 megohm.

** Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning, Glass Code No.5113 polished to 1/2 stock thickness) from a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux on the filter is 0.01 lumen. The load resistor has a value of 0.01 megohm, and 200 volts are applied between cathode and all other electrodes connected together as anode.

♦ For spectral characteristic of this source, see sheet 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.

⊕ Measured at a tube temperature of 25° C and with the supply voltage (E) adjusted to give a luminous sensitivity of 2000 amperes per lumen. Dark current caused by thermionic emission may be reduced by the use of a refrigerant.

■ For maximum signal-to-noise ratio, operation with a supply voltage (E) below 2000 volts is recommended.

★ Under the following conditions: Supply voltage (E) is 2000 volts, 25° C tube temperature, external-shield potential of -2000 volts, ac-amplifier bandwidth of 1 cycle per second, tungsten light source 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. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

□ Measured between 10 per cent and 90 per cent of maximum anode-pulse height. This anode-pulse rise time is determined primarily by transit-time variations in the multiplier stages and with an incident-light spot approximately 1 millimeter in diameter centered on the photocathode.

‡ These values also represent the difference in time of transit between the photocathode and dynode No.1 for electrons simultaneously released from the center and from the periphery of the specified areas.

⊛ For maximum signal-to-noise ratio, operation with a supply voltage (E) below 2300 volts is recommended.

★★ Same as (★) except the supply voltage (E) is 2400 volts, and the external-shield potential is -2400 volts.

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MULTIPLIER PHOTOTUBE

TABLE I

VOLTAGE TO BE PROVIDED BY DIVIDER

Between	COLUMN A 5.4% of Supply Voltage (E) multiplied by	COLUMN B 2.75% of Supply Voltage (E) multiplied by
Cathode and Focusing Electrode	♣	♣
Cathode and Dynode No.1	2	2
Dynode No.1 and Dynode No.2	1	1
Dynode No.2 and Dynode No.3	1	1
Dynode No.3 and Dynode No.4	1	1
Dynode No.4 and Dynode No.5	1	1
Dynode No.5 and Dynode No.6	1	1
Dynode No.6 and Dynode No.7	1	1.2
Dynode No.7 and Dynode No.8	1	1.5
Dynode No.8 and Dynode No.9	1	1.9
Dynode No.9 and Dynode No.10	1	2.4
Dynode No.10 and Dynode No.11	1	3
Dynode No.11 and Dynode No.12	1.25	3.8
Dynode No.12 and Dynode No.13	1.5	4.8
Dynode No.13 and Dynode No.14	1.75	6
Dynode No.14 and Anode	2	4.8
Anode and Cathode	18.5	36.4

♣ Focusing electrode is connected to arm of potentiometer between cathode and dynode No.1. Focusing-electrode voltage is adjusted to give maximum gain.

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RCA

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MULTIPLIER PHOTOTUBE

OPERATING CONSIDERATIONS

Exposure of the 7264 to strong ultraviolet radiation may cause an increase in anode dark current. After cessation of such irradiation, the dark current drops rapidly.

The *operating stability* of the 7264 depends on the magnitude and duration of the anode current. When the 7264 is operated at high average values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 7264 usually recovers a substantial percentage of such loss in sensitivity.

Operation at an average anode current well below the maximum rated value of 2 milliamperes is recommended when stability is important. When maximum stability is required, the anode current should not exceed 250 microamperes.

Electrostatic and/or *magnetic shielding* of the 7264 may be necessary. It is to be noted that the use of an external magnetic and/or electrostatic shield at high negative potential is a safety hazard unless the shield is connected to the potential source through an impedance in the order of 10 megohms. If the shield is not so connected, *extreme care should be observed in providing adequate safeguards to prevent personnel from coming in contact with the high potential of the shield.*

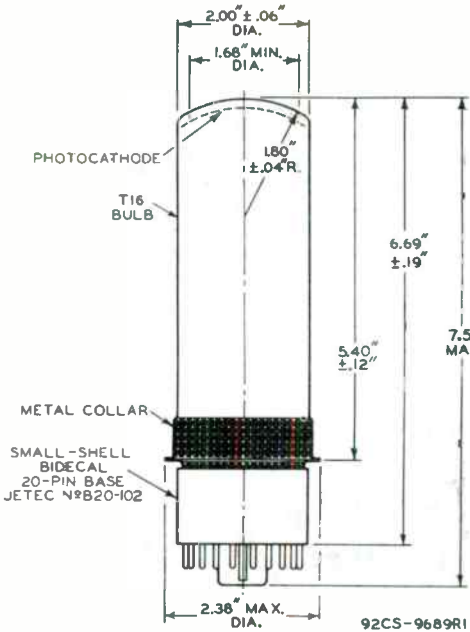
SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-11 Response
is shown at the front of this Section

World Radio History

RCA

7264

MULTIPLIER PHOTOTUBE



℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

World Radio History

RCA

7264

TYPICAL ANODE CHARACTERISTICS

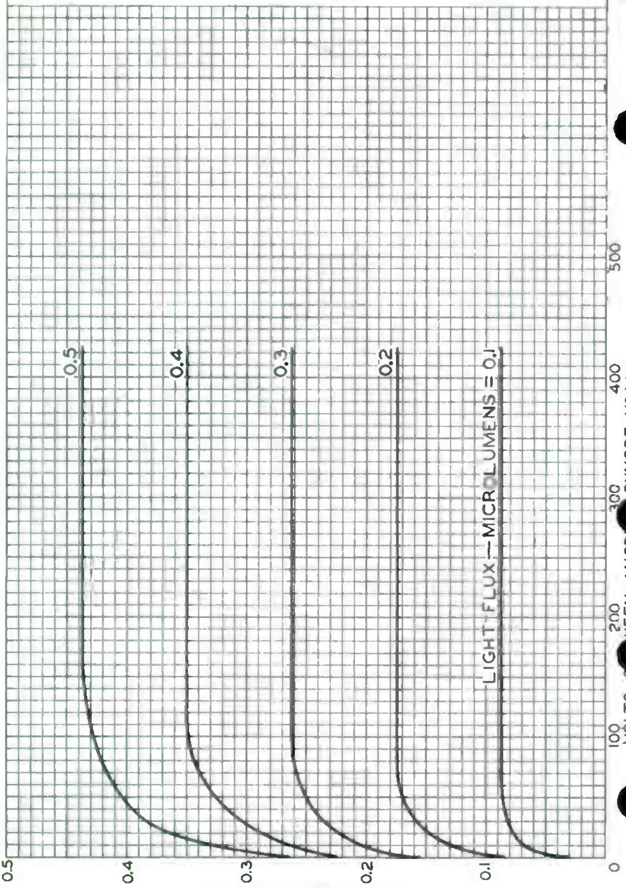
VERY-LOW-LIGHT-LEVEL, LOW-NOISE, HIGH-GAIN SERVICE

CATHODE-TO-GRID-№1 VOLTS = 108
GRID-№1-TO-DYNODE-№1 (DY_1) VOLTS = 108

DY_1-TO-DY_2, DY_2-TO-DY_3, ETC. TO DY_{10}-TO-DY_{11} } VOLTS = 108

DY_{11}-TO-DY_{12} VOLTS = 135
DY_{12}-TO-DY_{13} VOLTS = 160
DY_{13}-TO-DY_{14} VOLTS = 189
GRID-№2 VOLTS ADJUSTED TO GIVE MAXIMUM GAIN.

LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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RCA

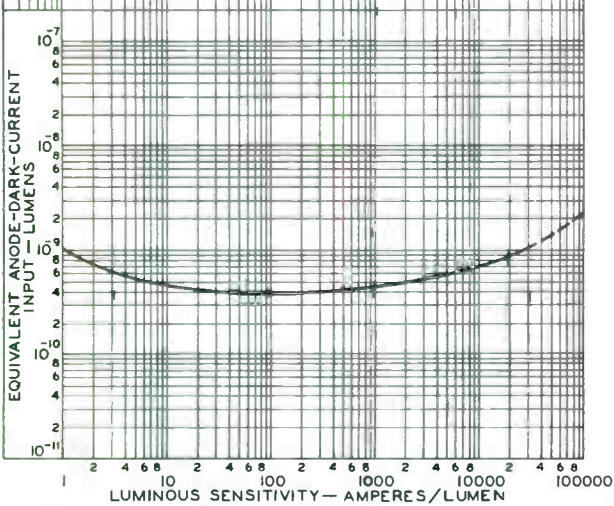
7264

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC
VERY-LOW-LIGHT-LEVEL, LOW-NOISE, HIGH-GAIN SERVICE

LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	5.4% OF E MULTIPLIED BY
CATHODE & GRID №1	1
GRID №1 & DYNODE №1 (DY_1)	1
DY_1 & DY_2	1
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1
DY_7 & DY_8	1
DY_8 & DY_9	1
DY_9 & DY_{10}	1
DY_{10} & DY_{11}	1
DY_{11} & DY_{12}	1.25
DY_{12} & DY_{13}	1.5
DY_{13} & DY_{14}	1.75
DY_{14} & ANODE	2.
ANODE & CATHODE	18.5

GRID-№2 VOLTS ADJUSTED TO GIVE MAXIMUM GAIN.
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.
TUBE TEMPERATURE = 25° C
DASHED PORTION INDICATES INSTABILITY.



ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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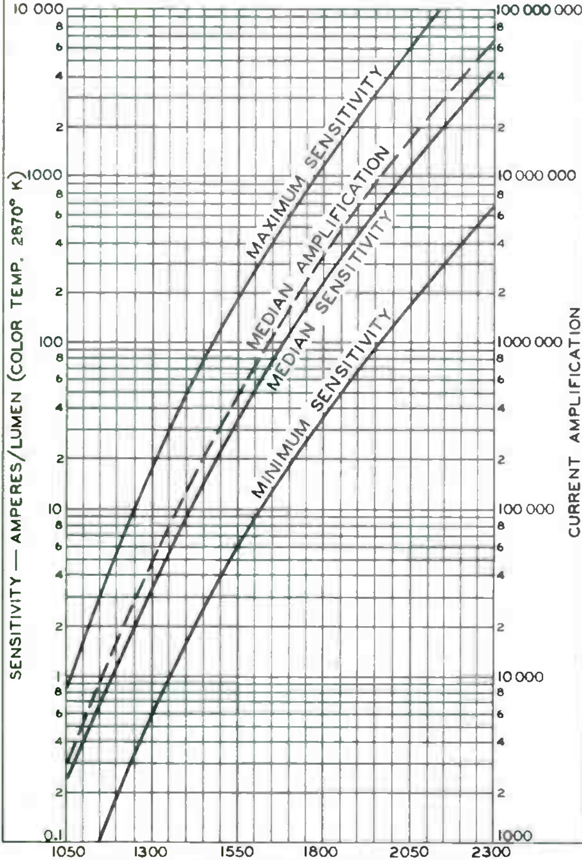
7264

7264
CHARACTERISTICS
VERY-LOW-LIGHT-LEVEL, LOW-NOISE, HIGH-GAIN SERVICE

THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	5.4 % OF E MULT. BY	BETWEEN	5.4 % OF E MULT. BY
CATHODE & GRID Nº 1	1	DY_{11} & DY_{12}	1.25
GRID Nº 1 & DYNODE Nº 1	1	DY_{12} & DY_{13}	1.5
DYNODE Nº 1 (DY_1) & DY_2 ETC. THRU DY_{10} & DY_{11}	1	DY_{13} & DY_{14}	1.75
		DY_{14} & ANODE	2

GRID-Nº 2 VOLTS ADJUSTED TO GIVE MAXIMUM GAIN.



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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World Radio History

RCA

7264

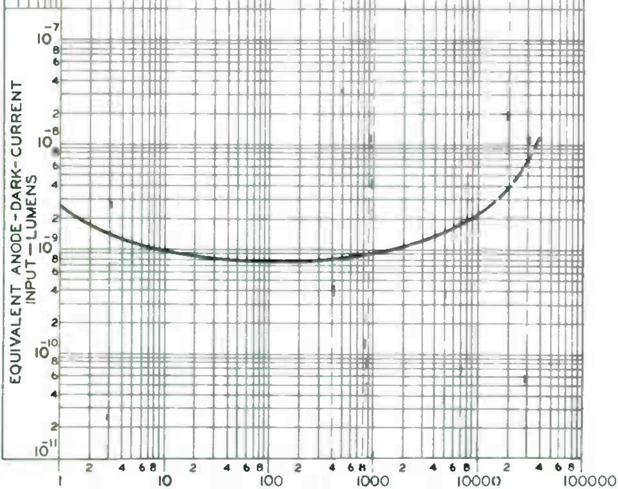
7264

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC
HIGH-OUTPUT-PULSE SERVICE

LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	2.75 % OF E MULTIPLIED BY
CATHODE & GRID No 1	1
GRID No 1 & DYNODE No 1 (DY_1)	1
DY_1 & DY_2	1
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1.2
DY_7 & DY_8	1.5
DY_8 & DY_9	1.9
DY_9 & DY_{10}	2.4
DY_{10} & DY_{11}	3
DY_{11} & DY_{12}	3.8
DY_{12} & DY_{13}	4.8
DY_{13} & DY_{14}	6
DY_{14} & ANODE	4.8
ANODE & CATHODE	36.4

GRID-No 2 VOLTS ADJUSTED TO GIVE MAXIMUM GAIN.
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.
TUBE TEMPERATURE = 25° C
DASHED PORTION INDICATES INSTABILITY.



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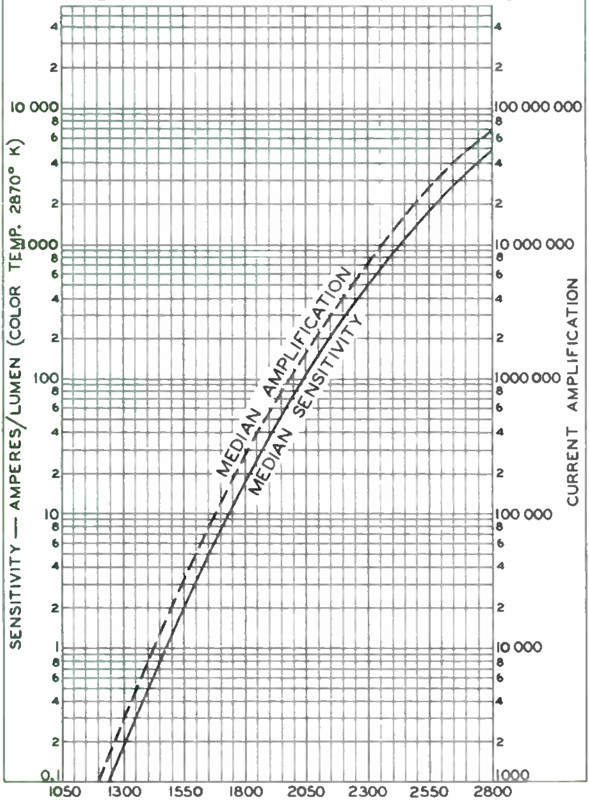
7264
CHARACTERISTICS
HIGH-OUTPUT-PULSE SERVICE

THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	2.75% OF E MULT. BY	BETWEEN	2.75% OF E MULT. BY
CATHODE & GRID Nº 1	1	DY_8 & DY_9	1.9
GRID Nº 1 & DYNODE Nº 1 (DY_1)	1	DY_9 & DY_{10}	2.4
DY_1 & DY_2 ETC. THRU DY_5 & DY_6	1	DY_{10} & DY_{11}	3
		DY_{11} & DY_{12}	3.8
		DY_{12} & DY_{13}	4.8
DY_6 & DY_7	1.2	DY_{13} & DY_{14}	6
DY_7 & DY_8	1.5	DY_{14} & ANODE	4.8

GRID-Nº 2 VOLTS ADJUSTED TO GIVE MAXIMUM GAIN.



SUPPLY VOLTS (E) BETWEEN ANODE & CATHODE

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MULTIPLIER PHOTOTUBE

14-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE WITH 1.68"-DIA., CURVED, CIRCULAR, SEMITRANSPARENT CATHODE AND S-20 RESPONSE
VERY SHORT TIME-RESOLUTION CAPABILITY

DATA

General:

Spectral Response		S-20
Wavelength of Maximum Response	4200 ± 500	angstroms
Cathode, Semitransparent:		
Shape		Curved Circular
Window:		
Area	2.2	sq. in.
Minimum diameter	1.68	in.
Inoex of refraction	1.51	
Direct Interelectrode Capacitances (Approx.):		
Anode to dynode No.14	2.8	$\mu\mu$f
Anode to all other electrodes	6	$\mu\mu$f
Dynode No.14 to all other electrodes	7.5	$\mu\mu$f
Maximum Overall Length		7.5"
Seated Length	6.69" ± 0.19"	
Maximum Diameter		2.38"
Operating Position		Any
Weight (Approx.)		8 oz
Bulb		T16
Socket		Alden No.220FT with 20 contacts, or equivalent
Base		Small-Shell Bidecal 20-Pin (JEDEC No.B20-102)
Basing Designation for BOTTOM VIEW		20C

Pin 1 - No Connection
Pin 2 - Dynode No.1
Pin 3 - Dynode No.3
Pin 4 - Dynode No.5
Pin 5 - Dynode No.7
Pin 6 - Dynode No.9
Pin 7 - Dynode No.11
Pin 8 - Dynode No.13
Pin 9 - Grid No.2 (Accelerating Electrode)
Pin 10 - Anode
Pin 11 - Dynode No.14
Pin 12 - Dynode No.12
Pin 13 - Dynode No.10
Pin 14 - Dynode No.8
Pin 15 - Dynode No.6

DIRECTION OF LIGHT: INTO END OF BULB

Pin 16 - Dynode No.4
Pin 17 - Dynode No.2
Pin 18 - No Connection
Pin 19 - Grid No.1 (Focusing Electrode)
Pin 20 - Photocathode
Metal Collar§ - Connected internally to Focusing Electrode—Do Not Make Electrical Connection to Collar

Maximum Ratings, ***Absolute Values:***

SUPPLY VOLTAGE BETWEEN ANODE AND CATHODE (DC)	3000 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.14 AND ANODE (DC)	500 max.	volts

§: See next page.

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MULTIPLIER PHOTOTUBE

SUPPLY VOLTAGE BETWEEN CONSECUTIVE DYNODES (DC)	600 max.	volts
SUPPLY VOLTAGE BETWEEN ACCELERATING ELECTRODE AND DYNODE No.13 (DC)	±600 max.	volts
DYNODE-No.1 SUPPLY VOLTAGE (DC)	500 max.	volts
FOCUSING-ELECTRODE SUPPLY VOLTAGE (DC)	500 max.	volts
AVERAGE ANODE CURRENT●	1 max.	ma
AMBIENT TEMPERATURE	85 max.	°C

Characteristics Range Values for Equipment Design:

Under conditions with dc supply voltage (E) across a voltage divider providing electrode voltages shown in Table 1

With E = 2400 volts (Except as noted) and accelerating-electrode voltage adjusted to give maximum gain

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4200 angstroms	–	0.6	–	amp/μw
Cathode radiant, at 4200 angstroms	–	0.064	–	μa/μw
Luminous:#				
At 0 cps	165	1400	6800	amp/lumen
With dynode No.14 as output electrode†	–	980	–	amp/lumen
Cathode luminous:				
With tungsten light source▲	100	150	–	μa/lumen
With blue light source**♦	0.05	–	–	μa
With red light source□⊛	0.30	–	–	μa
Current Amplification	–	9.35×10^{6}	–	
Equivalent Anode-Dark-Current Input⬢■	–	2×10^{-10}	8×10^{-10}	lumen
Equivalent Noise Input:★				
At +25° C.	–	7.5×10^{-13}	3.3×10^{-12}	lumen
At -80° C.	–	1×10^{-13}	–	lumen
Anode-Pulse Rise Time‡	–	3	–	milliμsec
Greatest Delay Between Anode Pulses:				
Due to position from which electrons are simultaneously released within a circle centered on tube face and having				

§,●,#,†,▲,**,♦,□,⊛,⬢,■,★,‡: See next page.

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MULTIPLIER PHOTOTUBE

	Min.	Median	Max.	
a diameter of—				
1.12".	-	1♦	-	milliμsec
1.56".	-	3♦	-	milliμsec

§ The metal collar may be at high potential depending on the circuit application and should be insulated accordingly.

● Averaged over any interval of 30 seconds maximum.

Under the following conditions: The light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A light input of 0.1 microlumen is used. The load resistor has a value of 0.01 megohm.

† An output current of opposite polarity to that obtained at the anode may be provided by using dynode No.14 as the output electrode. With this arrangement, the load is connected in the dynode-No.14 circuit and the anode serves only as collector.

▲ Under the following conditions: The light source is a tungsten-filament lamp 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 together as anode. The load resistor has a value of 0.01 megohm.

** Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning, Glass Code No.5113 polished to 1/2 stock thickness) from a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux on the filter is 0.01 lumen. The load resistor has a value of 0.01 megohm, and 200 volts are applied between cathode and all other electrodes connected together as anode.

♦ For spectral characteristic of this source, see sheet 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.

□ Under the following conditions: Light incident on the cathode is transmitted through a red filter (Corning, Glass Code No.2418, or equivalent) from a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux on the filter is 0.01 lumen. The load resistor has a value of 0.01 megohm, and 200 volts are applied between cathode and all other electrodes connected together as anode.

● For spectral characteristic of this source, see sheet SPECTRAL CHARACTERISTIC OF 2870° K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870° K SOURCE AFTER PASSING THROUGH INDICATED RED FILTER at front of this section.

● Measured at a tube temperature of 25° C and with the supply voltage (E) adjusted to give a luminous sensitivity of 1000 amperes per lumen. Dark current caused by thermionic emission may be reduced by the use of a refrigerant.

■ For maximum signal-to-noise ratio, operation with a supply voltage (E) below 2400 volts is recommended.

★ Under the following conditions: Supply voltage (E) is 2400 volts, external shield connected to metal collar, ac-amplifier bandwidth of 1 cycle per second, tungsten light source 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. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

‡ Measured between 10 per cent and 90 per cent of the maximum anode-pulse height. This anode-pulse rise time is determined primarily by transit-time variations in the multiplier stages only and with an incident-light spot approximately 1 millimeter in diameter centered on the photocathode.

♦ These values also represent the difference in time of transit between the photocathode and dynode No.1 for electrons simultaneously released from the center and from the periphery of the specified area.

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MULTIPLIER PHOTOTUBE

TABLE 1	
VOLTAGE TO BE PROVIDED BY DIVIDER	
Between	5.4% of Supply Voltage (E) multiplied by
Cathode and Focusing Electrode*	1.6
Cathode and Dynode No.1	2
Dynode No.1 and Dynode No.2	1
Dynode No.2 and Dynode No.3	1
Dynode No.3 and Dynode No.4	1
Dynode No.4 and Dynode No.5	1
Dynode No.5 and Dynode No.6	1
Dynode No.6 and Dynode No.7	1
Dynode No.7 and Dynode No.8	1
Dynode No.8 and Dynode No.9	1
Dynode No.9 and Dynode No.10	1
Dynode No.10 and Dynode No.11	1
Dynode No.11 and Dynode No.12	1.25
Dynode No.12 and Dynode No.13	1.5
Dynode No.13 and Dynode No.14	1.75
Dynode No.14 and Anode	2
Anode and Cathode	18.5

OPERATING CONSIDERATIONS

Exposing the 7265 to strong ultraviolet radiation may cause an increase in anode dark current. After cessation of such irradiation, the dark current returns rapidly toward its initial value.

The *operating stability* of the 7265 depends on the magnitude and duration of the anode current. When the 7265 is operated at high average values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extend of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 7265 usually recovers a substantial percentage of such loss in sensitivity.

Operation at an average anode current well below the maximum rated value of 1 milliampere is recommended when stability is important. When maximum stability is required, the anode current should not exceed 250 microamperes.

Electrostatic and/or *magnetic shielding* of the 7265 may be necessary.

* The metal collar *(See Dimensional Outline)* is connected internally to the focusing electrode. Extreme care should be taken in the design of apparatus to prevent operating personnel from coming in contact with the collar when the circuit application is such that the collar is at high potential.

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MULTIPLIER PHOTOTUBE

Adequate *light shielding* should be provided to prevent extraneous light from reaching any part of the 7265. Although the metallic coating on the inner side wall of the glass bulb serves to reduce the amount of extraneous light reaching the electrodes, it is inadequate to shield completely the entire structure from extraneous light.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-20 Response
is shown at the front of this Section

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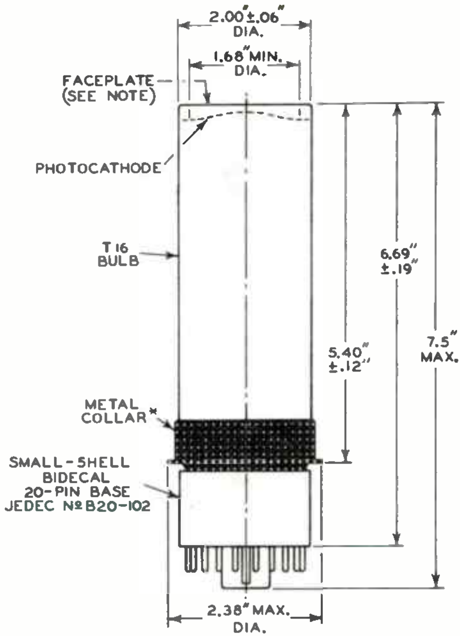
MULTIPLIER PHOTOTUBE



* MUST BE ADEQUATELY INSULATED.
92CS-9786R1

CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

NOTE: WITHIN 1.68" DIAMETER, DEVIATION FROM FLATNESS OF EXTERNAL SURFACE OF FACEPLATE WILL NOT EXCEED 0.005" FROM PEAK TO VALLEY.

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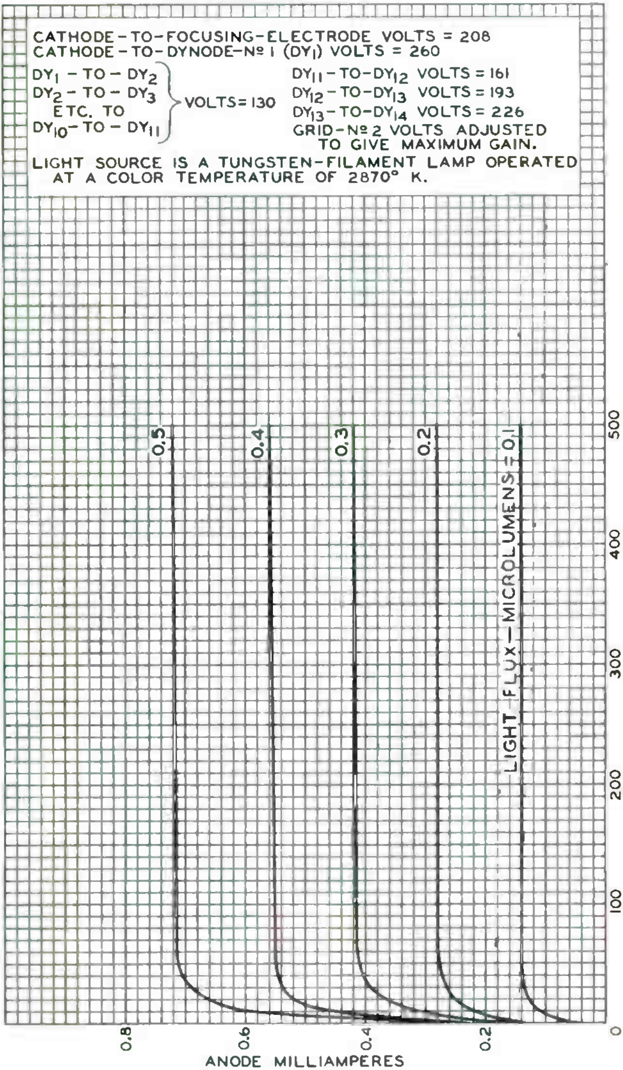
AVERAGE ANODE CHARACTERISTICS



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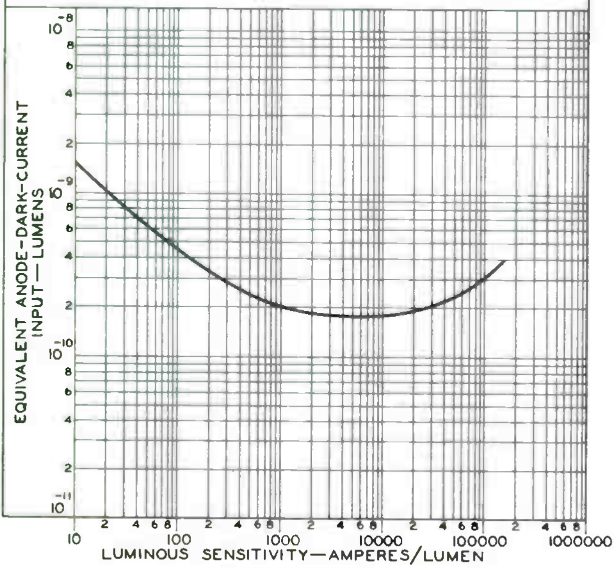
7265

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	5.4 % OF E MULTIPLIED BY
CATHODE & FOCUSING ELECTRODE	1.6
CATHODE & DYNODE №1 (DY_1)	2
DY_1 & DY_2	1
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1
DY_7 & DY_8	1
DY_8 & DY_9	1
DY_9 & DY_{10}	1
DY_{10} & DY_{11}	1
DY_{11} & DY_{12}	1.25
DY_{12} & DY_{13}	1.5
DY_{13} & DY_{14}	1.75
DY_{14} & ANODE	2
ANODE & CATHODE	18.5

GRID-№2 VOLTS ADJUSTED TO GIVE MAXIMUM GAIN.
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.
TUBE TEMPERATURE = 25° C



ELECTRON TUBE DIVISION 92CM-9783

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RCA

7265

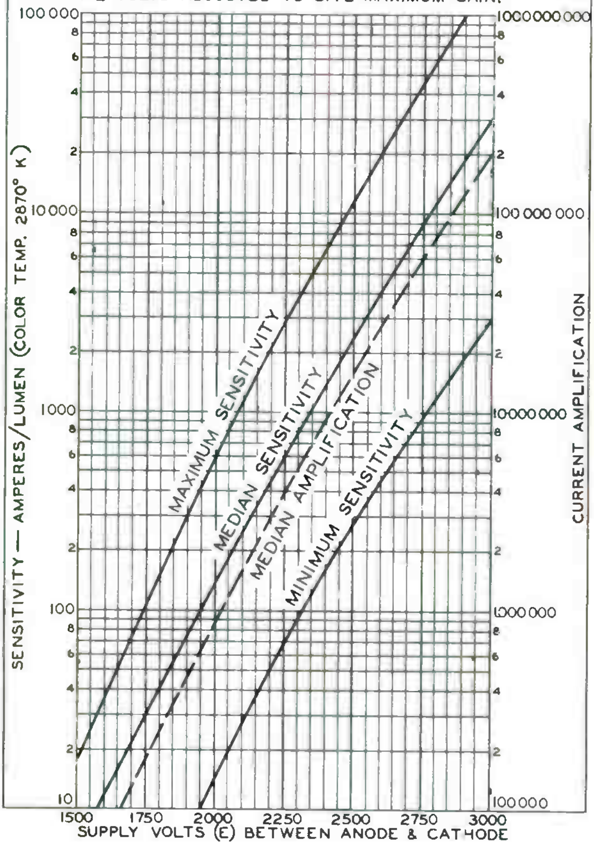
7265

CHARACTERISTICS

THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	5.4 % OF E MULT. BY	BETWEEN	5.4 % OF E MULT. BY
CATHODE & FOCUSING ELECTRODE	1.6	DY_{11} & DY_{12}	1.25
CATHODE & DYNODE No 1	2	DY_{12} & DY_{13}	1.5
DYNODE No 1 (DY_1) & DY_2 ETC. THRU DY_{10} & DY_{11}	1	DY_{13} & DY_{14}	1.75
		DY_{14} & ANODE	2

GRID-No 2 VOLTS ADJUSTED TO GIVE MAXIMUM GAIN.



ELECTRON TUBE DIVISION 92CM-9785

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World Radio History

World Radio History

Image Orthicon

MAGNETIC FOCUS — MAGNETIC DEFLECTION

ANTI-GHOST IMAGE SECTION

For Outdoor and Studio Pickup with Black-and-White TV Cameras

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance (Approx.):		
Anode to all other electrodes	12	$\mu\mu f$
Spectral Response		S-10
Wavelength of Maximum Response	4500 ± 300	angstroms
Photocathode, Semitransparent:		
Rectangular image (4 x 3 aspect ratio):		
Useful size of	1.8" max.	diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring; a condition that may be achieved in some camera designs with a 1.6" diagonal image on the photocathode.

Orientation of . . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base. The horizontal and vertical scan should preferably start at the corner of the raster nearest pin 6 of the shoulder base.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	15.20" ± 0.25"
Greatest Diameter of Bulb	3.00" ± 0.06"
Minimum Deflection-Coil Inside Diameter	2-3/8"
Deflecting-Coil Length	5"
Focusing-Coil Length	10"
Alignment-Coil:	
Length	15/16"
Position on neck	Centerline of coil located 8.5" from flat area of the jumbo annular base.
Photocathode Distance Inside End of Focusing Coil	1/2"

Operating Position . . . The tube should never be operated in a vertical position with the Diheptal-base end up nor in any other position where the axis of the tube with the base up makes an angle of less than 20° with the vertical.

Weight (Approx.) . . . . 1 lb 2 oz

World Radio History

Shoulder Base. . . . . .Keyed Jumbo Annular 7-Pin

BOTTOM VIEW

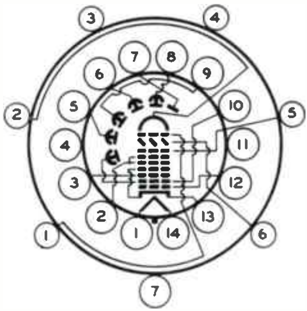
Pin 1 - Grid No.6
Pin 2 - Photocathode
Pin 3 - Internal Connection—Do Not Use
Pin 4 - Internal Connection—Do Not Use
Pin 5 - Grid No.5
Pin 6 - Target
Pin 7 - Internal Connection—Do Not Use

End Base . . . . .Small-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-45)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.4, Field Mesh
Pin 3 - Grid No.3
Pin 4 - Internal Connection—Do Not Use
Pin 5 - Dynode No.2
Pin 6 - Dynode No.4
Pin 7 - Anode
Pin 8 - Dynode No.5
Pin 9 - Dynode No.3
Pin 10 - Dynode No.1, Grid No.2
Pin 11 - Internal Connection—Do Not Use
Pin 12 - Grid No.1
Pin 13 - Cathode, Suppressor Grid
Pin 14 - Heater

DIRECTION OF LIGHT: PERPENDICULAR TO LARGE END OF TUBE



WHITE INDEX LINE ON FACE

NOTE: In the tube symbol, the suppressor grid connected to the cathode, and the field-mesh grid connected to grid No.4, are intentionally without numbers to avoid upsetting industry practice of associating functional camera control knobs with specified grid numbers. For example, beam-focus control is generally associated with knob identified as G_4 (grid No.4).

Maximum and Minimum Ratings, ***Absolute-Maximum Values:***

PHOTOCATHODE:		
Voltage.	-700 max.	volts
Illumination	50 max.	fc
OPERATING TEMPERATURE:		
Any part of bulb	65 max.	°C
Of bulb at large end of tube (Target section)	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between target section and any part of bulb hotter than target section	5 max.	°C
GRID-No.6 VOLTAGE.	-700 max.	volts
TARGET VOLTAGE:		
Positive value	10 max.	volts
Negative value	10 max.	volts
GRID-No.5 VOLTAGE.	150 max.	volts

World Radio History

GRID-No.4 VOLTAGE	350 max.		volts
GRID-No.3 VOLTAGE	400 max.		volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	350 max.		volts
GRID-No.1 VOLTAGE:			
Negative-bias value	125 max.		volts
Positive-bias value	0 max.		volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	125 max.		volts
Heater positive with respect to cathode	10 max.		volts
ANODE SUPPLY VOLTAGE[a]	1350 max.		volts
VOLTAGE PER MULTIPLIER STAGE	350 max.		volts

Typical Operating Values:[b]

Photocathode Voltage (Image Focus)[c]	-400 to -540	volts
Grid-No.6 Voltage (Accelerator)— Approx. 75% of photocathode voltage[d]	-300 to -405	volts
Target-Cutoff Voltage[e]	-3 to +1	volts
Grid-No.5 Voltage (Decelerator)	0 to 40	volts
Grid-No.4 Voltage (Beam Focus)[c]	140 to 180	volts
Grid-No.3 Voltage[f]	260 to 300	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Target-Temperature Range	35 to 45	°C
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil[g]	75	gausses
Field Strength of Alignment Coil	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operating Values and with camera lens set to bring the picture highlights one stop above the "knee" of the light-transfer characteristic

	Min.	*Average*	*Max.*	
Cathode Radiant Sensitivity at 4500 angstroms	-	0.028	-	μa/μw
Luminous Sensitivity (2870° K)	30	60	-	μa/lm
Anode Current (DC)	-	30	50	μa
Signal-Output Current (Peak to peak)	5	-	30	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for bandwidth of 4.5 Mc.	30:1	37:1	-	
Photocathode Illumination at 2870° K required to reach "knee" of light-transfer characteristic	-	0.01	0.028	fc

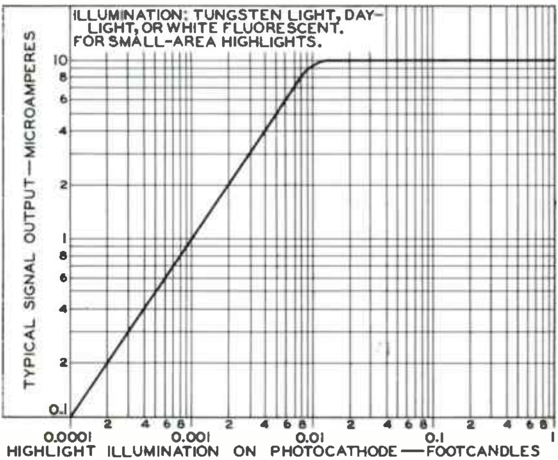
World Radio History

Amplitude Response at 400 TV lines per picture height (Per cent of large-area black to large-area white)[h]	30	40	-	%
Limiting Horizontal Resolution	500	-	-	TV lines

[a] Dynode-voltage values are shown under *Typical Operating Values*.
[b] With 7293A operated in RCA-TK-11 or -TK-31 camera. Other cameras may require slightly different voltage ranges.
[c] Adjust for best focus.
[d] For minimum highlight flare or "ghost" the grid-No.6 voltage should be 73 per cent of the photocathode voltage.
[e] Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from -3 to +5 volts.
[f] Adjust to give the most uniformly shaded picture near maximum signal.
[g] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.
[h] Measured with amplifier having flat frequency response.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-10 RESPONSE is shown at front of this Section

BASIC LIGHT-TRANSFER CHARACTERISTIC



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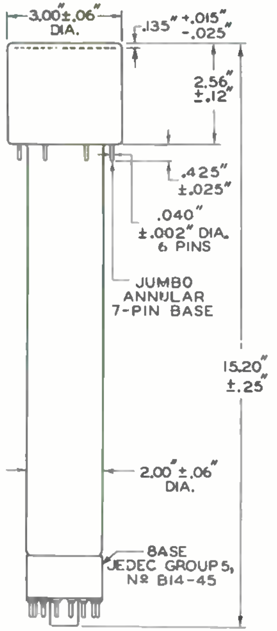
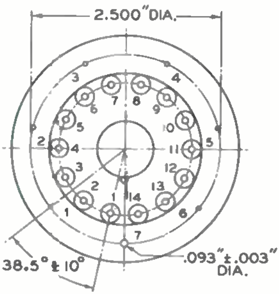
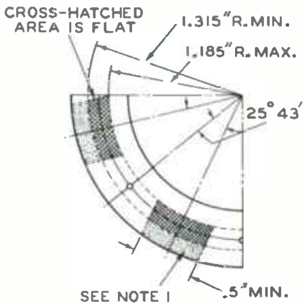




ENLARGED BOTTOM VIEW

DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.050" MAX.

ANNULAR-BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

92CM-8293R3

World Radio History

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LONG-LIFE TARGET
MAGNETIC FOCUS

MAGNETIC DEFLECTION
ANTI-GHOST IMAGE SECTION

For Outdoor and Studio Pickup with Black-and-White TV Cameras. The 7293A/L is Directly Interchangeable with the 7293A in All Cameras.

The 7293A/L is the same as the 7293A except utilizes a longer-life non-deteriorating glass target.

The sturdy, long-life, non-deteriorating, glass target of type 7293A/L is characterized by high gain, resistance to "burn-in", and the absence of any granular structure. Because charge transportation through this target material is electronic rather than ionic as in ordinary glass targets, the electrical characteristics of the target, such as secondary emission and resistivity, are essentially constant and sensitivity of the 7293A/L is stable throughout life.

Other important advantages of this target are that the undesirable characteristics of scene retention or "sticking-picture" and raster "burn-in" due to underscanning are significantly reduced. The resistance of the 7293A/L to image "burn-in" provides a highly desirable operational feature because it is not necessary to use an orbiter or continually move the camera when focused on a stationary scene.

OPERATING CONSIDERATIONS

Dos and Don'ts on Use of RCA-7293A/L

Dos

1. Allow 7293A/L to warm up prior to operation.
2. Hold temperature of the 7293A/L within operating range.
3. Make sure alignment coil is properly adjusted.
4. Adjust beam-focus control for best usable resolution.
5. Condition spare 7293A/L's by operating several hours once each month.
6. Determine proper operating point with target voltage adjusted to exactly 2 volts above target cutoff.
7. Uncap lens before voltages are applied to the 7293A/L.

Don'ts

1. Don't force the 7293A/L into its shoulder socket.
2. Don't operate the 7293A/L without scanning.
3. Don't operate a 7293A/L having an ion spot.
4. Don't use more beam current than necessary to discharge the highlights of the scene.
5. Don't turn off beam while voltages are applied to photocathode, grid No.6, target, dynodes, and anode during warm-up or standby operation.

World Radio History

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Image Orthicon

MAGNETIC FOCUS — MAGNETIC DEFLECTION

EXCELLENT RESOLUTION CAPABILITY

For Outdoor and Studio Pickup with High-Quality Black-and-White TV Cameras. The 7295B is Unilaterally Interchangeable with Types 7295 and 7295A.

DATA

General:

Heater, for Unipotential Cathode:

Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp

Direct Interelectrode Capacitance:

Anode to all other electrodes	12	pf
Target-to-Mesh Spacing	0.002	inch
Spectral Response		S-10
Wavelength of Maximum Response	4500 ± 300	angstroms

Photocathode, Semitransparent:

Rectangular image (4 x 3 aspect ratio):

Useful size . . . . 1.6" max. diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

Orientation . . . . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of the faceplate and the grid-No.6 envelope terminal. The horizontal and vertical scan should start at the corner of the picture between the grid-No.6 and the photocathode envelope terminals.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	19.375" ± 0.310"
Greatest Diameter of Bulb	4.500" ± 0.094"
Minimum Deflecting-Coil Inside Diameter	3.2"
Deflecting-Coil Length	7"
Focusing-Coil Length	15"

Alignment-Coil:

Position on neck. . . Centerline of magnetic field should be located 9.25" from the flat area of the shoulder.

Operating Position	See *Operating Considerations*
Weight (Approx.)	2.3 lbs
Socket	Cinch[a] Part No.3M14. or equivalent
Envelope Terminals	5

BOTTOM VIEW▲

Terminal Over Pin 2 - Field Mesh

Terminal Over Pin 4 - Photocathode (PC)

Terminal On Side of Envelope Opposite Base Key - Grid No.6 (G_6)

▲ See basing diagram on next page.

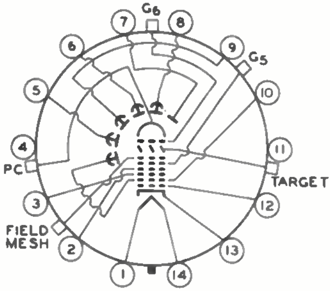
World Radio History

Terminal Over Pin 9 - Grid No.5 (G_5)
Terminal Over Pin 11 - Target

End Base. . . . . Small-Shell Diheptal 14-Pin (JEDEC Group 5, No. B14-45)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.4
Pin 3 - Grid No.3
Pin 4 - Do Not Use
Pin 5 - Dynode No.2
Pin 6 - Dynode No.4
Pin 7 - Anode
Pin 8 - Dynode No.5
Pin 9 - Dynode No.3
Pin 10 - Dynode No.1, Grid No.2
Pin 11 - Do Not Use
Pin 12 - Grid No.1
Pin 13 - Cathode
Pin 14 - Heater



Maximum and Minimum Ratings, ***Absolute-Maximum Values:***

PHOTOCATHODE:		
Voltage	-700 max.	volts
Illumination.	50 max.	fc
OPERATING TEMPERATURE:[b]		
Any part of bulb.	65 max.	°C
Of bulb at large end of tube (Image section)	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between image section and any part of bulb hotter than image section . .	5 max.	°C
GRID-No.6 VOLTAGE	-700 max.	volts
TARGET VOLTAGE:		
Positive value.	10 max.	volts
Negative value.	10 max.	volts
FIELD-MESH VOLTAGE[c]	30 max.	volts
GRID-No.5 VOLTAGE	300 max.	volts
GRID-No.4 VOLTAGE	350 max.	volts
GRID-No.3 VOLTAGE	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value	125 max.	volts
Positive-bias value	0 max.	volts
VOLTAGE PER MULTIPLIER STAGE.	350 max.	volts
ANODE SUPPLY VOLTAGE[d]	1650 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode .	125 max.	volts
Heater positive with respect to cathode .	10 max.	volts

World Radio History

Typical Operating Values:[e]

Photocathode Voltage	-600	volts
Grid-No.6 Voltage (Image Focus) Approx. 50% of photocathode voltage[f]	-250 to -350	volts
Target Voltage Above Cutoff[g]	2.3	volts
Field-Mesh Voltage[c]	15 to 25	volts
Grid-No.5 Voltage (Decelerator)	40	volts
Grid-No.4 Voltage (Beam Focus)	70 to 90	volts
Grid-No.3 Voltage[h]	250 to 275	volts
Grid-No.2 & Dynode-No.1 Voltage	280	volts
Grid-No.1 Voltage for picture cutoff	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Recommended Target-Temperature Range[b]	35 to 45	°C
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength of Focusing Coil (Approx.):[j]		
At center of scanning section	60	gausses
In plane of photocathode	120	gausses
Field Strength of Alignment Coil	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operating Values including Recommended Target-Temperature Range, target voltage adjusted to 2.3 volts above cutoff, and with the camera lens set to bring picture highlights one stop above the "knee" of the accompanying Basic Light-Transfer-Characteristic Curve

	Min.	*Average*	*Max.*	
Cathode Radiant Sensitivity at 4500 angstroms	-	0.030	-	a/w
Luminous Sensitivity	30	60	-	μa/lm
Signal-Output Current (Peak to Peak)	10	-	40	μa
Ratio of Peak-to-Peak Highlight Video Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc	60.1	75.1	-	
Photocathode Illumination at 2870° K Required to bring Picture Highlights One Stop above "Knee" of Light-Transfer Characteristic	-	-	0.110	fc
Amplitude Response at 400 TV Lines per Picture Height (Per cent of large-area black to large-area white)[k]	60	75	-	%
Uniformity:[m]				
Ratio of Shading (Background) Signal to Highlight Signal	-	0.10	0.15	

World Radio History

	Min.	Average	Max.	
Decrease from Peak Highlight Signal Level of Signal from any Point on Scanned Area of Target. .	–	12	25	%

[a] Cinch Manufacturing Corporation, 1026 South Homan Avenue, Chicago 24, Illinois.

[b] Operating outside the *Recommended Target-Temperature Range* shown under *Typical Operating Values* will not damage the 7295B provided the *Maximum Temperature Ratings* of the tube are not exceeded. Optimum performance, however, is only obtained when the tube is operated within the *Recommended Target-Temperature Range*.

[c] With respect to grid No.4.

[d] Dynode-voltage values are shown under *Typical Operating Values*.

[e] With 7295B operated in RCA TK-60 camera at fixed photocathode voltage.

[f] Adjust for optimum focus.

[g] The target supply voltage should be adjustable from -5 to 5 volts.

[h] Adjust to give the most uniformly shaded picture near maximum signal.

[j] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

[k] Measured with amplifier having flat frequency response.

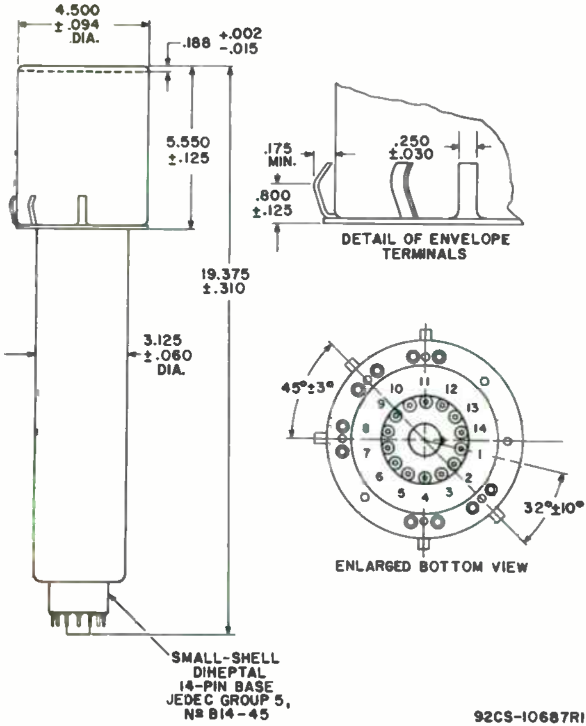
[m] With uniform illumination on photocathode.

OPERATING CONSIDERATIONS

The tube should never be operated in a vertical position with the Diheptal/base end up nor in any other position where the axis of the tube with base up makes an angle of less than 20° with the vertical.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Photosensitive Device having S-10 Response is shown at the front of this Section

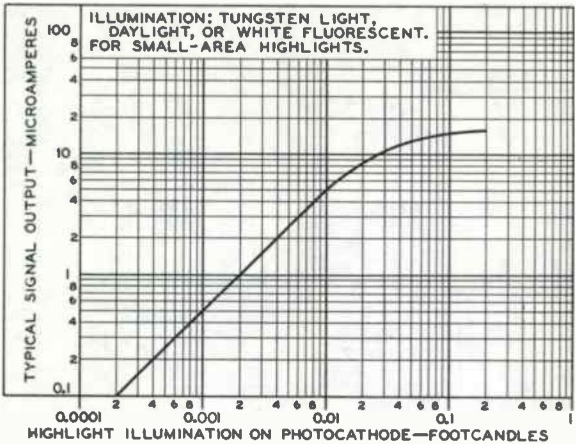
World Radio History



ALL DIMENSIONS IN INCHES

World Radio History

BASIC LIGHT-TRANSFER CHARACTERISTIC



92CS-10692

World Radio History

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LONG-LIFE TARGET
MAGNETIC FOCUS

FIELD-MESH TYPE
MAGNETIC DEFLECTION

For High-Quality Black-and-White TV Pickup in Studio or Outdoor Service. The 7295B/L is Directly Interchangeable with the 7295, 7295A, and 7295B in all Cameras.

The 7295B/L is the same as the 7295B except utilizes a stable, long-life glass target.

The stable, long-life, glass target of type 7295B/L is characterized by high gain, resistance to "burn-in", and the absence of any granular structure. Because charge transportation through this target material is electronic rather than ionic as in ordinary glass targets, the electrical characteristics of the target, such as secondary emission and resistivity, are essentially constant and sensitivity of the 7295B/L is stable throughout life.

Other important advantages of this target are that the undesirable characteristics of scene retention or "sticking picture" and raster "burn-in" due to underscanning are significantly reduced. The resistance of the 7295B/L to image "burn-in" provides a highly desirable operational feature because it is not necessary to use an orbiter or continually move the camera when focused on a stationary scene.

OPERATING CONSIDERATIONS

Dos and Don'ts on Use of RCA-7295B/L

Dos

1. Allow the 7295B/L to warm up prior to operation.
2. Hold temperature of the 7295B/L within operating range.
3. Make sure alignment coil is properly adjusted.
4. Adjust beam-focus control for best usable resolution.
5. Condition spare 7295B/L's by operating several hours once each month.
6. Determine proper operating point with target voltage adjusted to the desired voltage above target cutoff.
7. Uncap lens before voltages are applied to the 7295B/L.

Don'ts

1. Don't force the 7295B/L into its shoulder socket.
2. Don't operate the 7295B/L without scanning.
3. Don't operate a 7295B/L having an ion spot.
4. Don't use more beam current than necessary to discharge the highlights of the scene.
5. Don't turn off beam while voltages are applied to photocathode, grid No. 6, target, dynodes, and anode during warm-up or standby operation.

World Radio History

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RCA

7326

MULTIPLIER PHOTOTUBE

10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE WITH 1.68"-DIAMETER, CURVED, CIRCULAR, SEMITRANSPARENT PHOTOCATHODE AND S-20 RESPONSE

DATA

General:

Spectral Response		S-20
Wavelength of Maximum Response	4200 ± 500	angstroms
Cathode, Semitransparent:		
Shape		Curved Circular
Window:		
Area	2.2	sq. in.
Minimum diameter	1.68	in.
Index of refraction	1.51	
Direct Interelectrode Capacitances (Approx.):		
Anode to dynode No.10	2.4	μμf
Anode to all other electrodes	5.5	μμf
Dynode No.10 to all other electrodes	6.5	μμf
Maximum Overall Length		6.78"
Seated Length		5.84" ± 0.19"
Maximum Diameter		2.38"
Operating Position		Any
Weight (Approx.)		6 oz
Bulb		T16
Base		Medium-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-38), Non-hygroscopic
Basing Designation for BOTTOM VIEW		14AM

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

DIRECTION OF LIGHT: INTO END OF BULB

Pin 12 - Internal Connection—Do Not Use
Pin 13 - Focusing Electrode
Pin 14 - Photocathode
Metal Collar - No Connection (If used, connect only to photocathode)

Maximum Ratings, *Absolute Values*:

SUPPLY VOLTAGE BETWEEN ANODE AND CATHODE (DC)	2400 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE (DC)	500 max.	volts
SUPPLY VOLTAGE BETWEEN CONSECUTIVE DYNODES (DC)	600 max.	volts
DYNODE-No.1 SUPPLY VOLTAGE (DC)	500 max.	volts
FOCUSING-ELECTRODE SUPPLY VOLTAGE (DC)	500 max.	volts
AVERAGE ANODE CURRENT•	1 max.	ma
AMBIENT TEMPERATURE	85 max.	°C

•: See next page.

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MULTIPLIER PHOTOTUBE

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; 1/8 of E between cathode and focusing electrode; 1/12 of E for each succeeding dynode stage; and 1/12 of E between dynode No. 10 and anode

With E = 1800 volts (Except as noted)

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4200 angstroms. . . .	–	9600	–	μa/μw
Cathode radiant, at 4200 angstroms. . . .	–	0.064	–	μa/μw
Luminous♦.	5	22.5	150	amp/lumen
Cathode luminous:				
With tungsten light source▲.	120	150	–	μa/lumen
With blue light source**♦. . .	0.05	–	–	μa
With red light source□§ . . .	0.3	–	–	μa
Current Amplification. . .	–	1.5×10^5	–	
Equivalent Anode-Dark-Current Input+■.	–	3×10^{-10}	1.4×10^{-9}	lumen
Equivalent Noise Input:★				
At +25° C.	–	1.9×10^{-12}	4.3×10^{-12}	lumen
At -80° C.	–	3×10^{-13}	6×10^{-13}	lumen
Anode-Pulse Rise Time●.	–	2.5	–	milliμsec
Greatest Delay Between Anode Pulses:				
Due to position from which electrons are simultaneously released within a circle centered on tube face and having a diameter of—				
1.12".	–	1†	–	milliμsec
1.56".	–	3†	–	milliμsec

● Averaged over any interval of 30 seconds maximum.

♦,▲,**,♦,□,§,+,■,★,●,†: See next page.

World Radio History

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MULTIPLIER PHOTOTUBE

● Under the following conditions: The light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A light input of 0.1 microlumen is used. The load resistor has a value of 0.01 megohm.

▲ Under the following conditions: The light source is a tungsten-filament lamp 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 together as anode. The load resistor has a value of 0.01 megohm.

** Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning, Glass Code No.5113 polished to 1/2 stock thickness) from a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux on the filter is 0.01 lumen. The load resistor has a value of 0.01 megohm and 200 volts are applied between cathode and all other electrodes connected together as anode.

♦ For spectral characteristic of this source, see sheet 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.

□ Under the following conditions: Light incident on the cathode is transmitted through a red filter (Corning, Glass Code No.2418, or equivalent) from a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux on the filter is 0.01 lumen. The load resistor has a value of 0.01 megohm, and 200 volts are applied between cathode and all other electrodes connected together as anode.

§ For spectral characteristic of this source, see sheet SPECTRAL CHARACTERISTIC OF 2870° K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870° K SOURCE AFTER PASSING THROUGH INDICATED RED FILTER at front of this section.

♣ Measured at a tube temperature of 25° C and with the supply voltage (E) adjusted to give a luminous sensitivity of 20 amperes per lumen. Dark current caused by thermionic emission may be reduced by the use of a refrigerant.

■ For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1800 volts is recommended.

★ Under the following conditions: Supply voltage (E) is 1800 volts, external-shield potential of -1800 volts, ac-amplifier bandwidth of 1 cycle per second, tungsten light source 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. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

● Measured between 10 per cent and 90 per cent of maximum anode-pulse height. This anode-pulse rise time is determined primarily by transit-time variations in the multiplier stages and with an incident-light spot approximately 1 millimeter in diameter centered on the photocathode.

† These values also represent the difference in time of transit between the photocathode and dynode No.1 for electrons simultaneously released from the center and from the periphery of the specified areas.

OPERATING CONSIDERATIONS

Operation at an *average anode current* well below the maximum rated value of 1 milliampere is recommended when stability is important.

Electrostatic and/or *magnetic shielding* of the 7326 may be necessary.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-20 Response is shown at front of this Section

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

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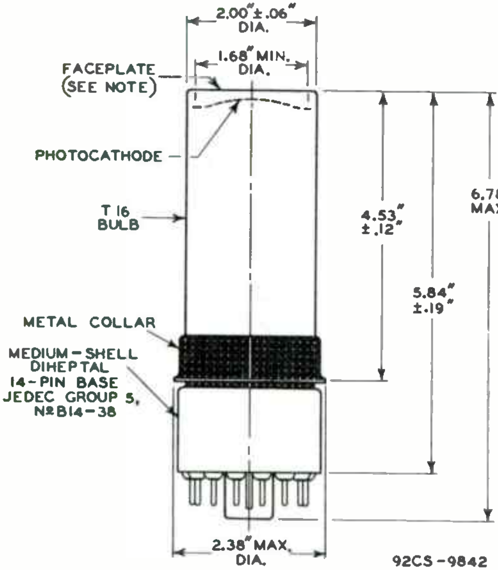
MULTIPLIER PHOTOTUBE



CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

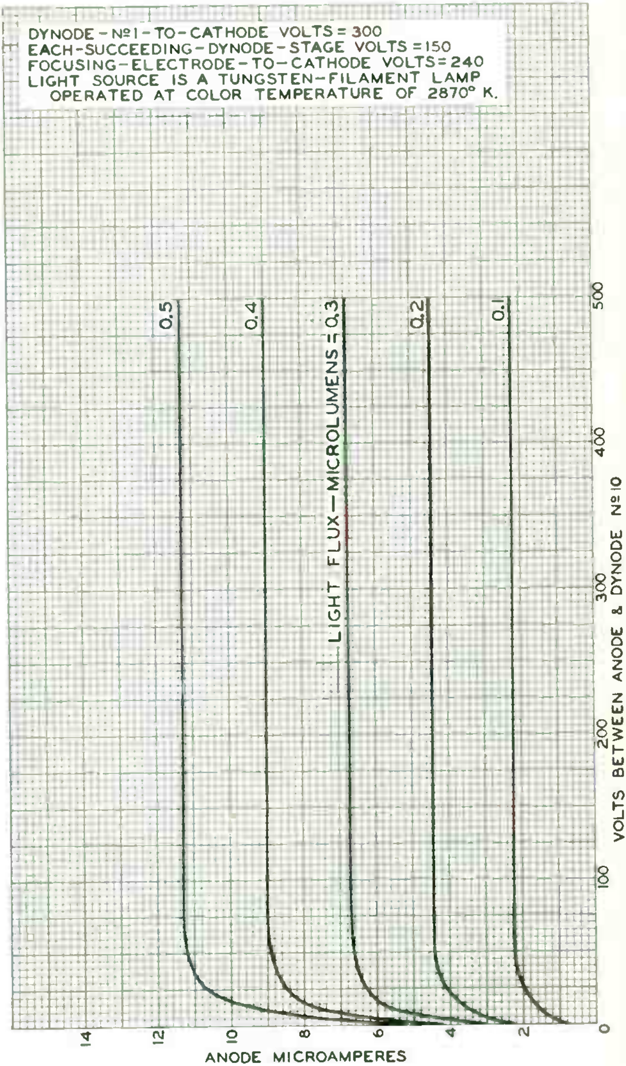
NOTE: WITHIN 1.68" DIAMETER, DEVIATION FROM FLATNESS OF EXTERNAL SURFACE OF FACEPLATE WILL NOT EXCEED 0.005" FROM PEAK TO VALLEY.

World Radio History

RCA

7326

TYPICAL ANODE CHARACTERISTICS



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92CM-9840

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7326

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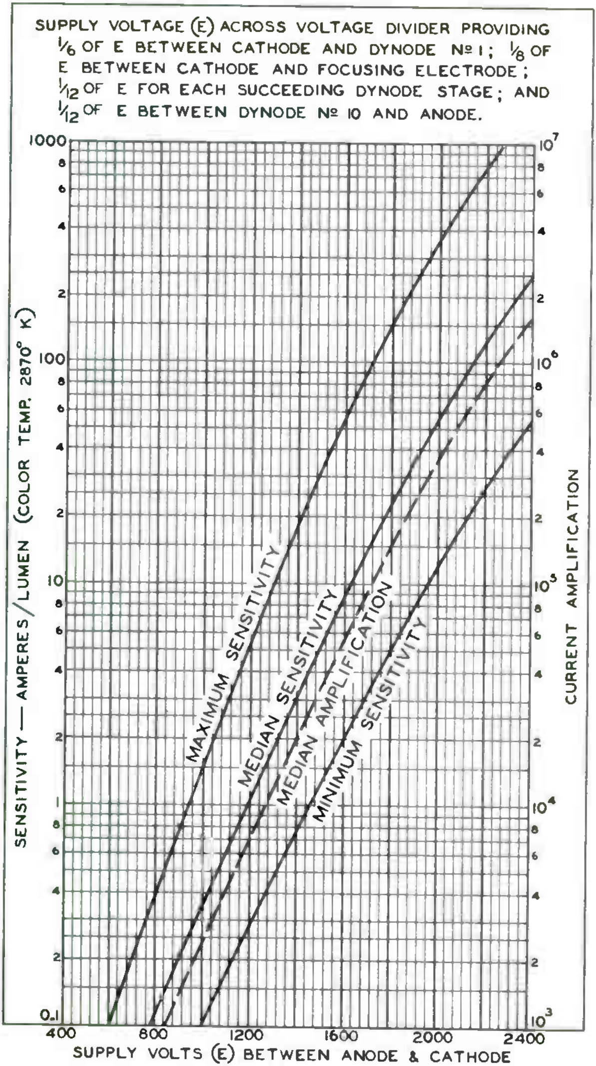
CHARACTERISTICS



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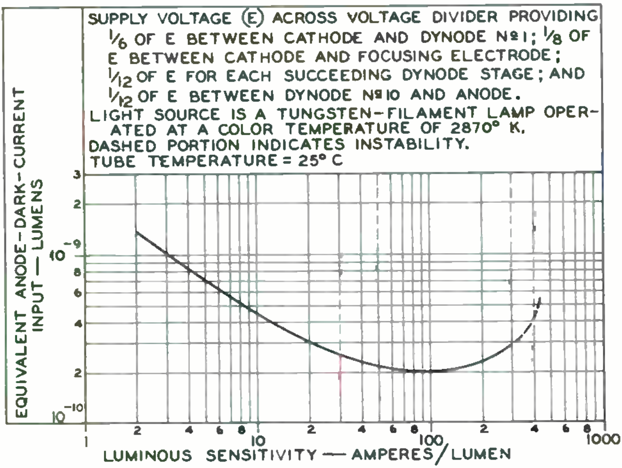
TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



92CS-9841

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"MICRODAMP" CONSTRUCTION FOR REDUCED MICROPHONICS

FIELD MESH FOR REDUCED "WHITE EDGE" EFFECTS

MAGNETIC FOCUS — MAGNETIC DEFLECTION

For High-Quality Black-and-White Studio TV Cameras, Live Pickup, and Magnetic Tape Recording Requiring High-Signal-to-Noise Ratio. The 7389B is Unilaterally Interchangeable with the 7389 and 7389A.

General:

Heater, for Unipotential Cathode:
- Voltage (AC or DC) . . . . 6.3 ± 10% volts
- Current at 6.3 volts . . . . 0.6 amp

Direct Interelectrode Capacitance:
- Anode to all other electrodes . . . . 12 pf

Target-to-Mesh Spacing . . . . 0.001 inch

Spectral Response S-10

Wavelength of Maximum Response . . . . . 4500 ± 300 angstroms

Photocathode, Semitransparent:

Rectangular image (4 x 3 aspect ratio):

Useful size of . . . . 1.6" max. diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

Orientation of . . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and the grid-No.6 envelope terminal. The horizontal and vertical scan should start at the corner of the picture between the grid-No.6 and the photocathode envelope terminals.

Focusing Method . . . . Magnetic

Deflection Method . . . . Magnetic

Overall Length . . . . 19.375" ± 0.310"

Greatest Diameter of Bulb . . . . 4.500" ± 0.094"

Minimum Deflecting-Coil Inside Diameter . . . . 3.2"

Deflecting-Coil Length . . . . 7"

Focusing-Coil Length . . . . 15"

Alignment-Coil:
- Position on neck . . . . Centerline of magnetic field should be located 9.25" from the flat area of the shoulder.

Operating Position . . . . See *Operating Considerations*

Weight (Approx.) . . . . 2.3 lbs

Socket . . . . Cinch[a] Part No.3M14, or equivalent

World Radio History

Envelope Terminals. 5

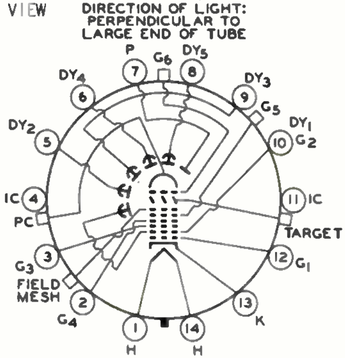
BOTTOM VIEW

Terminal Over Pin 2 - Field Mesh
Terminal Over Pin 4 - Photocathode (PC)
Terminal On Side Of Envelope
Opposite Base Key - Grid No.6 (G_6)
Terminal Over Pin 9 - Grid No.5 (G_5)
Terminal Over Pin 11 - Target

End Base. . . . . Small-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-45)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.4
Pin 3 - Grid No.3
Pin 4 - Do Not Use
Pin 5 - Dynode No.2
Pin 6 - Dynode No.4
Pin 7 - Anode
Pin 8 - Dynode No.5
Pin 9 - Dynode No.3
Pin 10 - Dynode No.1, Grid No.2
Pin 11 - Do Not Use
Pin 12 - Grid No.1
Pin 13 - Cathode
Pin 14 - Heater



Maximum and Minimum Ratings, *Absolute-Maximum Values:*

Photocathode:		
Voltage.	-700 max.	volts
Illumination	50 max.	fc
Operating Temperature:[b]		
Any part of bulb	65 max.	°C
Of bulb at larg end of tube (Image section).	35 min.	°C
Temperature Difference:		
Between image section and any part of bulb hotter than image section. . . .	5 max.	°C
Grid-No.6 Voltage.	-700 max.	volts
Target Voltage:		
Positive value	10 max.	volts
Negative value	10 max.	volts
Field-Mesh Voltage[c].	30 max.	volts
Grid-No.5 Voltage.	300 max.	volts
Grid-No.4 Voltage.	350 max.	volts
Grid-No.3 Voltage.	400 max.	volts
Grid-No.2 & Dynode-No.1 Voltage.	350 max.	volts
Grid-No.1 Voltage:		
Negative-bias value.	125 max.	volts
Positive-bias value.	0 max.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	10 max.	volts

World Radio History

Anode-Supply Voltage[d]	1650 max.	volts
Voltage Per Multiplier Stage	350 max.	volts

Typical Operating Values:[e]

Photocathode Voltage	-600	volts
Grid-No.6 Voltage (Image focus) Approx. 70% of photocathode voltage[f]	-370 to -470	volts
Target Voltage Above Cutoff[g]	2.3	volts
Field-Mesh Voltage[c]	15 to 25	volts
Grid-No.5 Voltage (Decelerator)	40	volts
Grid-No.4 Voltage (Beam Focus)	70 to 90	volts
Grid-No.3 Voltage[h]	250 to 275	volts
Grid-No.2 & Dynode-No.1 Voltage	280	volts
Grid-No.1 Voltage for Picture Cutoff	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Recommended-Target-Temperature Range:[b]	35 to 45	°C
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength of Focusing Coil (Approx.):[j]		
At center of scanning section:	60	gausses
In plane of photocathode	120	gausses
Field Strength of Alignment Coil	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operating Values including Recommended Target-Temperature Range, target voltage adjusted to 2.3 volts above cutoff, and with the camera lens set to bring the picture highlights 1/2 stop above the "knee" of the accompanying Basic Light-Transfer-Characteristic Curve

	Min.	*Typ.*	*Max.*	
Cathode Radiant Sensitivity at 4500 angstroms	-	0.030	-	a/w
Luminous Sensitivity	30	60	-	μa/lm
Anode Current (DC)	-	30	-	μa
Signal-Output Current (Peak to Peak)	10	-	40	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc.	35:1	95:1	-	
Photocathode Illumination at 2870° K Required to bring Picture Highlights 1/2 Stop above "Knee" of Light Transfer Characteristic	-	0.070	0.130	fc
Amplitude Response at 400 TV Lines per Picture Height (Per cent of large-area black to large-area white)[k]	60	75	-	%

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	Min.	Typ.	Max.	
Uniformity:[m]				
Ratio of Shading (Background) Signal to Highlight Signal.	-	0.10	0.15	
Decrease from Peak Highlight Signal Level of Signal from any Point on Scanned Area of Target	-	12	25	%

[a] Cinch Manufacturing Corporation, 1026 South Homan Avenue, Chicago 24, Illinois.

[b] Operating outside the *Recommended Target-Temperature Range* shown under *Typical Operating Values* will not damage the 7389B provided the *Maximum Temperature Ratings* of the tube are not exceeded. Optimum performance, however, is only obtained when the tube is operated within the *Recommended Target-Temperature Range*.

[c] With respect to grid No.4.

[d] Dynode-voltage values are shown under *Typical Operating Values*.

[e] With 7389B operated in RCA TK-60 camera at fixed photocathode voltage.

[f] Adjust for optimum focus.

[g] The target supply voltage should be adjustable from -5 to 5 volts.

[h] Adjust to give the most uniformly shaded picture near maximum signal.

[j] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

[k] Measured with amplifier having flat frequency response.

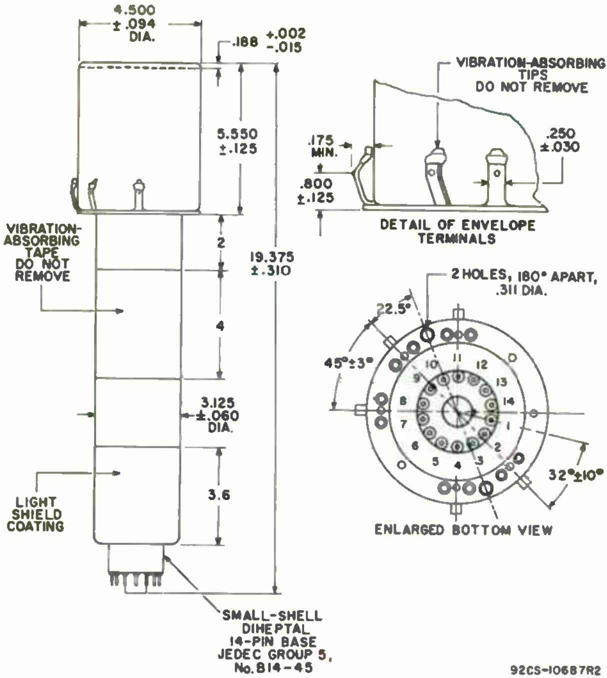
[m] With uniform illumination on photocathode.

OPERATING CONSIDERATIONS

The tube should never be operated in a vertical position with the Diheptal/base end up nor in any other position where the axis of the tube with base up makes an angle of less than 20° with the vertical.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Photosensitive Device having S-10 Response
is shown at the front of this Section

World Radio History



DIMENSIONS IN INCHES

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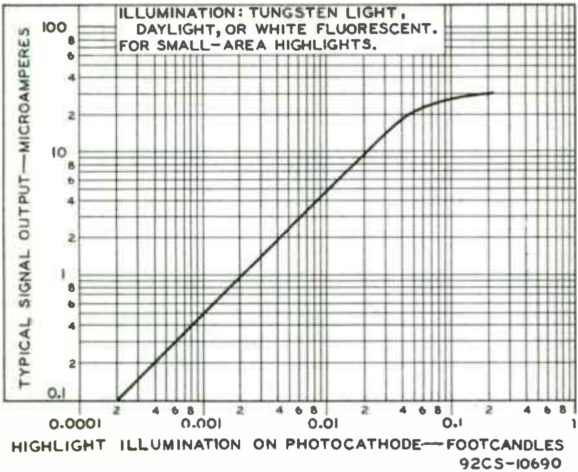
BASIC LIGHT-TRANSFER CHARACTERISTIC



World Radio History

Image Orthicon

"MICRODAMP" CONSTRUCTION FOR REDUCED MICROPHONICS
FIELD MESH FOR REDUCED "WHITE EDGE" EFFECTS

LONG-LIFE TARGET
MAGNETIC FOCUS

FIELD-MESH TYPE
MAGNETIC DEFLECTION

For Extremely High-Quality Performance in Black-and-White Studio TV Cameras and Television Tape-Recording Operations. The 7389B/L is Directly Interchangeable with the 7389, 7389A, and 7389B in all Cameras.

The 7389B/L *is the same as the* 7389B *except utilizes a stable, long-life glass target.*

The stable, long-life, glass target of type 7389B/L is characterized by high gain, resistance to "burn-in", and the absence of any granular structure. Because charge transportation through this target material is electronic rather than ionic as in ordinary glass targets, the electrical characteristics of the target, such as secondary emission and resistivity, are essentially constant and sensitivity of the 7389B/L is stable throughout life.

Other important advantages of this target are that the undesirable characteristics of scene retention or "sticking picture" and raster "burn-in" due to underscanning are significantly reduced. The resistance of the 7389B/L to image "burn-in" provides a highly desirable operational feature because it is not necessary to use an orbiter or continually move the camera when focused on a stationary scene.

OPERATING CONSIDERATIONS

Dos and Don'ts on Use of RCA 7389B/L

Dos

1. Allow the 7389B/L to warm up prior to operation.
2. Hold temperature of the 7389B/L within operating range.
3. Make sure alignment coil is properly adjusted.
4. Adjust beam-focus control to best usable resolution.
5. Condition spare 7389B/L's by operating several hours once each month.
6. Determine proper operation point with target voltage adjusted to the desired voltage above target cutoff.
7. Uncap lens before voltage are applied to the 7389B/L.

Don'ts

1. Don't force the 7389B/L into its shoulder socket.
2. Don't operate the 7389B/L without scanning.
3. Don't operate a 7389B/L having an ion spot.
4. Don't use more beam current than necessary to discharge the highlights of the scene.
5. Don't turn off beam while voltages are applied to photocathode grid No. 6, target, dynodes, and anode during warm-up or standby operation.

World Radio History

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RCA

7404

IMAGE-CONVERTER TUBE

MONOVOLTAGE TYPE HAVING S-21 RESPONSE

For use, in combination with suitable optical systems, in viewing an object or specimen irradiated with near-ultraviolet radiation

DATA

General:

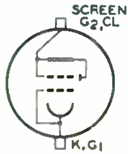
Spectral Response	S-21
Wavelength of Maximum Response	4400 ± 500 angstroms
Photocathode, Semitransparent:	
Shape	Circular
Minimum useful diameter	0.75"
Fluorescent Screen:	
Shape	Circular
Minimum useful diameter	0.57"
Phosphor	P20■, Aluminized
Fluorescence	Yellow-Green
Phosphorescence	Yellow-Green
Persistence	Medium-Short
Focusing Method (Self-focusing)	Electrostatic
Overall Length	2.28" ± 0.05"
Greatest Diameter (Excluding side tip)	1.35" ± 0.03"
Maximum Radius (Including side tip)	0.75"
Weight (Approx.)	1.5 oz
Operating Position	Any

Terminal Connections *(See Dimensional Outline)*:

DIRECTION OF INCIDENT RADIATION: PERPENDICULAR TO PHOTOCATHODE END OF TUBE

CL - Collector

G_1 - Grid No. 1 (Focusing Electrode)



G_2 - Grid No. 2 (Focusing & Accelerating Electrode)

K - Photocathode

Maximum Ratings, *Absolute-Maximum Values:*

FLUORESCENT-SCREEN VOLTAGE:□		
Peak instantaneous	13000 max.	volts
Average (DC)	12500 max.	volts
AVERAGE PHOTOCATHODE CURRENT (Continuous operation)*	0.35 max.	μa
AMBIENT TEMPERATURE	75 max.	°C

Characteristics:

At Ambient Temperature of 25° C

Fluorescent-Screen Voltage (DC)□	12000	volts
Median Paraxial Magnification Factor♦	0.75	
Median Conversion Efficiency†	6000	lumens/watt
Minimum Resolution▲	25	line pairs per mm

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World Radio History

7404

7404

IMAGE-CONVERTER TUBE

Median Equivalent Screen-Background Input at 2537 angstroms§. . . . . 1×10^{-10} watt/cm²

■ For Curves, *see front of Cathode-Ray Tube, Storage Tube, & Monoscope Section. See also Operating Considerations.*

□ Referred to photocathode.

* Averaged over any interval of 10 seconds maximum.

♁ Defined as the ratio of the linear size of the image on the fluorescent screen to the linear size of the image on the photocathode. The image on the photocathode consists of two parallel lines 0.08" long, each located 0.08" from the tube axis. Size of the image on the fluorescent screen is determined by measuring the spacing between the two parallel lines.

† Defined as the quotient of luminous flux output to incident radiant flux at 2537 angstroms.

▲ The resolution, both horizontally and vertically in a 0.15-inch-diameter circle centered on the photocathode, is determined with a pattern consisting of alternate black and white lines of equal width. Any two adjacent lines are designated as a "line-pair".

§ Defined as that value of incident radiation required to cause an increase in screen brightness equal to the screen-background brightness.

OPERATING CONSIDERATIONS

The curves giving the *spectral-energy emission characteristic* and the *persistence characteristics* of phosphor P20 are located in the front of the Cathode-Ray Tube, Storage Tube, & Monoscope Section. Only persistence-characteristic curve A applies to the 7404.

Subjecting the 7404 to intense incident-radiation levels may temporarily decrease the tube's sensitivity even though there is no voltage applied. The magnitude and duration of this decrease depend on the length of exposure. Permanent damage to the tube may result if it is exposed to radiant energy so great as to cause excessive heating of the photocathode.

Support for the 7404 may be provided at the photocathode end by a cushioned arrangement and at the screen end by a suitable fixture which will exert adequate but not excessive pressure to hold the tube firmly against the cushion.

Connections to the two terminals of the tube, indicated on the *Dimensional Outline*, should not be soldered to the terminals. They may be made by spring fingers engaging the rim or the straight side of each terminal.

Magnetic shielding of the 7404 is required to minimize the effects of extraneous fields on tube performance. It is to be noted that ac magnetic fields are particularly objectionable in that they seriously impair tube resolution. If an iron or steel case is used, care should be taken in its construction to insure that the case is completely demagnetized.

The *high voltage at which the 7404 is operated may be very dangerous.* Great care should be taken in the design of apparatus to prevent the user from coming in contact with the high voltage. Precautions must include safeguards which eliminate all hazards to operating personnel. In the use of high-voltage tubes, such as the 7404, it should always be

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RCA

7404

IMAGE-CONVERTER TUBE

remembered that high voltage may appear at normally low-potential points in the circuit because of capacitor breakdown or incorrect circuit connections. Before any part of the circuit is touched, the voltage-supply switch should be turned off and both terminals of any capacitors connected to ground.

The curve showing the Tentative Spectral-Sensitivity Characteristic of Photosensitive Device having S-21 Response located at the front of this Section applies to the 7404

AVERAGE CHARACTERISTIC

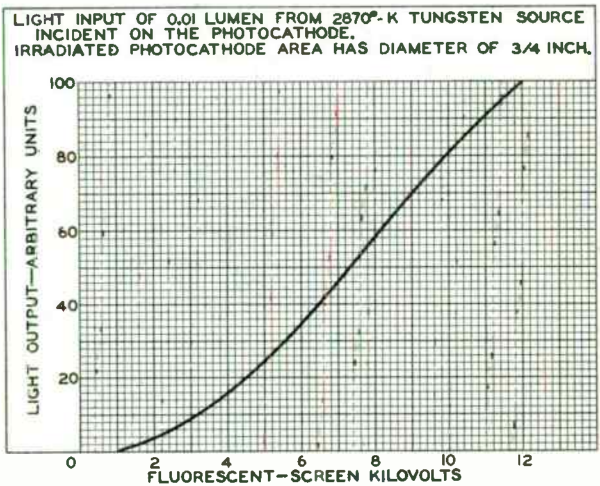

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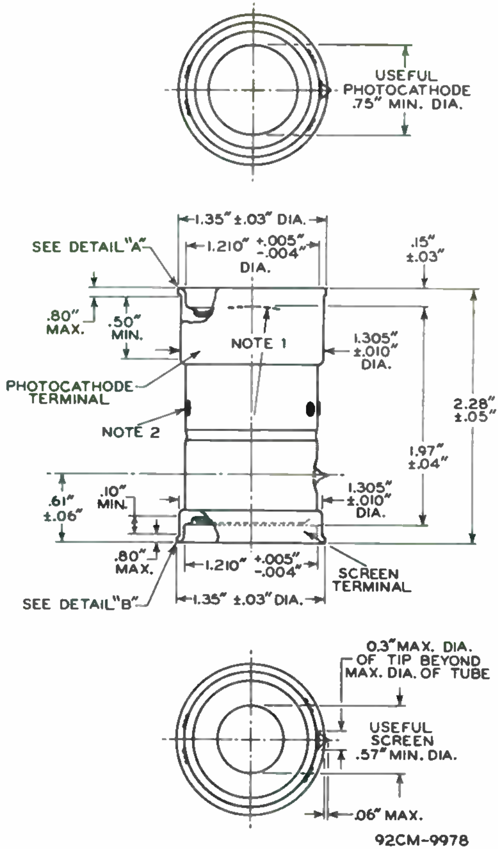
IMAGE-CONVERTER TUBE



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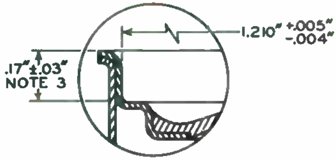
RCA

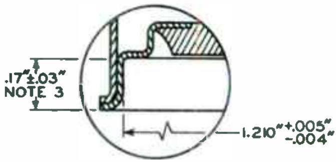
7404

IMAGE-CONVERTER TUBE

DETAIL A



DETAIL B



NOTE 1: RADIUS OF CURVATURE OF FACEPLATE IS 1.230" ± 0.005"; FACEPLATE THICKNESS AT CENTER IS 0.030" ± 0.005".

NOTE 2: FIVE INSULATED LEAD TIPS WILL NOT EXTEND BEYOND MAXIMUM OUTSIDE DIAMETER OF TUBE. LEADS ARE USED ONLY DURING TUBE MANUFACTURE.

NOTE 3: DEPTH IS MEASURED TO TANGENT OF THE TWO RADII.

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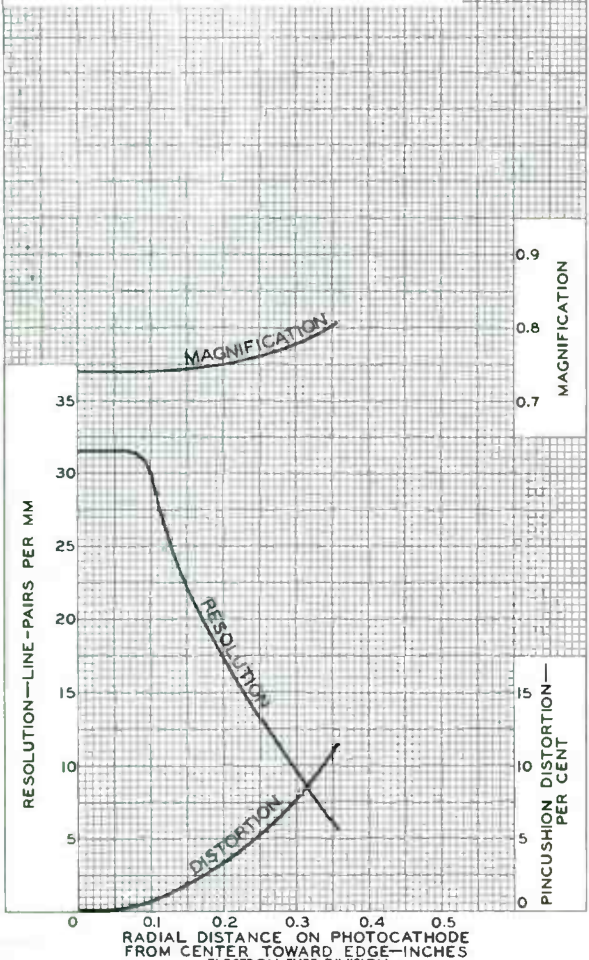
AVERAGE CHARACTERISTICS

PINCUSHION DISTORTION (PER CENT) = $\left(\frac{Mx}{Mc} - 1\right) \times 100$

WHERE:

Mx = MAGNIFICATION AT DISTANCE "x" FROM CENTER OF PHOTOCATHODE

Mc = MAGNIFICATION AT CENTER OF PHOTOCATHODE



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92CM-9984

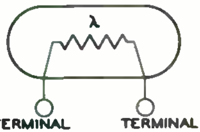
7412
PHOTOCONDUCTIVE CELL

CADMIUM-SULFIDE, HEAD-ON TYPE

DATA

General:

Spectral Response	S-15
Wavelength of Maximum Response	5800 ± 500 angstroms
Sensitive Surface:	
Shape	Rectangular
Length (Minimum)	0.20 in.
Width (Minimum)	0.02 in.
Area (Minimum)	0.004 sq. in.
Maximum Length (Excluding flexible leads)	1.35"
Diameter	0.29" ± 0.01"
Leads, Flexible	2
Minimum length	1.4"
Diameter	0.018" ± 0.005"
Operating Position	Any
Weight (Approx.)	0.06 oz



DIRECTION OF LIGHT:
INTO END OF BULB

λ indicates that the primary characteristic of the element within the envelope symbol is designed to vary under the influence of light.

Maximum Ratings, *Absolute-Maximum Values:*

VOLTAGE BETWEEN TERMINALS (DC or Peak AC)	200 max.	volts
PHOTOCURRENT	1000 max.	μa
POWER DISSIPATION	50 max.	mw
AMBIENT TEMPERATURE	60 max.	°C

Characteristics:

With dc voltage of 12 volts between terminals and an ambient temperature of 25° C

	Min.	Median	Max.	
Sensitivity:				
Radiant●, at 5800 angstroms	-	1580	-	μa/μw
Luminous*#	-	4.5	-	amp/lumen
Illumination*#	100	300	800	μa/fc
Photocurrent▲	-	-	0.1	μa
Rise		See Curves		
Decay		See Curves		

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7412

7412

PHOTOCONDUCTIVE CELL

♦ For conditions where the incident power is 2×10^{-9} watt.

* For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K.

\# Incident illumination on the sensitive surface is 0.01 footcandle.

▲ Measured approximately 20 seconds after removal of incident-illumination level of 0.01 footcandle.

OPERATING CONSIDERATIONS

The *flexible leads* of the 7412 are usually soldered to the circuit elements. Soldering of the leads may be made close to the seals provided care is taken to conduct excessive heat away from the seals. Otherwise, the heat of soldering will break the seals and damage the cell.

A *clamp* around the glass envelope may be used to hold the cell in position. However, care must be taken in clamping to avoid cracking the glass envelope or introducing strains in the envelope which could lead to eventual breakage.

The *voltage between terminals* of the 7412 may be applied without regard to polarity.

The *angle of view* of the 7412 may be narrowed by the use of a hood of the desired length placed in front of the cell.

If the source of radiation is some distance from the cell, the use of a lens system may be desirable to utilize more effectively the available radiation. *However, the radiation should not be focused onto such a small area that localized overheating of the sensitive surface may result with consequent adverse affects on its characteristics.* Exposure of the 7412 to radiation (even without voltage applied) so intense as to cause excessive heating of the cell may permanently damage it.

For a given illumination, the output current will have its highest value when the incident illumination is normal (angle of incidence is 90°) to the face of the cell. For smaller angles of incidence, the output current decreases. The decrease depends upon several factors including the angle of incidence of the illumination, the amount of illumination, and the area of sensitive surface illuminated.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Photoconductive Cell having S-15 Response is shown at the front of this Section

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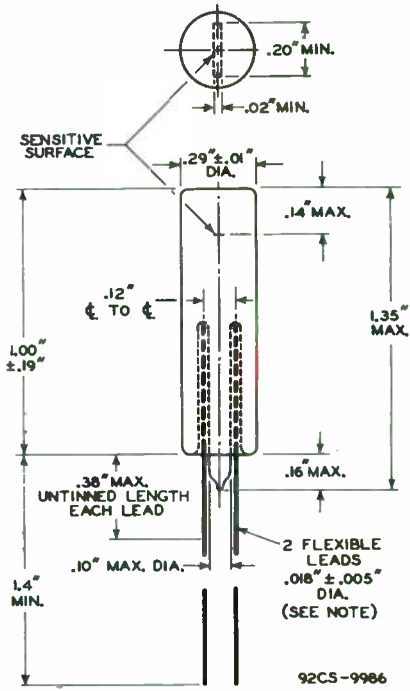
7412

PHOTOCONDUCTIVE CELL



NOTE: THE SPECIFIED LEAD DIAMETER IS MAINTAINED ONLY WITHIN THE UNTINNED LENGTH.

World Radio History

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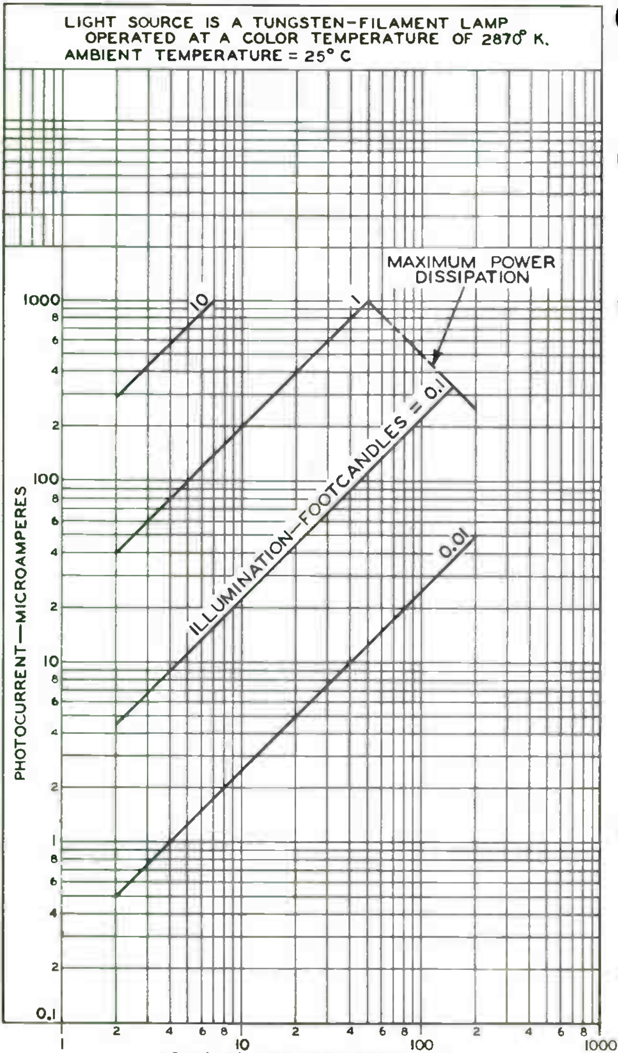
7412

AVERAGE CHARACTERISTICS



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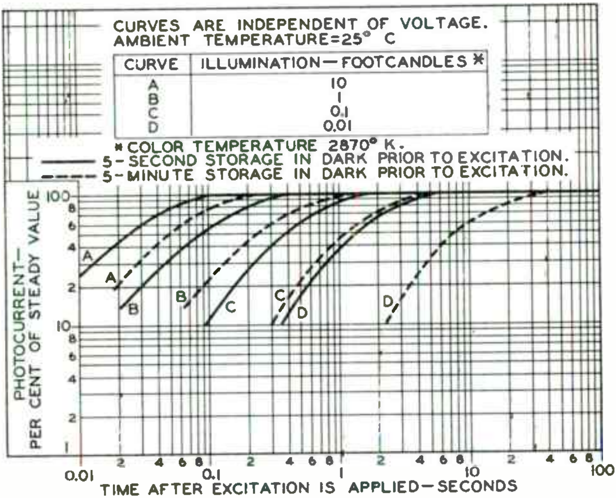
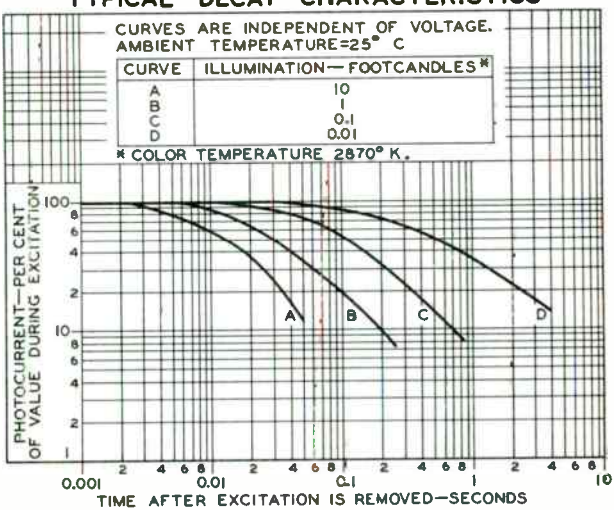
7412

TYPICAL RISE CHARACTERISTICS



92CS-9532

TYPICAL DECAY CHARACTERISTICS



92CS-9533

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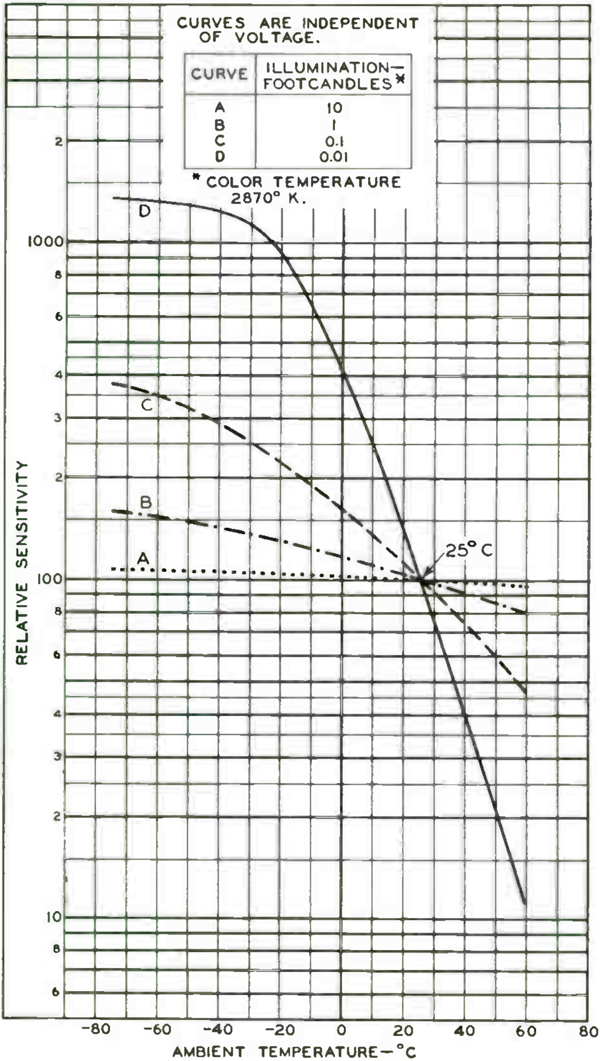
7412

TYPICAL CHARACTERISTICS



ELECTRON TUBE DIVISION 92CM-9538

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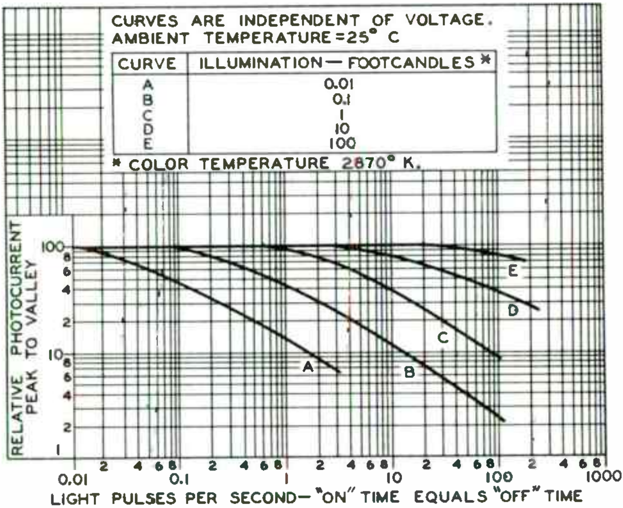
RESPONSE CHARACTERISTICS



92CS-9534

World Radio History

World Radio History

RCA
7513
IMAGE ORTHICON

MAGNETIC FOCUS — MAGNETIC DEFLECTION

For color and high-quality black-and-white TV cameras

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:		
Anode to all other electrodes .	12	$\mu\mu f$
Maximum Target-to-Mesh Spacing . .	0.0008	inch
Photocathode, Semitransparent:		
Response		S-10
Wavelength of maximum response	4500 ± 300	angstroms
Rectangular image (4 x 3 aspect ratio):		
Useful size of	1.8" max.	diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

Orientation of . . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base. The horizontal and vertical scan should start at the corner of the raster nearest pin 6 of the shoulder base.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	15.20" ± 0.25"
Greatest Diameter of Bulb	3.00" ± 0.06"
Minimum Deflecting-Coil Inside Diameter	2-3/8"
Deflecting-Coil Length	5"
Focusing-Coil Length	10"
Alignment Coil:	
Length	15/16"
Position on neck . .	Centerline of coil located 8.5" from the flat area of the jumbo annular base.
Photocathode Distance Inside End of Focusing Coil . . .	1/2"
Operating Position	*See Operating Considerations*
Weight (Approx.)	1 lb 6 oz
Shoulder Base	Keyed Jumbo Annular 7-Pin

BOTTOM VIEW■

Pin 1 - Grid No.6
Pin 2 - Photocathode
Pin 3 - Internal Connection—Do Not Use
Pin 4 - Internal Connection—Do Not Use
Pin 5 - Grid No.5
Pin 6 - Target
Pin 7 - Internal Connection—Do Not Use

■ See basing diagram on next page.

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World Radio History

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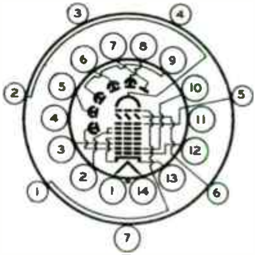
IMAGE ORTHICON

End Base. . . . . Small-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-45)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.4, Field-Mesh Grid
Pin 3 - Grid No.3
Pin 4 - Internal Connection—Do Not Use
Pin 5 - Dynode No.2
Pin 6 - Dynode No.4
Pin 7 - Anode
Pin 8 - Dynode No.5
Pin 9 - Dynode No.3
Pin 10 - Dynode No.1, Grid No.2
Pin 11 - Internal Connection—Do Not Use
Pin 12 - Grid No.1
Pin 13 - Cathode, Suppressor Grid
Pin 14 - Heater



NOTE: In the tube symbol, the suppressor grid connected to the cathode, and the field-mesh grid connected to grid No.4, are intentionally without numbers to avoid upsetting industry practice of associating functional camera control knobs with specific grid numbers. For example, beam-focus control is generally associated with knob identified as G_4 (grid No.4).

Maximum and Minimum Ratings, ***Absolute-Maximum Values:***

PHOTOCATHODE:		
Voltage	-550 max.	volts
Illumination.	50 max.	fc
OPERATING TEMPERATURE:		
Of any part of bulb	50 max.	°C
Of bulb at large end of tube (Image section)	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between image section and any part of bulb hotter than image section .	5 max.	°C
GRID-No.6 VOLTAGE	-550 max.	volts
TARGET VOLTAGE:		
Positive value.	10 max.	volts
Negative value.	10 max.	volts
GRID-No.5 VOLTAGE	150 max.	volts
GRID-No.4 VOLTAGE	300 max.	volts
GRID-No.3 VOLTAGE	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value	125 max.	volts
Positive-bias value	0 max.	volts

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RCA

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IMAGE ORTHICON

PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts
ANODE-SUPPLY VOLTAGE*	1350 max.	volts
VOLTAGE PER MULTIPLIER STAGE.	350 max.	volts

Typical Operating Values:

Photocathode Voltage (Image focus)• . .	-400 to -540	volts
Grid-No.6 Voltage (Accelerator)— Approx. 65% of photocathode voltage .	-260 to -350	volts
Target-Cutoff Voltage•.	-3 to +1	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam focus)•	140 to 180	volts
Grid-No.3 Voltage#.	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for picture cutoff. .	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Target-Temperature Range.	35 to 45	°C
Minimum Peak-to-Peak Blanking Voltage .	5	volts
Field Strength at Center of Focusing Coil▲	75	gausses
Field Strength of Alignment Coil (Approx.).	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operating Values and with picture highlights at the "knee" of the light-transfer characteristic

	Min.	*Average*	*Max.*	
Cathode Radiant Sensitivity at 4500 angstroms	-	0.028	-	μa/μw
Anode Current (DC).	-	30	-	μa
Signal-Output Current (Peak to Peak).	5	-	38	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc	40:1	55:1	-	
Photocathode Illumination at 2870° K Required to Reach "Knee" of Light-Transfer Characteristic . . .	-	0.028	0.04	fc
Amplitude Response at 400 TV Lines per Picture Height (Per cent of large-area black to large-area white)**.	28	35	-	%

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

7513

IMAGE ORTHICON

* Ratio of dynode voltages is shown under *Typical Operating Values*.

♣ Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

● Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from −3 to +5 volts.

\# Adjust to give the most uniformly shaded picture near maximum signal.

▲ Within this range, the actual focusing-voltage value will not differ by more than 2% from that for any other tube when all other operating conditions are held constant, i.e., when different tubes are operated in the same camera with the same deflecting yoke, with fixed focusing-field current, with grid-No.6 voltage at a fixed percentage of the photocathode voltage, and with all other voltages held constant.

** Measured with amplifier having flat frequency response.

OPERATING CONSIDERATIONS

The *operating position* of the 7513 should preferably be such that any loose particles in the neck of the tube will not fall down and strike or become lodged on the target. Therefore, it is recommended that the tube never be operated in a vertical position with the Diheptal-base end up nor in any other position where the axis of the tube with base up makes an angle of less than 20° with the vertical.

Resolution in excess of 500 lines at the center of the picture can be produced by the 7513.

To utilize the resolution capability of the 7513 in the horizontal direction with the standard scanning rate of 525 lines, it is necessary to use a video amplifier having a bandwidth of at least 6 megacycles.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Photosensitive Device having S-10 Response
is shown at the front of this Section

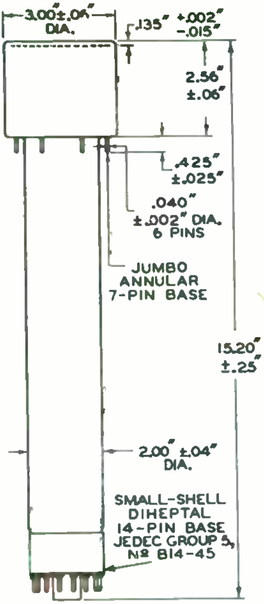
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

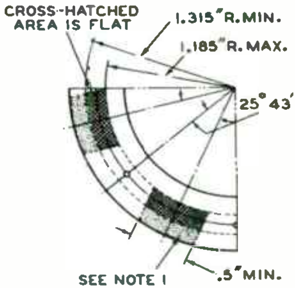
RCA

7513

IMAGE ORTHICON



DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR-BASE GAUGE

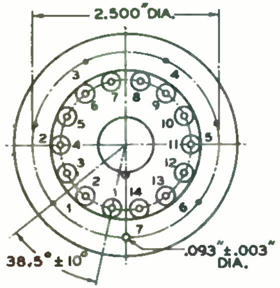
ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".



ENLARGED BOTTOM VIEW

92CM-10154R1

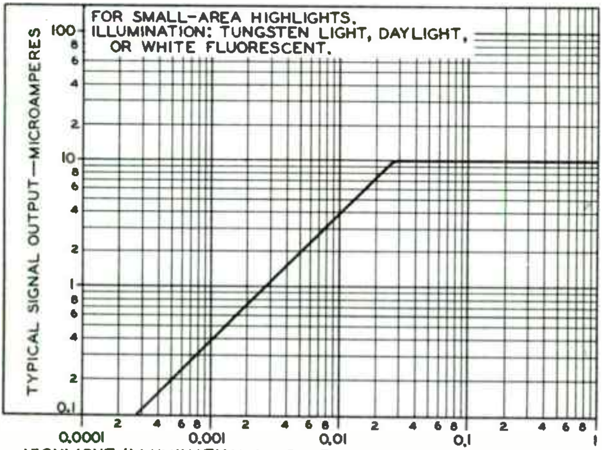
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

7513

7513

BASIC LIGHT-TRANSFER CHARACTERISTIC



92CS-10152

World Radio History

Image Orthicon

LONG-LIFE TARGET
MAGNETIC FOCUS

MAGNETIC DEFLECTION
PRECISION CONSTRUCTION TYPE

For Studio Pickup with Color and High-Quality Black-and-White TV Cameras. The 7513/L is Directly Interchangeable with the 7513 in All Cameras.

The 7513/L is the same as the 7513 except utilizes a longer life non-deteriorating glass target.

The sturdy, long-life, non-deteriorating, glass target of type 7513/L is characterized by high gain, resistance to "burn-in", and the absence of any granular structure. Because charge transportation through this target material is electronic rather than ionic as in ordinary glass targets, the electrical characteristics of the target, such as secondary emission and resistivity, are essentially constant and sensitivity of the 7513/L is stable throughout life.

Other important advantages of this target are that the undesirable characteristics of scene retention or "sticking picture" and raster "burn-in" due to underscanning are significantly reduced. The resistance of the 7513/L to image "burn-in" provides a highly desirable operational feature because it is not necessary to use an orbiter or continually move the camera when focused on a stationary scene.

OPERATING CONSIDERATIONS

Dos and Don'ts on Use of RCA-7513/L

Dos

1. Allow the 7513/L to warm up prior to operation.
2. Hold temperature of the 7513/L within operating range.
3. Make sure alignment coil is properly adjusted.
4. Adjust beam-focus control for best usable resolution.
5. Condition spare 7513/L's by operating several hours once each month.
6. Determine proper operating point with target voltage adjusted to exactly 2 volts above target cutoff.
7. Uncap lens before voltages are applied to the 7513/L.

Don'ts

1. Don't force the 7513/L into its shoulder socket.
2. Don't operate the 7513/L without scanning.
3. Don't operate a 7513/L having an ion spot.
4. Don't use more beam current than necessary to discharge the highlights of the scene.
5. Don't turn off beam while voltages are applied to photocathode, grid No.6, target, dynodes, and anode during warm-up or standby operation.

World Radio History

World Radio History

Image Orthicon

SEMICONDUCTIVE TARGET, S-10 RESPONSE

VERY HIGH SENSITIVITY — MAGNETIC FOCUS
HIGH RESOLUTION — MAGNETIC DEFLECTION

For Studio and Remote Low-Light Level Color and Black-and-White TV Pickup. Sensitivity Equivalent to Film having ASA Exposure Index of 20,000.

DATA

General:

Heater, for Unipotential Cathode:
- Voltage (AC or DC) . . . . 6.3 ± 10% volts
- Current at 6.3 volts . . . . 0.6 amp

Direct Interelectrode Capacitance:
- Anode to all other electrodes . . . . 12 pf

Spectral Response S-10

Wavelength of Maximum Response . . . . . 4500 ± 300 angstroms

Photocathode, Semitransparent:
- Rectangular image (4 x 3 aspect ratio):
  - Useful size of . . . . 1.8" max. diagonal

    Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.
  - Orientation of . . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base.

Focusing Method . . . . Magnetic

Deflection Method . . . . Magnetic

Overall Length . . . . 15.20" ± 0.25"

Greatest Diameter of Bulb . . . . 3.00" ± 0.06"

Minimum Deflecting-Coil Inside Diameter . . . . 2-3/8"

Deflecting Coil . . . . Cleveland Electronics, Part No. 0Y-1[a], or equivalent

Deflecting-Coil Length . . . . 5"

Focusing Coil . . . . Cleveland Electronics, Part No. 0F-2[a], or equivalent

Focusing-Coil Length . . . . 10"

Alignment Coil . . . . Cleveland Electronics, Part No. 0A-3[a], or equivalent

Alignment-Coil Length . . . . 15/16"

Photocathode Distance Inside End of Focusing Coil . . . 1/2"

Socket . . . . Cinch Part No. 3M14[b], or equivalent

Operating Position . . The tube should never be operated in a vertical position with the diheptal-base end up nor in any other position where the axis of the tube with the base up makes an angle of less than 20° with the vertical.

Weight (Approx.) . . . . 1 lb 6 oz

World Radio History

7629A

Shoulder Base. . . . . Keyed Jumbo Annular 7-Pin

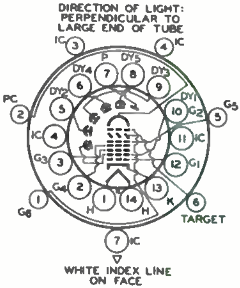
BOTTOM VIEW

Pin 1 – Grid No.6
Pin 2 – Photocathode
Pin 3 – Do Not Use
Pin 4 – Do Not Use
Pin 5 – Grid No.5
Pin 6 – Target
Pin 7 – Do Not Use

End Base . . . Small-Shell Diheptal 14-Pin (JEDEC No.B14-45)

BOTTOM VIEW

Pin 1 – Heater
Pin 2 – Grid No.4
Pin 3 – Grid No.3
Pin 4 – Do Not Use
Pin 5 – Dynode No.2
Pin 6 – Dynode No.4
Pin 7 – Anode
Pin 8 – Dynode No.5
Pin 9 – Dynode No.3
Pin 10 – Dynode No.1, Grid No.2
Pin 11 – Do Not Use
Pin 12 – Grid No.1
Pin 13 – Cathode
Pin 14 – Heater



Maximum and Minimum Ratings, *Absolute-Maximum Values:*

PHOTOCATHODE:		
Voltage.	-550 max.	volts
Illumination	50 max.	fc
OPERATING TEMPERATURE:		
Of any part of bulb.	55 max.	°C
Of bulb at large end of tube (Target section)	0 min.	°C
TEMPERATURE DIFFERENCE:		
Between target section and any part of bulb hotter than target section	5 max.	°C
GRID-No.6 VOLTAGE.	-550 max.	volts
TARGET VOLTAGE:		
Positive value	10 max.	volts
Negative value	10 max.	volts
GRID-No.5 VOLTAGE.	150 max.	volts
GRID-No.4 VOLTAGE.	300 max.	volts
GRID-No.3 VOLTAGE.	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE.	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value.	125 max.	volts
Positive-bias value.	0 max.	volts
VOLTAGE PER MULTIPLIER STAGE	350 max.	volts
ANODE-SUPPLY VOLTAGE[c].	1350 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts

World Radio History

Typical Operating Values:[d]

Photocathode Voltage (Image Focus)[e]	-400 to -540	volts
Grid-No.6 Voltage (Accelerator)— (Approx. 75% of photocathode voltage)	-300 to -405	volts
Target-Cutoff Voltage[f]	-3 to 1	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam Focus)[e]	140 to 180	volts
Grid-No.3 Voltage[g]	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil[h]	75	gausses
Field Strength of Alignment Coil	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operating Values and with camera lens set to bring the picture highlights one stop above the "knee" of the accompanying Basic Light-Transfer-Characteristic Curve

	Min.	*Typ.*	*Max.*	
Cathode Radiant Sensitivity at 4500 angstroms	-	0.033	-	a/w
Luminous Sensitivity	40	65	-	μa/lm
Anode Current (DC)	-	30	-	μa
Signal-Output Current (Peak to Peak)	4	6	10	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc.	-	32:1	-	
Photocathode Illumination at 2870° K Required to bring Picture Highlights One Stop above "Knee" of Light Transfer Characteristic	-	0.007	-	fc
Peak-to-Peak Response to Square-Wave Test Pattern of 400 TV Lines Per Picture Height (Per cent of large-area black to large-area white)[j]	-	65	-	%

World Radio History

[a] Made by Cleveland Electronics Inc., 1974 East 61st Street, Cleveland, Ohio.

[b] Made by Cinch Manufacturing Company, 1026 South Homan Avenue, Chicago 24, Illinois.

[c] Dynode voltage values are shown under *Typical Operating Values*.

[d] With 7629A operated in properly adjusted RCA TK-31 camera.

[e] Adjust for best focus.

[f] Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from -3 to 5 volts.

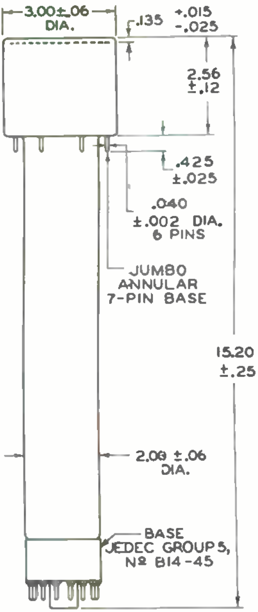
[g] Adjust to give the most uniformly shaded picture near maximum signal.

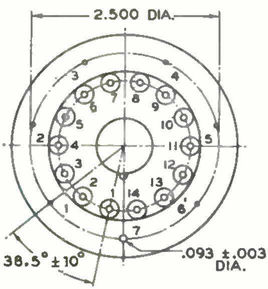
[h] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with indicator located outside of and at the image end of the focusing coil.

[j] Measured with amplifier having flat frequency response.

SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOSENSITIVE DEVICE HAVING S-10 RESPONSE
is shown at front of this Section

World Radio History



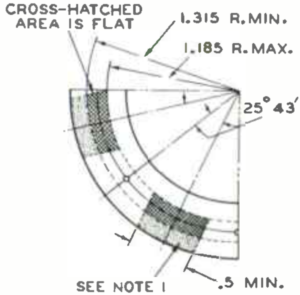


ENLARGED BOTTOM VIEW

92CM-8293R3

DIMENSIONS IN INCHES

DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR BASE GAUGE

Angular variations between pins as well as eccentricity of neck cylinder with respect to photocathode cylinder are held to tolerances such that pins and neck cylinder will fit flat-plate gauge with:

a. Six holes having diameter of 0.065" ± 0.001" and one hole having diameter of 0.150" ± 0.001". All holes have depth of 0.265" ± 0.001". The six 0.065" holes are enlarged by 45° taper to depth of 0.047". All holes are spaced at angles of 51°26′ ± 5′ on circle diameter of 2.500" ± 0.001".

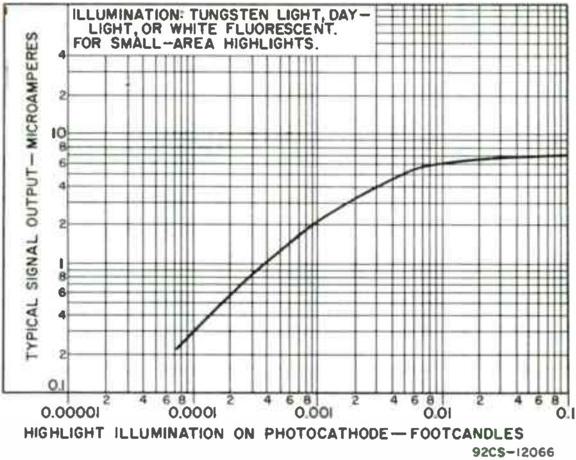
b. Seven stops having height of 0.187" ± 0.001", centered between pin holes, to bear against flat areas of base.

c. Rim extending out a minimum of 0.125" from 2.812" diameter and having height of 0.126" ± 0.001".

d. Neck-cylinder clearance hole having diameter of 2.200" ± 0.001".

World Radio History

BASIC LIGHT-TRANSFER CHARACTERISTIC



World Radio History

Vidicon

For Industrial TV Applications with Black-and-White TV Cameras

DATA

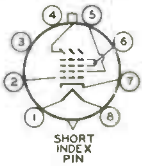
General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:		
Target to all other electrodes	3.1	μμf
Spectral Response		S-18
Wavelength of Maximum Response	4500 + 500 − 300	angstroms
Radiant Sensitivity at 4500 angstroms	0.08	μa/μwatt
Photoconductive Layer:		
Maximum useful diagonal of rectangular image (4 x 3 aspect ratio)		0.625"

Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the plane passing through the tube axis and short index pin.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	6.250" ± 0.063"
Greatest Diameter	1.125" ± 0.010"
Weight (Approx.)	2 oz
Operating Position	Any
Bulb	T8
Socket	Cinch No.54A18088, or equivalent
Base	Small-Button Ditetrar 8-Pin (JEDEC No.E8-11)
Basing Designation for BOTTOM VIEW	8HM

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Internal Connection— Do Not Use
Pin 4 – Same as Pin 3
Pin 5 – Grid No.2
Pin 6 – Grid No.4, Grid No.3



DIRECTION OF LIGHT: INTO FACE END OF TUBE

Pin 7 – Cathode
Pin 8 – Heater
Flange – Target
Short Index Pin – Same as Pin 3

Maximum Ratings, ***Absolute-Maximum Values:***

For scanned area of 1/2" x 3/8"

GRID-No.3 & GRID-No.4 VOLTAGE	750 max.	volts
GRID-No.2 VOLTAGE	750 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value	300 max.	volts
Positive-bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts

World Radio History

PEAK TARGET CURRENT[a]	0.6 max.	μa
FACEPLATE:		
Illumination	500 max.	fc
Temperature	71 max.	°C

Typical Operation:

For scanned area of 1/2" x 3/8" and faceplate temperature of 30° to 35° C

Grid-No.4 (Decelerator) & Grid-No.3 (Beam-Focus-Electrode[b]) Voltage . . .	200[c] to 300	volts
Grid-No.2 (Accelerator) Voltage	300	volts
Grid-No.1 Voltage for picture cutoff[d] .	-45 to -100	volts
Average "Gamma" of Transfer Characteristic for signal-output current between 0.05 μa and 0.2 μa . .	0.55	
Target Voltage to produce 0.02 μa dark current:		
Maximum	30	volts
Typical	25	volts
Minimum Peak-to-Peak Blanking Voltage:		
When applied to grid No.1	30	volts
When applied to cathode	10	volts
Field Strength at center of focusing coil (Approx.)	40	gausses
Field Strength of Adjustable Alignment Coil[e]	0 to 4	gausses

Maximum-sensitivity operation

Faceplate Illumination (Highlight) . . .	0.5	fc
Target Voltage[f]	35 to 70	volts
Dark Current[g]	0.2	μa
Signal-Output Current:[h]		
Typical	0.2	μa

[a] Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

[b] Beam focus is obtained by combined effect of grid-No.3 voltage which should be adjustable over indicated range, and a focusing coil having an average field strength of 40 gausses.

[c] Definition, focus uniformity, and picture quality decrease with decreasing grid-No.4 and grid-No.3 voltage. In general, grid No.4 and grid No.3 should be operated above 250 volts.

[d] With no blanking voltage on grid No.1.

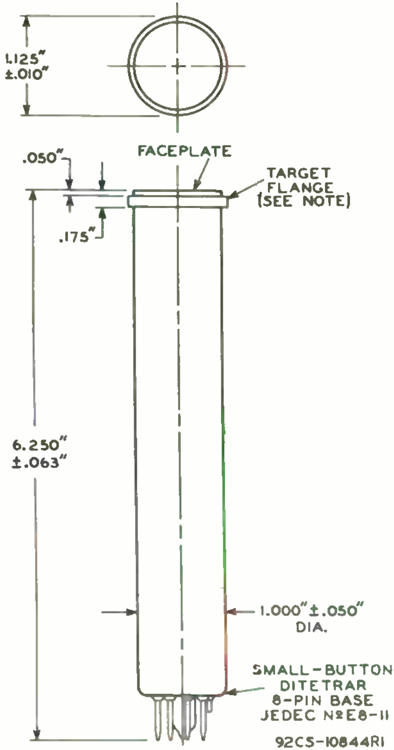
[e] The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

[f] The target voltage for each 7697 must be adjusted to that value which gives the desired operating dark current.

[g] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

[h] Defined as the component of the highlight target current after the dark-current component has been subtracted.

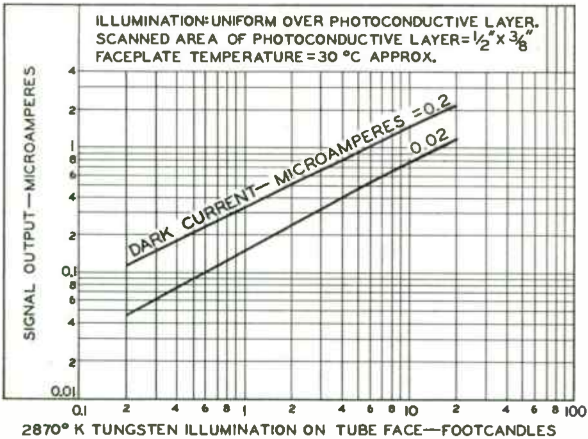
World Radio History



NOTE: THE TARGET CONNECTOR MUST BE CAPABLE OF MAKING CONTACT AT ANY POINT ON TARGET FLANGE.

World Radio History

TYPICAL LIGHT-TRANSFER CHARACTERISTICS



92CS-10847

World Radio History

Vidicon

MAGNETIC FOCUS | **1" - DIAMETER** | **MAGNETIC DEFLECTION**

For Live-Scene Pickup with Color or Black-and White TV Cameras in Industrial Closed-Circuit Systems. The 7735A is Unilaterally Interchangeable with Type 7735.

GENERAL

Heater, for Unipotential Cathode
- Voltage (AC or DC) . . . . 6.3 ± 10% V
- Current at 6.3 volts . . . . 0.6 A

Direct Interelectrode Capacitance[a]
- Target to all other electrodes . . . . 4.6 pF

Spectral Response. . . . . See Accompanying Curve

Photoconductive Layer. . . . . 0.62 in
- Maximum useful diagonal of rectangular image (4 x 3 aspect ratio)[b]

Focusing Method. . . . . Magnetic

Deflection Method. . . . . Magnetic

Overall Length . . . . 6.25 ± 0.25 in

Greatest Diameter. . . . . 1.125 ± 0.010 in

Operating Position . . . . Any

Weight (Approx.) . . . . 2 oz

Bulb T8

Focusing Coil. . . . . . .Cleveland Electronics[c,d] No.VF-115-5, or equivalent ←

Deflecting Yoke. . . . .Cleveland Electronics[c,d] No.VY-111-3, or equivalent ←

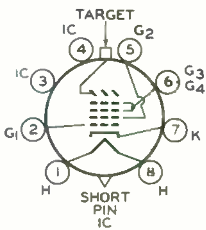
Alignment Coil . . . . . .Cleveland Electronics[c,d] No.VA-118, or equivalent ←

Socket . . . . .Cinch[e] No.54A18088, or equivalent

Base . . . . . . Small-Button Ditetrar 8-Pin, (JEDEC No.E8-11)

Basing Designation for BOTTOM VIEW 8HM

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Do Not Use
Pin 4 - Do Not Use
Pin 5 - Grid No.2
Pin 6 - Grid No.3 and No.4
Pin 7 - Cathode
Pin 8 - Heater
Flange - Target
Short Pin - Do Not Use



DIRECTION OF LIGHT: INTO FACE END OF TUBE

MAXIMUM RATINGS, ABSOLUTE-MAXIMUM VALUES

For scanned area of 1/2" x 3/8"

Grid-No.3 & Grid-No.4 Voltage . . . . 750 V

Grid-No.2 Voltage. . . . . 750 V

← Indicates a change.

World Radio History

Grid-No. 1 Voltage		
Negative bias value	300	V
Positive bias value	0	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	125	V
Heater positive with respect to cathode	10	V
Target Voltage	100	V
Dark Current	0.25	µA
Peak Target Current[f]	0.55	µA
Faceplate		
Illumination	1000	fc
Temperature	71	°C

TYPICAL OPERATION

For scanned area of 1/2" x 3/8"
Faceplate temperature of 30° to 35°C

Grid-No. 4 (Decelerator) & Grid-No. 3 (Beam-Focus Electrode[g]**) Voltage**	250[h] to 300	V
Grid-No. 2 (Accelerator) Voltage	300	V
Grid-No. 1 Voltage for Picture Cutoff[j]	-45 to -100	V
Average "Gamma" of Transfer Characteristic	0.65	
→ Signal-output current between 0.02 µa & 0.2 µa		
Visual Equivalent Signal-to-Noise Ratio (Approx.)[k]	300:1	
→ **Lag**[m]		
Maximum value	20	%
Typical value	15	%
Minimum Peak-to-Peak Blanking Voltage		
When applied to grid No. 1	75	V
When applied to cathode	20	V
Field Strength at Center of Focusing Coil (Approx.)	40	G
Field Strength of Adjustable Alignment Coil[n]	0 to 4	G

Maximum-sensitivity operation—0.1 footcandle on faceplate

Faceplate Illumination (Highlight)	0.1	fc
→ **Target Voltage**[p,q]	35 to 70	V
Dark Current[r]	0.2	µA
Signal-Output Current[s]		
Typical	0.14	µA

Intermediate-sensitivity operation—0.5 footcandle on footplate

Faceplate Illumination (Highlight)	0.5	fc
Target Voltage[p,q]	30 to 60	V
Dark Current[r]	0.1	µA
Signal-Output Current[s]		
Typical	0.27	µA

Average-sensitivity operation—1 footcandle on faceplate

Faceplate Illumination (Highlight)	1	fc
Target Voltage[p,q]	20 to 40	V
Dark Current[r]	0.02	µA
Signal-Output Current[s]		
Typical	0.2	µA
Minimum	0.15	µA

→ Indicates a change.

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[a] This capacitance, which effectively is the output impedance of the 7735A, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms.

[b] Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the straight sides of the masked portions of the faceplate. The straight sides are parallel to the plane passing through the tube axis and short index pin. The masking is for orientation only and does not define the proper scanned area of the photoconductive layer.

[c] Made by Cleveland Electronics Inc., 1974 East 61st St., Cleveland, Ohio.

[d] These components are chosen to provide tube operation with minimum beam-landing error.

[e] Made by Cinch Manufacturing Corporation, 1026 S. Homan Ave., Chicago 24, Illinois.

[f] Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

[g] Beam focus is obtained by combined effect of grid-No.3 voltage which should be adjustable over indicated range, and a focusing coil having an average field strength of 40 gauss.

[h] Definition, focus uniformity, and picture quality decrease with decreasing grid-No.4 and grid-No.3 voltage. In general, grid No.4 and grid No.3 should be operated above 250 volts.

[j] With no blanking voltage on grid No.1.

[k] Measured with high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc and a peak signal-output current of 0.35 microampere. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of the highlight video-signal current to rms noise current, multiplied by a factor of 3.

[m] Defined as the per cent of initial value of signal-output current 1/20 second after illumination is removed. Values shown are for initial signal-output current of 0.2 microampere and a dark current of 0.02 microampere.

[n] The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil

[p] The target voltage for each 7735A must be adjusted to the value which gives the desired operating dark current.

[q] Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

[r] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change is scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

[s] Defined as the component of the highlight target current after the dark-current component has been subtracted.

OPERATING CONSIDERATIONS

The *target connection* is made by a suitable spring contact bearing against the edge of the metal ring at the face end of the tube. This spring contact may conveniently be provided as part of the focusing-coil design.

The *deflecting yoke and focusing coil* used with the 7735A are designed to cause the scanning beam to land perpendicularly to the target at all points of the scanned area with minimum beam-landing error and resultant superior uniformity of sensitivity and focus over the scanned area. The recommended location of these components is shown in *Recommended Location and Length of Deflecting, Focusing, and Alignment Components.*

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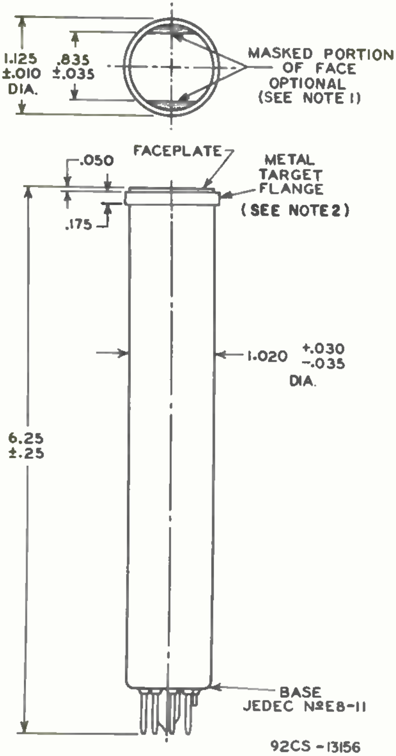
→ DIMENSIONAL OUTLINE



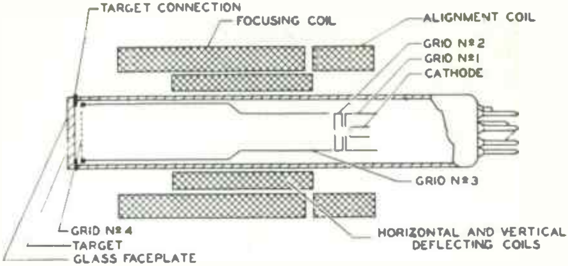
DIMENSIONS IN INCHES

Note 1: Straight sides of masked portions are parallel to the plane passing through tube axis and short pin.

Note 2: Target contact flange in the form of a metal ring encircling the tube and having the indicated diameter may be located along the tube axis in any part of or all of the space between the dashed lines.

→ Indicates a change.

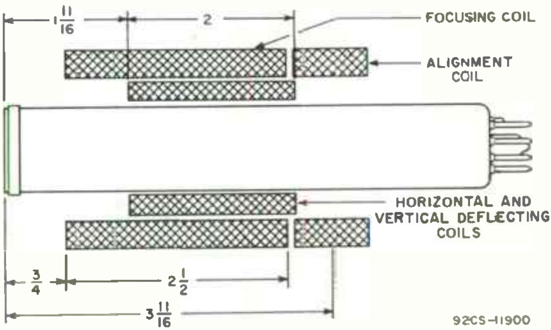
SCHEMATIC ARRANGEMENT



92CS-10681R1

RECOMMENDED LOCATION AND LENGTH OF DEFLECTING, FOCUSING, AND ALIGNMENT COMPONENTS

To obtain minimum beam-landing error

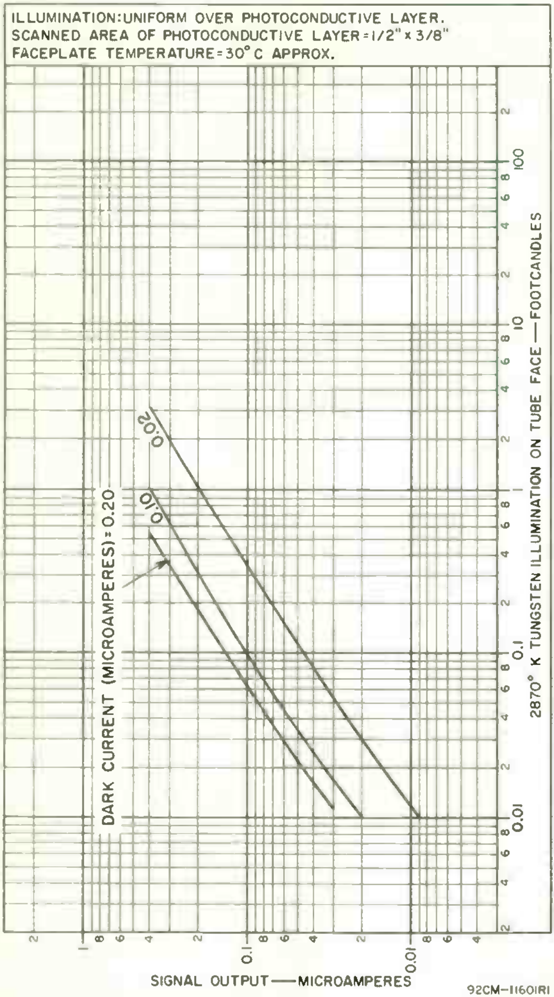


92CS-11900

DIMENSIONS IN INCHES

World Radio History

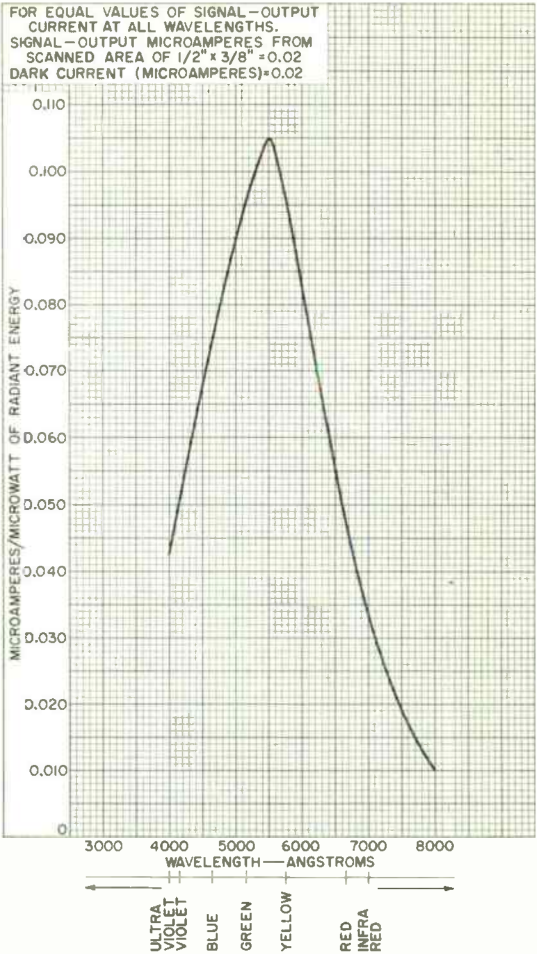
Typical Light Transfer Characteristics



92CM-11601R1

World Radio History

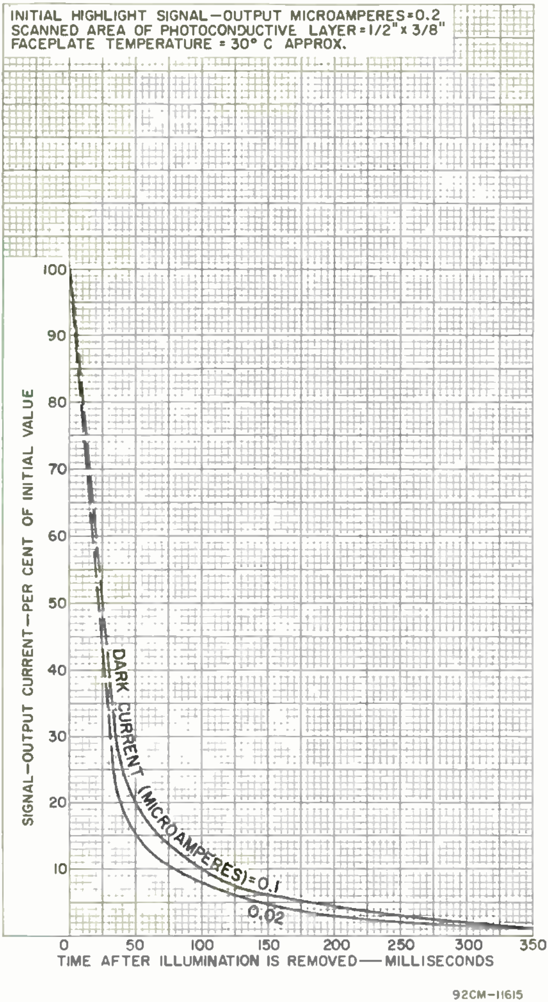
Typical Spectral Sensitivity Characteristic



92CM-11619

World Radio History

Typical Persistence Characteristics



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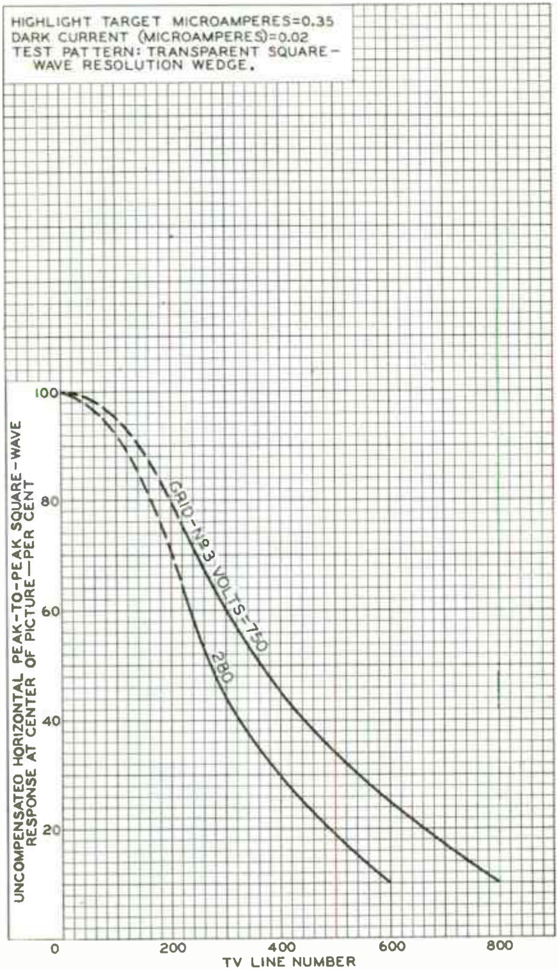
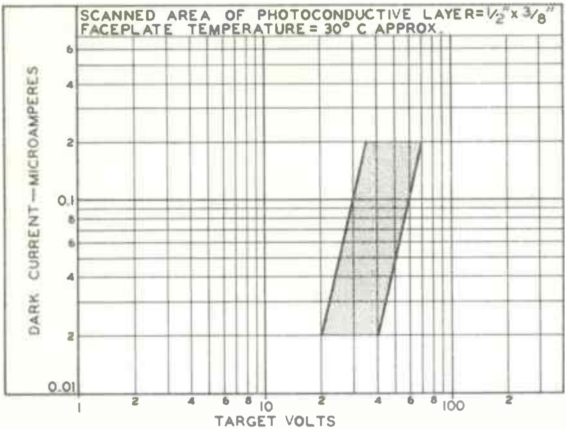
Curves Showing Uncompensated Horizontal Square-Wave Response



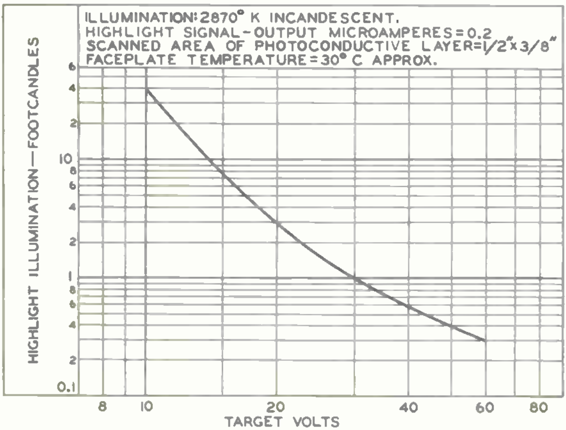
92CM-10683R1

Dark Current Range



92CS-10684R1

Typical Characteristic



92CS-10685R1

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7735B

Vidicon

MAGNETIC FOCUS — 1" - DIAMETER — MAGNETIC DEFLECTION

For Live-Scene Pickup with Color or Black-and White TV Cameras in Broadcast, Industrial, and Closed-Circuit Systems. The 7735B is Unilaterally Interchangeable with Types 7735 & 7735A.

GENERAL

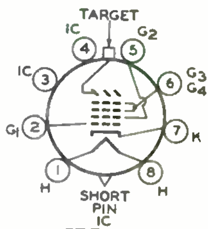
Heater, for Unipotential Cathode
- Voltage (AC or DC) . . . . 6.3 ± 10% V
- Current at 6.3 volts . . . . 0.6 A

Direct Interelectrode Capacitance[a]
- Target to all other electrodes . . . . 4.6 pF

Spectral Response. . . . . See Accompanying Curve
Photoconductive Layer. . . . . 0.62 in
- Maximum useful diagonal of rectangular image (4 × 3 aspect ratio)[b]

Focusing Method. Magnetic
Deflection Method. . . . . Magnetic
Overall Length . . . . 6.25 ± 0.25 in
Greatest Diameter. . . . . 1.125 ± 0.010 in
Operating Position . . . . Any
Weight (Approx.) . . . . 2 oz
Bulb T8
Focusing Coil. . . . . . .Cleveland Electronics[c,d] No. VF-115-5, or equivalent
Deflecting Yoke. . . . . .Cleveland Electronics[c,d] No. VY-111-3, or equivalent
Alignment Coil . . . . . . .Cleveland Electronics[c,d] No. VA-118, or equivalent
Socket . . . . .Cinch[e] No. 54A18088, or equivalent
Base . . . . . . .Small-Button Ditetrar 8-Pin, (JEDEC No. E8-11)
Basing Designation for BOTTOM VIEW 8HM

Pin 1 – Heater
Pin 2 – Grid No. 1
Pin 3 – Do Not Use
Pin 4 – Do Not Use
Pin 5 – Grid No. 2
Pin 6 – Grids No. 3 and No. 4
Pin 7 – Cathode
Pin 8 – Heater
Flange – Target
Short Pin – Make No Connection



DIRECTION OF LIGHT: INTO FACE END OF TUBE

ABSOLUTE-MAXIMUM RATINGS

For scanned area of 1/2" x 3/8"

Grid-No. 3 & Grid-No. 4 Voltage. . . . . 1000 V
Grid-No. 2 Voltage. . . . . 1000 V

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Grid-No. 1 Voltage		
Negative bias value.	300	V
Positive bias value.	0	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode.	125	V
Heater positive with respect to cathode.	10	V
Target Voltage	100	V
Dark Current	0.25	μA
Peak Target Current[f]	0.55	μA
Faceplate		
Illumination	1000	fc
Temperature.	71	°C

TYPICAL OPERATION AND PERFORMANCE DATA

For scanned area of 1/2" x 3/8"
Faceplate temperature of 30° to 35°C

	Low-Voltage Operation	*High Voltage Operation*	
Grid-No. 4 (Decelerator) & Grid-No. 3 (Beam-Focus Electrode) Voltage.	250 to 300[g]	750	V
Grid-No. 2 (Accelerator) Voltage.	300	300	V
Grid-No. 1 Voltage for Picture Cutoff[h]	-45 to -100	-45 to -100	V
Average "Gamma" of Transfer Characteristic.	0.65	0.65	
Signal-output current between 0.02 μA & 0.2 μA			
Visual Equivalent Signal-to-Noise Ratio (Approx.)[j].	300:1	300:1	
Lag[k]			
Maximum value.	28	28	%
Typical value.	23	23	%
Minimum Peak-to-Peak Blanking Voltage			
When applied to grid No.1 . .	75	75	V
When applied to cathode. . .	20	20	V
Limiting Resolution at Center of Picture			
Typical value.	750	900	TV Lines
Minimum value.	750	-	TV Lines
Amplitude Response to a 400 TV Line Square-Wave Test Pattern	35	50	%
At center of picture			
Field Strength at Center of Focusing Coil[m].	53	68	G
Peak Deflecting-Coil Current			
Horizontal	185	375	mA
Vertical	25	43	mA
Field Strength of Adjustable Alignment Coil.	0 to 4	0 to 4	G

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High-sensitivity operation—0.5 footcandle on faceplate

	Low-Voltage Operation	High-Voltage Operation	
Faceplate Illumination (Highlight)	0.5	-	fc
Target Voltage[n,p]	30 to 60	-	V
Dark Current[q]	0.10	-	µA
Signal-Output Current[r]			
Typical	0.27	-	µA

Average-sensitivity operation—1.0 footcandle on faceplate

Faceplate Illumination (Highlight)	1.0	-	fc
Target Voltage[n,p]	20 to 40	-	V
Dark Current[q]	0.025	-	µA
Signal-Output Current[r]			
Typical	0.275	-	µA
Minimum	0.265	-	µA

High-Light Level Operation—10 footcandles on faceplate

Faceplate Illumination (Highlight)	10	-	fc
Target Voltage[n,p]	10 to 22	-	V
Dark Current[q]	0.005	-	µA
Signal-Output Current[r]			
Typical	0.3	-	µA

a This capacitance, which effectively is the output impedance of the 7735B, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms

b Orientation of quality rectangle is obtained when the horizontal scan is essentially parallel to the straight sides of the masked portions of the faceplate. The straight sides are parallel to the plane passing through the tube axis and short pin. The masking is for orientation only and does not define the proper scanned area of the photoconductive layer.

c Made by Cleveland Electronics Inc., 1974 East 61st St., Cleveland, Ohio.

d These components are chosen to provide tube operation with minimum beam-landing error.

e Made by Cinch Manufacturing Corporation, 1026 S. Homan Ave., Chicago 24, Illinois.

f Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

g Definition, focus uniformity, and picture quality decrease with decreasing grid-No.4 and grid-No.3 voltage. In general, grid-No.4 and grid-No.3 should be operated above 250 volts.

h With no blanking voltage on grid No.1.

j Measured with high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc/s and a peak signal-output current of 0.35 microampere. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of the highlight video-signal current to rms noise current, multiplied by a factor of 3.

k Defined as the per cent of initial value of signal-output current 1/20 second after illumination is removed. Values shown are for initial signal-output current of 0.3 microampere and a dark current of 0.025 microampere.

m The polarity of the focusing coil should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

n The target voltage for each 7735B must be adjusted to the value which gives the desired operating signal current.

p Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

World Radio History

q The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

r Defined as the component of the highlight target current after the dark-current component has been subtracted.

OPERATING CONSIDERATIONS

Target connection is made by a suitable spring contact bearing against the edge of the metal ring at the face end of the tube.

Faceplate-temperature should not exceed 71°C (160°F), either during operation or storage of the 7735B. Operation with a faceplate temperature in the range from about 25° to 35°C (77° to 95°F) is recommended.

Provisions should also be made in the camera installation to hold the faceplate temperature of the 7735B at a *steady value* within the recommended range. Dark current increases with increasing temperature. It is highly desirable to operate the 7735B at a steady temperature to maintain dark current at a preselected value. This mode of operation ensures both optimum and stable day-to-day performance. If such provisions cannot be made, changes in target voltage may be required from time to time to maintain the desired picture quality.

As shown under *Uncompensated Horizontal Square-Wave Response*, a substantial increase in both limiting resolution and amplitude response of the 7735B may be obtained by increasing the operating voltages on grid No.4 and grid No.3. The focusing-coil field strength must be increased and more deflecting power is required at higher electrode voltages as indicated under *Typical Operation and Performance Data*.

Operation at higher electrode voltages may introduce additional beam-landing errors that may be partially compensated for by repositioning the deflecting components. Full compensation may require the application of a modulating voltage of suitable waveform, at both horizontal and vertical scan rates, to the cathode, grid No.1, and grid No.2 of the 7735B.

Dos and Don'ts on Use of RCA-7735B

Dos

1. Adjust camera scanning to utilize maximum useful area of photoconductive layer.

2. Orient the vidicon so that horizontal scan is essentially parallel to the plane passing through tube axis and short pin.

3. Align electron beam.

4. With lens capped, adjust target voltage for each individual vidicon to the highest value that will still give uniform background.

5. Match any visible raster pattern of photoconductive layer with new scan by reorienting the vidicon as required.

6. Use only sufficient beam current to bring out picture highlights.

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7. Open lens iris or increase the scene illumination to obtain the "snappiest" picture without noticeable smear from moving objects. Target voltage should be reduced if light on the tube and/or resultant signal is excessive.

8. Always cap lens when transporting camera (see "Don'ts" 5).

Don'ts

1. Don't underscan the photoconductive layer.

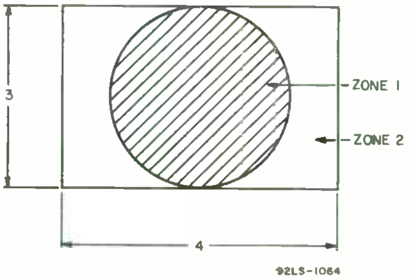
2. Don't change camera size and centering controls once the scanned area of photoconductive layer has been properly positioned.

3. Don't rotate vidicon from its original operating position in deflecting yoke.

4. Don't turn beam of vidicon on without normal scanning or remove scanning before beam of vidicon is turned off.

5. DON'T ALLOW IMAGE OF THE SUN OR OTHER VERY INTENSE SOURCE OF ILLUMINATION TO BE FOCUSED ON PHOTOCONDUCTIVE LAYER AT ANY TIME.

SPURIOUS SIGNAL TEST



This test is performed using a uniformly diffused white test pattern that is separated into two zones as shown above. The 7735B is operated under the conditions specified under *Typical Operation and Performance Data* with the lens adjusted to provide a target current of 0.3 microampere. The 7735B is adjusted to provide maximum picture resolution. Spurious signals are evaluated by size which is represented by equivalent numbers of raster lines in a 525 TV line system. Allowable spot size for each zone is shown in Table 1. To be classified as a spot, a contrast ratio of 1.5:1 must exist for white spots and 2:1 for black spots. Smudges, streaks, or mottled and grainy background must have a contrast ratio of 1.5:1 to constitute a reject item.

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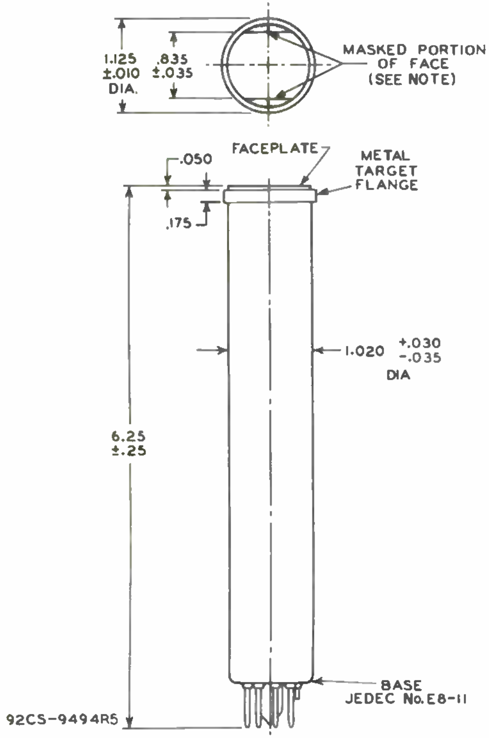
TABLE I *(For scanned area of 1/2" x 3/8")*

Equivalent Number of Raster Lines	ZONE 1 Allowed Spots	ZONE 2 Allowed Spots
Over 3	0	0
3 but not including 1	1	2
1 or less	footnote s	footnote s

Minimum separation between any 2 spots greater than 1 raster line is limited to 16 raster lines.

s Spots of this size are allowed unless concentration causes a smudged appearance.

DIMENSIONAL OUTLINE



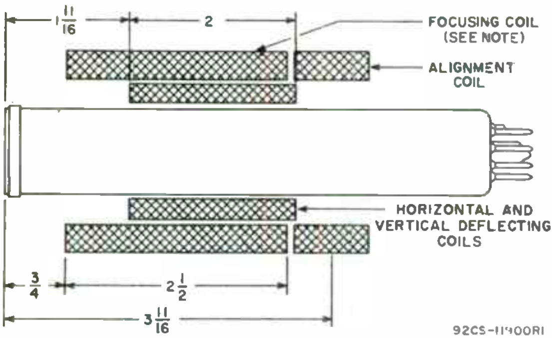
DIMENSIONS IN INCHES

Note: Straight sides of masked portions are parallel to the plane passing through tube axis and short pin.

World Radio History

RECOMMENDED LOCATION AND LENGTH OF
DEFLECTING, FOCUSING, AND ALIGNMENT COMPONENTS

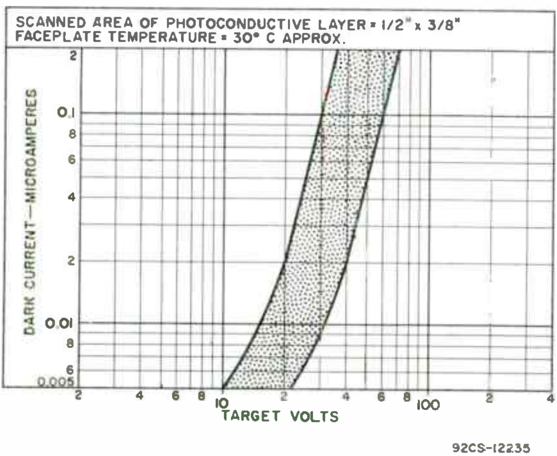
To obtain minimum beam-landing error



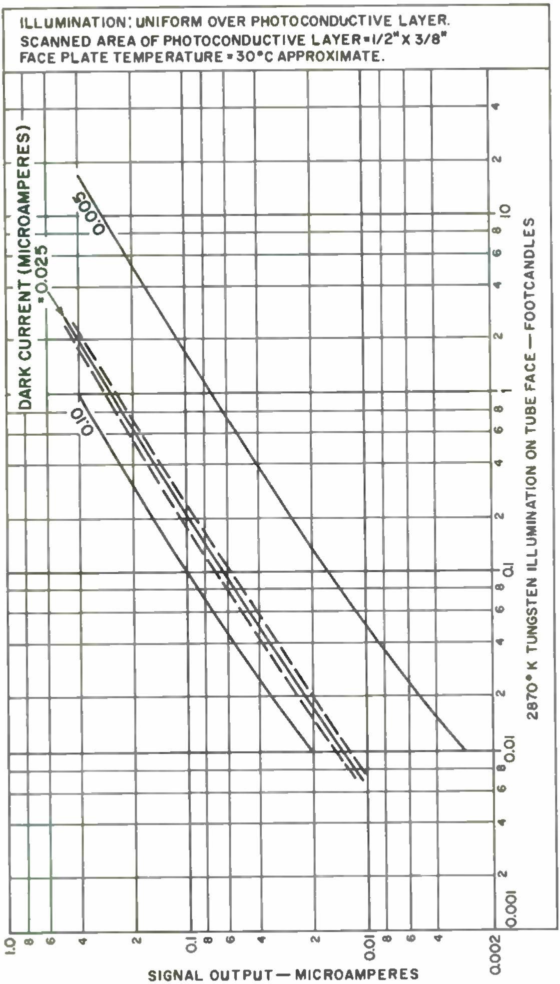
DIMENSIONS IN INCHES

Note: Cross-Hatching indicates wound position of focusing coil.

Range of Dark Current



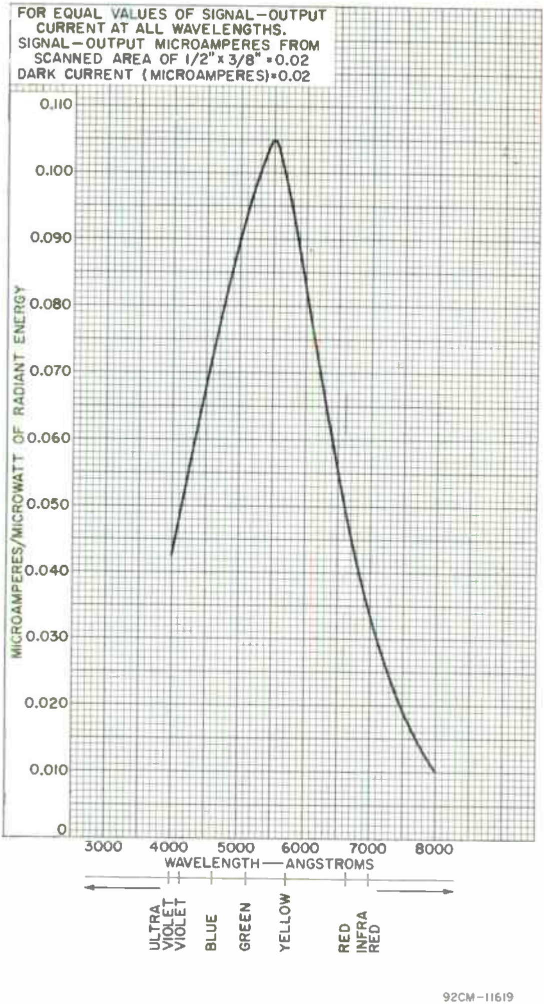
Light Transfer Characteristics



92CM-13503

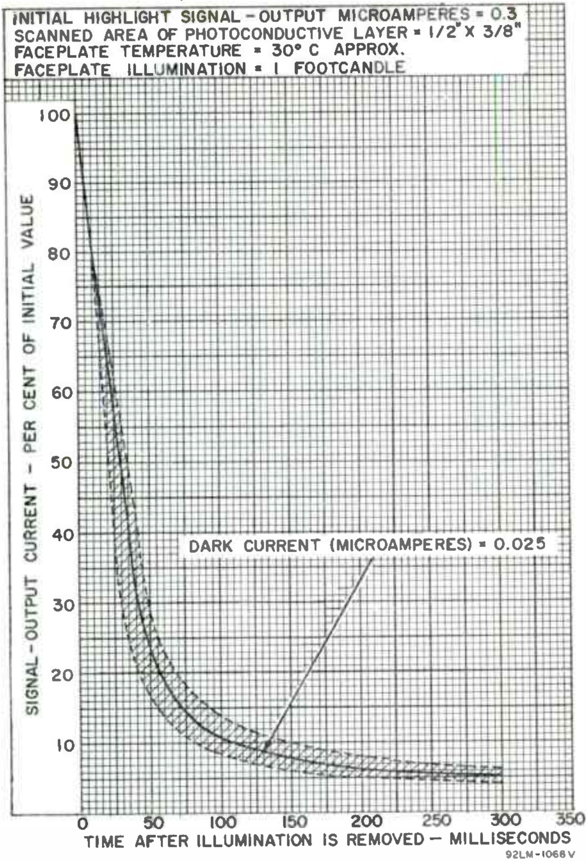
World Radio History

Typical Spectral Sensitivity Characteristic



World Radio History

Typical Persistence Characteristic



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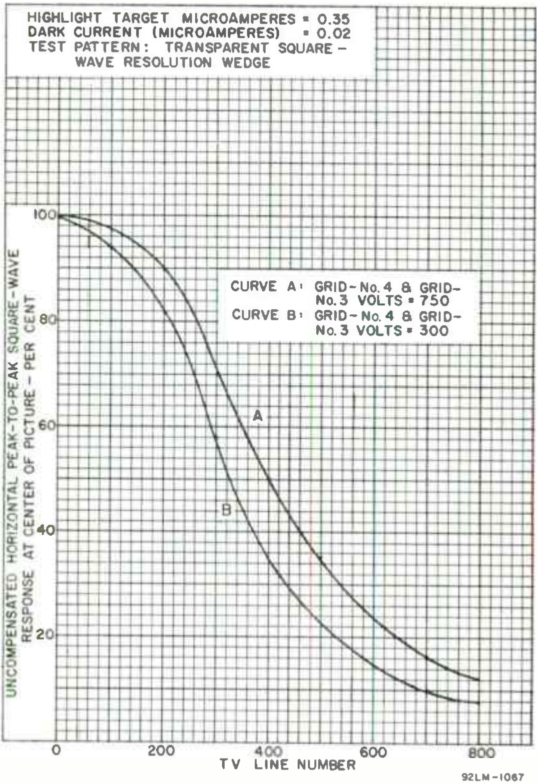
Curves Showing Uncompensated Horizontal Square-Wave Response



World Radio History

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Multiplier Phototube

10-STAGE, HEAD-ON, SPHERICAL-FACEPLATE TYPE HAVING ENCLOSED, IN-LINE DYNODE STRUCTURE, 1.68"-DIAMETER, SPHERICAL, SEMITRANSPARENT PHOTOCATHODE, S-11 RESPONSE, AND VERY SHORT TIME-RESOLUTION CAPABILITY

DATA

General:

Spectral Response. S-11
Wavelength of Maximum Response . . . . . 4400 ± 500 angstroms
Cathode, Semitransparent:
  Shape. . . . . Spherical
  Window:

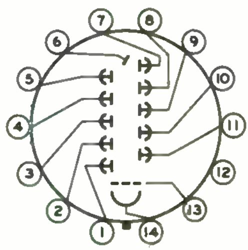
Area (Projected)	2.2	sq. in.
Minimum diameter	1.68	in.
Index of refraction.	1.51	

Direct Interelectrode Capacitances (Approx.):

Anode to dynode No.10.	3.8	μμf
Anode to all other electrodes. . . .	5	μμf
Dynode No.10 to all other electrodes.	6.5	μμf

Maximum Overall Length . . . . 6.12"
Seated Length. . . . . 5.18" ± 0.19"
Maximum Diameter . . . . 2.31"
Operating Position . . . . Any
Weight (Approx.) . . . . 6 oz
Bulb T16
Socket . . . . Cinch No.3M14, or equivalent
Base . . . . Medium-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-38)
Basing Designation for BOTTOM VIEW 14AV

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 - Internal Connection— Do Not Use
Pin 13 - Focusing Electrode
Pin 14 - Photocathode



DIRECTION OF LIGHT: INTO END OF BULB

Maximum Ratings, ***Absolute-Maximum Values:***

SUPPLY VOLTAGE BETWEEN ANODE AND CATHODE (DC)	2500 max.	volts

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SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE (DC)	400	max.	volts
SUPPLY VOLTAGE BETWEEN CONSECUTIVE DYNODES (DC)	300	max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.1 AND CATHODE (DC)	600	max.	volts
SUPPLY VOLTAGE BETWEEN FOCUSING ELECTRODE AND CATHODE (DC)	600	max.	volts
AVERAGE ANODE CURRENT▲	2	max.	ma
AMBIENT TEMPERATURE	75	max.	°C

Characteristics Range Values for Equipment Design:

Under conditions with dc supply voltage (E) across a voltage divider providing electrode voltages shown in Table I

With E = 2000 volts (Except as noted) and focusing-electrode voltage adjusted to give maximum current amplification

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4400 angstroms	–	9.6×10^5	–	amp/watt
Cathode radiant, at 4400 angstroms	–	0.056	–	amp/watt
Luminous, at 0 cps●	200	1200	6000	amp/lumen
Cathode luminous:				
With tungsten light source*	50	70	–	µa/lumen
With blue light source♦*	0.05	–	–	µa
Current Amplification	–	1.7×10^7	–	
Equivalent Anode-Dark-Current Input● at luminous sensitivity of 230 amperes/lumen	–	9×10^{-10}	3.5×10^{-9}	lumen
Equivalent Noise Input♠	–	6×10^{-12}	–	lumen
Anode-Pulse Rise Time●	–	2×10^{-9}	–	sec
Greatest Delay Between Anode Pulses:				
Due to position from which electrons are simultaneously released within a circle centered on tube face having a diameter of—				
1.4"	–	3×10^{-10}●	–	sec
1.6"	–	5×10^{-10}●	–	sec

With E = 1500 volts (Except as noted) and focusing-electrode voltage adjusted to give maximum current amplification

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4400 angstroms	–	1×10^5	–	amp/watt
Cathode radiant, at 4400 angstroms	–	0.056	–	amp/watt
Luminous, at 0 cps●	23	130	680	amp/lumen

World Radio History

	Min.	Median	Max.	
Cathode luminous: With tungsten light source★ . . .	50	70	-	μa/lumen
Current Amplification .	-	1.8×10^6	-	
Equivalent Anode-Dark-Current Input‡ at luminous sensitivity of 20 amperes/lumen .	-	8×10^{-10}	2.5×10^{-9}	lumen
Equivalent Noise Input♠	-	4×10^{-12}	1×10^{-11}	lumen
Pulse Height Resolution*	-	8.5	9	%

With E = 1000 volts (Except as noted) and focusing-electrode voltage adjusted to give maximum current amplification

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms	-	4.8×10^3	-	amp/watt
Cathode radiant, at 4400 angstroms .	-	0.056	-	amp/watt
Luminous, at 0 cps● .	1	6	30	amp/lumen
Cathode luminous: With tungsten light source★ . . .	50	70	-	μa/lumen
Current Amplification .	-	8.6×10^4	-	
Equivalent Anode-Dark-Current Input‡ at luminous sensitivity of 6 amperes/lumen. .	-	5×10^{-10}	-	lumen
Equivalent Noise Input♠	-	5×10^{-12}	-	lumen

▲ Averaged over any interval of 30 seconds maximum.

● Under the following conditions: The light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A light input of 0.1 microlumen is used.

★ Under the following conditions: The light source is a tungsten-filament lamp 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 together as anode.

♦ Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning No.C.S. 5-58, Glass Code No.5113 polished to 1/2 stock thickness) from a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux on the filter is 0.01 lumen. A voltage of 200 volts is applied between cathode and all other electrodes connected together as anode.

* For spectral characteristic of this source, see sheet 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.

‡ Measured at a tube temperature of 25° C. Dark current may be reduced by the use of a refrigerant.

♠ Under the following conditions: Supply voltage (E) is as shown, 25° C tube temperature, external shield is connected to cathode, bandwidth 1 cycle per second, tungsten light source 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. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

♣ 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 variations in the multiplier stages and is measured under conditions with an incident-light spot approximately 1 millimeter in diameter centered on the photocathode.

World Radio History

● These values represent the difference in time of transit between the photocathode and dynode No. 1 for electrons simultaneously released from the center and from the periphery of the specified areas.

Measured with supply voltage (E) = 1200 to 1300 volts; radiation source, an isotope of cesium having an atomic mass of 137 (Cs^{137}); scintillation counter crystal, a cylindrical 2" x 2" thallium-activated sodium-iodide type [NaI(Tl) — type 8D8S50, Serial No. AL281, manufactured by Harshaw Chemical Co., 1945 E. 97 Street, Cleveland 6, Ohio].

TABLE I

VOLTAGE TO BE PROVIDED BY DIVIDER	
Between	8.06% of Supply Voltage (E) multiplied by
Cathode and Dynode No.1	2
Dynode No.1 and Dynode No.2	1.4
Dynode No.2 and Dynode No.3	1
Dynode No.3 and Dynode No.4	1
Dynode No.4 and Dynode No.5	1
Dynode No.5 and Dynode No.6	1
Dynode No.6 and Dynode No.7	1
Dynode No.7 and Dynode No.8	1
Dynode No.8 and Dynode No.9	1
Dynode No.9 and Dynode No.10	1
Dynode No.10 and Anode	1
Anode and Cathode	12.4

Focusing electrode is connected to arm of potentiometer between cathode and dynode No. 1. The focusing-electrode voltage is varied to give maximum current amplification.

OPERATING CONSIDERATIONS

The *operating stability* of the 7746 is dependent on the magnitude of the anode current and its duration. When the 7746 is operated at high average values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 7746 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum-rated value of 2 milliamperes is recommended when stability of operation is important. When maximum stability is required, the average anode current should not exceed 10 microamperes.

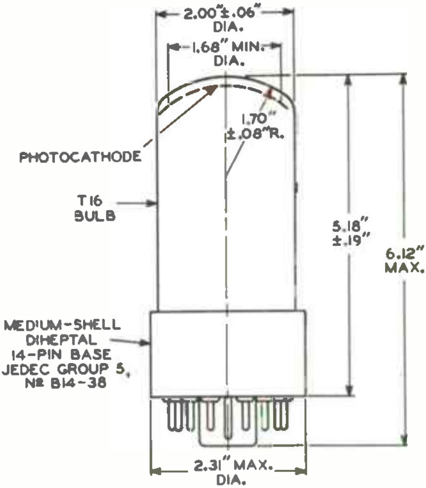
Electrostatic and/or *magnetic shielding* of the 7746 may be necessary.

Adequate *light shielding* should be provided to prevent extraneous light from reaching any part of the 7746.

World Radio History

The *high voltages at which the 7746 is operated are very dangerous.* Care should be taken in the design of apparatus to prevent the operator from coming in contact with these high voltages. Precautions should include the enclosure of high-potential terminals and the use of interlock switches to break the primary circuit of the high-voltage power supply when access to the apparatus is required.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-11 Response
is shown at front of this Section



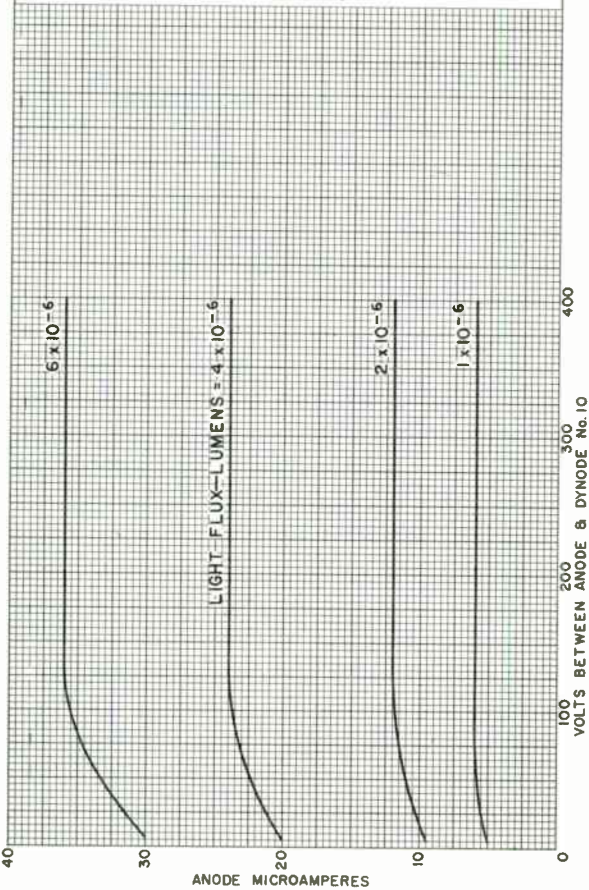
92CS-10592

CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

World Radio History

TYPICAL ANODE CHARACTERISTICS

DYNODE–No. 1–TO–CATHODE VOLTS = 160
DYNODE–No. 1–TO–DYNODE–No. 2 VOLTS = 110
EACH SUCCEEDING–DYNODE–STAGE VOLTS = 80
FOCUSING–ELECTRODE VOLTAGE ADJUSTED FOR MAXIMUM CURRENT AMPLIFICATION.
LIGHT SOURCE IS A TUNGSTEN–FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.



92CM–10596R1

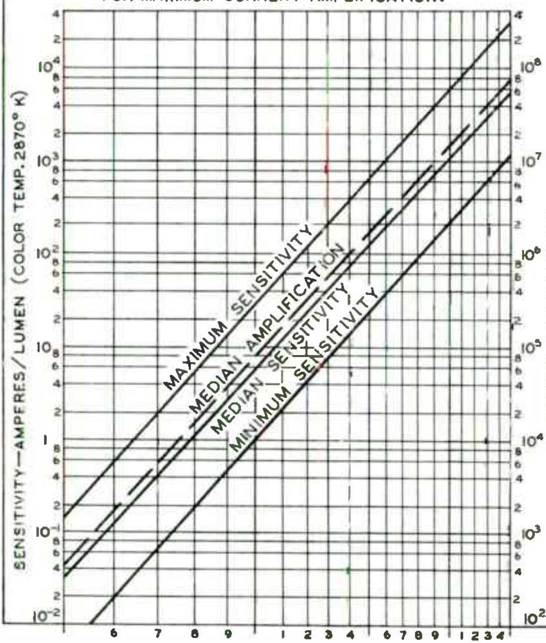
World Radio History

CHARACTERISTICS

THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	8.06% OF E MULTIPLIED BY
CATHODE & DY1	2
DY1 & DY2	1.4
DY2 & DY3	1
DY3 & DY4	1
DY4 & DY5	1
DY5 & DY6	1
DY6 & DY7	1
DY7 & DY8	1
DY8 & DY9	1
DY9 & DY10	1
DY10 & ANODE	1
ANODE & CATHODE	12.4

FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED FOR MAXIMUM CURRENT AMPLIFICATION.



92CM-10597R1

World Radio History

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

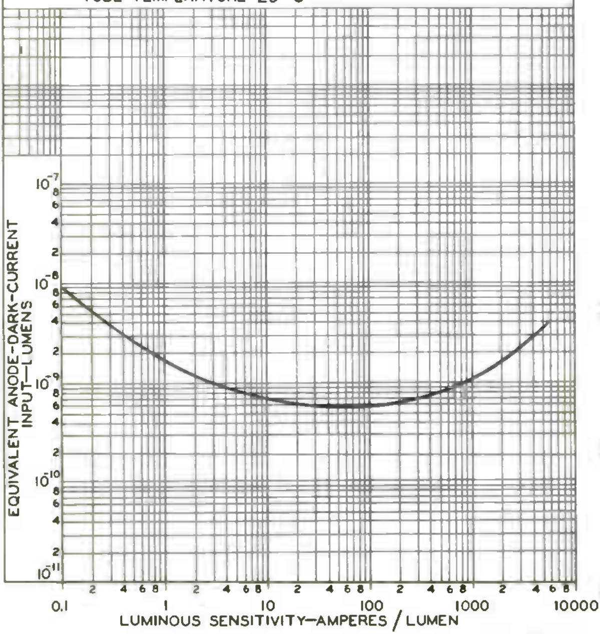
LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	8.06% OF E MULTIPLIED BY
CATHODE & DY_1	2
DY_1 & DY_2	1.4
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1
DY_7 & DY_8	1
DY_8 & DY_9	1
DY_9 & DY_{10}	1
DY_{10} & ANODE	1
ANODE & CATHODE	12.4

FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED FOR MAXIMUM CURRENT AMPLIFICATION.

LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.

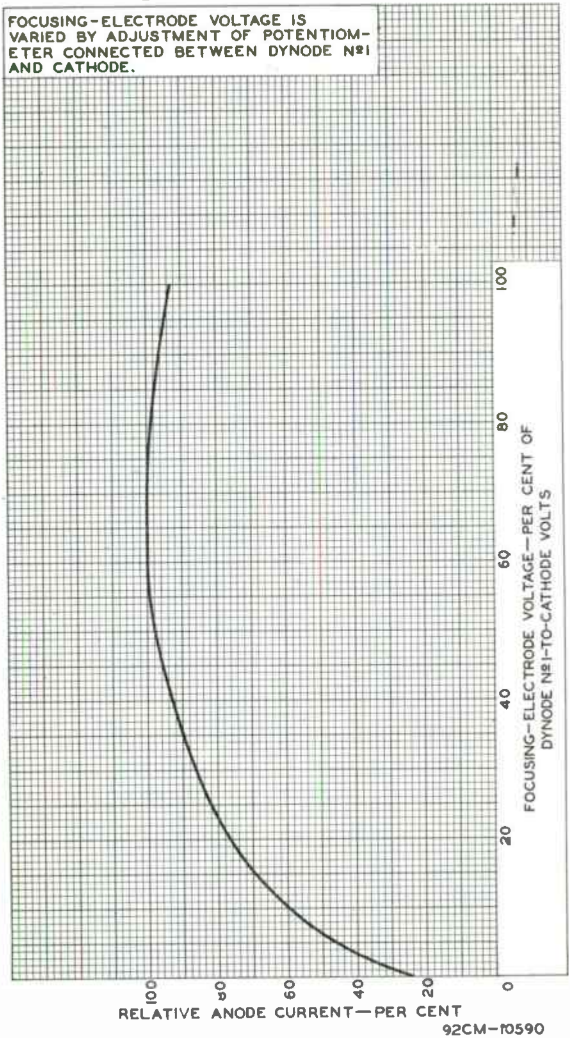
TUBE TEMPERATURE = 25° C



92CM-10593R1

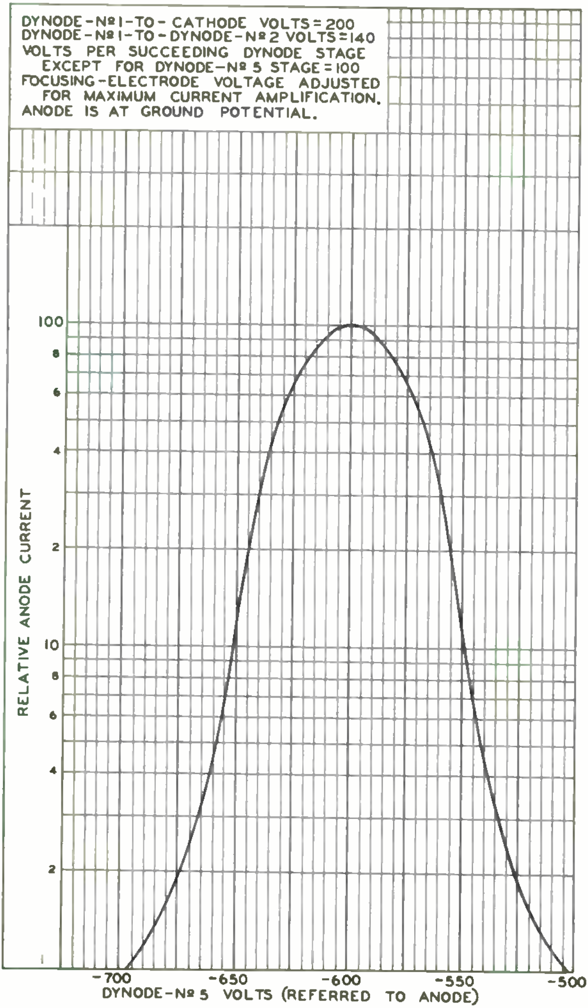
World Radio History

AVERAGE FOCUSING-ELECTRODE-VOLTAGE CHARACTERISTIC



World Radio History

TYPICAL ANODE-CURRENT CHARACTERISTIC



92CM-10598

World Radio History

Multiplier Phototube

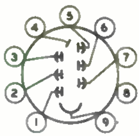
6-STAGE, HEAD-ON, FLAT-FACEPLATE, COMPACT TYPE HAVING IN-LINE DYNODE STRUCTURE, 0.5"-DIAMETER CURVED, CIRCULAR, SEMITRANSPARENT PHOTOCATHODE AND S-11 RESPONSE

DATA

General:

Spectral Response	S-11	
Wavelength of Maximum Response	4400 ± 500	angstroms
Cathode, Semitransparent:		
Shape	Curved Circular	
Window:		
Area	0.2	sq. in.
Minimum diameter	0.5	in.
Index of refraction	1.51	
Direct Interelectrode Capacitances (Approx.):		
Anode to dynode No.6	1.8	μμf
Anode to all other electrodes	2.8	μμf
Maximum Overall Length	2.75"	
Seated Length	2.18" ± 0.06"	
Maximum Diameter	0.78"	
Operating Position	Any	
Weight (Approx.)	0.6 oz	
Bulb	T6	
Socket	Cinch No.121-11-10-134, or equivalent	
Base	Small-Button Nimar 9-Pin (JEDEC No.E9-37)	
Basing Designation for BOTTOM VIEW	9NG	

Pin 1 – Dynode No.1
Pin 2 – Dynode No.3
Pin 3 – Dynode No.5
Pin 4 – Anode
Pin 5 – Dynode No.6
Pin 6 – Dynode No.4



DIRECTION OF LIGHT: INTO END OF BULB

Pin 7 – Dynode No.2
Pin 8 – Internal Connection— Do Not Use
Pin 9 – Photocathode

Maximum Ratings, ***Absolute-Maximum Values:***

SUPPLY VOLTAGE BETWEEN ANODE AND CATHODE (DC or Peak AC)	1500 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.6 AND ANODE (DC or Peak AC)	300 max.	volts
SUPPLY VOLTAGE BETWEEN CONSECUTIVE DYNODES (DC or Peak AC)	200 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.1 AND CATHODE (DC or Peak AC)	400 max.	volts
AVERAGE ANODE CURRENT	0.5 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

World Radio History

Characteristics Range Values for Equipment Design:

Under conditions with dc supply voltage (E) across a voltage divider providing 1/4 of E between cathode and dynode No.1; 1/8 of E for each succeeding stage; and 1/8 of E between dynode No.6 and anode

With E = 1200 volts (Except as noted)

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4400 angstroms.	–	0.00024	–	amp/μw
Cathode radiant, at 4400 angstroms . . .	–	0.048	–	amp/watt
Luminous, at 0 cps●. . .	0.1	0.3	1.0	amp/lumen
Cathode luminous:				
With tungsten light source★ . .	40	60	–	μa/lumen
With blue light source♦*	–	0.06	–	μa
Current Amplification. .	–	5×10^3	–	
Equivalent Anode-Dark-Current Input♠	–	1×10^{-8}	3×10^{-8}	lumen
Equivalent Noise Input♣		3×10^{-10}	1×10^{-9}	lumen

▲ Averaged over any interval of 30 seconds maximum.

● Under the following conditions: The light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A light input of 10 microlumens is used. The load resistor has a value of 0.01 megohm.

★ Under the following conditions: The light source is a tungsten-filament lamp 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 together as anode.

♦ Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning. Glass Code No.5113 polished to 1/2 stock thickness) from a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux on the filter is 0.01 lumen. The load resistor has a value of 0.01 megohm and 200 volts are applied between cathode and all other electrodes connected together as anode.

* For spectral characteristic of this source, see sheet 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.

♠ Measured at a tube temperature of 25° C and with the supply voltage (E) adjusted to give a luminous sensitivity of 0.3 ampere per lumen. Dark current may be reduced by the use of a refrigerant.

♣ Under the following conditions: Supply voltage (E) is as shown, 25°-C tube temperature, external shield is connected to cathode, bandwidth 1 cycle per second, tungsten light source 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 pulses is equal to the "off" period. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

OPERATING CONSIDERATIONS

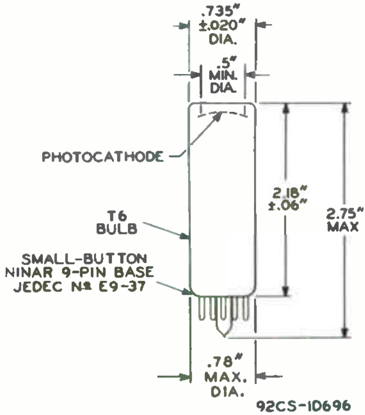
The use of an *average anode current* will below the maximum-rated value of 0.5 milliampere is recommended when stability of operation is important.

World Radio History

Electrostatic and/or *magnetic shielding of the 7764* may be necessary.

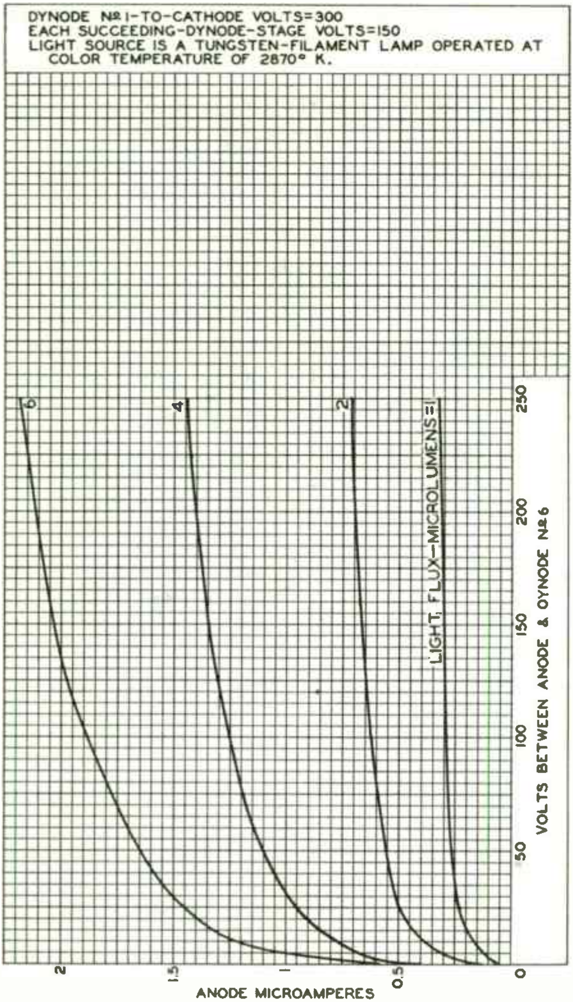
The high voltages at which the 7764 is operated are very dangerous. Before any part of the circuit is touched, the power-supply switch should be turned off and both terminals of any capacitors grounded.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-11 Response
is shown at front of this Section



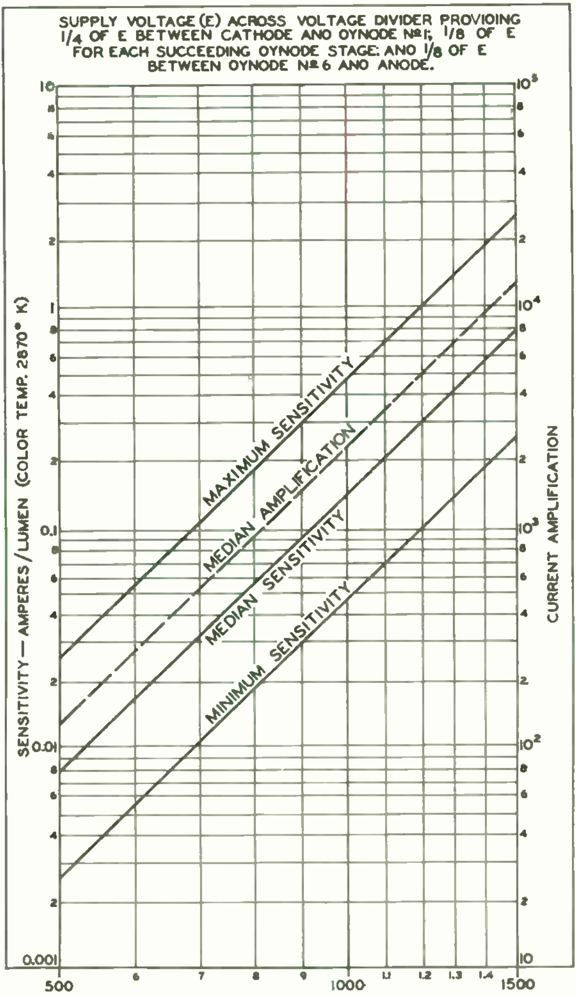
World Radio History

AVERAGE ANODE CHARACTERISTICS



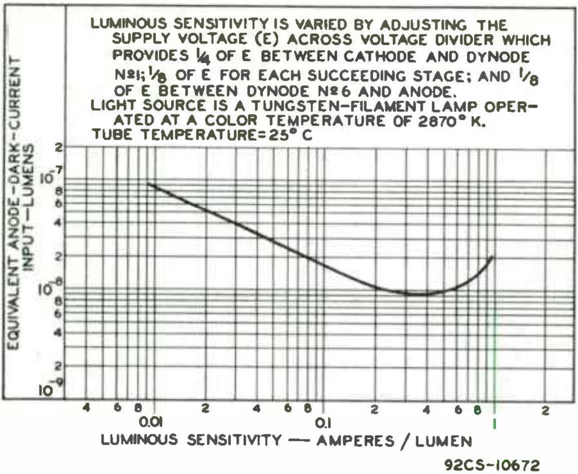
92CM-10673

CHARACTERISTICS



World Radio History

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



World Radio History

Multiplier Phototube

10-STAGE, HEAD-ON, FLAT-FACEPLATE — **IN-LINE DYNODE STRUCTURE**

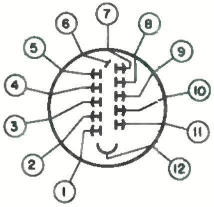
For Low-Level Light Applications having Space Restrictions Encountered in Geological Exploration and Biological Tracer Studies

DATA

General:

Spectral Response	S-11
Wavelength of Maximum Response	4400 ± 500 angstroms
Cathode, Semitransparent	Cesium-Antimony
Shape	Curved, Circular
Minimum area	0.2 sq. in.
Minimum diameter	0.5 in.
Window	Lime Glass (Corning[a] No.0080), or equivalent
Index of refraction	1.51
Dynode Material	Copper-Beryllium
Direct Interelectrode Capacitances (Approx.):	
Anode to dynode No.10	2.4 pf
Anode to all other electrodes	3.2 pf
Dynode No.8 to all other electrodes	3.6 pf
Dynode No.6 to all other electrodes	4.3 pf
Dynode No.4 to all other electrodes	4.6 pf
Maximum Overall Length (Excluding semiflexible leads)	4.0"
Maximum Diameter	0.78"
Operating Position	Any
Weight (Approx.)	0.9 oz
Bulb	T6
Magnetic Shield	Perfection Mica Co.[b], or equivalent
Base	Small-Button Thirteenar 12-Semiflexible Lead, (JEDEC No.E12-72), and Protective Plastic Shell
Basing Designation for BOTTOM VIEW	13A

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 7 – Dynode No.10
Lead 8 – Dynode No.8
Lead 9 – Dynode No.6
Lead 10 – Dynode No.4
Lead 11 – Dynode No.2
Lead 12 – Photocathode



DIRECTION OF RADIATION: INTO END OF BULB

Maximum Ratings, ***Absolute-Maximum Values:***

SUPPLY VOLTAGE BETWEEN ANODE AND CATHODE (DC or Peak AC)	1500 max.	volts

← Indicates a change.

World Radio History

SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE (DC or Peak AC)	300 max.	volts
SUPPLY VOLTAGE BETWEEN CONSECUTIVE DYNODES (DC or Peak AC)	200 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.1 AND CATHODE (DC or Peak AC)	400 max.	volts
AVERAGE ANODE CURRENT[c]	0.5 max.	ma
AMBIENT TEMPERATURE	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.

With E = 1250 volts (Except as noted)

	Min.	Typical	Max.	
Sensitivity:				
Radiant at 4400 angstroms	–	1.28×10^{4}	–	a/w
Cathode radiant, at 4400 angstroms . . .	–	0.048	–	a/w
Luminous:				
At 0 cps[d]	7	16	60	a/lm
Cathode luminous:				
With tungsten light source[e] . . .	4×10^{-5}	6×10^{-5}	–	a/lm
With blue light source[f,j] . .	4×10^{-8}	6×10^{-8}	–	a
Current Amplification . .	–	2.67×10^{5}	–	
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 7.5 a/lm[g]	–	5×10^{-10}	5×10^{-9}	lm
Equivalent Noise Input[h] .	–	3×10^{-12}	1×10^{-11}	lm

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

[b] Magnetic shielding material in the form of foil or tape as available from the Magnetic Shield Division, Perfection Mica Company, 1829 Civic Opera Bldg., 20 North Wacker Drive, Chicago 6, Illinois.

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

[d] 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.

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

[f] 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.

[g] At a tube temperature of 25° C. Dark current may be reduced by use of a refrigerant.

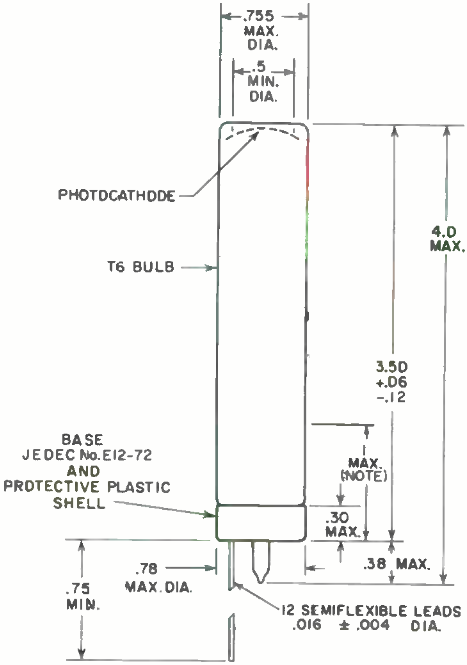
[h] Under the following conditions: Supply voltage (E) is as shown, 25° C tube temperature, external shield connected to cathode, bandwidth 1 cycle per second, tungsten-light source at a color temperature of 2870° K interrupted at a low audio frequency to produce incident radiation pulses alternating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

→ Indicates a change.

World Radio History

j 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-11 RESPONSE
is shown at front of this Section



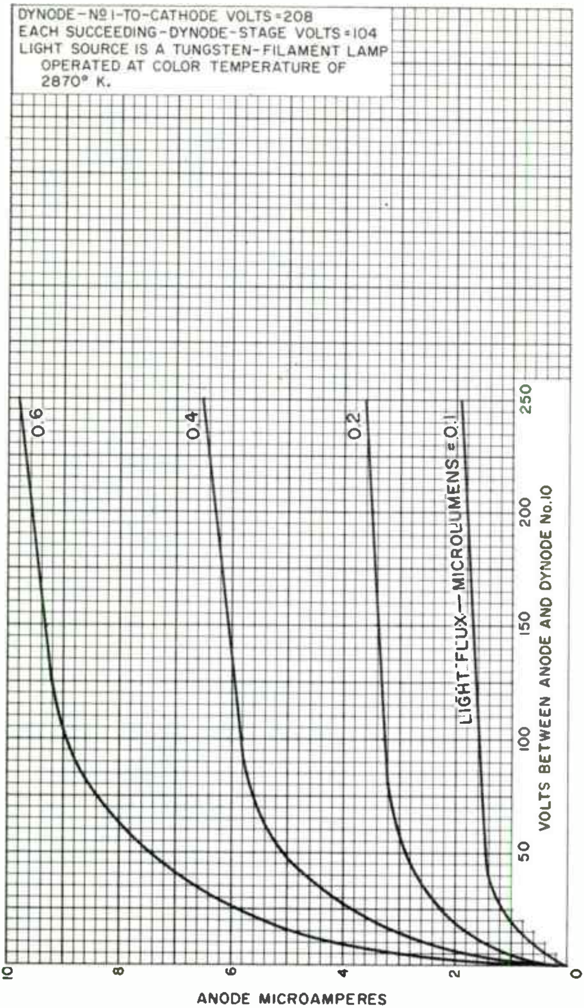
92CS-10659R2

ALL DIMENSIONS IN INCHES

NOTE: WITHIN THIS LENGTH, MAXIMUM DIAMETER OF TUBE IS 0.78".

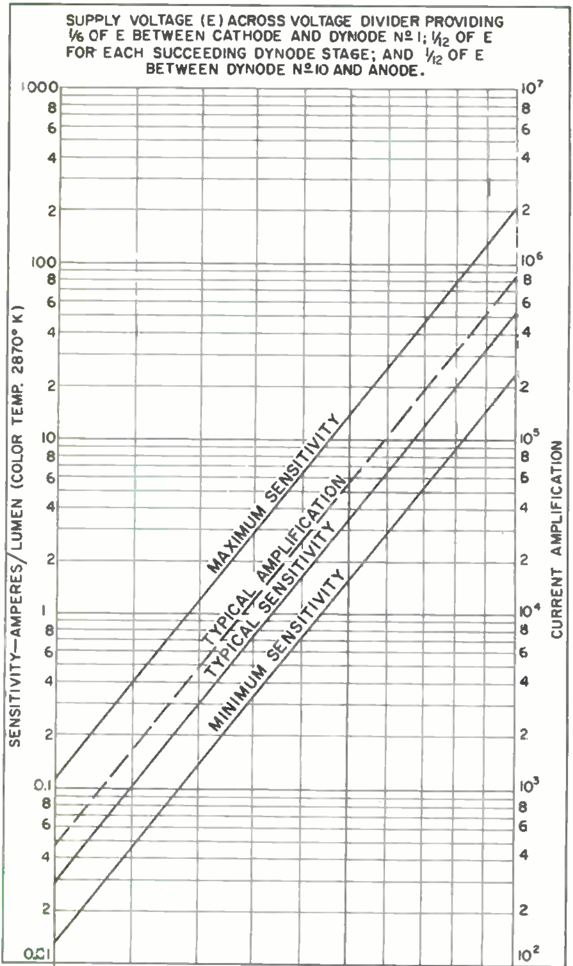
World Radio History

TYPICAL ANODE CHARACTERISTICS



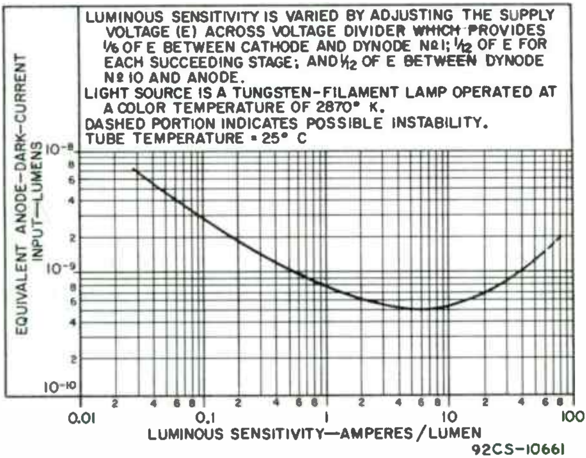
92CM-10660R1

CHARACTERISTICS



92CM-10657R1

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



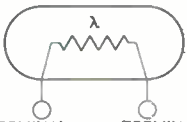
Photoconductive Cell

CADMIUM-SELENIDE, HEAD-ON TYPE

DATA

General:

Spectral Response	See *Accompanying Curve*
Wavelength of Maximum Response	7300 ± 500 angstroms
Sensitive Surface:	
Shape	Rectangular
Length	0.220" ± 0.015"
Width	0.008" ± 0.003"
Area (Average)	0.00176 sq. in.
Maximum Length (Excluding flexible leads)	0.500"
Diameter	0.29" ± 0.01"
Envelope	Glass
Seals	Hermetic
Leads, Flexible	2
Minimum length	1.5"
Diameter	0.016" ± 0.003"
Operating Position	Any
Weight (Approx.)	0.04 oz



λ indicates that the primary characteristic of the element within the envelope symbol is designed to vary under the influence of light.

Maximum Ratings, *Absolute-Maximum Values:*

VOLTAGE BETWEEN TERMINALS (DC or Peak AC)	100 max.	volts
PHOTOCURRENT	1000 max.	μa
POWER DISSIPATION	30 max.	mw
AMBIENT TEMPERATURE	50 max.	°C

Characteristics:

With dc voltage of 22.5 volts between terminals and an ambient temperature of 25° C

	Min	Median	Max.	
Sensitivity:				
Radiant▲ at 7300 angstroms	–	6550	–	a/w
Luminous●,★	–	41	–	a/lm
Illumination●,★	–	500	–	μa/fc
Photocurrent♦	–	–	0.05	μa

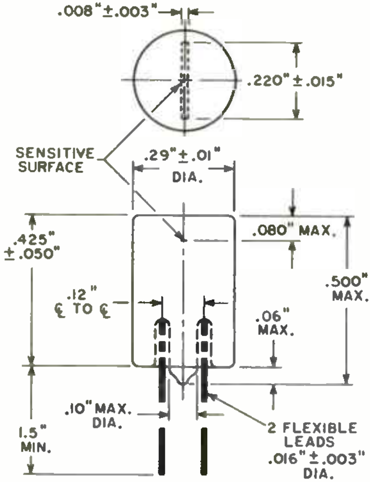
World Radio History

▲ For conditions where the incident power is 7.65 x 10^{-10} watts.

● For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K.

★ Incident illumination on the sensitive surface is 0.01 footcandle.

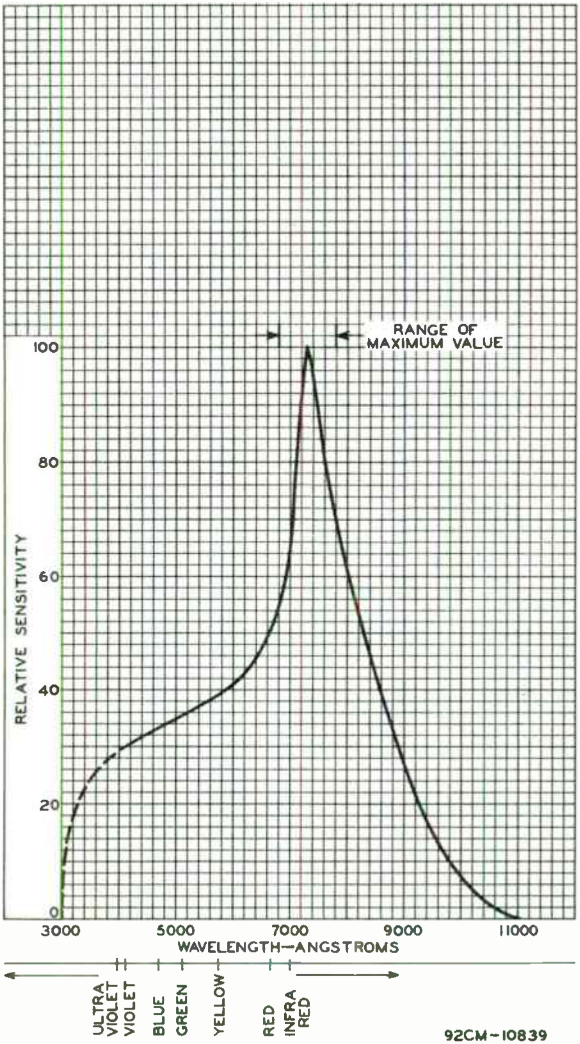
♦ Measured 20 seconds after removal of incident-illumination level of 0.01 footcandle.



92CS-10865

World Radio History

SPECTRAL-SENSITIVITY CHARACTERISTIC
For Equal Values of Radiant Flux at All Wavelengths



World Radio History

World Radio History

Multiplier Phototube

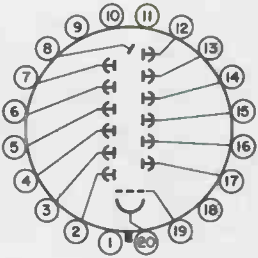
12-STAGE, HEAD-ON, SPHERICAL-FACEPLATE TYPE HAVING ENCLOSED, IN-LINE DYNODE STRUCTURE, 1.68"-DIAMETER, SPHERICAL, SEMITRANSPARENT PHOTOCATHODE, S-11 RESPONSE, HIGH CURRENT AMPLIFICATION, AND EXTREMELY SHORT RISE TIME

DATA

General:

Spectral Response		S-11
Wavelength of Maximum Response		4400 ± 500 angstroms
Cathode, Semitransparent:		
Shape		Spherical
Window:		
Area (Projected)	2.2	sq. in.
Minimum diameter	1.68	in.
Index of refraction	1.51	
Direct Interelectrode Capacitances (Approx.):		
Anode to dynode No.12	3.8	μμf
Anode to all other electrodes	5.7	μμf
Dynode No.12 to all other electrodes	6.8	μμf
Maximum Overall Length		6.31"
Seated Length		5.50" ± 0.19"
Maximum Diameter		2.06"
Operating Position		Any
Weight (Approx.)		7 oz
Bulb		T16
Socket		Cinch No.CX-875[a], or equivalent
Base		Small-Shell Bidecal 20-Pin (JEDEC No.B20-102)
Basing Designation for BOTTOM VIEW		20E

Pin 1 – No Connection
Pin 2 – Dynode No.1
Pin 3 – Dynode No.3
Pin 4 – Dynode No.5
Pin 5 – Dynode No.7
Pin 6 – Dynode No.9
Pin 7 – Dynode No.11
Pin 8 – Anode
Pin 9 – No Connection
Pin 10 – No Connection
Pin 11 – No Connection
Pin 12 – Dynode No.12
Pin 13 – Dynode No.10
Pin 14 – Dynode No.8
Pin 15 – Dynode No.6
Pin 16 – Dynode No.4
Pin 17 – Dynode No.2
Pin 18 – No Connection
Pin 19 – Grid No.1 (Focusing Electrode)
Pin 20 – Photocathode



DIRECTION OF LIGHT: INTO END OF BULB

World Radio History

Maximum Ratings, ***Absolute-Maximum Values:***

SUPPLY VOLTAGE BETWEEN ANODE AND CATHODE (DC)	2600 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.12 AND ANODE (DC)	400 max.	volts
SUPPLY VOLTAGE BETWEEN CONSECUTIVE DYNODES (DC)	300 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.1 AND CATHODE (DC)	600 max.	volts
SUPPLY VOLTAGE BETWEEN FOCUSING ELECTRODE AND CATHODE (DC)	600 max.	volts
AVERAGE ANODE CURRENT[b]	2 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

Characteristics Range Values for Equipment Design:

Under conditions with dc supply voltage (E) across a voltage divider providing electrode voltages shown in Table I

With E = 2300 volts (Except as noted) and focusing-electrode voltage adjusted to give maximum current amplification

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4400 angstroms	–	4.8×10^{6}	–	a/w
Cathode radiant, at 4400 angstroms . .	–	0.056	–	a/w
Luminous, at 0 cps[c] .	1.4×10^{3}	6×10^{3}	50×10^{3}	a/lm
Cathode luminous:				
With tungsten light source[d] . .	50	70	–	µa/lm
With blue light source[e,f]	0.05	–	–	µa
Current Amplification .	–	8.6×10^{7}	–	
Equivalent Anode-Dark-Current Input[g] at luminous sensitivity of 6000 a/lm . .	–	4×10^{-10}	2.5×10^{-9}	lm
Equivalent Noise Input[h]	–	3×10^{-12}	–	lm
Anode-Pulse Rise Time[j] .	–	2×10^{-9}	–	sec
Greatest Delay Between Anode Pulses:				
Due to position from which electrons are simultaneously released within a circle centered on tube face having a diameter of—				
1.4"	–	3×10^{-10}[k]	–	sec
1.6"	–	5×10^{-10}[k]	–	sec

World Radio History

With E = 1800 volts (Except as noted) and focusing-electrode voltage adjusted to give maximum current amplification

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms.	-	5.1×10^5	-	a/w
Cathode radiant, at 4400 angstroms. . .	-	0.056	-	a/w
Luminous, at 0 cps[c]. . .	-	640	-	a/lm
Cathode luminous: With tungsten light source[d].	50	70	-	µa/lm
Current Amplification. . .	-	9.1×10^6	-	
Equivalent Anode-Dark-Current Input[g] at luminous sensitivity of 160 a/lm.	-	4×10^{-10}	-	lm
Equivalent Noise Input[h]. .	-	2.4×10^{-12}	-	lm

With E = 1300 volts (Except as noted) and focusing-electrode voltage adjusted to give maximum current amplification

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms.	-	2.9×10^4	-	a/w
Cathode radiant, at 4400 angstroms. . .	-	0.056	-	a/w
Luminous, at 0 cps[c]. . .	8	36	300	a/lm
Cathode luminous: With tungsten light source[d].	50	70	-	µa/lm
Current Amplification. . .	-	5×10^5	-	
Equivalent Anode-Dark-Current Input[g] at luminous sensitivity of 9 a/lm.	-	5×10^{-10}	2×10^{-9}	lm
Equivalent Noise Input[h]. .	-	3×10^{-12}	-	lm
Pulse Height Resolution[m] .	-	8.5	-	%

[a] Made by Cinch Manufacturing Corporation, 1026 South Homan Avenue, Chicago 24, Illinois.

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

[c] Under the following conditions: The light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A light input of 0.1 microlumen is used.

[d] Under the following conditions: The light source is a tungsten-filament lamp operated at a color temperature of 2870° K. The value of input flux is 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected together as anode.

[e] 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) from a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux on the filter is 0.01 lumen. A voltage of 200 volts is applied between cathode and all other electrodes connected together as anode.

[f] For spectral characteristic of this source, see sheet 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.

World Radio History

g Measured at a tube temperature of 25° C. Dark current may be reduced by the use of a refrigerant.

h Under the following conditions: Supply voltage (E) is as shown, 25°-C tube temperature, external shield is connected to cathode, bandwidth 1 cycle per second, tungsten light source 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. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

j 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 variations in the multiplier stages and is measured under conditions with an incident light spot approximately 1 millimeter in diameter centered on the photocathode.

k These values represent the difference in time of transit between the photocathode and dynode No.1 for electrons simultaneously released from the center and from the periphery of the specified areas.

m Measured with supply voltage (E) = 1100 to 1400 volts; radiation source, an isotope of cesium having an atomic mass of 137 (Cs^{137}); scintillation-counter crystal, a cylindrical 2" x 2" thallium-activated sodium-iodide type [NaI(Tl) — type 8DS50, Serial No.AL281, manufactured by Harshaw Chemical Company, 1945 East 97 Street, Cleveland 6, Ohio].

TABLE I

VOLTAGE TO BE PROVIDED BY DIVIDER	
Between	6.95% of Supply Voltage (E) multiplied by
Cathode and Dynode No.1	2
Dynode No.1 and Dynode No.2	1.4
Dynode No.2 and Dynode No.3	1
Dynode No.3 and Dynode No.4	1
Dynode No.4 and Dynode No.5	1
Dynode No.5 and Dynode No.6	1
Dynode No.6 and Dynode No.7	1
Dynode No.7 and Dynode No.8	1
Dynode No.8 and Dynode No.9	1
Dynode No.9 and Dynode No.10	1
Dynode No.10 and Dynode No.11	1
Dynode No.11 and Dynode No.12	1
Dynoge No.12 and Anode	1
Anode and Cathode	14.4

Focusing electrode is connected to arm of potentiometer between cathode and dynode No.1. The focusing-electrode voltage is varied to give maximum current amplification.

World Radio History

OPERATING CONSIDERATIONS

The *operating stability* of the 7850 is dependent on the magnitude of the anode current and its duration. When the 7850 is operated at high average values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 7850 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum-rated value of 2 milliamperes is recommended when stability of operation is important. When maximum stability is required, the average anode current should not exceed 10 microamperes.

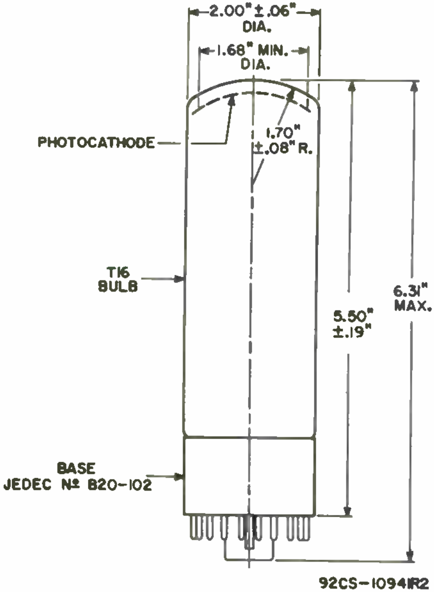
Electrostatic and/or *magnetic shielding* of the 7850 may be necessary.

Adequate *light shielding* should be provided to prevent extraneous light from reaching any part of the 7850.

The *high voltages at which the 7850 is operated are very dangerous.* Care should be taken in the design of apparatus to prevent the operator from coming in contact with these high voltages. Precautions should include the enclosure of high-potential terminals and the use of interlock switches to break the primary circuit of the high-voltage power supply when access to the apparatus is required.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-11 Response
is shown at the front of this Section

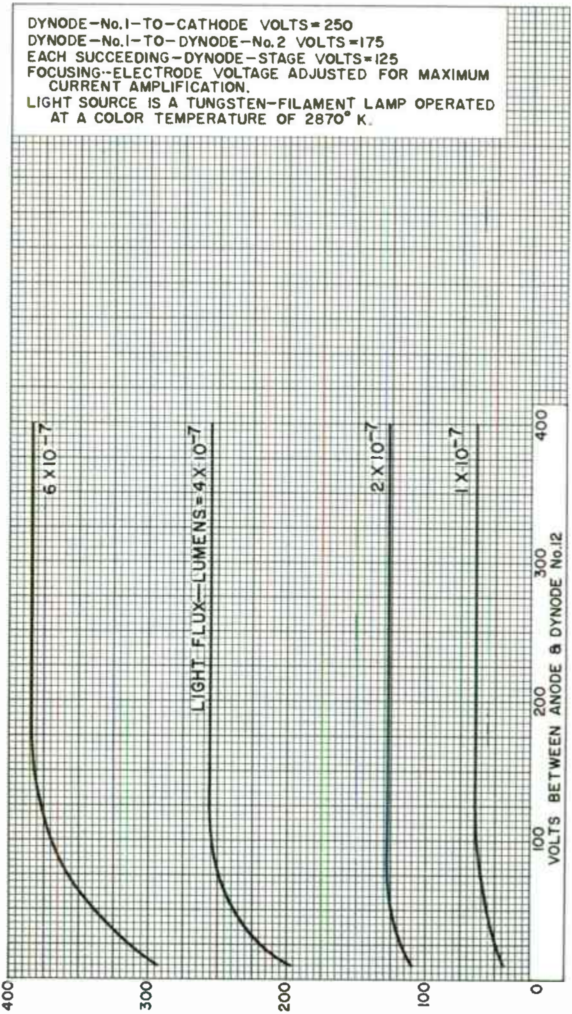
World Radio History



CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

World Radio History

TYPICAL ANODE CHARACTERISTICS



92CM—10937

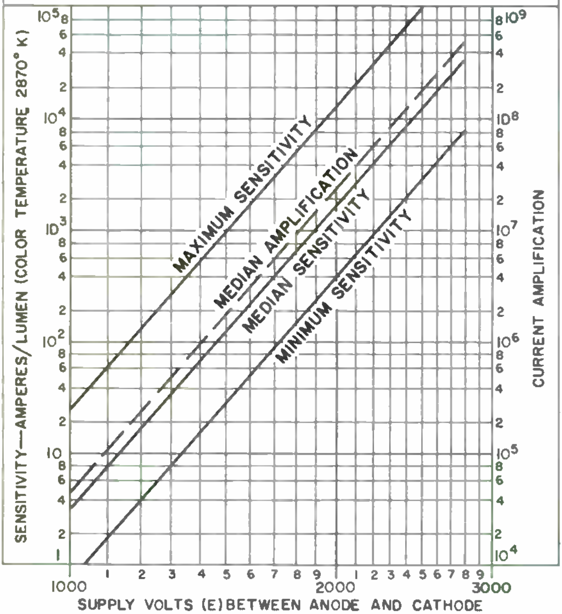
World Radio History

CHARACTERISTICS

THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	6.95 % OF E MULTIPLIED BY
CATHODE & DY_1	2
DY_1 & DY_2	1.4
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1
DY_7 & DY_8	1
DY_8 & DY_9	1
DY_9 & DY_{10}	1
DY_{10} & DY_{11}	1
DY_{11} & DY_{12}	1
DY_{12} & ANODE	1
ANODE & CATHODE	14.4

FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED FOR MAXIMUM CURRENT AMPLIFICATION.



92CM-10946

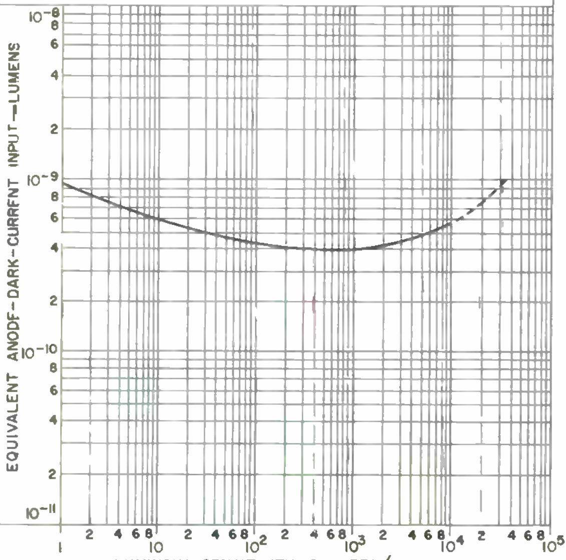
World Radio History

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	6.95 % OF E MULTIPLIED BY
CATHODE & DY_1	2
DY_1 & DY_2	1.4
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1
DY_7 & DY_8	1
DY_8 & DY_9	1
DY_9 & DY_{10}	1
DY_{10} & DY_{11}	1
DY_{11} & DY_{12}	1
DY_{12} & ANODE	1
ANODE & CATHODE	14.4

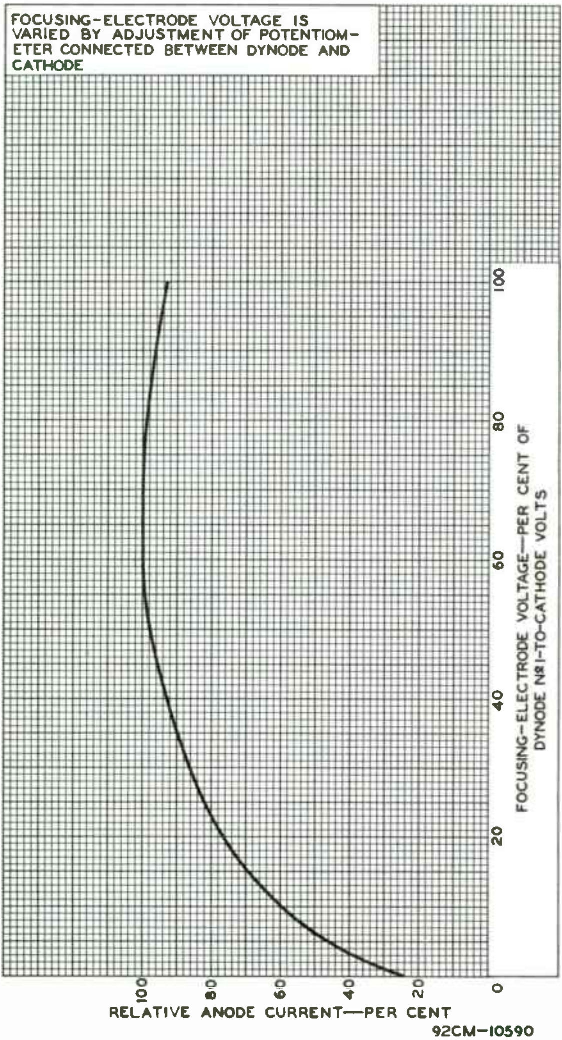
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED FOR MAXIMUM CURRENT AMPLIFICATION.
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.
TUBE TEMPERATURE = 25° C



92CM-10940

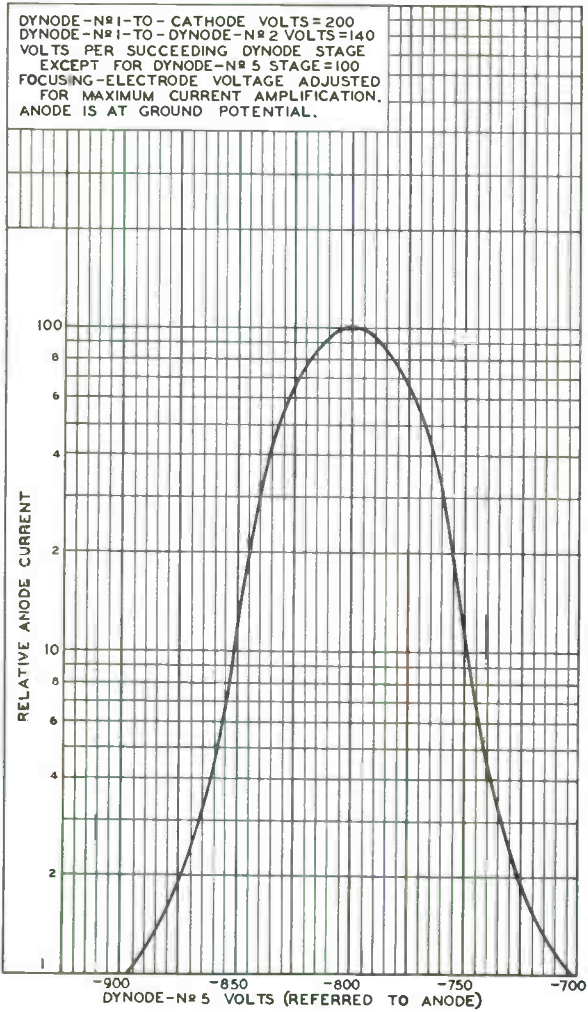
World Radio History

AVERAGE FOCUSING-ELECTRODE-VOLTAGE CHARACTERISTIC



World Radio History

TYPICAL ANODE-CURRENT CHARACTERISTIC



World Radio History

World Radio History

Image Orthicon

SEMICONDUCTIVE TARGET, S-20 RESPONSE

VERY HIGH SENSITIVITY — **MAGNETIC FOCUS**
VERY HIGH RESOLUTION — **MAGNETIC DEFLECTION**

For Extremely Low-Light-Level Black-and-White TV Pickup High-Resolution Pictures at 10^{-5} Footcandle, and Useful Pictures at 10^{-6} Footcandle

DATA

General:

Heater, for Unipotential Cathode:

Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp

Direct Interelectrode Capacitance:

Anode to all other electrodes	12	pf

Spectral Response S-20

Wavelength of Maximum Response . . . . 4200 ± 500 angstroms

Photocathode, Semitransparent:

Rectangular image (4 x 3 aspect ratio):

Useful size of . . . . 1.8" max. diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

Orientation of . . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base.

Focusing Method . . . . Magnetic

Deflection Method . . . . Magnetic

Overall Length . . . . 15.20" ± 0.25"

Greatest Diameter of Bulb . . . . 3.00" ± 0.06"

Minimum Deflecting-Coil Inside Diameter . . . . 2-3/8"

Deflecting Coil . . . . .Cleveland Electronics, Part No.OY-1[a], or equivalent

Deflecting-Coil Length . . . . 5"

Focusing Coil . . . . .Cleveland Electronics, Part No.OF-2[a], or equivalent

Focusing Coil Length . . . . 10"

Alignment Coil . . . . .Cleveland Electronics, Part No.OA-3[a], or equivalent

Alignment-Coil Length . . . . 15/16"

Photocathode Distance Inside End of Focusing Coil . . . 1/2"

Socket . . . . .Cinch Part No.3M14[b], or equivalent

Operating Position . . The tube should never be operated in a vertical position with the diheptal-base end up nor in any other position where the axis of the tube with the base up makes an angle of less than 20° with the vertical.

Weight (Approx.) . . . . 1 lb 6 oz

World Radio History

Shoulder Base. . . . . .Keyed Jumbo Annular 7-Pin

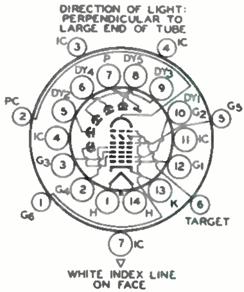
BOTTOM VIEW

Pin 1 - Grid No.6
Pin 2 - Photocathode
Pin 3 - Do Not Use
Pin 4 - Do Not Use
Pin 5 - Grid No.5
Pin 6 - Target
Pin 7 - Do Not Use

End Base . . . . Small-Shell Diheptal 14-Pin (JEDEC No.B14-45)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.4
Pin 3 - Grid No.3
Pin 4 - Do Not Use
Pin 5 - Dynode No.2
Pin 6 - Dynode No.4
Pin 7 - Anode
Pin 8 - Dynode No.5
Pin 9 - Dynode No.3
Pin 10 - Dynode No.1, Grid No.2
Pin 11 - Do Not Use
Pin 12 - Grid No.1
Pin 13 - Cathode
Pin 14 - Heater



Maximum and Minimum Ratings, ***Absolute-Maximum Values:***

PHOTOCATHODE:			
Voltage.	-550	max.	volts
Illumination	50	max.	fc
MAXIMUM OPERATING PHOTOCATHODE ILLUMINATION	0.001	max.	fc
OPERATING TEMPERATURE:			
Any part of bulb	55	max.	°C
Of bulb at large end of tube (Target section)	0	min.	°C
TEMPERATURE DIFFERENCE:			
Between target section and any part of bulb hotter than target section	5	max.	°C
GRID-No.6 VOLTAGE	-550	max.	volts
TARGET VOLTAGE:			
Positive value	4	max.	volts
Negative value	10	max.	volts
GRID-No.5 VOLTAGE.	150	max.	volts
GRID-No.4 VOLTAGE.	300	max.	volts
GRID-No.3 VOLTAGE.	400	max.	volts
GRID-No.2 & DYNODE-NO.1 VOLTAGE.	350	max.	volts
GRID-No.1 VOLTAGE:			
Negative bias value.	125	max.	volts
Positive bias value.	0	max.	volts
VOLTAGE PER MULTIPLIER STAGE	350	max.	volts
ANODE-SUPPLY VOLTAGE[c].	1350	max.	volts

World Radio History

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts

Typical Operating Values:[d]

Photocathode Voltage (Image Focus)	-400 to -540	volts
Grid-No.6 Voltage (Accelerator)-(Approx. 75% photocathode voltage)	-300 to -405	volts
Target-Cutoff Voltage[e]	-3 to 1	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam Focus)	140 to 180	volts
Grid-No.3 Voltage[f]	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil[g]	75	gausses
Field Strength of Alignment Coil	0 to 3	gausses

Performance Data:[h]

With conditions shown under Typical Operating Values and with an illumination level on the photocathode of 0.00001 footcandle

	Min.	*Typ.*	*Max.*	
Cathode Radiant Sensitivity at 4200 angstroms	-	0.073	-	a/w
Luminous Sensitivity	120	170	-	µa/lm
Anode Current (DC)	-	0.3	-	µa
Signal-Output Current (Peak to Peak)	-	0.1	-	µa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc	-	3:1	-	
Limiting Horizontal Resolution	-	650	-	TV Lines

World Radio History

[a] Made by Cleveland Electronics Inc., 1974 East 61st Street, Cleveland, Ohio.

[b] Made by Cinch Manufacturing Company, 1026 South Homan Avenue, Chicago 24, Illinois.

[c] Dynode voltage values are shown under *Typical Operating Values.*

[d] With 7967 operated in properly adjusted RCA TK-31 camera.

[e] Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from -3 to 5 volts.

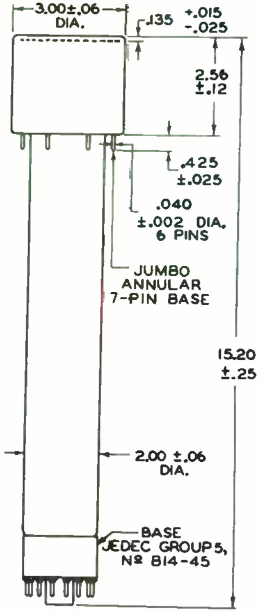
[f] Adjust to give the most uniformly shaded picture near maximum signal.

[g] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with indicator located outside of and at the image end of the focusing coil.

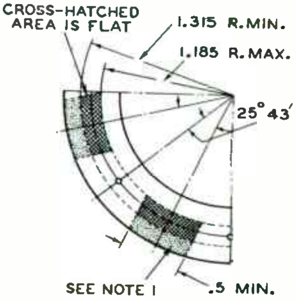
[h] With output from the 7967 coupled into a low-noise video amplifier.

SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOSENSITIVE DEVICE HAVING S-20 Response
is shown at front of this Section

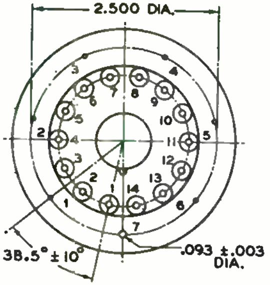
World Radio History



DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.



ENLARGED BOTTOM VIEW

92CM-8293R3

DIMENSIONS IN INCHES

ANNULAR BASE GAUGE

Angular variations between pins as well as eccentricity of neck cylinder with respect to photocathode cylinder are held to tolerances such that pins and neck cylinder will fit flat-plate gauge with:

a. Six holes having diameter of 0.065" ± 0.001" and one hole having diameter of 0.150" ± 0.001". All holes have depth of 0.265" ± 0.001". The six 0.065" holes are enlarged by 45° taper to depth of 0.047". All holes are spaced at angles of 51°26′ ± 5′ on circle diameter of 2.500" ± 0.001".

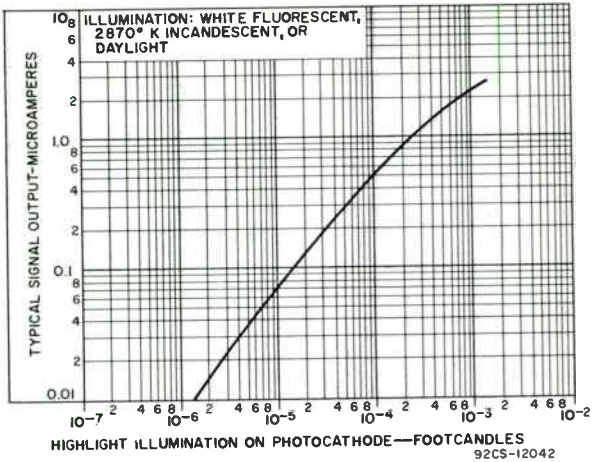
b. Seven stops having height of 0.187" ± 0.001", centered between pin holes, to bear against flat areas of base.

c. Rim extending out a minimum of 0.125" from 2.812" diameter and having height of 0.126" ± 0.001".

d. Neck-cylinder clearance hole having diameter of 2.200" ± 0.001".

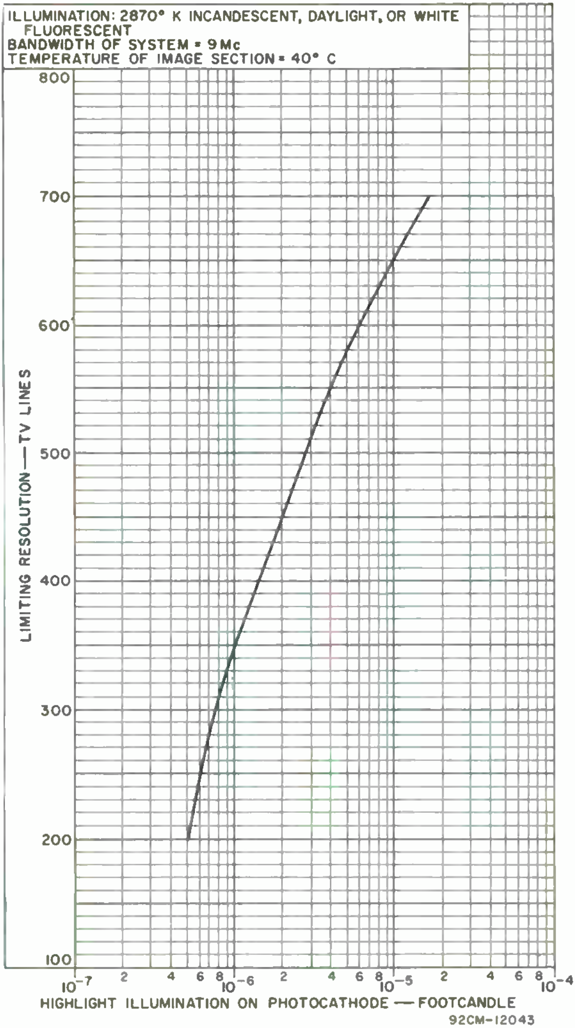
World Radio History

BASIC LIGHT-TRANSFER CHARACTERISTIC



World Radio History

EFFECT OF PHOTOCATHODE ILLUMINATION ON LIMITING RESOLUTION OF TYPICAL 7967



World Radio History

Vidicon

1-1/2" DIAMETER

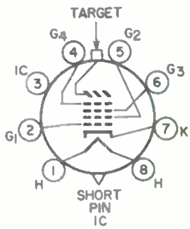
MAGNETIC FOCUS — MAGNETIC DEFLECTION

For Broadcast Film-Pickup or Data Transmission with Color or Black-and-White TV Cameras Requiring Resolutions of more than 1200 TV Lines

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:[a]		
Target to all other electrodes	8.0	pf
Spectral Response		S-18
Wavelength of Maximum Response	4500 +500 -300	angstroms
Photoconductive Layer:		
Maximum useful diagonal of rectangular image (4 × 3 aspect ratio)[b]		1"
Focusing Method		Magnetic
Deflection Method		Magnetic
Overall Length		7.75" ± 0.25"
Greatest Diameter		1.59" ± 0.01"
Bulb Diameter		1.50" ± 0.01" ←
Operating Position		Any
Weight (Approx.)		5.25 oz
Bulb		T12
Focusing-Alignment Assembly		Cleveland Electronics[c] No. 15-VFA-259, or equivalent
Deflecting Yoke[d]		Cleveland Electronics[c] No. 15-VY-258, or equivalent
Socket		Alden[e] No. 208-SBSDC, or equivalent ←
Base		Small-Button Super-Ditetrar 8-Pin (JEDEC No. E8-78)
Basing Designation for BOTTOM VIEW		8LB

Pin 1 - Heater
Pin 2 - Grid No. 1
Pin 3 - Do Not Use
Pin 4 - Grid No. 4
Pin 5 - Grid No. 2
Pin 6 - Grid No. 3
Pin 7 - Cathode
Pin 8 - Heater
Flange - Target
Short Pin - Do Not Use



DIRECTION OF LIGHT: INTO FACE END OF TUBE

Maximum Ratings, *Absolute-Maximum Values:*

For scanned area of 0.6" x 0.8"

Grid-No.4 Voltage	1500	volts
Grid-No.3 Voltage	1500	volts

← indicates a change.

World Radio History

Grid-No. 2 Voltage	550	volts
Grid-No. 1 Voltage:		
Negative-bias value	300	volts
Positive-bias value	0	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	125	volts
Heater positive with respect to cathode	10	volts
Target Voltage	125	volts
Dark Current	0.25	μa
Peak Target Current[f]	0.60	μa
Faceplate:		
Illumination	1000	fc
→ Temperature	71	°C

→ Typical Operation:

For scanned area of 0.6" x 0.8" and faceplate temperature of 30° to 35° C

Grid-No. 4 (Decelerator) Voltage[g]	1400	volts
Grid-No. 3 (Beam-Focus Electrode) Voltage[h]	800 to 1000	volts
Grid-No. 2 (Accelerator) Voltage	300	volts
Grid-No. 1 Voltage for picture cutoff[j]	-45 to -100	volts
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μa and 0.6 μa	0.65	
Minimum Peak-to-Peak Blanking Voltage:		
When applied to grid No. 1	75	volts
When applied to cathode	20	volts
Lag:[k]		
Maximum value	33	%
Typical value	25	%
Limiting Resolution:		
At center of picture—		
Typical value	1500	TV lines
Minimum value	1200	TV lines
At corners of picture—		
Typical value	900	TV lines
Amplitude Response to a 400 TV Line Square-Wave Test Pattern at Center of Picture:		
Minimum value	60	%
Field Strength at Center of Focusing Coil (Approx.)	46	gauss
Field Strength of Adjustable Alignment Coil[m]	0 to 4	gauss
Peak Deflecting-Coil Current for Specified Deflecting Yoke:		
Horizontal	240	ma
Vertical	50	ma

Average-Sensitivity Operation

Faceplate Illumination (Highlight)	10	fc
Target Voltage[n,p]	20 to 50	volts
Dark Current[q]	0.02	μa
Signal-Output Current[r] (Typical)	0.5	μa

→ Indicates a change.

World Radio History

Minimum-Lag Operation

Faceplate Illumination (Highlight)	50	fc
Target Voltage[n,p]	10 to 30	volts
Dark Current[q]	0.005	μa
Signal-Output Current[r] (Typical)	0.5	μa

[a] This capacitance, which effectively is the output impedance of the 8051 is increased when the tube is mounted in the deflecting-yoke and focusing-alignment assembly. The resistive component of the output impedance is in the order of 100 megohms.

[b] Proper orientation of quality rectangle is obtained when the horizontal scan is essentially parallel to the plane passing through the axis and short index pin. The masking is for orientation only and does not define the proper scanned area of photoconductive layer. Final orientation should be such that the image also fits inside of any internal mask of the mesh assembly.

[c] Cleveland Electronics Inc., 1974 East 61st St., Cleveland, Ohio.

[d] For minimum geometric distortion, the deflecting yoke should be located in its proper axial position 3/4-inch from the face of the tube.

[e] Alden Products Co., 9140 North Main Street, Brockton 64, Mass.

[f] Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

[g] Grid-No.4 voltage must always be greater than grid-No.3 voltage. For minimum "porthole" effect, grid-No.4 voltage should be adjusted to approximately 1.6 times the grid-No.3 voltage value, and the focusing-alignment assembly and deflecting yoke positioned as shown in accompanying diagram.

[h] Beam focus is obtained by the combined effect of grid-No.3 voltage, which should be adjustable over indicated range, and a focusing coil having an average field strength of 46 gauss.

[j] With no blanking voltage on grid No.1.

[k] Defined as the per cent of initial value of signal-output current 1/20 second after illumination is removed. Values shown are for initial signal-output current of 0.2 microampere and a dark current of 0.02 microampere.

[m] The alignment coil should be located on the tube so that its center is at a distance of 6 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

[n] Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

[p] The target voltage for each 8051 must be adjusted to that value which gives the desired operating dark current.

[q] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

[r] Defined as the component of the highlight target current after the dark-current component has been subtracted.

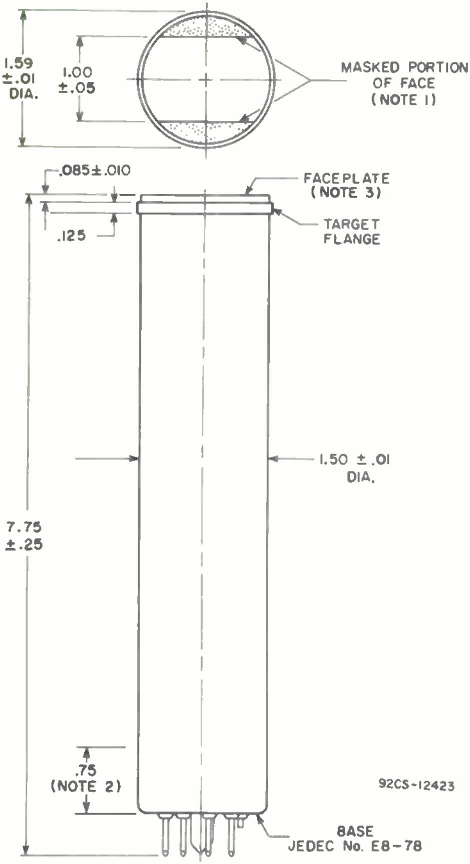
OPERATING CONSIDERATIONS

The *target connection* is made by a suitable spring contact bearing against the edge of the metal ring at the face end of the tube.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-18 RESPONSE is shown at front of this section

World Radio History

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

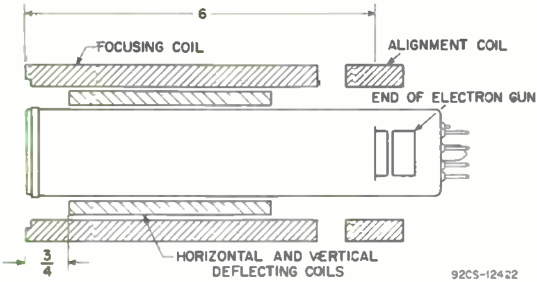
Note 1: Straight sides of masked portions are parallel to the plane passing through tube axis and short index pin.

Note 2: Within this area the minimum bulb diameter dimension does not apply.

Note 3: Faceplate thickness is 0.135" ± 0.005".

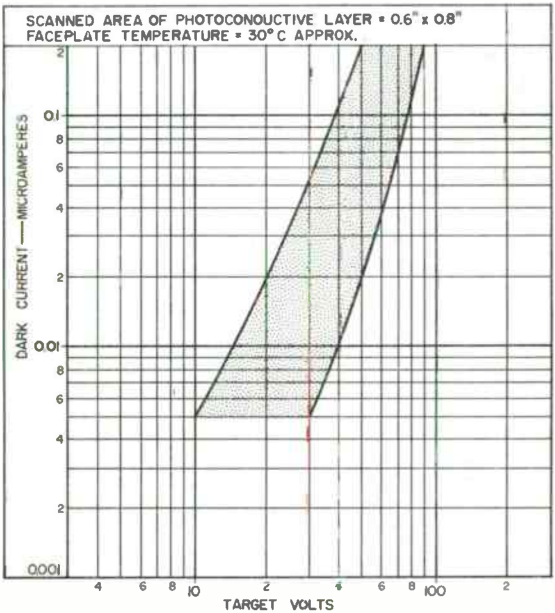
World Radio History

COMPONENT LOCATIONS



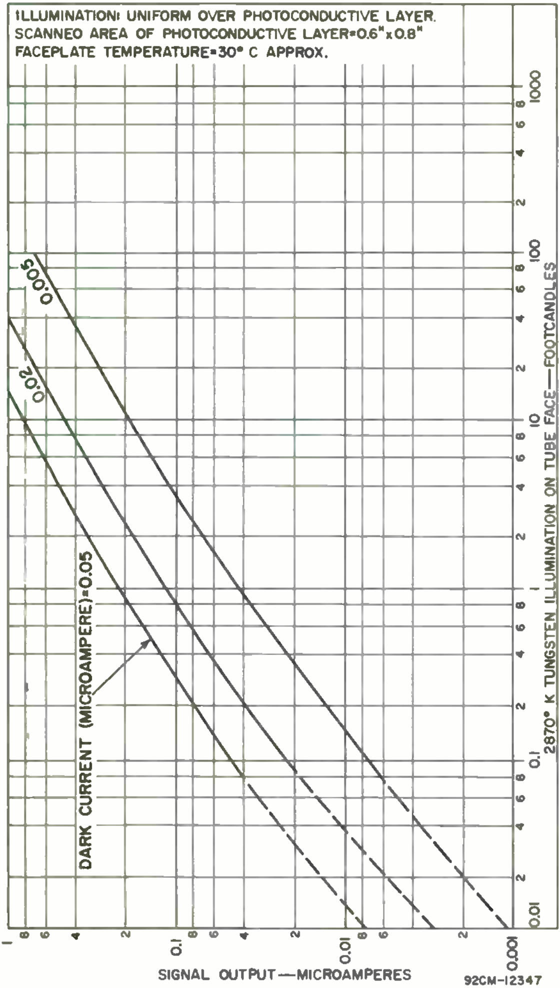
DIMENSIONS IN INCHES

RANGE OF DARK CURRENT



World Radio History

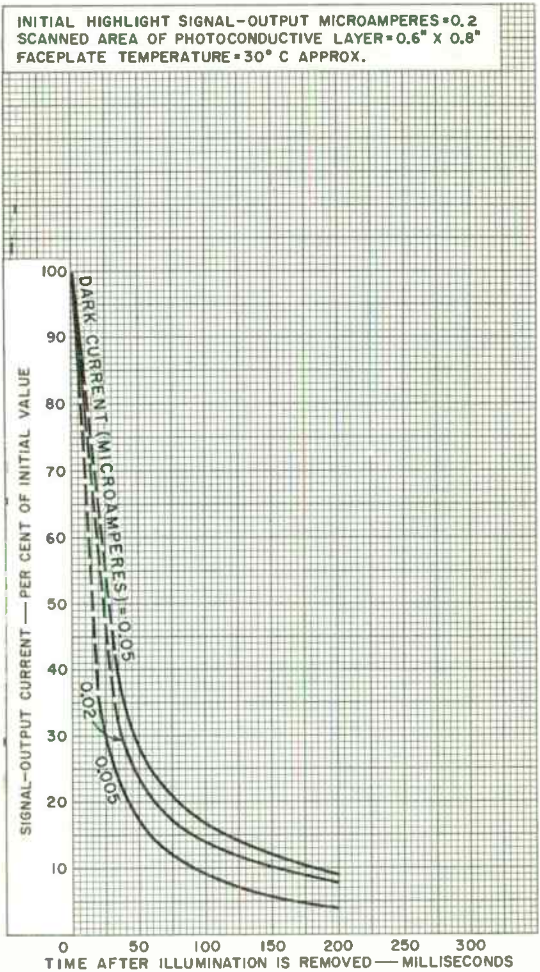
LIGHT TRANSFER CHARACTERISTICS



RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

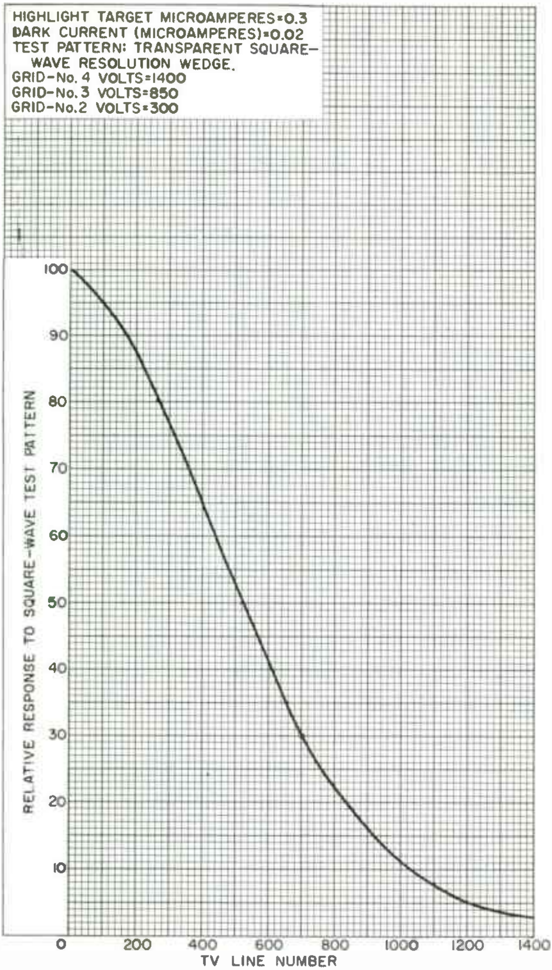
World Radio History

TYPICAL PERSISTENCE CHARACTERISTICS



92CM-11153R1

UNCOMPENSATED HORIZONTAL RESPONSE TO A SQUARE-WAVE TEST PATTERN



92CM-12418R1

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

World Radio History

Multiplier Phototube

10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE HAVING VENETIAN-BLIND-TYPE DYNODE STRUCTURE, 1.68" MINIMUM-DIAMETER, FLAT, CIRCULAR, SEMITRANSPARENT PHOTOCATHODE AND S-11 RESPONSE

DATA

General:

Spectral Response S-11
Wavelength of Maximum Response. . . . . 4400 ± 500 angstroms
Cathode, Semitransparent:
  Shape . . . . .Circular
  Window:
    Minimum area. . . . . 2.20 sq. in.
    Minimum diameter. . . . . 1.68 in.
    Index of refraction 1.51
Direct Interelectrode Capacitances (Approx.):
  Anode to dynode No.10 . . . . 7 μμf
  Anode to all other electrodes . . . . 8.5 μμf
Maximum Overall Length. . . . . 5.81"
Seated Length . . . . 4.87" ± 0.19"
Maximum Diameter. . . . . 2.31"
Operating Position. . . . . Any
Weight (Approx.). . . . . 7 oz
Bulb. T16
Socket. . . . . Cinch No.3M14[a], or equivalent
Base. . . . . .Medium-Shell Diheptal 14-Pin
(JEDEC Group 5, No.B14-38)
  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 – Internal Connection—Do Not Use
Pin 13 – Focusing Electrode
Pin 14 – Photocathode

DIRECTION OF LIGHT: INTO END OF BULB

Maximum Ratings, ***Absolute-Maximum Values:***

SUPPLY VOLTAGE BETWEEN ANODE AND CATHODE (DC).	2000 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE (DC).	300 max.	volts
SUPPLY VOLTAGE BETWEEN CONSECUTIVE DYNODES (DC).	250 max.	volts

World Radio History

SUPPLY VOLTAGE BETWEEN DYNODE No.1 AND CATHODE (DC)	600 max.	volts
SUPPLY VOLTAGE BETWEEN FOCUSING ELECTRODE AND CATHODE (DC)	600 max.	volts
AVERAGE ANODE CURRENT[b]	2 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

Characteristics Range Values for Equipment Design:

Under conditions with dc supply voltage (E) across a voltage divider providing electrode voltages shown in Table I

With E = 2000 volts (Except as noted) and focusing-electrode voltage adjusted to give maximum current amplification

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms[c]	–	9.6×10^4	–	a/w
Cathode radiant, at 4400 angstroms[d]	0.048	0.6	–	a/w
Luminous, at 0 cps[e]	–	120	–	a/lm
Cathode Luminous[f]	–	7.5×10^{-5}	–	a/lm
Equivalent Anode-Dark-Current Input at 4400 angstroms[g]	–	4×10^{-13}	–	w
Equivalent Noise Input at 4400 angstroms[h]	–	5.3×10^{-15}	–	w

With E = 1500 volts (Except as noted) and focusing-electrode voltage adjusted to give maximum current amplification

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms[c]	7.2×10^3	1.5×10^4	1.76×10^5	a/w
Cathode radiant, at 4400 angstroms[d]	0.048	0.06	–	a/w
Luminous, at 0 cps[e]	–	19	–	a/lm
Cathode luminous[f]	–	7.5×10^{-5}	–	a/lm
Current Amplification	–	2.5×10^5	–	
Equivalent Anode-Dark-Current Input at 4400 angstroms[j]	–	5.5×10^{-13}	9×10^{-13}	w
	–	4.4×10^{-10}	–	lm
Equivalent Noise Input at 4400 angstroms[h]	–	3.3×10^{-15}	1.3×10^{-14}	w
	–	2.7×10^{-12}	–	lm

World Radio History

With E = 1250 volts (Except as noted) and focusing-electrode voltage adjusted to give maximum current amplification

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms[c] . . .	-	4.8×10^{3}	-	a/w
Cathode radiant, at 4400 angstroms[d] . . .	0.048	0.06	-	a/w
Luminous, at 0 cps[e]	-	6	-	a/lm
Cathode luminous[f]	-	7.5×10^{-5}	-	a/lm
Equivalent Anode-Dark-Current Input at 4400 angstroms[g]	-	2.3×10^{-13}	-	w
Equivalent Noise Input at 4400 angstroms[h]	-	7.45×10^{-15}	-	w

[a] Cinch Manufacturing Corporation, 1026 South Homan Avenue, Chicago 24, Illinois.

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

[c] Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning No. C.S. 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 10 microlumens. Radiant sensitivity is determined on the basis of the S-11 Spectral Response-Characteristic curve located at the front of this Section.

[d] Under the same conditions as shown under (c) except value of light flux incident on the filter is 0.1 lumen.

[e] Under the following conditions: The light source is a tungsten filament lamp operated at a color temperature of 2870° K. A light input of 10 microlumens is used.

[f] Under the following conditions: The light source is a tungsten-filament lamp 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 together as anode.

[g] At a tube temperature of 25° C. Dark current may be reduced by use of a refrigerant.

[h] Under the following conditions: Supply voltage (E) is as shown, 25° C tube temperature, external shield is connected to cathode, bandwidth 1 cycle per second, light source as shown under (c) 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. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

[j] At a tube temperature of 25° C and with supply voltage (E) adjusted to give a radiant sensitivity of 7200 amperes per watt. Dark current may be reduced by the use of a refrigerant.

World Radio History

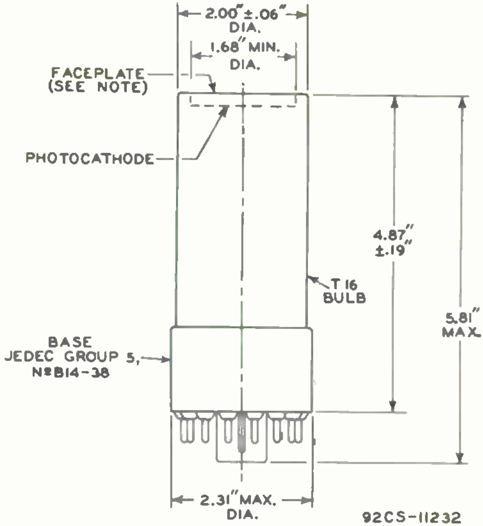
TABLE I

VOLTAGE TO BE PROVIDED BY DIVIDER	
Between	8.3% of Supply Voltage (E) multiplied by
Cathode and Dynode No.1	2
Dynode No.1 and Dynode No.2	1
Dynode No.2 and Dynode No.3	1
Dynode No.3 and Dynode No.4	1
Dynode No.4 and Dynode No.5	1
Dynode No.5 and Dynode No.6	1
Dynode No.6 and Dynode No.7	1
Dynode No.7 and Dynode No.8	1
Dynode No.8 and Dynode No.9	1
Dynode No.9 and Dynode No.10	1
Dynode No.10 and Anode	1
Anode and Cathode	12

Focusing electrode is connected to arm of potentiometer between cathode and dynode No.1. The focusing-electrode voltage is varied to give maximum current amplification.

SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOSENSITIVE DEVICE HAVING S-11 RESPONSE
is shown at the front of this section

World Radio History

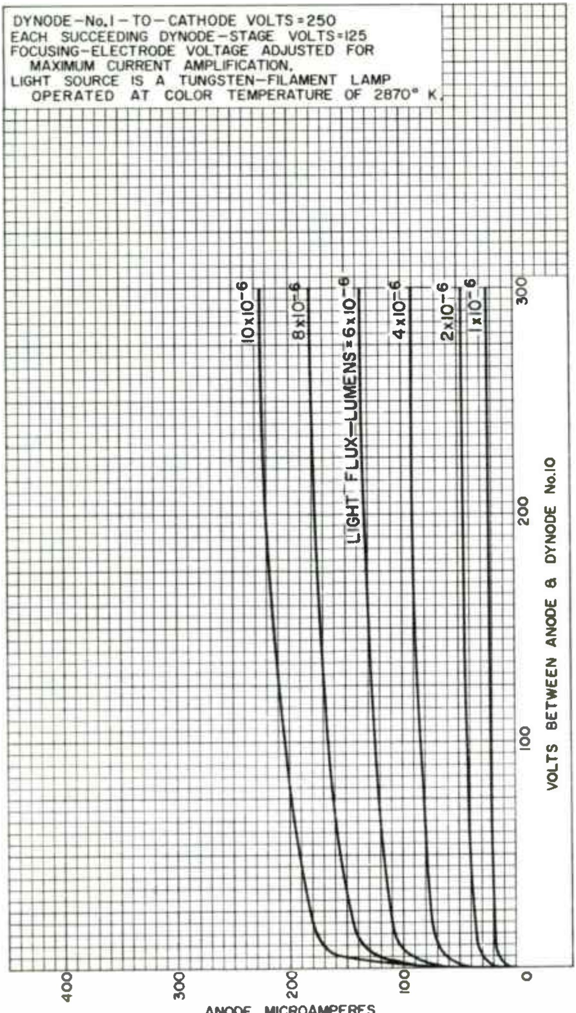


CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

NOTE: WITHIN 1.68" DIAMETER, DEVIATION FROM FLATNESS OF EXTERNAL SURFACE OF FACEPLATE WILL NOT EXCEED 0.010" FROM PEAK TO VALLEY.

World Radio History

TYPICAL ANODE CHARACTERISTICS

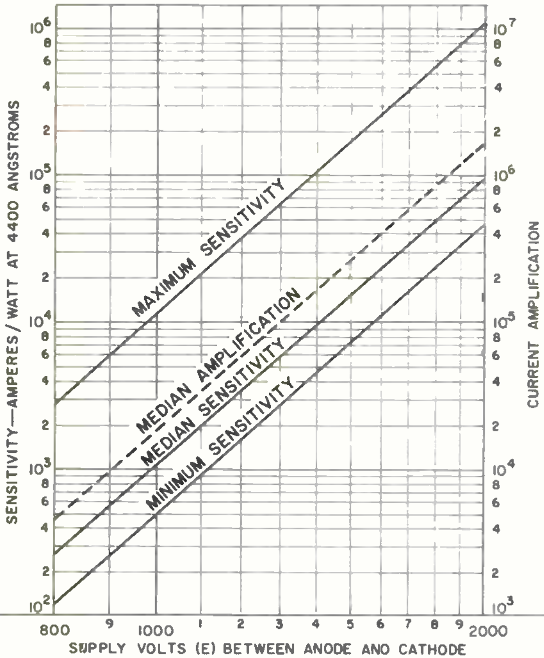


CHARACTERISTICS

THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	8.3% OF E MULTIPLIED BY
CATHODE & DY_1	2
DY_1 & DY_2	1
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1
DY_7 & DY_8	1
DY_8 & DY_9	1
DY_9 & DY_{10}	1
DY_{10} & ANODE	1
ANODE & CATHODE	12

FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED FOR MAXIMUM CURRENT AMPLIFICATION.



92CM-11086R1

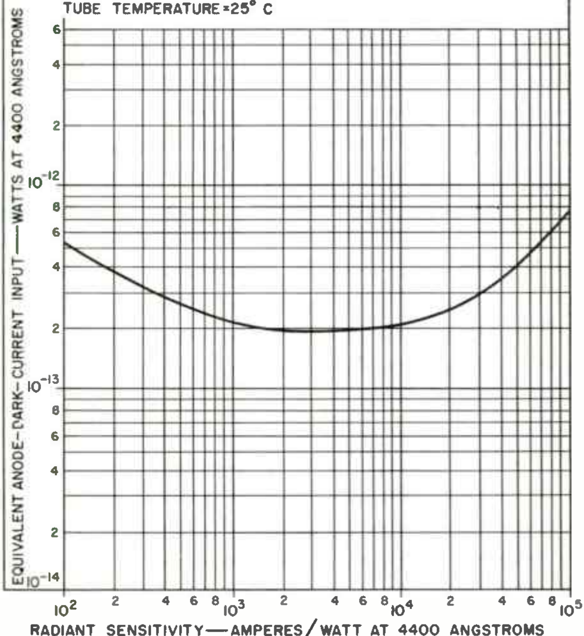
TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

RADIANT SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	8.3 % OF E MULTIPLIED BY
CATHODE & DY_1	2
DY_1 & DY_2	1
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1
DY_7 & DY_8	1
DY_8 & DY_9	1
DY_9 & DY_{10}	1
DY_{10} & ANODE	1
ANODE & CATHODE	12

FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED FOR MAXIMUM CURRENT AMPLIFICATION.

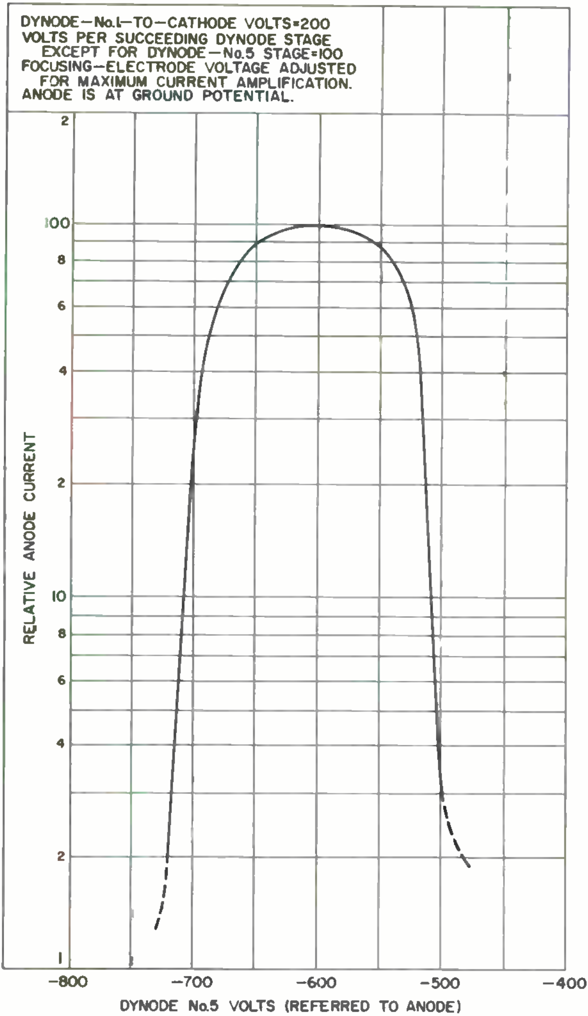
TUBE TEMPERATURE = 25° C



92CM-11146

World Radio History

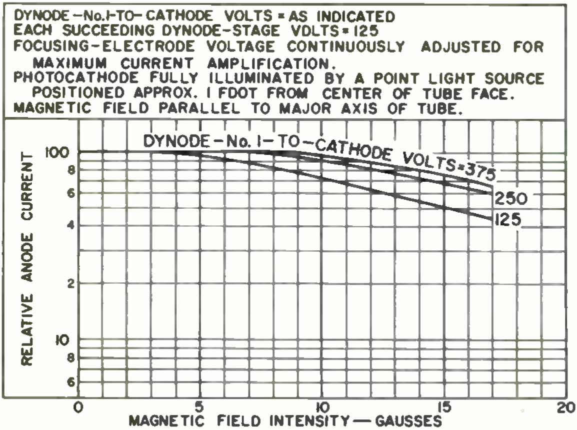
TYPICAL ANODE-CURRENT CHARACTERISTIC



92CM—11078

World Radio History

TYPICAL ANODE-CURRENT CHARACTERISTICS



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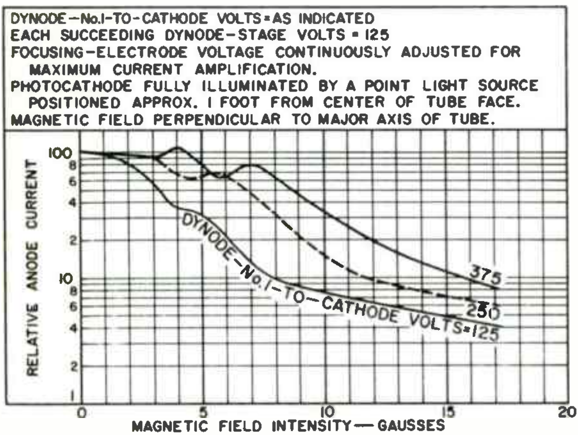


92CS-11236R1

World Radio History

Multiplier Phototube

10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE HAVING VENETIAN-BLIND-TYPE DYNODE STRUCTURE, 2.59" MINIMUM-DIAMETER, FLAT, CIRCULAR, SEMITRANSPARENT PHOTOCATHODE AND S-11 RESPONSE

DATA

General:

Spectral Response S-11
Wavelength of Maximum Response . . . . 4400 ± 500 angstroms
Cathode, Semitransparent:
  Shape . . . . Circular
  Window:
    Minimum area . . . . 5.27 sq. in.
    Minimum diameter . . . . 2.59 in.
    Index of refraction 1.51
Direct Interelectrode Capacitances (Approx.):
  Anode to dynode No.10 . . . . 7 μμf
  Anode to all other electrodes . . . . 8.5 μμf
Maximum Overall Length . . . . 6.31"
Seated Length . . . . 5.38" ± 0.18"
Maximum Diameter . . . . 3.06"
Operating Position . . . . Any
Weight (Approx.) . . . . 9 oz
Bulb J24
Socket . . . . Cinch No.3M14[a], or equivalent
Base . . . . Medium-Shell Diheptal 14-Pin
(JEDEC Group 5, No.B14-38)
  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 - Internal Connection—Do Not Use
Pin 13 - Focusing Electrode
Pin 14 - Photocathode

DIRECTION OF LIGHT: INTO END OF BULB

Maximum Ratings, ***Absolute-Maximum Values:***

SUPPLY VOLTAGE BETWEEN ANODE AND CATHODE (DC) . . . . 2000 max. volts
SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE (DC) . . . . 300 max. volts
SUPPLY VOLTAGE BETWEEN CONSECUTIVE DYNODES (DC) . . . . 250 max. volts

World Radio History

SUPPLY VOLTAGE BETWEEN DYNODE No.1 AND CATHODE (DC)	600 max.	volts
SUPPLY VOLTAGE BETWEEN FOCUSING ELECTRODE AND CATHODE (DC)	600 max.	volts
AVERAGE ANODE CURRENT[b]	2 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

Characteristics Range Values for Equipment Design:

Under conditions with dc supply voltage (E) across a voltage divider providing electrode voltages shown in Table I

With E = 2000 volts (Except as noted) and focusing-electrode voltage adjusted to give maximum current amplification

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4400 angstroms[c]	–	9.6×10^4	–	a/w
Cathode radiant, at 4400 angstroms[d]	0.048	0.6	–	a/w
Luminous, at 0 cps[e]	–	120	–	a/lm
Cathode Luminous[f]	–	7.5×10^{-5}	–	a/lm
Equivalent Anode-Dark-Current Input at 4400 angstroms[g]	–	4×10^{-13}	–	w
Equivalent Noise Input at 4400 angstroms[h]	–	5.3×10^{-15}	–	w

With E = 1500 volts (Except as noted) and focusing-electrode voltage adjusted to give maximum current amplification

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4400 angstroms[c]	7.2×10^3	1.5×10^4	1.76×10^5	a/w
Cathode radiant at 4400 angstroms[d]	0.048	0.06	–	a/w
Luminous, at 0 cps[e]	–	19	–	a/lm
Cathode Luminous[f]	–	7.5×10^{-5}	–	a/lm
Current Amplification	–	2.5×10^5	–	
Equivalent Anode-Dark-Current Input at 4400 angstroms[j]	–	5.5×10^{-13}	9×10^{-13}	w
	–	4.4×10^{-10}	–	lm
Equivalent Noise Input at 4400 angstroms[h]	–	3.3×10^{-15}	1.3×10^{-14}	w
	–	2.7×10^{-12}	–	lm

World Radio History

With E = 1250 volts (Except as noted) and focusing-electrode voltage adjusted to give maximum current amplification

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms[c]	-	4.8×10^3	-	a/w
Cathode radiant at 4400 angstroms[d]	0.048	0.06	-	a/w
Luminous at 0 cps[e]	-	6	-	a/lm
Cathode luminous[f]	-	7.5×10^{-5}	-	a/lm
Equivalent Anode-Dark-Current Input at 4400 angstroms[g]	-	2.3×10^{-13}	-	w
Equivalent Noise Input at 4400 angstroms[h]	-	7.45×10^{-15}	-	w

[a] Cinch Manufacturing Corporation, 1026 South Homan Avenue, Chicago 24, Illinois.

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

[c] Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning No.C.S.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 10 microlumens. Radiant sensitivity is determined on the basis of the S-11 Spectral Response-Characteristic curve located at the front of this Section.

[d] Under the same conditions as shown under (c) except value of light flux incident on the filter is 0.1 lumen.

[e] Under the following conditions: The light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A light input of 10 microlumens is used.

[f] Under the following conditions: The light source is a tungsten-filament lamp 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 together as anode.

[g] At a tube temperature of 25° C. Dark current may be reduced by use of a refrigerant.

[h] Under the following conditions: Supply voltage (E) is as shown, 25° C tube temperature, external shield is connected to cathode, bandwidth 1 cycle per second, light source as shown under (c) 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. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

[j] At a tube temperature of 25° C and with supply voltage (E) adjusted to give a radiant sensitivity of 7200 amperes per watt. Dark current may be reduced by the use of a refrigerant.

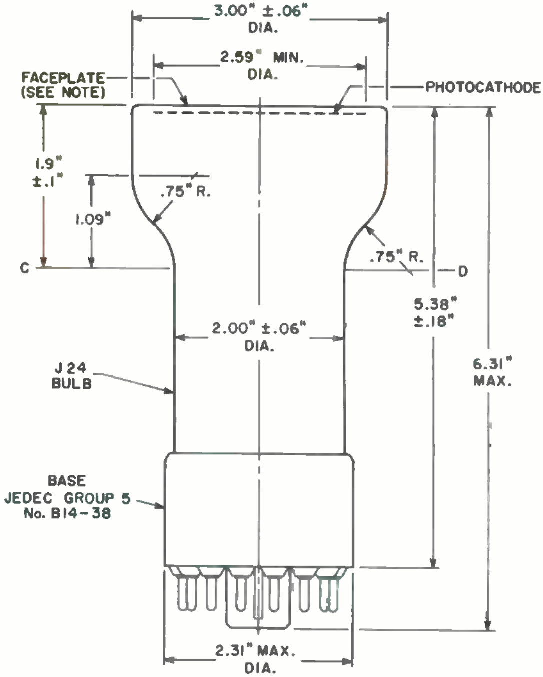
World Radio History

TABLE I

VOLTAGE TO BE PROVIDED BY DIVIDER	
Between	8.3% of Supply Voltage (E) multiplied by
Cathode and Dynode No.1	2
Dynode No.1 and Dynode No.2	1
Dynode No.2 and Dynode No.3	1
Dynode No.3 and Dynode No.4	1
Dynode No.4 and Dynode No.5	1
Dynode No.5 and Dynode No.6	1
Dynode No.6 and Dynode No.7	1
Dynode No.7 and Dynode No.8	1
Dynode No.8 and Dynode No.9	1
Dynode No.9 and Dynode No.10	1
Dynode No.10 and Anode	1
Anode and Cathode	12
Focusing electrode is connected to arm of potentiometer between cathode and dynode No.1. The focusing-electrode voltage is varied to give maximum current amplification.	

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-11 RESPONSE
is shown at the front of this Section

World Radio History



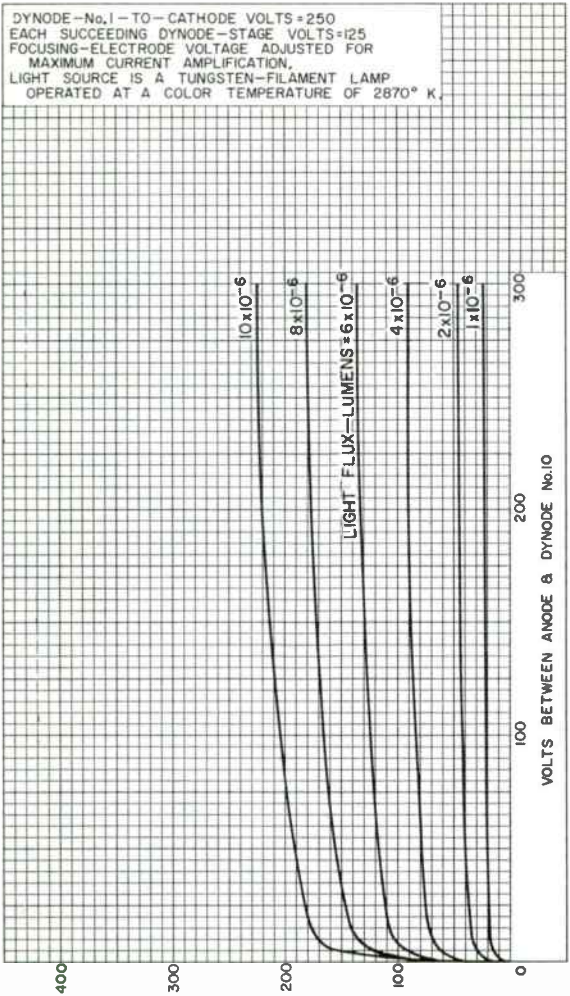
92CM-11080R1

CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

NOTE: WITHIN 2.59" DIAMETER, DEVIATION FROM FLATNESS OF EXTERNAL SURFACE OF FACEPLATE WILL NOT EXCEED 0.010" FROM PEAK TO VALLEY.

World Radio History

TYPICAL ANODE CHARACTERISTICS



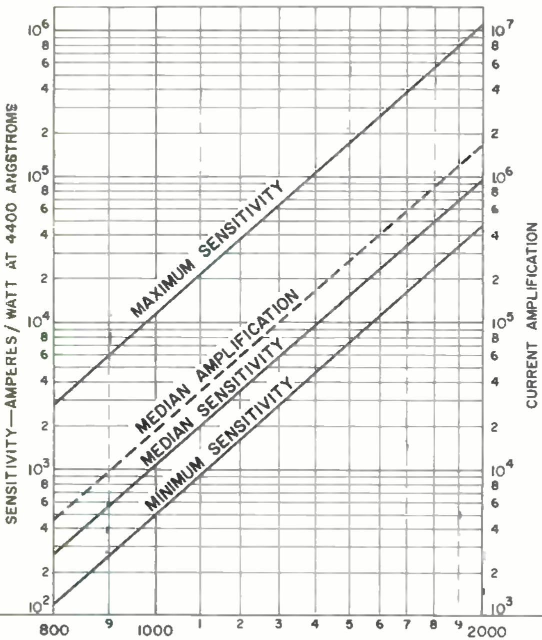
92CM-11079R1

CHARACTERISTICS

THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	8.3% OF E MULTIPLIED BY
CATHODE & DY_1	2
DY_1 & DY_2	1
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1
DY_7 & DY_8	1
DY_8 & DY_9	1
DY_9 & DY_{10}	1
DY_{10} & ANODE	1
ANODE & CATHODE	12

FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED FOR MAXIMUM CURRENT AMPLIFICATION.



92CM-11086R1

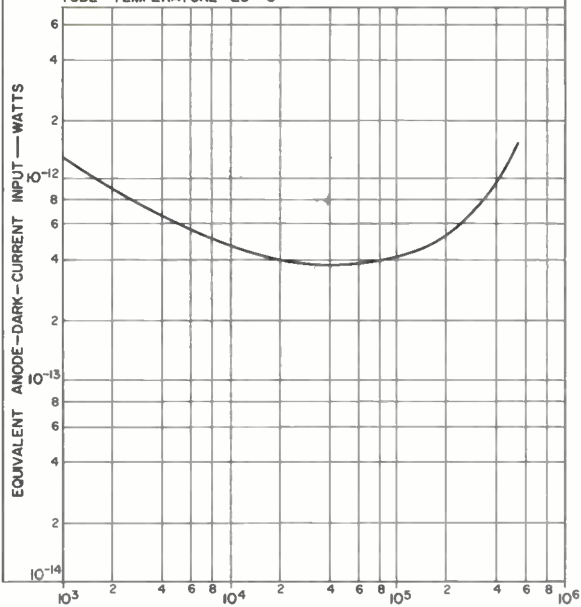
World Radio History

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

RADIANT SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	8.3 % OF E MULTIPLIED BY
CATHODE & DY_1	2
DY_1 & DY_2	1
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1
DY_7 & DY_8	1
DY_8 & DY_9	1
DY_9 & DY_{10}	1
DY_{10} & ANODE	1
ANODE & CATHODE	12

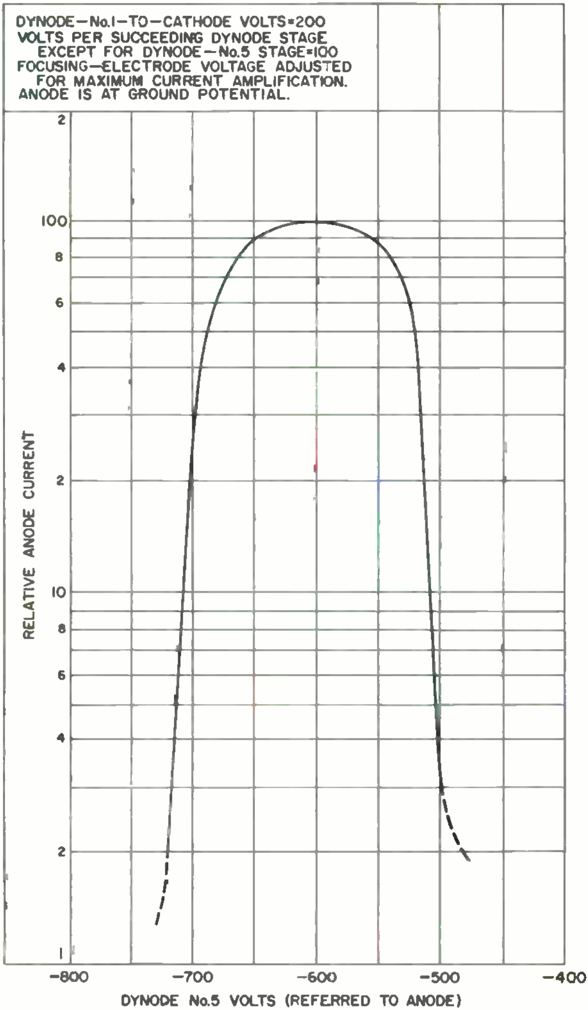
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED FOR MAXIMUM CURRENT AMPLIFICATION.
TUBE TEMPERATURE = 25° C



92CM-11082

World Radio History

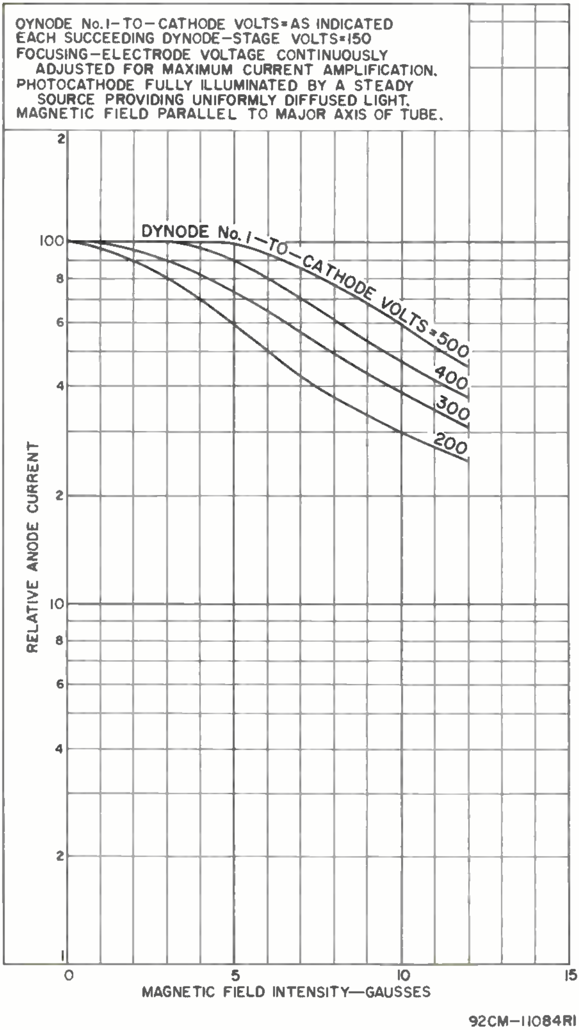
TYPICAL ANODE-CURRENT CHARACTERISTIC



92CM—11078

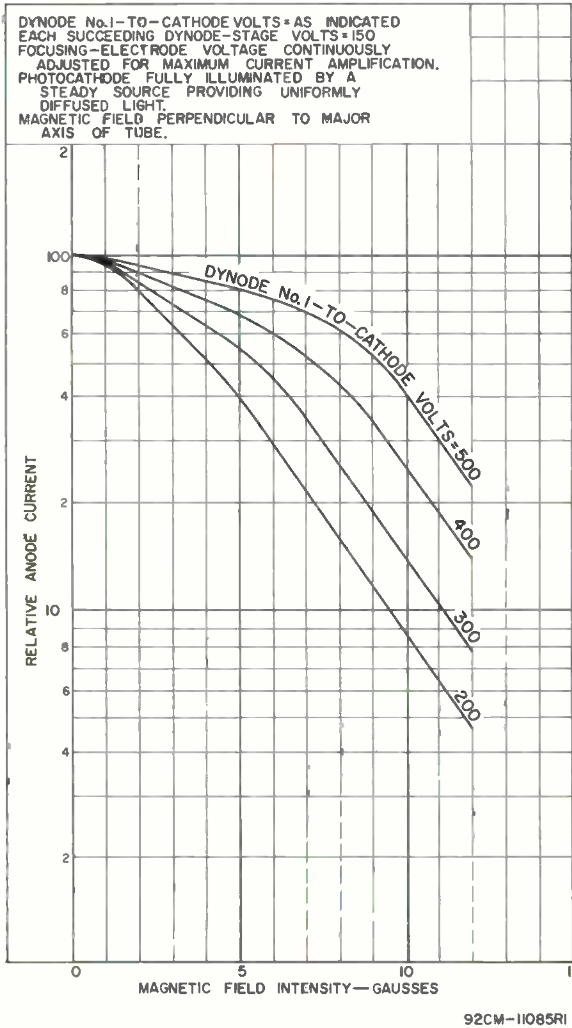
World Radio History

TYPICAL ANODE-CURRENT CHARACTERISTIC



World Radio History

TYPICAL ANODE-CURRENT CHARACTERISTIC



World Radio History

Multiplier Phototube

10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE HAVING VENETIAN-BLIND-TYPE DYNODE STRUCTURE, 4.38" MINIMUM DIAMETER, FLAT, CIRCULAR, SEMITRANSPARENT PHOTOCATHODE AND S-11 RESPONSE

DATA

General:

Spectral Response		S-11
Wavelength of Maximum Response	4400 ± 500	angstroms
Cathode, Semitransparent:		
Shape		Circular
Window:		
Minimum area	15.1	sq. in.
Minimum diameter	4.38	in.
Index of refraction	1.51	
Direct Interelectrode Capacitances (Approx.):		
Anode to dynode No.10	7	μμf
Anode to all other electrodes	8.5	μμf
Maximum Overall Length		7.69"
Seated Length		6.75" ± 0.19"
Maximum Diameter		5.31"
Operating Position		Any
Weight (Approx.)		1 lb 7 oz
Bulb		J42
Socket		Cinch No.3M14[a], or equivalent
Base		Medium-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-38)
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 – Internal Connection—Do Not Use
Pin 13 – Focusing Electrode
Pin 14 – Photocathode

DIRECTION OF LIGHT:
INTO END OF BULB

Maximum Ratings, ***Absolute-Maximum Values:***

SUPPLY VOLTAGE BETWEEN ANODE AND CATHODE (DC)	2000 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE (DC)	300 max.	volts
SUPPLY VOLTAGE BETWEEN CONSECUTIVE DYNODES (DC)	250 max.	volts

World Radio History

SUPPLY VOLTAGE BETWEEN DYNODE No.1 AND CATHODE (DC).	600 max.	volts
SUPPLY VOLTAGE BETWEEN FOCUSING ELECTRODE AND CATHODE (DC).	600 max.	volts
AVERAGE ANODE CURRENT[b].	2 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

Characteristics Range Values for Equipment Design:

Under conditions with dc supply voltage (E) across a voltage divider providing electrode voltages shown in Table I

With E = 2000 volts (Except as noted) and focusing-electrode voltage adjusted to give maximum current amplification

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4400 angstroms[c]. . . .	-	9.6×10^4	-	a/w
Cathode radiant, at 4400 angstroms[d] .	0.048	0.06	-	a/w
Luminous, at 0 cps[e].	-	120	-	a/lm
Cathode luminous[f] .	-	7.5×10^{-5}	-	a/lm
Equivalent Anode-Dark-Current Input at 4400 angstroms[g] .	-	4×10^{-13}	-	w
Equivalent Noise Input at 4400 angstroms[h].	-	5.3×10^{-15}	-	w

With E = 1500 volts (Except as noted) and focusing-electrode voltage adjusted to give maximum current amplification

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4400 angstroms[c]. . . .	7.2×10^3	1.5×10^4	1.76×10^5	a/w
Cathode radiant, at 4400 angstroms[d]	0.048	0.06	-	a/w
Luminous, at 0 cps[e].	-	19	-	a/lm
Cathode luminous[f] .	-	7.5×10^{-5}	-	a/lm
Current Amplification	-	2.5×10^5	-	
Equivalent Anode-Dark-Current Input at 4400 angstroms[j] .	-	5.5×10^{-13}	9×10^{-13}	w
	-	4.4×10^{-10}	-	lm
Equivalent Noise Input at 4400 angstroms[h].	-	3.3×10^{-15}	1.3×10^{-14}	w
	-	2.7×10^{-12}	-	lm

With E = 1250 volts (Except as noted) and focusing-electrode voltage adjusted to give maximum current amplification

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4400 angstroms[c]	-	4.8×10^3	-	a/w
Cathode radiant, at 4400 angstroms[d]	0.048	0.06	-	a/w

World Radio History

Luminous, at 0 cps[e]. .	-	6	-	a/lm
Cathode luminous[f]. . .	-	7.5×10^{-5}	-	a/lm
Equivalent Anode-Dark-Current Input at 4400 angstroms[g]. . . .	-	2.3×10^{-13}	-	w
Equivalent Noise Input at 4400 angstroms[h]	-	7.45×10^{-15}	-	w

[a] Cinch Manufacturing Corporation, 1026 South Homan Avenue, Chicago 24, Illinois.

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

[c] Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning No.C.S.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 10 microlumens. Radiant sensitivity is determined on the basis of an S-11 Spectral Response Characteristic curve located at front of this Section.

[d] Under the same conditions as shown under (c) except value of light flux incident on the filter is 0.1 lumen.

[e] Under the following conditions: The light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A light input of 10 microlumens is used.

[f] Under the following conditions: The light source is a tungsten-filament lamp 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 together as anode.

[g] At a tube temperature of 25° C. Dark current may be reduced by use of a refrigerant.

[h] Under the following conditions: Supply voltage (E) is as shown, 25° C tube temperature, external shield is connected to cathode, bandwidth 1 cycle per second, light source as shown under (c) 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. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

[j] At a tube temperature of 25° C and with supply voltage (E) adjusted to give a radiant sensitivity of 7200 amperes per watt. Dark current may be reduced by the use of a refrigerant.

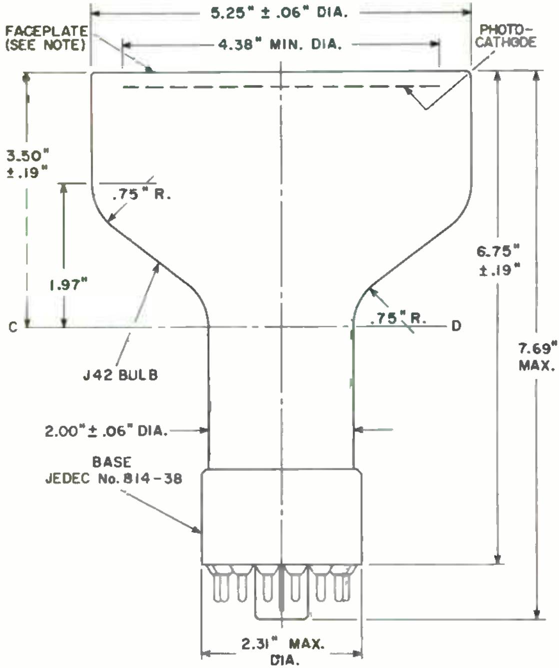
World Radio History

TABLE I

VOLTAGE TO BE PROVIDED BY DIVIDER	
Between	8.3% of Supply Voltage (E) multiplied by
Cathode and Dynode No.1	2
Dynode No.1 and Dynode No.2	1
Dynode No.2 and Dynode No.3	1
Dynode No.3 and Dynode No.4	1
Dynode No.4 and Dynode No.5	1
Dynode No.5 and Dynode No.6	1
Dynode No.6 and Dynode No.7	1
Dynode No.7 and Dynode No.8	1
Dynode No.8 and Dynode No.9	1
Dynode No.9 and Dynode No.10	1
Dynode No.10 and Anode	1
Anode and Cathode	12
Focusing electrode is connected to arm of potentiometer between cathode and dynode No.1. The focusing-electrode voltage is varied to give maximum current amplification.	

SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOTUBE HAVING S-11 RESPONSE
is shown at front of this Section

World Radio History



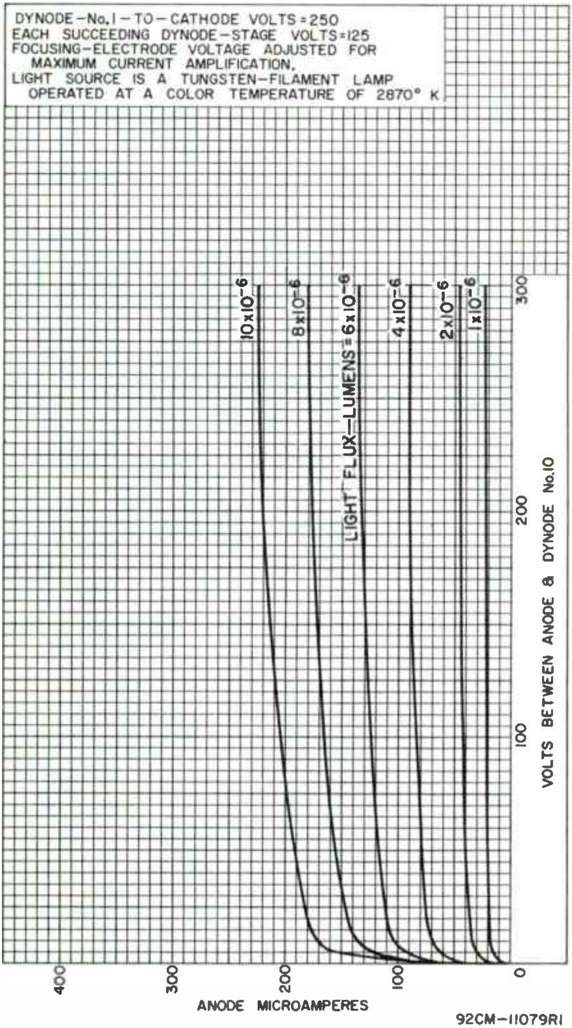
92CM-11148R1

CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

NOTE: WITHIN 4.38" DIAMETER, DEVIATION FROM FLATNESS OF EXTERNAL SURFACE OF FACEPLATE WILL NOT EXCEED 0.010" FROM PEAK TO VALLEY.

World Radio History

TYPICAL ANODE CHARACTERISTICS

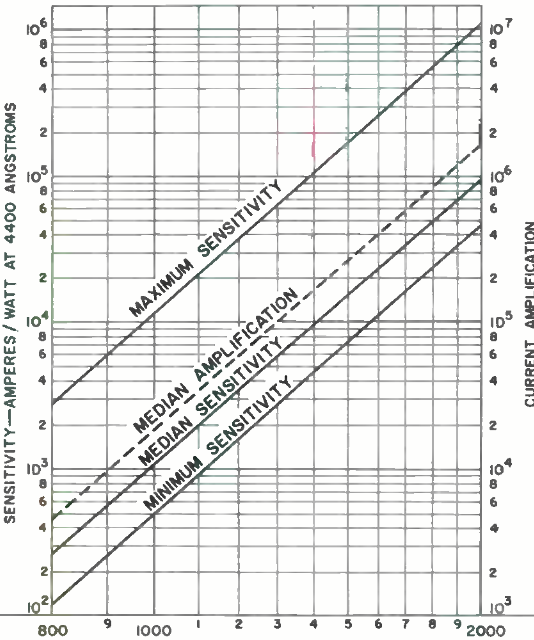


CHARACTERISTICS

THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	8.3% OF E MULTIPLIED BY
CATHODE & DY_1	2
DY_1 & DY_2	1
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1
DY_7 & DY_8	1
DY_8 & DY_9	1
DY_9 & DY_{10}	1
DY_{10} & ANODE	1
ANODE & CATHODE	12

FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED FOR MAXIMUM CURRENT AMPLIFICATION.



92CM-11086R1

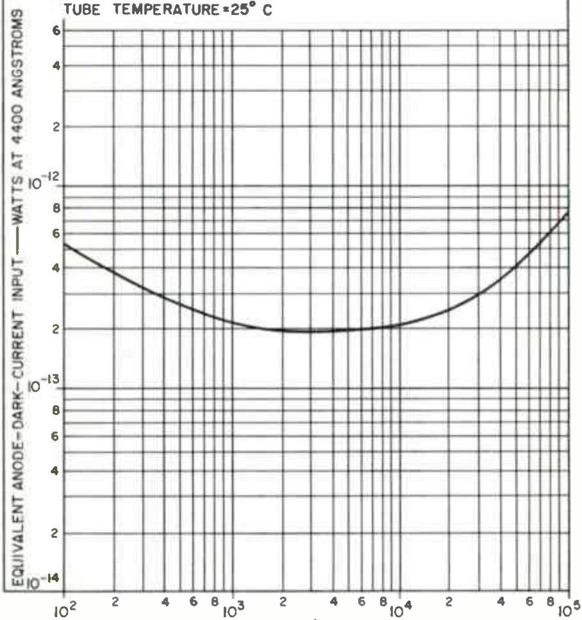
World Radio History

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

RADIANT SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	8.3 % OF E MULTIPLIED BY
CATHODE & DY_1	2
DY_1 & DY_2	1
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1
DY_7 & DY_8	1
DY_8 & DY_9	1
DY_9 & DY_{10}	1
DY_{10} & ANODE	1
ANODE & CATHODE	12

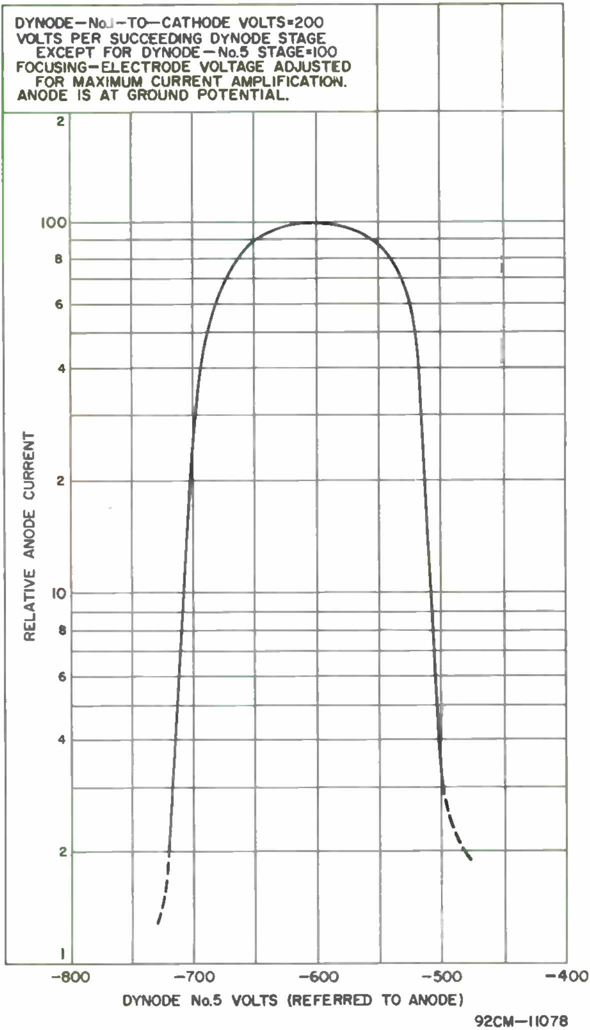
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED FOR MAXIMUM CURRENT AMPLIFICATION.
TUBE TEMPERATURE = 25° C



92CM-11146

World Radio History

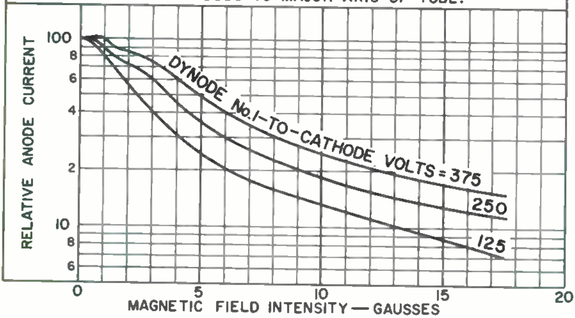
TYPICAL ANODE-CURRENT CHARACTERISTIC



World Radio History

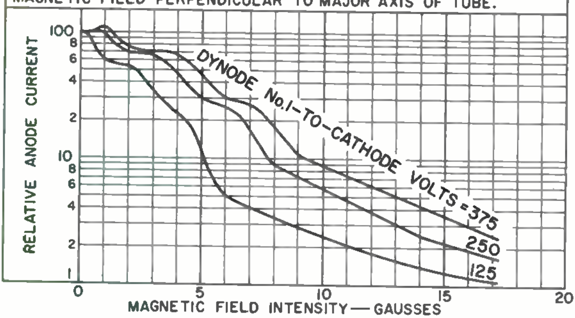
TYPICAL ANODE-CURRENT CHARACTERISTICS

DYNODE No.1-TO-CATHODE VOLTS = AS INDICATED
EACH SUCCEEDING DYNODE-STAGE VOLTS = 125
FOCUSING-ELECTRODE VOLTAGE CONTINUOUSLY ADJUSTED FOR MAXIMUM CURRENT AMPLIFICATION.
PHOTOCATHODE FULLY ILLUMINATED BY A POINT LIGHT SOURCE POSITIONED APPROX. 1 FOOT FROM CENTER OF TUBE FACE.
MAGNETIC FIELD PARALLEL TO MAJOR AXIS OF TUBE.



92CS-11187R1

DYNODE No.1-TO-CATHODE VOLTS = AS INDICATED
EACH SUCCEEDING DYNODE-STAGE VOLTS = 125
FOCUSING-ELECTRODE VOLTAGE CONTINUOUSLY ADJUSTED FOR MAXIMUM CURRENT AMPLIFICATION.
PHOTOCATHODE FULLY ILLUMINATED BY A POINT LIGHT SOURCE POSITIONED APPROX. 1 FOOT FROM CENTER OF TUBE FACE.
MAGNETIC FIELD PERPENDICULAR TO MAJOR AXIS OF TUBE.



92CS-11188R1

World Radio History

Image Orthicon

FIELD MESH
SEMICONDUCTIVE TARGET

MAGNETIC FOCUS
MAGNETIC DEFLECTION

For Low-Light-Level Studio and Remote Color (Scene illumination—40 fc or less) and Black-and-White (Scene illumination—as low as 1 fc) TV Pickup Service

DATA

General:

Heater, for Unipotential Cathode:
  Voltage (AC or DC). . . . . 6.3 ± 10% volts
  Current at 6.3 volts. . . . . 0.6 amp
Direct Interelectrode Capacitance:
  Anode to all other electrodes . . . 12 pf
Spectral Response S-10
Wavelength of Maximum Response. . . . 4500 ± 300 angstroms
Photocathode, Semitransparent:
  Rectangular image (4 x 3 aspect ratio):
    Useful size of. . . . . 1.8" max. diagonal
      Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.
      Orientation of. . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base.
Focusing Method . . . . Magnetic
Deflection Method . . . . Magnetic
Overall Length . . . . 15.20" ± 0.25"
Greatest Diameter of Bulb . . . . 3.00" ± 0.06"
Minimum Deflecting-Coil Inside Diameter . . . . 2-3/8"
Deflecting Coil . . . . Cleveland Electronics, Part No.OY-1[a], or equivalent
Deflecting Coil Length . . . . 5"
Focusing Coil . . . . Cleveland Electronics, Part No.OF-2[a], or equivalent
Focusing Coil Length. 10"
Alignment Coil. . . . . Cleveland Electronics, Part No.OA-3[a], or equivalent
Alignment-Coil Length . . . . 15/16"
Photocathode Distance Inside End of Focusing Coil . . . 1/2"
Operating Position. . . The tube should never be operated in a vertical position with the diheptal-base end up nor in any other position where the axis of the tube with the base up makes an angle of less than 20° with the vertical.
Weight (Approx.) 1lb 6oz
Socket. . . . . Cinch Part No.3M14[b], or equivalent

World Radio History

Shoulder Base. . . . . .Keyed Jumbo Annular 7-Pin

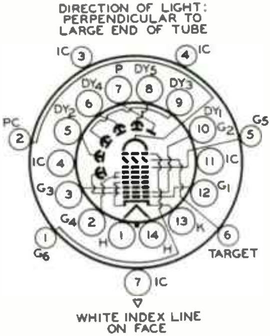
BOTTOM VIEW

Pin 1 - Grid No.6
Pin 2 - Photocathode
Pin 3 - Do Not Use
Pin 4 - Do Not Use
Pin 5 - Grid No.5
Pin 6 - Target
Pin 7 - Do Not Use

End Base . . . . .Small-Shell Diheptal 14-Pin (JEDEC No.B14-45)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.4 & Field Mesh
Pin 3 - Grid No.3
Pin 4 - Do Not Use
Pin 5 - Dynode No.2
Pin 6 - Dynode No.4
Pin 7 - Anode
Pin 8 - Dynode No.5
Pin 9 - Dynode No.3
Pin 10 - Dynode No.1, Grid No.2
Pin 11 - Do Not Use
Pin 12 - Grid No.1
Pin 13 - Cathode & Suppressor[c]
Pin 14 - Heater



Maximum and Minimum Ratings, *Absolute-Maximum Values:*

PHOTOCATHODE:			
Voltage	-550	max.	volts
Illumination.	50	max.	fc
OPERATING TEMPERATURE:			
Of any part of bulb	55	max.	°C
Of bulb at large end of tube (Target section).	0	min.	°C
TEMPERATURE DIFFERENCE:			
Between target section and any part of bulb hotter than target section.	5	max.	°C
GRID-No.6 VOLTAGE	-550	max.	volts
TARGET VOLTAGE:			
Positive value.	10	max.	volts
Negative value.	10	max.	volts
GRID-No.5 VOLTAGE	150	max.	volts
GRID-No.4 VOLTAGE	300	max.	volts
GRID-No.3 VOLTAGE	400	max.	volts
GRID-No.2 & DYNODE No.1 VOLTAGE.	350	max.	volts
GRID-No.1 VOLTAGE:			
Negative bias value	125	max.	volts
Positive bias value	0	max.	volts
VOLTAGE PER MULTIPLIER STAGE.	350	max.	volts
ANODE-SUPPLY VOLTAGE[d]	1350	max.	volts

World Radio History

PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	125	max.	volts
Heater positive with respect to cathode	10	max.	volts

Typical Operating Values:[e]

Photocathode Voltage (Image Focus)[f]	-400 to -540	volts
Grid-No.6 Voltage (Accelerator) - Approx. 75% photocathode voltage	-300 to -405	volts
Target-Cutoff Voltage[g]	-3 to 1	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam Focus)[f]	140 to 180	volts
Grid-No.3 Voltage[h]	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil[j]	75	gausses
Field Strength of Alignment Coil	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operating Values and with camera lens set to bring the picture highlights one stop above the "knee" of the accompanying Basic Light-Transfer-Characteristic Curve

	Min.	*Typical*	*Max.*	
Cathode Radiant Sensitivity at 4500 angstroms	-	0.033	-	a/w
Luminous Sensitivity	40	65		μa/lm
Anode Current (DC)	-	30	-	μa
Signal-Output Current (Peak to Peak)	-	5	-	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc	-	37:1	-	
Photocathode Illumination at 2870° K Required to bring Picture Highlights one stop above the "Knee" of Light Transfer Characteristic	-	0.007	-	fc

World Radio History

Peak-to-Peak Response to Square-Wave Test Pattern at 400 TV Lines per Picture Height (Per cent of large-area black to large-area white)[k]	-	65	-	%

[a] Made by Cleveland Electronics Inc., 1974 East 61st Street, Cleveland, Ohio.

[b] Made by Cinch Manufacturing Company, 1026 South Homan Avenue, Chicago 24, Illinois.

[c] The suppressor grid connected to the cathode and the field-mesh grid connected to grid No.4 are not given as numbered grids in order to conform with industry practice of associating functional camera control knobs with specific grid numbers. For example, beam-focus control is generally associated with knob identified as G4 (grid No.4), regardless of its position with respect to the cathode.

[d] Dynode-voltage values are shown under *Typical Operating Values*.

[e] With 8092A operated in RCA-TK-11 or -TK-31 camera. Other cameras may require slightly different voltage ranges.

[f] Adjust for best focus.

[g] Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from -3 to 5 volts.

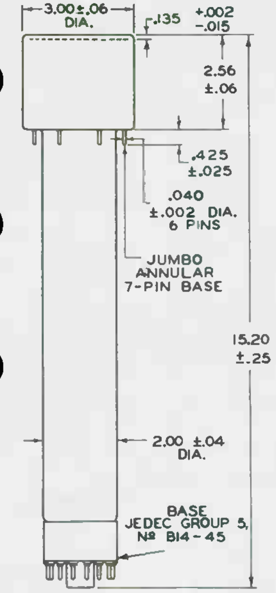
[h] Adjust to give the most uniformly shaded picture near maximum signal.

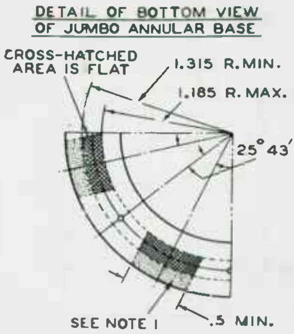
[j] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with indicator located outside of and at the image end of the focusing coil.

[k] Measured with amplifier having flat frequency response.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-10 RESPONSE
is shown at front of this Section

World Radio History





NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR BASE GAUGE

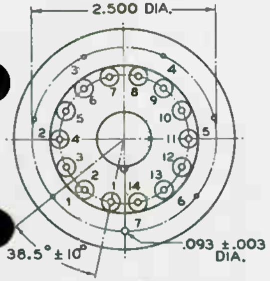
ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51° 26′ ± 5′ ON CIRCLE DIAMETER OF 2.500" ± 0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".



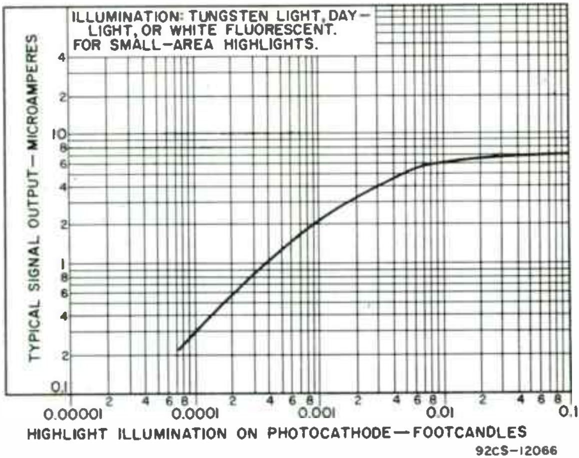
ENLARGED BOTTOM VIEW

DIMENSIONS IN INCHES

92CM-10154R2

World Radio History

BASIC LIGHT-TRANSFER CHARACTERISTIC



World Radio History

Image Orthicon

MAGNETIC FOCUS MAGNETIC DEFLECTION

ANTI-GHOST IMAGE SECTION

For Studio Black-and-White TV Cameras. The 8093A is Unilaterally Interchangeable with the 8093.

DATA

General:

Heater, for Unipotential Cathode:
  Voltage (AC or DC). . . . . 6.3 ± 10% volts
  Current at heater volts = 6.3 . . . 0.600 amp
Direct Interelectrode Capacitance (Approx.):
  Anode to all other electrodes . . . 12 μμf
Target-to-Mesh Spacing (Average). . . . . 0.001"
Spectral Response S-10
Wavelength of Maximum Response. . . . 4500 ± 300 angstroms
Photocathode, Semitransparent:
  Rectangular image (4 x 3 aspect ratio):
    Useful size of. . . . . 1.8" max. diagonal
      Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring; a condition that may be achieved in some camera designs with a 1.6" diagonal image on the photocathode.
    Orientation of. . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base. The horizontal and vertical scan should preferably start at the corner of the raster nearest pin 6 of the shoulder base.
Focusing Method . . . . .Magnetic
Deflection Method . . . . .Magnetic
Overall Length. . . . . 15.20" ± 0.25"
Greatest Diameter of Bulb . . . . 3.00" ± 0.06"
Minimum Deflection-Coil Inside Diameter . . . . 2-3/8"
Deflecting-Coil Length. 5"
Focusing-Coil Length. . . . . 10"
Alignment-Coil:
  Length. . . . . 15/16"
  Position on neck. . . . . Centerline of coil located 8.5" from flat area of the jumbo annular base.
Photocathode Distance Inside End of Focusing Coil . . . . 1/2"
Operating Position. . .The tube should never be operated in a vertical position with the Diheptal-base end up nor in any other position where the axis of the tube with the base up makes an angle of less than 20° with the vertical.
Weight (Approx.). . . . . 1 lb 2 oz

World Radio History

8093A

Shoulder Base . . . . Keyed Jumbo Annular 7-Pin

BOTTOM VIEW

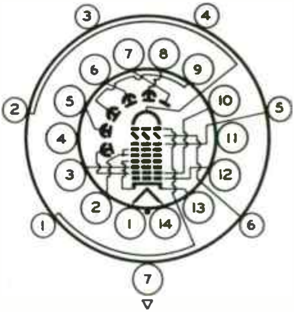
Pin 1 - Grid No.6
Pin 2 - Photocathode
Pin 3 - Do Not Use
Pin 4 - Do Not Use
Pin 5 - Grid No.5
Pin 6 - Target
Pin 7 - Do Not Use

End Base. . . . . Small-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-45)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.4, Field Mesh
Pin 3 - Grid No.3
Pin 4 - Do Not Use
Pin 5 - Dynode No.2
Pin 6 - Dynode No.4
Pin 7 - Anode
Pin 8 - Dynode No.5
Pin 9 - Dynode No.3
Pin 10 - Dynode No.1, Grid No.2
Pin 11 - Do Not Use
Pin 12 - Grid No.1
Pin 13 - Cathode, Suppressor Grid
Pin 14 - Heater

DIRECTION OF LIGHT: PERPENDICULAR TO LARGE END OF TUBE



WHITE INDEX LINE ON FACE

NOTE: In the tube symbol, the suppressor grid connected to the cathode, and the field-mesh grid connected to grid No.4, are intentionally without numbers to avoid upsetting industry practice of associating functional camera control knobs with specified grid numbers. For example, beam-focus control is generally associated with knob identified as G_4 (Grid No.4).

Maximum and Minimum Ratings, ***Absolute-Maximum Values:***

PHOTOCATHODE:		
Voltage	-550 max.	volts
Illumination.	50 max.	fc
OPERATING TEMPERATURE:		
Any part of bulb.	50 max.	°C
Of bulb at large end of tube (Target section).	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between target section and any part of bulb hotter than target section. . .	5 max.	°C
GRID-No.6 VOLTAGE	-550 max.	volts
TARGET VOLTAGE:		
Positive value.	10 max.	volts
Negative value.	10 max.	volts
GRID-No.5 VOLTAGE	150 max.	volts
GRID-No.4 VOLTAGE	300 max.	volts
GRID-No.3 VOLTAGE	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	350 max.	volts

World Radio History

GRID-No.1 VOLTAGE:		
Negative-bias value	125 max.	volts
Positive-bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts
ANODE SUPPLY VOLTAGE[a]	1350 max.	volts
VOLTAGE PER MULTIPLIER STAGE	350 max.	volts

Typical Operating Values:[b]

Photocathode Voltage (Image Focus)[c]	-325 to -475	volts
Grid-No.6 Voltage (Accelerator)— Approx. 75% of photocathode voltage[d]	-210 to -360	volts
Target-Cutoff Voltage[e]	-3 to +1	volts
Grid-No.5 Voltage (Decelerator)	0 to 40	volts
Grid-No.4 Voltage (Beam Focus)[c]	140 to 180	volts
Grid-No.3 Voltage[f]	260 to 300	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Target-Temperature Range	35 to 45	°C
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil[g]	75	gausses
Field Strength of Alignment Coil	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operating Values and with camera lens set to bring the picture highlights one stop above the "knee" of the light-transfer characteristic

	Min	*Average*	*Max.*	
Cathode Radiant Sensitivity at 4500 angstroms	-	0.028	-	μa/μw
Luminous Sensitivity (2870° K)	30	60	-	μa/lm
Anode Current (DC)	-	30	50	μa
Signal-Output Current (Peak to peak)	5	-	30	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for bandwidth of 4.5 Mc.	40	45	-	
Photocathode Illumination at 2870° K required to bring picture highlights one stop above the "knee" of light-transfer characteristic	-	0.040	0.060	fc

World Radio History

Amplitude Response at 400 TV lines per picture height (Per cent of large-area black to large-area white)[h]	30	50	-	%
Limiting Horizontal Resolution	500	675	-	TV lines
Uniformity:				
Ratio of shading (Background) signal to highlight signal	-	0.12	0.15	
Variation of highlight signal (Per cent of maximum highlight signal)[j]	-	20	25	%

[a] Dynode-voltage values are shown under *Typical Operating Values*.

[b] With 8093A operated in RCA-TK-11 or -TK-31 camera. Other cameras may require slightly different voltage ranges.

[c] Adjust for best focus.

[d] For minimum highlight flare or "ghost" the grid-No.6 voltage should be 73 per cent of the photocathode voltage.

[e] Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from -3 to +5 volts.

[f] Adjust to give the most uniformly shaded picture near maximum signal.

[g] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

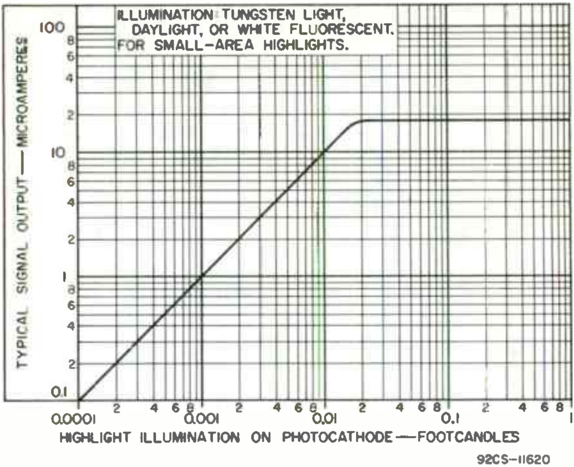
[h] Measured with amplifier having flat frequency response.

[j] Variation of response over scanned area.

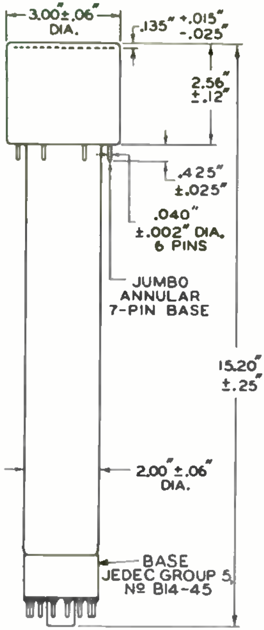
SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-10 RESPONSE is shown at front of this section

World Radio History

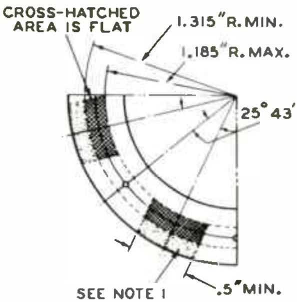
BASIC LIGHT-TRANSFER CHARACTERISTIC

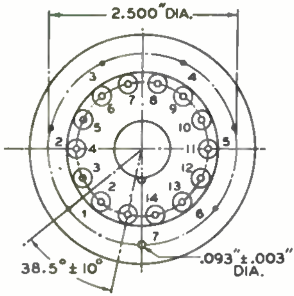


World Radio History



DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE





ENLARGED BOTTOM VIEW

92CM-8293R3

NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR-BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

World Radio History

Image Orthicon

LONG-LIFE TARGET, FIELD-MESH, ANTIGHOST IMAGE SECTION

MAGNETIC FOCUS **MAGNETIC DEFLECTION**

For High-Quality Pictures in Black-and-White TV Service Using Conventional Lighting Facilities and Ordinary Operating Techniques. The 8093A/L is Directly Interchangeable with the 8093 and 8093A in All Cameras.

The 8093A/L is the same as the 8093A except utilizes a longer life non-deteriorating glass target.

The sturdy, long-life, non-deteriorating, glass target of type 8093A/L is characterized by high gain, resistance to "burn-in", and the absence of any granular structure. Because charge transportation through this target material is electronic rather than ionic as in ordinary glass targets, the electrical characteristics of the target, such as secondary emission and resistivity, are essentially constant and sensitivity of the 8093A/L is stable throughout life.

Other important advantages of this target are that the undesirable characteristics of scene retention or "sticking picture" and raster "burn-in" due to underscanning are significantly reduced. The resistance of the 8093A/L to image "burn-in" provides a highly desirable operational feature because it is not necessary to use an orbiter or continually move the camera when focused on a stationary scene.

OPERATING CONSIDERATIONS

Dos and Don'ts on Use of RCA-8093A/L

Dos

1. Allow the 8093A/L to warm up prior to operation.
2. Hold temperature of the 8093A/L within operating range.
3. Make sure alignment coil is properly adjusted.
4. Adjust beam-focus control for best usable resolution.
5. Condition spare 8093A/L's by operating several hours once each month.
6. Determine proper operating point with target voltage adjusted to exactly 2 volts above target cutoff.
7. Uncap lens before voltages are applied to the 8093A/L.

Don'ts

1. Don't force the 8093A/L into its shoulder socket.
2. Don't operate the 8093A/L without scanning.
3. Don't operate a 8093A/L having an ion spot.
4. Don't use more beam current than necessary to discharge the highlights of the scene.
5. Don't turn off beam while voltages are applied to photocathode, grid No.6, target, dynodes, and anode during warm-up or standby operation.

World Radio History

World Radio History

Vidicon

LOW-POWER (0.6-WATT) DARK HEATER
ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION
SEPARATE GRID-No.5 CONNECTION

For Compact, Lightweight, Transistorized TV Cameras in Industrial and Other Closed-Circuit TV Systems. Well Suited for Black-and-White or Color Pickup.

GENERAL

Heater, for Unipotential Cathode
- Voltage (AC or DC) . . . . 6.3 ± 10% V
- Current at 6.3 V . . . . 0.095 A

Direct Interelectrode Capacitance[a] . . . . . . 5.0 pF
- Target to all other electrodes

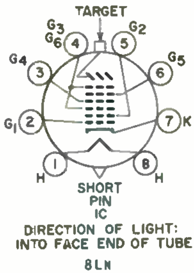
Spectral Response. . . . . . . See *Typical Spectral Sensitivity Characteristic*

Photoconductive Layer. . . . . 0.62 in
- Maximum useful diagonal of rectangle image (4×3 aspect ratio)[b]

Focusing Method. . . . . .Electrostatic
Deflection Method. . . . . Magnetic
Overall Length . . . . 6.25 ± 0.10 in
Greatest Diameter. . . . . 1.125 ± 0.010 in
Operating Position . . . . Any
Weight (Approx.) . . . . 2.8 oz
Bulb T8
Bulb Diameter. . . . . 1.025 ± 0.003 in
Deflecting-Alignment Assembly. . . . . Cleveland Electronics[c] No.VYA-300, or equivalent
Socket . . . . Cinch[d] No.133-98-11-015, or equivalent
Base . . . . . . .Small-Button Ditetrar 8-Pin, (JEDEC No.E8-11)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.4
Pin 4 – Grid No.3 & No.6
Pin 5 – Grid No.2
Pin 6 – Grid No.5
Pin 7 – Cathode
Pin 8 – Heater
Flange – Target
Short Pin – Do Not Use



ABSOLUTE MAXIMUM VALUES

For scanned area of 1/2 x 3/8 inch

Grid-No.6 & Grid-No.3 Voltage[e]. . . . . 1350 V
Grid-No.5 Voltage[e] . . . . 1000 V
Grid-No.4 Voltage. 400 V

← Indicates a change.

World Radio History

Grid-No.2 Voltage	850	V
Grid-No.1 Voltage		
Negative bias value	300	V
Positive bias value	0	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	125	V
Heater positive with respect to cathode	10	V
Target Voltage	100	V
Dark Current	0.2	µA
Peak Target Current[f]	0.6	µA
Faceplate		
Illumination	5000[g]	fc
Temperature	71	°C

→ TYPICAL OPERATION AND PERFORMANCE DATA

For scanned area 1/2 x 3/8 inch and faceplate temperature of 30° to 35 °C

	Low Voltage Operation	Intermediate Voltage Operation	High-Voltage Operation	
Grid-No.6 (Decelerator) & Grid-No.3 Voltage	300	500	750	V
Grid-No.5 Voltage	180	300	450	V
Grid-No.4 (Beam-Focus Electrode) Voltage	20 to 60	50 to 100	90 to 150	V
Grid-No.2 (Accelerator) Voltage	300	300	300	V
Grid-No.1 Voltage for Picture Cutoff[h]	-45 to -100	-45 to -100	-45 to -100	V
Typical Electrode Currents				
Grid No.6 & 3	1.7	2.5	3	µA
Grid No.5	0.05	0.2	0.3	µA
Grid No.4	0.0015	0.006	0.008	µA
Grid No.2	375	450	500	µA
Lag[j]				
Maximum value	28	28	28	%
Typical value	23	23	23	%
Visual Equivalent Signal-to-Noise Ratio (Approx.)[k]	300:1	300:1	300:1	
Average "Gamma" of Transfer Characteristic for Signal-Output Current between 0.02 µA and 0.2 µA	0.65	0.65	0.65	
Minimum Peak-to-Peak Blanking Voltage				
When applied to grid No.1	75	75	75	V
When applied to cathode	20	20	20	V
Limiting Resolution at Center of Picture	600	700	800	TV Lines

→ Indicates a change.

World Radio History

Amplitude Response to a 400 TV Line Square-Wave Test Pattern at Center of Picture	17	25	33	%
Peak Deflecting-Coil Current				
Horizontal	95	110	125	mA
Vertical	10	12	14	mA
Field Strength of Adjustable Alignment Coil[m]	0 to 1	0 to 1	0 to 1	G

High-sensitivity operation—0.1 footcandle on faceplate

Faceplate Illumination (Highlight)	0.1	fc
Target Voltage[n,p]	30 to 60	V
Dark Current[q]	0.1	μA
Signal-Output Current[r]	0.1	μA

Average-sensitivity operation—1 footcandle on faceplate

Faceplate Illumination (Highlight)	1	fc
Target Voltage[n,p]	25 to 48	V
Dark Current[q]	0.035	μA
Signal-Output Current[r]		
Typical	0.265	μA
Minimum	0.25	μA

[a] This capacitance which effectively is the output impedance of the 8134, is increased when the tube is mounted in the deflecting-yoke assembly. The resistive component of the output impedance is in the order of 100 megohms.

[b] Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the straight sides of the masked portions of the faceplate. The straight sides are parallel to the plane passing through the tube axis and short pin.

[c] Made by Cleveland Electronics Inc., 1974 East 61st St., Cleveland, Ohio.

[d] Made by Cinch Manufacturing Company, 1026 S. Homan Ave., Chicago 24, Illinois.

[e] The maximum voltage difference between grids No.6 & 3 and No.5 should not exceed 750 volts.

[f] Video amplifiers must be designed properly to handle peak target currents of this magnitude to avoid amplifier overload or picture distortion.

[g] For condition where "white light" is uniformly diffused over entire tube face.

[h] With no blanking voltage on grid No.1.

[j] Defined as the per cent of initial value of signal-output current 1/20 second after illumination is removed. Values shown are for initial signal-output current of 0.3 microampere and a dark current of 0.035 microampere.

[k] Measured with high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 MHz and a peak signal-output current of 0.35 microampere. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of the highlight video-signal current to rms noise current, multiplied by a factor of 3.

[m] The alignment coil should be located on the tube so that its center is at a distance of 4-15/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube and the deflecting yoke.

[n] Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

[p] The target voltage for each 8134 must be adjusted to that value which gives the desired operating signal current.

[q] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

[r] Defined as the component of the highlight target current after the dark-current component has been subtracted.

World Radio History

OPERATING CONSIDERATIONS

Resolution of the 8134 is about 600 TV lines per picture height when operated with a grid-No.6 & 3 voltage of 300 volts and a grid-No.5 voltage of 180 volts. A resolution capability of about 800 TV lines is obtained when the 8134 is operated with a grid-No.6 & 3 voltage of 750 volts and a grid-No.5 voltage of 450 volts.

The *target connection* may be made by a suitable spring-finger contact bearing against the edge of the metal ring at the face end of the tube.

Do and Don'ts on Use of RCA-8134

Dos

1. Adjust camera scanning to utilize maximum useful area of photoconductive layer.

2. Orient the vidicon so that horizontal scan is essentially parallel to the plane passing through tube axis and short index pin.

3. Align electron beam.

4. With lens capped, adjust target voltage for each individual vidicon to the highest value that will still give uniform background.

5. Match any visible raster pattern on photoconductive layer with new scan by reorienting the vidicon as required.

6. Use only sufficient beam current to bring out picture highlights.

7. Open lens iris or increase the scene illumination to obtain the "snappiest" picture without noticeable smear from moving objects. Target voltage should be reduced if light on the tube and/or resultant signal is excessive.

8. Always cap lens when transporting camera (see "Don'ts" 5).

Don'ts

1. Don't underscan the photoconductive layer.

2. Don't change camera size and centering controls once the scanned area of photoconductive layer has been properly positioned.

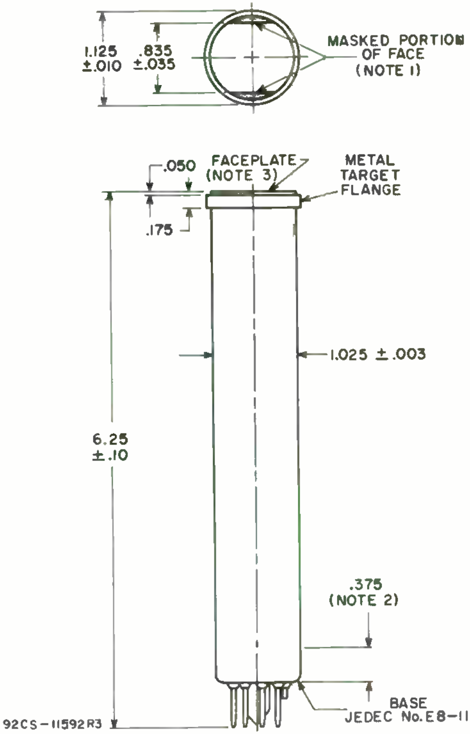
3. Don't rotate vidicon from its original operating position in deflecting yoke.

4. Don't turn beam of vidicon on without normal scanning or remove scanning before beam of vidicon is turned off.

5. DON'T ALLOW IMAGE OF THE SUN OR OTHER VERY INTENSE SOURCE OF ILLUMINATION TO BE FOCUSED ON PHOTOCONDUCTIVE LAYER AT ANY TIME.

World Radio History

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Note 1: Straight sides of masked portions are parallel to the plane passing through tube axis and short pin.

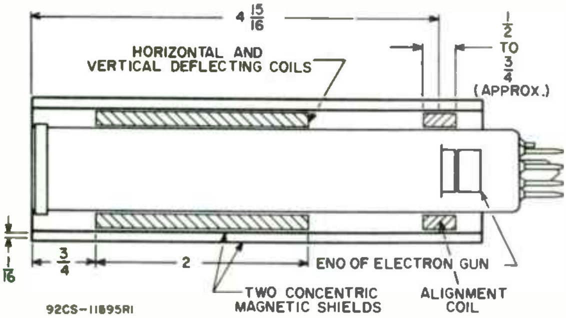
Note 2: Within this distance, diameter of bulb is 1.025 + 0.003-0.030 inches. Tube is acceptable regarding camber when it can be inserted into a 1-inch long cylinder gauge which has an inner diameter of 1.0280 + 0.0011-0.0000 inches. The gauge must pass along the tube length from the base to the metal target flange.

Note 3: Faceplate thickness is 0.094 ± 0.012 inches.

World Radio History

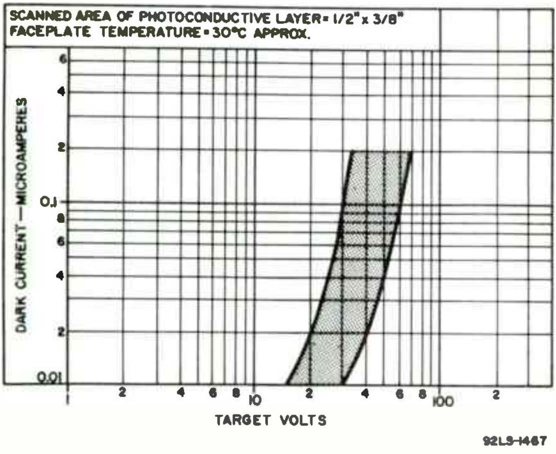
RECOMMENDED LOCATION OF DEFLECTING YOKE AND ALIGNMENT COIL

For optimum geometry and optimum output-signal uniformity



DIMENSIONS IN INCHES

Range of Dark Current



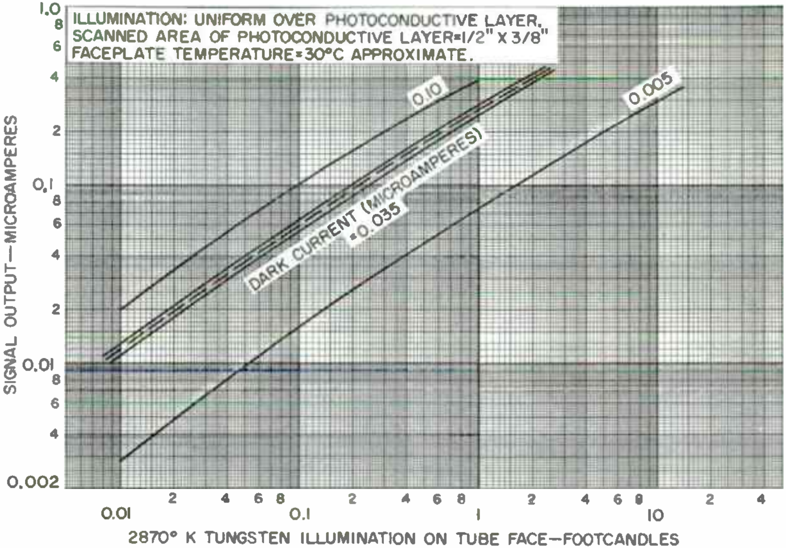
RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

World Radio History

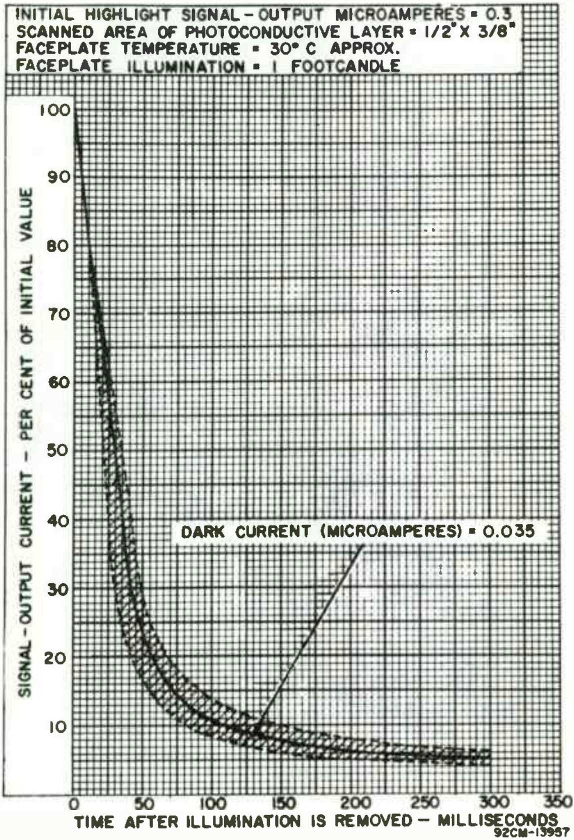
RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.

8134

Light Transfer Characteristics

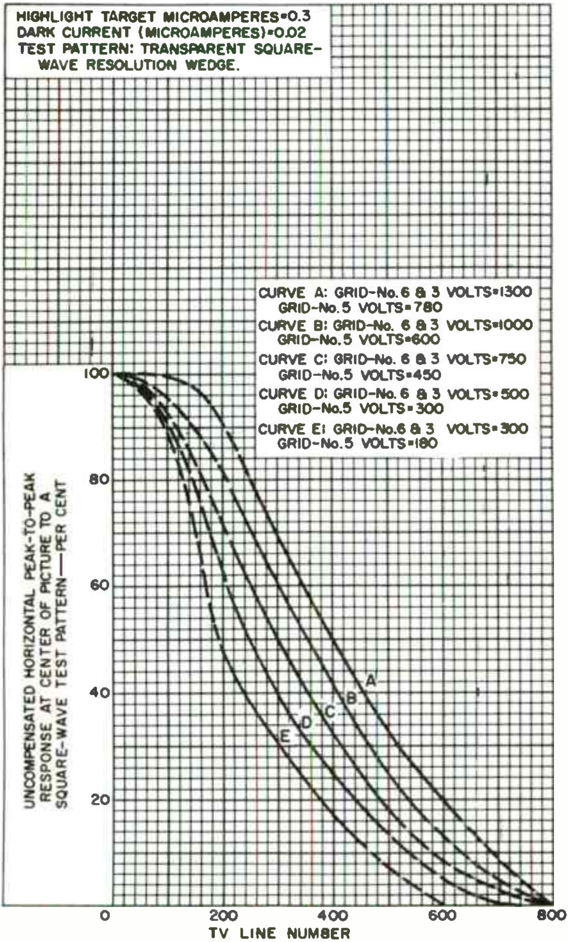


Typical Persistence Characteristic



World Radio History

Uncompensated Horizontal Square-Wave Response



92CM-13824

World Radio History

World Radio History

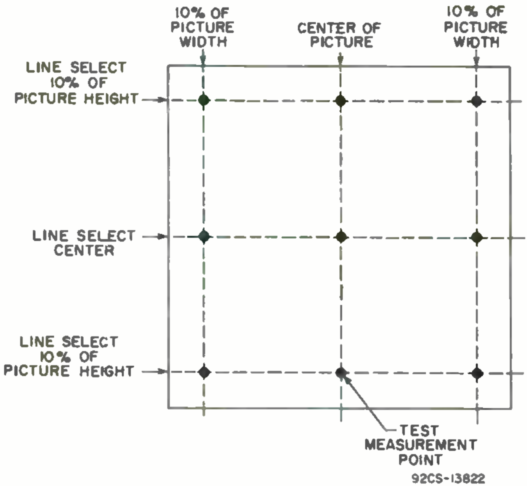
Vidicon

SEPARATE GRID-No.5 CONNECTION | LOW-POWER (0.6-WATT) DARK HEATER
ELECTROSTATIC FOCUS | MAGNETIC DEFLECTION

For Compact, Lightweight, Transistorized TV Cameras in Industrial and Other Closed-Circuit TV Systems. Designed to Provide High-Quality Service in Color TV Cameras.

The 8134/V1 is electrically and mechanically identical with the 8134 except for the primary difference that it is tested to meet extremely stringent criteria or signal uniformity or shading, and associated characteristics such as beam astigmatism and beat pattern.

SIGNAL UNIFORMITY TEST POINTS



5 cm x 5 cm Oscilloscope Display

SIGNAL-UNIFORMITY TEST

The 8134/V1 is tested for *Signal Uniformity* in an RCA Monochrome TK-27 Simulator as follows:

Heater Voltage	6.0	V
Grid-No.6 & Grid-No.3 Voltage	850	V
Grid-No.5 Voltage	365	V
Grid-No.2 Voltage	100 to 300	V
Grid-No.1 Voltage	-20	V

World Radio History

Beam current is adjusted to just discharge the target by varying the grid-No.2 voltage within the specified range. The camera is interconnected with appropriate camera controls, picture monitor, and oscilloscope. An opaque mask, having an 0.44 x 0.33-inch rectangular opening, is centered on the face of the 8134/V1. The tube face is illuminated with uniform light from a collimated point source.

After target voltage is adjusted to 10 volts (dc), the brightness of the light source is varied to obtain a peak signal current of 0.4 microampere. To assure full target signal is being discharged, the beam control is adjusted until peak signal amplitude is obtained on the display of the oscilloscope. The illumination is then reduced to obtain a peak signal current of 0.3 microampere without further adjustment of beam current. The signal amplitude is set to 100 per cent at the exact center of picture — 5 cm on the oscilloscope — with the blanking level equal to zero.

With horizontal and vertical scanning centered, the scan amplitudes are adjusted to just match the optical window provided by the 0.44 x 0.33-inch mask. The beam of the 8134/V1 is aligned for the most symmetrical and uniform signal with the horizontal line selector passing through the center of the picture. The line selector is then repositioned at a point 10 per cent down from the top of the picture and then 10 per cent up from the bottom of the picture. If required, additional adjustments in alignment are made to obtain minimum total deviation over the entire picture area from the 100 per cent signal amplitude.

Best possible electrical focus is maintained throughout these adjustments consistent with achieving the absolute minimum deviation in signal uniformity. Immediately prior to final measurement, the beam astigmatism of the 8134/V1 is such that at least 300 TV lines vertical resolution is visible at the center of the picture when the horizontal resolution is adjusted for 400 TV lines, or more. Under these conditions, no beat patterns shall be discernible in the picture.

The difference in signal between the 100 per-cent signal area and the other eight points shown under *Signal Uniformity Test Points* is noted. The permissible signal spread between the highest and lowest points does not exceed 15 per cent.

World Radio History

Vidicon

LOW-POWER (0.6-WATT) HEATER — **S-18 RESPONSE**
ELECTROSTATIC FOCUS — **MAGNETIC DEFLECTION**

For Transistorized, Low-Power, High-Performance TV Cameras

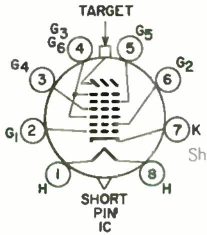
General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 5%	volts
Current at 6.3 volts.	0.095	amp
Direct Interelectrode Capacitance:[a]		
Target to all other electrodes. . .	11	pf
Spectral Response		S-18
Wavelength of Maximum Response. . . .	4500+500−300	angstroms
Photoconductive Layer:		
Maximum useful diagonal of rectangular image (4 x 3 aspect ratio)	1.0	inch

Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the straight side of the masked portions of the faceplate. The straight sides are parallel to the plane passing through the tube axis and short pin. The external masking is for orientation only and does not define the proper scanned area of the photoconductive layer. Final orientation should be such that the image fits inside of any internal mask of the mesh assembly.

Focusing Method	Electrostatic
Deflection Method	Magnetic
Overall Length.	10.250" ± 0.125"
Greatest Diameter	1.59" ± 0.01"
Operating Position.	Any
Weight (Approx.).	11 oz
Bulb.	T12
Bulb Diameter	1.500" ± 0.005"
Deflecting-Alignment Assembly[b]. . . .	Cleveland Electronics[c] No. 15VYA-333, or equivalent
Socket.	Alden[d] No. 208-SPEC, or equivalent
Base. . . .	Small-Button Super-Ditetrar 8-Pin (JEDEC No. E8-78)
Basing Designation for BOTTOM VIEW.	8MD

Pin 1 – Heater
Pin 2 – Grid No. 1
Pin 3 – Grid No. 4
Pin 4 – Grid No. 3 & No. 6
Pin 5 – Grid No. 5



DIRECTION OF LIGHT:
INTO FACE END OF TUBE

Pin 6 – Grid No. 2
Pin 7 – Cathode
Pin 8 – Heater
Flange – Target
Short Pin – Do Not Use

World Radio History

Maximum Ratings, *Absolute-Maximum Values:*

For Scanned Area of 0.6" x 0.8"

Grid-No.6 & Grid-No.3 Voltage[e]	1500 max.	volts
Grid-No.5 Voltage[e]	1500 max.	volts
Grid-No.4 Voltage	500 max.	volts
Grid-No.2 Voltage	750 max.	volts
Grid-No.1 Voltage:		
Negative bias value	300 max.	volts
Positive bias value	0 max.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts
Target Voltage	125 max.	volts
Dark Current	0.25 max.	μa
Peak Target Current[f]	0.6 max.	μa
Faceplate:		
Illumination	1000 max.	fc
Temperature	71 max.	°C

Typical Operation and Performance Data:

For Scanned Area of 0.6" x 0.8"
Faceplate Temperature of 28° to 34° C

Grid-No.6 (Decelerator) & Grid-No.3 Voltage[e]	1400	volts
Grid-No.5 Voltage[e]	700 to 840	volts
Grid-No.4 (Beam-Focus Electrode) Voltage	230 to 260	volts
Grid-No.2 (Accelerator) Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff[g]	-45 to -100	volts
Lag:[h]		
Typical	25	%
Maximum	30	%
Average "Gamma" of Transfer Characteristic for Signal-Output Current between 0.02 μa and 0.6 μa	0.65	
Minimum Peak-to-Peak Blanking Voltage:		
When applied to grid No.1	75	volts
When applied to cathode	20	volts
Limiting Resolution:		
At center of picture—		
Minimum	1200	TV lines
Typical	1400	TV lines
At corners of picture—		
Typical	1000	TV lines
Amplitude Response to a 400 TV-Line Square-Wave Test Pattern at Center of Picture:		
Minimum	55	%
Typical	60	%

World Radio History

Alignment-Coil Field Strength[j]	0 to 2	gauss
Peak Deflecting-Coil Current for Specified Deflecting-Alignment Assembly:		
Horizontal.	100	ma
Vertical.	20	ma
Average-Sensitivity Operation		
Faceplate Illumination (Highlight).	10	fc
Target Voltage[k,m]	20 to 60	volts
Dark Current[n].	0.02	µa
Signal-Output Current:[p]		
Typical	0.5	µa
Minimum-Lag Operation		
Faceplate Illumination (Highlight).	50	fc
Target Voltage[k,m]	10 to 30	volts
Dark Current[n]	0.005	µa
Signal-Output Current:[p]		
Typical	0.5	µa

[a] This capacitance, which effectively is the output impedance of the 8480, is increased when the tube is mounted in the deflecting-yoke assembly. The resistive component of the output impedance is in order of 100 megohms.

[b] For minimum geometric distortion, the front of the deflecting yoke should be located in its proper axial position 3/4 inch from the face of the tube.

[c] Cleveland Electronics Inc., 1974 East 61st St., Cleveland, Ohio

[d] Alden Products Co., 9140 North Main St., Brockton 64, Massachusetts.

[e] Grid-No.6 & 3 voltage must always be greater than grid-No.5 voltage. The maximum voltage difference between these electrodes, however, should not exceed 800 volts. The recommended ratio of grid-No.6 & 3 to grid-No.5 voltage is 1.67 to 2; best geometry being provided when the ratio is 1.67, and most uniform signal output when the ratio is 2. The operator should select the ratio within this range which provides the desired performance.

[f] Video amplifiers must be designed to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

[g] With no blanking voltage on grid No.1.

[h] Defined as the per cent of initial value of signal-output current 1/20 second after illumination is removed. Values shown are for initial signal-output current of 0.2 microampere and a dark current of 0.02 microampere.

[j] The alignment coil should be located on the tube so its center is at a distance of 8-1/4 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube and the deflecting yoke.

[k] Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

[m] The target voltage for each 8480 must be adjusted to that value which gives the desired operating dark current.

[n] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

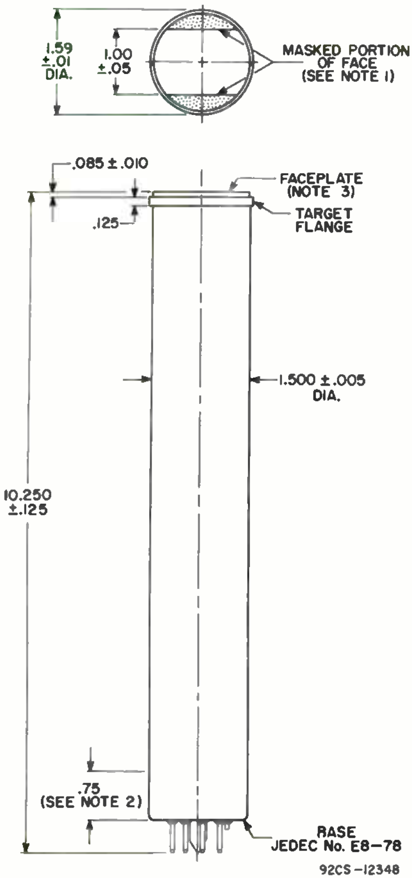
[p] Defined as the component of the highlight target current after the dark-current component has been subtracted.

OPERATING CONSIDERATIONS

The *target connection* may be made by a suitable spring-finger contact bearing against the edge of the metal ring at the face end of the tube.

World Radio History

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

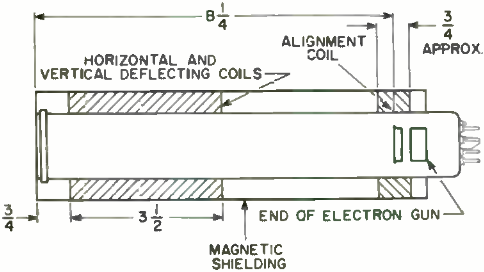
Note 1: Straight sides of masked portions are parallel to the plane passing through tube axis and short index pin.

Note 2: Within this area the minimum bulb diameter dimension does not apply.

Note 3: Faceplate thickness is 0.135" ± 0.005".

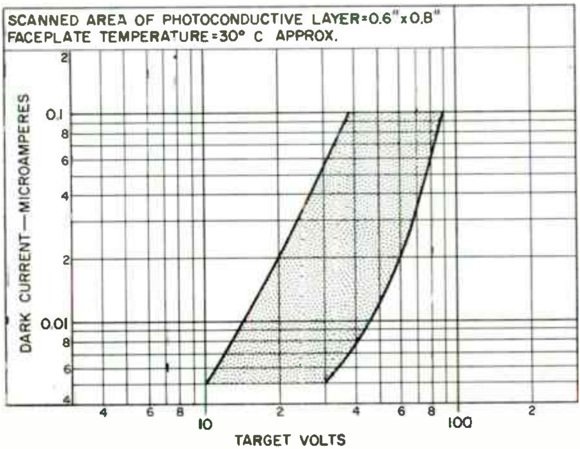
World Radio History

COMPONENT LOCATIONS



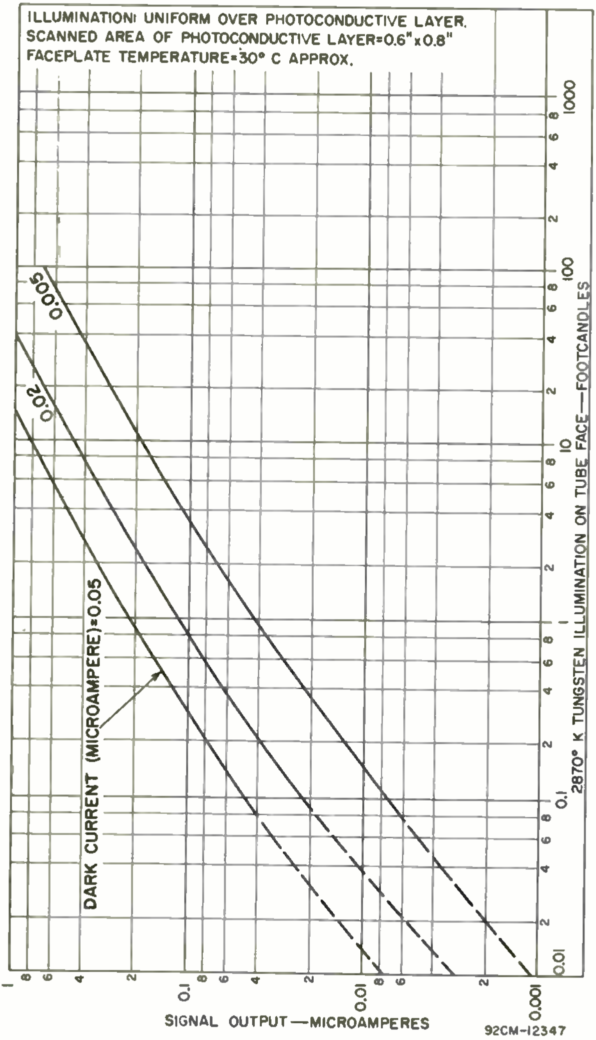
DIMENSIONS IN INCHES

TYPICAL RANGE OF DARK CURRENT



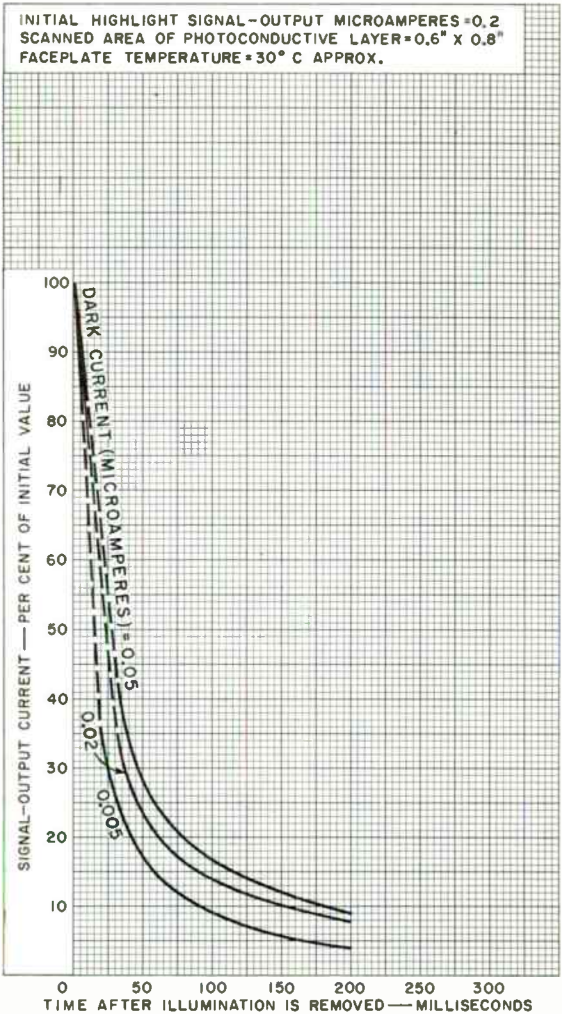
World Radio History

LIGHT TRANSFER CHARACTERISTICS



World Radio History

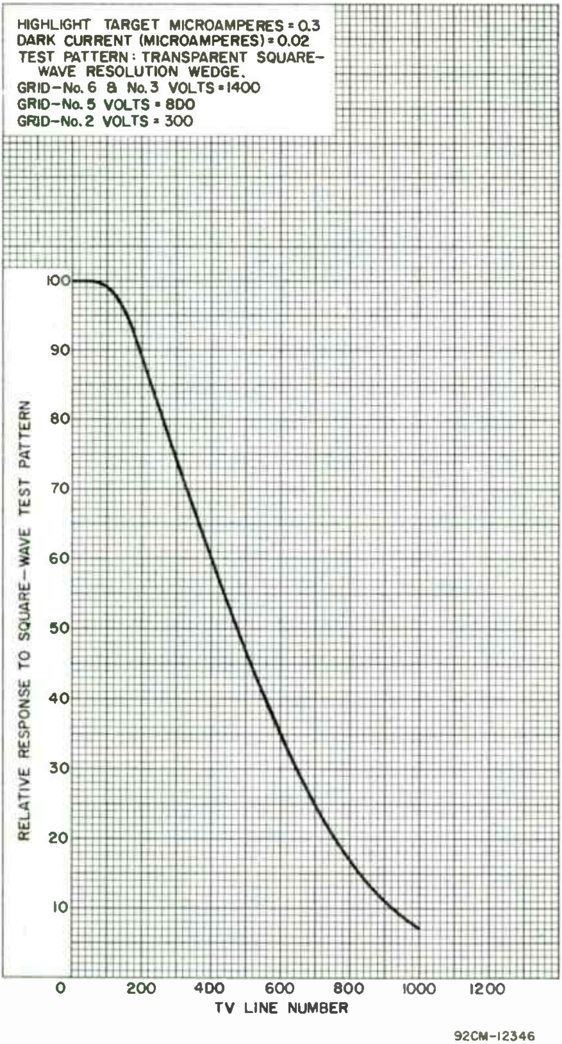
TYPICAL PERSISTENCE CHARACTERISTICS



92CM-11153R1

World Radio History

UNCOMPENSATED HORIZONTAL RESPONSE TO A SQUARE-WAVE TEST PATTERN



World Radio History

Vidicon

1" - DIAMETER

MAGNETIC FOCUS MAGNETIC DEFLECTION

For Live-Scene, or Film Pickup with Black-and White or Color Cameras. Features High Resolution with High Sensitivity and Low Lag. Grid No.3 and Grid No.4 Have Separate Base Terminals.

General:

Heater, for Unipotential Cathode:
- Voltage (AC or DC) . . . . 6.3 ± 10% volts
- Current at 6.3 volts . . . . 0.6 amp

Direct Interelectrode Capacitance:[a]
- Target to all other electrodes . . . . 4.6 pf

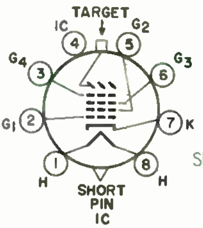
Spectral Response . . . . See Curve

Photoconductive Layer:
- Maximum useful diagonal of rectangular image (4 x 3 aspect ratio) . . . . 0.62"

Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the straight sides of the masked portions of the faceplate. The straight sides are parallel to the plane passing through the tube axis and short pin. The masking is for orientation only and does not define the proper scanned area of the photoconductive layer.

Focusing Method . . . . Magnetic
Deflection Method . . . . Magnetic
Overall Length . . . . 6.250" ± 0.125"
Greatest Diameter . . . . 1.125" ± 0.010"
Operating Position . . . . Any
Weight (Approx.) . . . . 2 oz
Bulb T8
Focusing Coil . . . . . Cleveland Electronics[b,c] No. VF-115-12, or equivalent
Deflecting Yoke . . . . Cleveland Electronics[b,c] No. VY-111-3, or equivalent
Alignment Coil . . . . Cleveland Electronics[b,c] No. VA-118, or equivalent
Base . . . . Small-Button Ditetrar 8-Pin (JEDEC No. E8-11)
Socket . . . . Cinch[d] No. 54A18088, or equivalent
Basing Designation for BOTTOM VIEW 8ME

Pin 1 - Heater
Pin 2 - Grid No. 1
Pin 3 - Grid No. 4
Pin 4 - Do Not Use
Pin 5 - Grid No. 2



Pin 6 - Grid No. 3
Pin 7 - Cathode
Pin 8 - Heater
Flange - Target
Short Pin - Do Not Use

Maximum Ratings, ***Absolute-Maximum Values:***

For scanned area of 1/2" x 3/8"

Grid-No.4 Voltage	1000 max.	volts
Grid-No.3 Voltage	1000 max.	volts
Grid-No.2 Voltage	750 max.	volts
Grid-No.1 Voltage:		
Negative bias value	300 max.	volts
Positive bias value	0 max.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts
Target Voltage	100 max.	volts
Dark Current	0.25 max.	μa
Peak Target Current[e]	0.55 max.	μa
Faceplate:		
Illumination	1000 max.	fc
Temperature	71 max.	°C

Typical Operation and Performance Data:

For scanned area of 1/2" x 3/8" and faceplate temperature of 30° to 35° C

	Low-Voltage Operation	*High-Voltage Operation*	
Grid-No.4 (Decelerator) Voltage	500	750	volts
Grid-No.3 (Beam-Focus Electrode) Voltage[f]	300[g]	450[g]	volts
Grid-No.2 (Accelerator) Voltage	300	300	volts
Grid-No.1 Voltage for Picture Cutoff[h]	-45 to -100	-45 to -100	volts
Lag[j], Typical	20	20	%
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μa and 0.2 μa	0.65	0.65	
Visual Equivalent Signal-to-Noise Ratio (Approx.)[k]	300:1	300:1	
Minimum Peak-to-Peak Blanking Voltage:			
When applied to grid No.1	75	75	volts
When applied to cathode	20	20	volts
Limiting Resolution:			
At center of picture	900	1000	TV lines
At corner of picture	600	700	TV lines

	Low-Voltage Operation	High-Voltage Operation	
Amplitude Response to a 400 TV Line Square-Wave Test Pattern at Center of Picture	35	45	%
Field Strength at Center of Focusing Coil[f]	41 ± 4	52 ± 4	gauss
Peak Deflecting-Coil Current:			
Horizontal	180	220	ma
Vertical	33	40	ma
Field Strength of Adjustable Alignment Coil[m]	0 to 4	0 to 4	gauss

Maximum-Sensitivity Operation - 0.1 Footcandle on Faceplate

Faceplate Illumination (Highlight)	0.1	fc
Target Voltage[r,p]	35 to 70	volts
Dark Current[q]	0.2	μa
Signal-Output Current:[r]		
Typical	0.14	μa

Intermediate-Sensitivity Operation - 0.5 Footcandle on Faceplate

Faceplate Illumination (Highlight)	0.5	fc
Target Voltage[n,p]	30 to 60	volts
Dark Current[q]	0.10	μa
Signal-Output Current:[r]		
Typical	0.27	μa

Average-Sensitivity Operation - 1.0 Footcandle on Faceplate

Faceplate Illumination (Highlight)	1.0	fc
Target Voltage[n,p]	20 to 40	volts
Dark Current[q]	0.02	μa
Signal-Output Current:[r]		
Typical	0.20	μa
Minimum	0.15	μa

High-Light Level Operation - 10 Footcandles on Faceplate

Faceplate Illumination (Highlight)	10	fc
Target Voltage[n,p]	10 to 22	volts
Dark Current[q]	0.005	μa
Signal-Output Current:[r]		
Typical	0.3	μa

World Radio History

[a] This capacitance, which effectively is the output impedance of the 8507, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms.

[b] Cleveland Electronics Inc., 1974 East 61st Street, Cleveland, Ohio.

[c] These components are chosen to provide tube operation with minimum beam-landing error when mounted in the recommended position along the tube axis.

[d] Cinch Manufacturing Corporation, 1026 S. Homan Avenue, Chicago 24, Illinois.

[e] Video amplifiers must be designed to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

[f] Beam focus is usually attained by varying the focus-coil current to obtain a field-strength value within the range shown under *Typical Operation and Performance Data*. If the field-strength of the focus coil is fixed, beam focus is obtained within a ± 10 per cent range of the grid-No.4 and grid No.3 voltages. However, the recommended ratio of 0.6 between grid No.3 and grid No.4 must be maintained as these voltages are varied.

[g] In general, grid No.3 should be operated above 250 volts and be 0.6 of grid-No.4 voltage.

[h] With no blanking voltage on grid No.1.

[j] Defined as the per cent of initial value of signal-output current 1/20 second after illumination is removed. Values shown are for initial signal-output current of 0.2 microampere and a dark current of 0.02 microampere.

[k] Measured with high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc and a peak signal-output current of 0.35 microampere. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of the highlight video-signal current to rms noise current, multiplied by a factor of 3.

[m] The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

[n] The target voltage for each 8507 must be adjusted to that value which gives the desired operating dark current.

[p] Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

[q] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

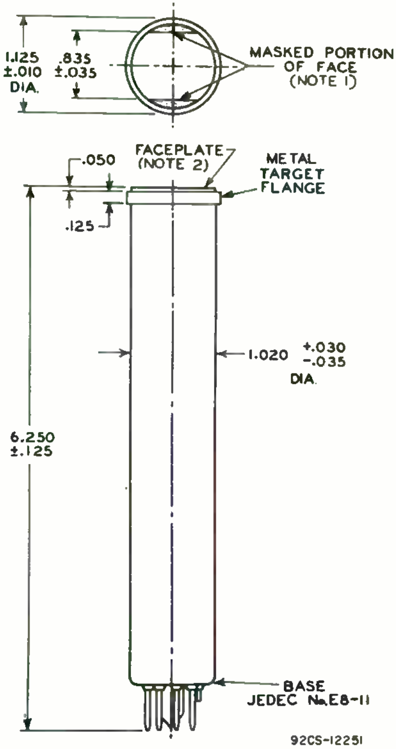
[r] Defined as the component of the highlight target current after the dark-current component has been subtracted.

OPERATING CONSIDERATIONS

The *resolution capability* of the 8507 at the center of the picture is about 1000 TV lines and about 700 TV lines at the corner. This high resolution is obtained when the 8507 is operated with a grid-No.4 voltage of 750 volts and a grid-No.3 voltage of 450 volts. When the 8507 is operated at a grid-No.4 voltage of 500 volts and a grid-No.3 voltage of 300 volts, its resolution is about 900 TV lines at the center and 600 TV lines at the corner of the picture.

The *target connection* is made by a suitable spring contact bearing against the edge of the metal ring at the face end of the tube. This spring contact may conveniently be provided as part of the focusing-coil design.

World Radio History



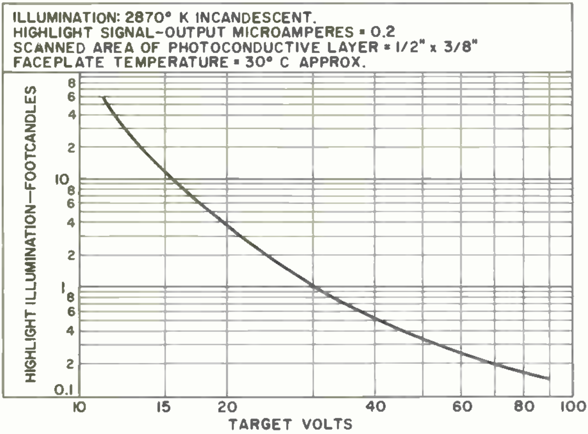
DIMENSIONS IN INCHES

Note 1: Straight sides of masked portions are parallel to the plane passing through tube axis and short index pin.

Note 2: Faceplate thickness is 0.094" ± 0.012".

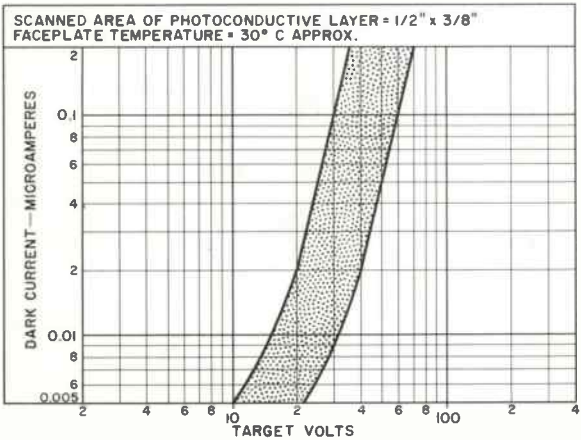
World Radio History

TYPICAL CHARACTERISTIC



92CS-12236

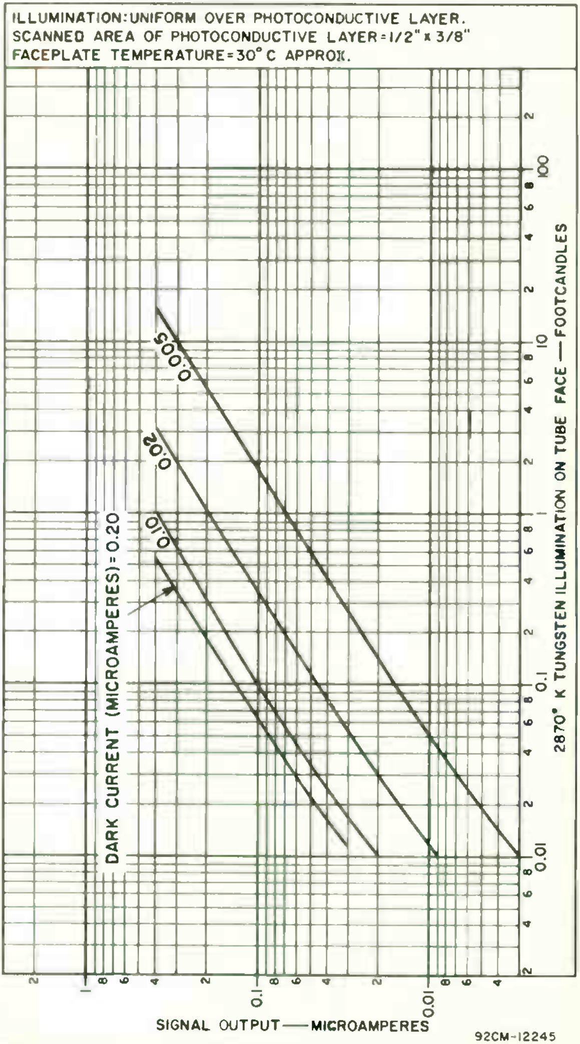
DARK-CURRENT RANGE



92CS-12235

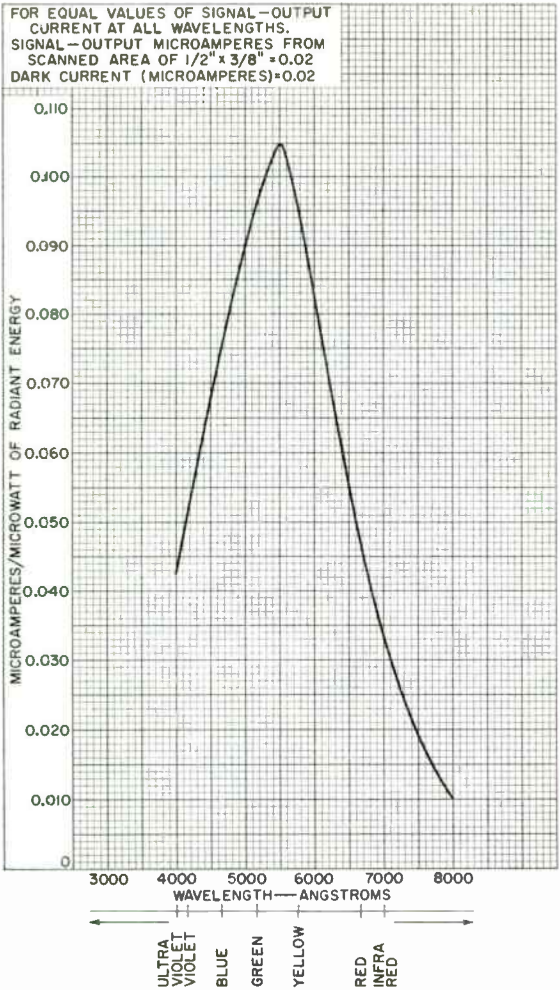
World Radio History

TYPICAL LIGHT TRANSFER CHARACTERISTICS



92CM-12245

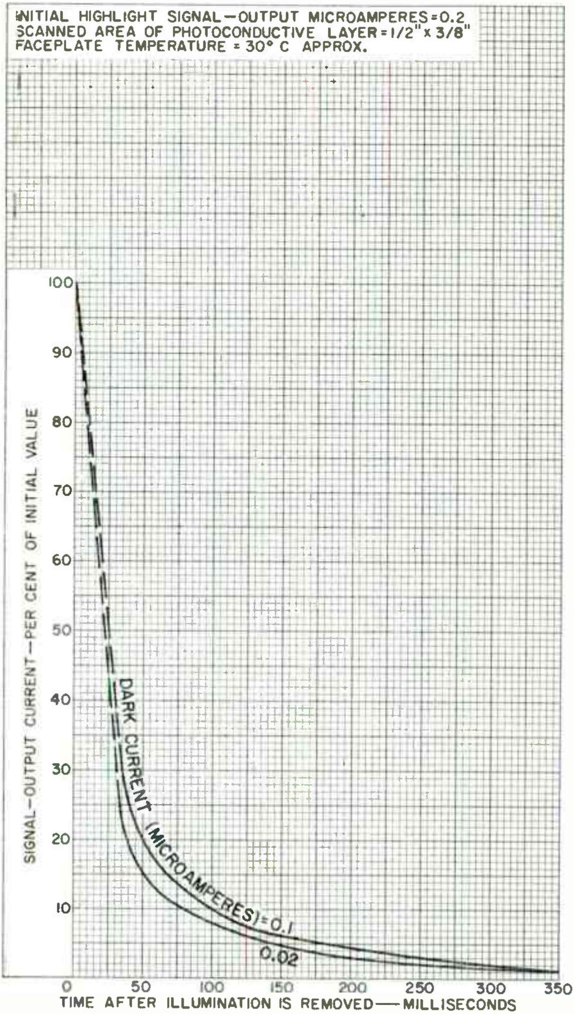
TYPICAL SPECTRAL-SENSITIVITY CHARACTERISTIC



92CM-11619

World Radio History

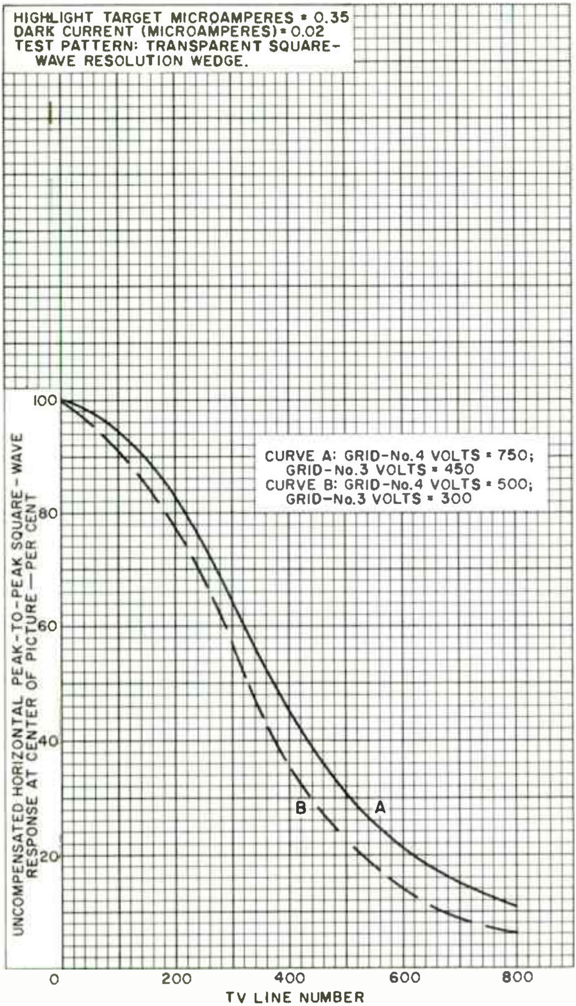
TYPICAL PERSISTENCE CHARACTERISTICS



92CM-11615

World Radio History

TYPICAL HORIZONTAL SQUARE-WAVE RESPONSE CHARACTERISTICS



World Radio History

Vidicon

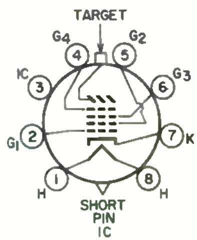
MAGNETIC FOCUS   1-1/2" Diameter   MAGNETIC DEFLECTION

For Black-and-White Pickup in Industrial Closed-Circuit TV Systems Requiring Limiting Resolutions of more than 1200 TV Lines

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at heater volts = 6.3	0.6	amp
Direct Interelectrode Capacitance:[a]		
Target to all other electrodes	8.0	pf
Spectral Response	See Accompanying *Curve*	
Photoconductive Layer:		
Maximum useful diagonal of rectangular image (4 x 3 aspect ratio)[b]	1"	
Focusing Method	Magnetic	
Deflection Method	Magnetic	
Overall Length	7.75" ± 0.25"	
Greatest Diameter	1.59" ± 0.01"	
Bulb Diameter	1.50" ± 0.01"	
Operating Position	Any	
Weight (Approx.)	5.25 oz	
Bulb	T12	
Focusing-Alignment Assembly	Cleveland Electronics[c] No. 15-VFA-259, or equivalent	
Deflecting Yoke[d]	Cleveland Electronics[c] No. 15-VY-258, or equivalent	
Socket	Alden[e] No. 208-SBSDC, or equivalent	
Base	Small-Button Super-Ditetrar 8-Pin (JEDEC No. E8-78)	
Basing Designation for BOTTOM VIEW	8LB	

Pin 1 - Heater
Pin 2 - Grid No. 1
Pin 3 - Do Not Use
Pin 4 - Grid No. 4
Pin 5 - Grid No. 2
Pin 6 - Grid No. 3
Pin 7 - Cathode
Pin 8 - Heater
Flange - Target
Short Index Pin - Do Not Use



DIRECTION OF LIGHT: INTO FACE END OF TUBE

Maximum Ratings, ***Absolute-Maximum Values:***

For scanned area of 0.6" x 0.8"

Grid-No. 4 Voltage	1500 max.	volts
Grid-No. 3 Voltage	1500 max.	volts
Grid-No. 2 Voltage	550 max.	volts

World Radio History

Grid-No.1 Voltage:		
Negative-bias value	300 max.	volts
Positive-bias value	0 max.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts
Target Voltage	100 max.	volts
Dark Current	0.25 max.	μa
Peak Target Current[f]	0.60 max.	μa
Faceplate:		
Illumination	1000 max.	fc
Temperature	71 max.	°C

Typical Operation:

For scanned area of 0.6" x 0.8" and faceplate temperature of 28° to 34° C

Grid-No.4 (Decelerator) Voltage[g]	1400	volts
Grid-No.3 (Beam-Focus Electrode[h])	800 to 1000	volts
Grid-No.2 (Accelerator) Voltage	300	volts
Grid-No.1 Voltage for picture cutoff[j]	-45 to -100	volts
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μa and 0.6 μa	0.65	
Minimum Peak-to-Peak Blanking Voltage:		
When applied to grid No.1	75	volts
When applied to cathode	20	volts
Lag—Per Cent of Initial Value of Signal-Output Current 1/20 Second after Illumination is Removed:[k]		
Maximum value	45	%
Typical value	30	%
Limiting Resolution:		
At center of picture—		
Typical value	1500	TV lines
Minimum value	1200	TV lines
At corners of picture—		
Typical value	900	TV lines
Amplitude Response to a 400 TV Line Square-Wave Test Pattern at Center of Picture:		
Minimum value	60	%
Field Strength at Center of Focusing Coil (Approx.)	46	gauss
Field Strength of Adjustable Alignment Coil[m]	0 to 4	gauss
Peak Deflecting-Coil Current for Specified Deflecting Yoke:		
Horizontal	240	ma
Vertical	50	ma

Maximum-Sensitivity Operation—0.1 Footcandle on Faceplate

Faceplate Illumination (Highlight)	0.1	fc

World Radio History

Target Voltage[n,p]	30 to 60	volts
Dark Current[q]	0.1	μa
Signal-Output Current:[r]		
Typical	0.2	μa

Average-Sensitivity Operation—
1.0 Footcandle on Faceplate

Faceplate Illumination (Highlight)	1.0	fc
Target Voltage[n,p]	17 to 35	volts
Dark Current[q]	0.02	μa
Signal-Output Current:[r]		
Typical	0.20	μa
Minimum	0.15	μa

High-Light Level Operation—
10 Footcandles on Faceplate

Faceplate Illumination (Highlight)	10	fc
Target Voltage[n,p]	10 to 20	volts
Dark Current[q]	0.005	μa
Signal-Output Current:[r]		
Typical	0.3	μa

a This capacitance, which effectively is the output impedance of the 8521, is increased when the tube is mounted in the deflecting-yoke and focusing-alignment assembly. The resistive component of the output impedance is in the order of 100 megohms.

b Proper orientation of quality rectangle is obtained when the horizontal scan is essentially parallel to the plane passing through the axis and short index pin. The masking is for orientation only and does not define the proper scanned area of photoconductive layer. Final orientation should be such that the image also fits inside of any internal mask of the mesh assembly.

c Cleveland Electronics Inc., 1974 East 61st St., Cleveland, Ohio.

d For minimum geometric distortion, the deflecting yoke should be located in its proper axial position 3/4-inch from the face of the tube.

e Alden Products Co., 9140 North Main Street, Brockton 64, Mass.

f Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

g Grid-No.4 voltage must always be greater than grid-No.3 voltage. For minimum "porthole" effect, grid-No.4 voltage should be adjusted to approximately 1.6 times the grid-No.3 voltage value, and the focusing-alignment assembly and deflecting yoke positioned as shown in accompanying diagram.

h Beam focus is obtained by the combined effect of grid-No.3 voltage, which should be adjustable over indicated range, and a focusing coil having an average field strength of 40 gauss.

j With no blanking voltage on grid No.1.

k For initial signal-output current of 0.2 μa and a dark current of 0.02 μa.

m The alignment coil should be located on the tube so that its center is at a distance of 6 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

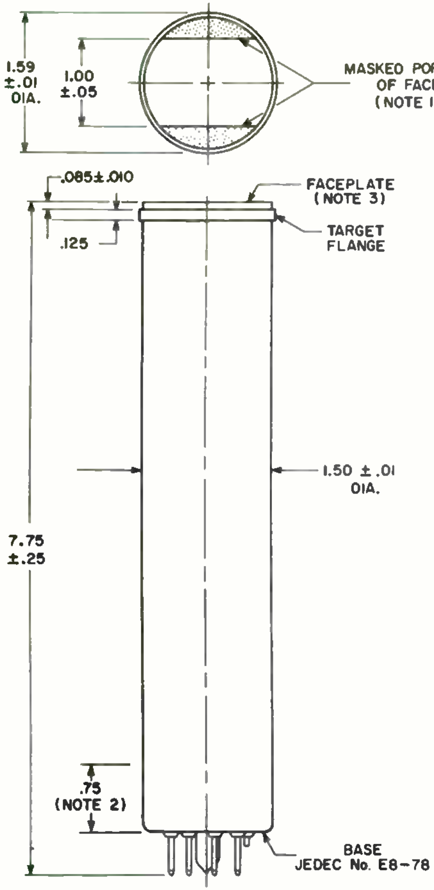
n Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

p The target voltage for each 8521 must be adjusted to that value which gives the desired operating dark current.

q The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

r Defined as the component of the highlight target current after the dark-current component has been subtracted.

World Radio History



DIMENSIONS IN INCHES

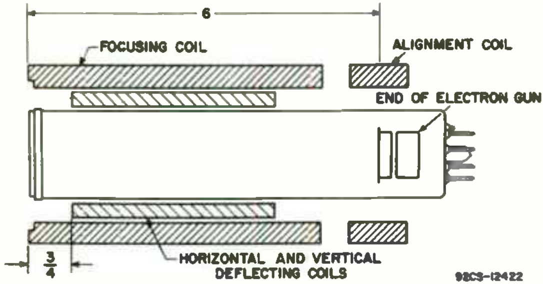
Note 1: Straight sides of masked portions are parallel to the plane passing through tube axis and short index pin.

Note 2: Within this area the minimum bulb diameter dimension does not apply.

Note 3: Faceplate thickness is 0.135" ± 0.005".

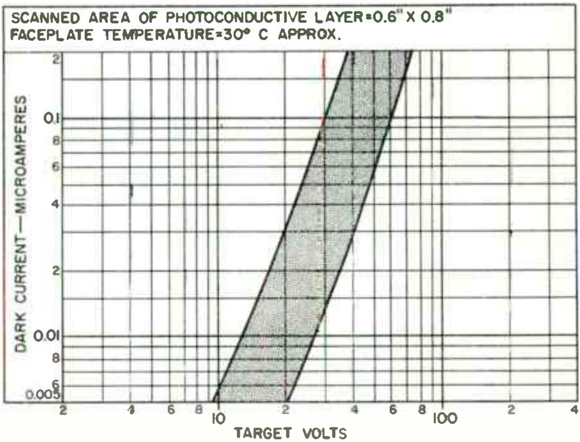
World Radio History

COMPONENT LOCATIONS



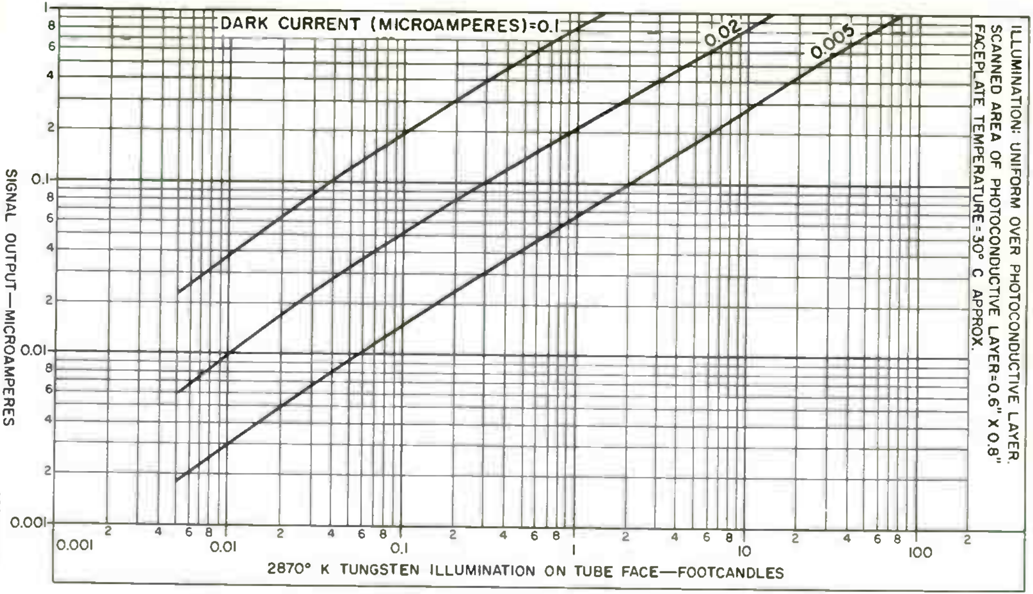
DIMENSIONS IN INCHES

RANGE OF DARK CURRENT



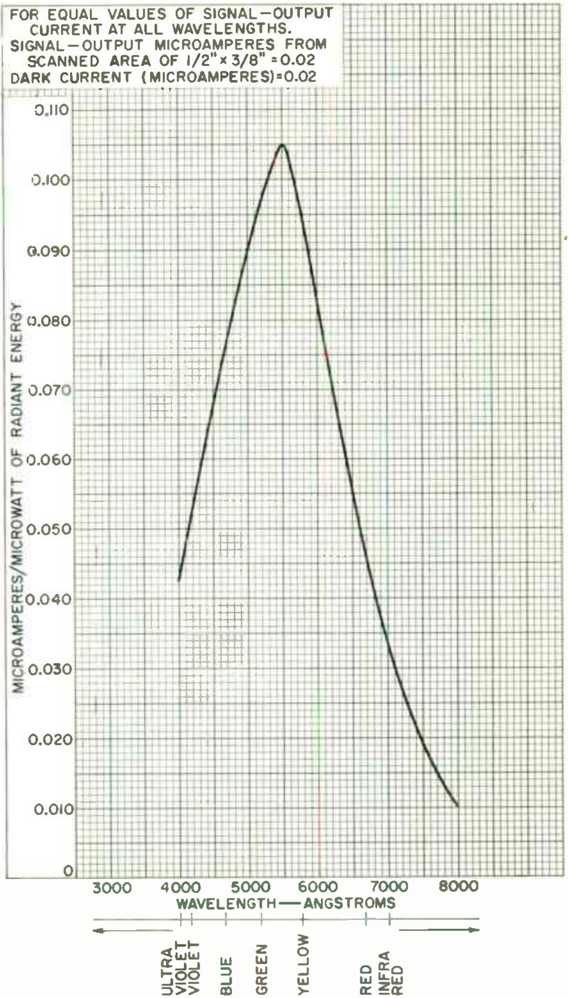
World Radio History

LIGHT TRANSFER CHARACTERISTICS



92CM-12413

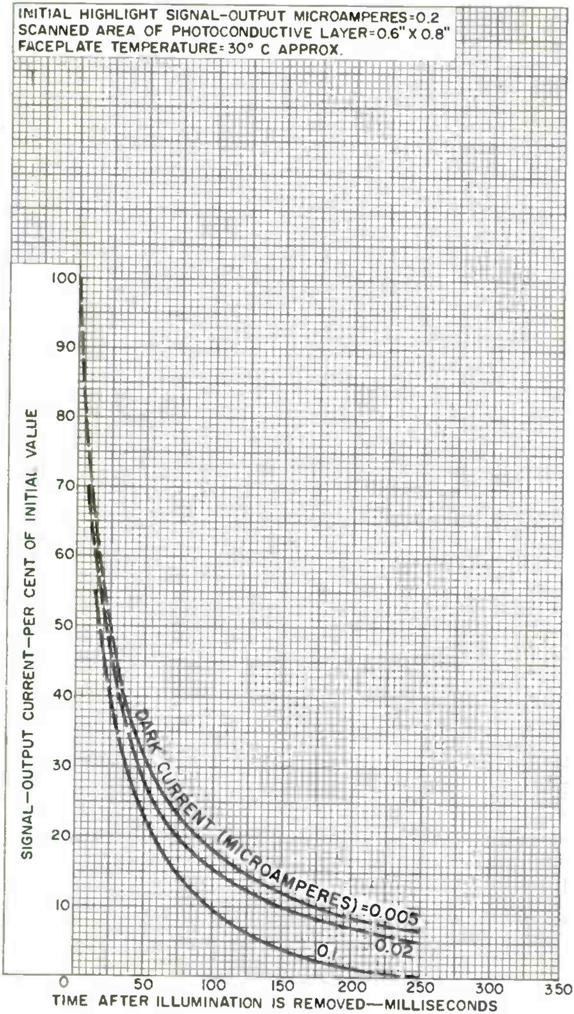
TYPICAL SPECTRAL SENSITIVITY CHARACTERISTIC



92CM-11619

World Radio History

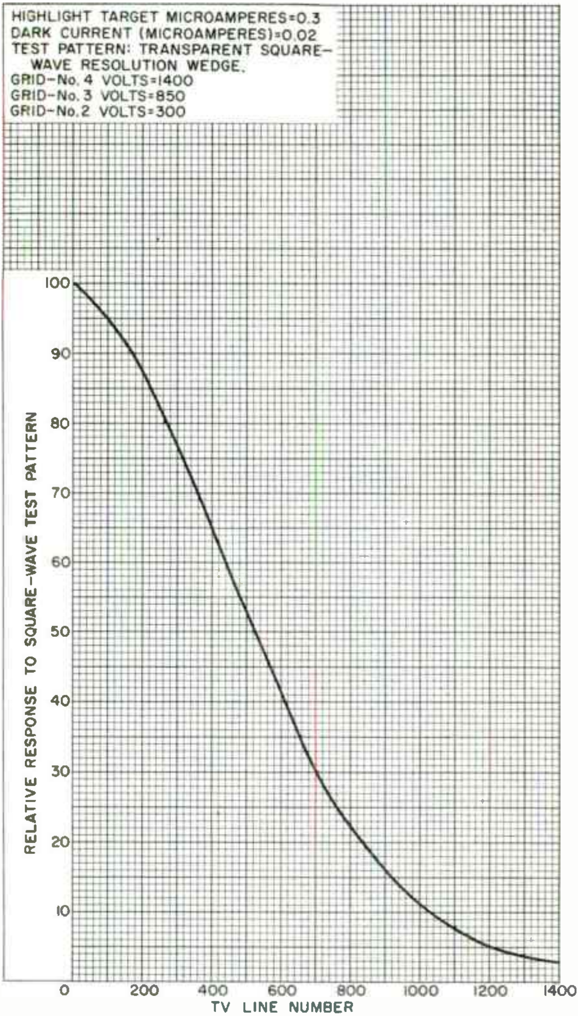
TYPICAL PERSISTENCE CHARACTERISTICS



92CM-12416

World Radio History

UNCOMPENSATED HORIZONTAL RESPONSE TO A SQUARE-WAVE TEST PATTERN



92CM-12418R1

World Radio History

Vidicon

LOW-POWER (0.6-WATT) "DARK HEATER" 1" DIAMETER PRECISION BULB[a]
ELECTROSTATIC FOCUS RUGGEDIZED MAGNETIC DEFLECTION

For Compact, Lightweight, Transistorized TV Cameras in Industrial and Other Closed-Circuit TV Systems Where Severe Environmental Conditions May be Encountered

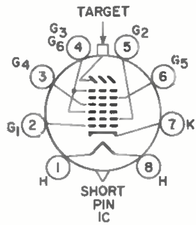
General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.095	amp
Direct Interelectrode Capacitance:[b]		
Target to all other electrodes	5.0	pf

Spectral Response . . . . . . See *Typical Spectral-Sensitivity Characteristic*, shown under Type 8134

Photoconductive Layer:	
Maximum useful diagonal of rectangular image (4 x 3 aspect ratio)[c]	0.62"
Focusing Method	Electrostatic
Deflection Method	Magnetic
Overall Length	6.25" ± 0.10"
Greatest Diameter	1.125" ± 0.010"
Operating Position	Any
Weight (Approx.)	2.8 oz
Bulb	T8
Bulb Diameter	1.025" ± 0.003"
Deflecting-Alignment Assembly	Cleveland Electronics[d] No. VYA-300, or equivalent
Socket	Cinch[e] No. 133-98-11-015, or equivalent
Base	Small-Button Ditetrar 8-Pin (JEDEC No. E8-11)
Basing Designation for BOTTOM VIEW	8LN

Pin 1 - Heater
Pin 2 - Grid No. 1
Pin 3 - Grid No. 4
Pin 4 - Grid No. 3 & No. 6
Pin 5 - Grid No. 2
Pin 6 - Grid No. 5
Pin 7 - Cathode
Pin 8 - Heater
Flange - Target
Short Pin - Do Not Use



DIRECTION OF LIGHT: INTO FACE END OF TUBE

Maximum Ratings, *Absolute-Maximum Values:*

For scanned area of 1/2" x 3/8"

Grid-No. 6 & Grid No. 3 Voltage[f]	1000	volts
Grid-No. 5 Voltage[f]	1000	volts
Grid-No. 4 Voltage	300	volts
Grid-No. 2 Voltage	750	volts

World Radio History

Grid-No.1 Voltage:		
Negative-bias value.	300	volts
Positive-bias value.	0	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode. .	125	volts
Heater positive with respect to cathode. .	10	volts
Target Voltage	100	volts
Dark Current	0.2	μa
Peak Target Current[g]	0.6	μa
Faceplate:		
Illumination	1000	fc
Temperature.	71	°C

Typical Operation and Performance Data:

For scanned area of 1/2" x 3/8" and faceplate temperature of 30° to 35° C and standard TV scanning rate

	Low-Voltage	Inter-mediate-Voltage	High-Voltage	
Grid-No.6 (Decelerator) & Grid-No.3 Voltage . .	300	500	750	volts
Grid-No.5 Voltage. . . .	180	300	450	volts
Grid-No.4 (Beam-Focus Electrode) Voltage. . .	20 to 60	50 to 100	90 to 150	volts
Grid-No.2 (Accelerator) Voltage	300	300	300	volts
Grid-No.1 Voltage for picture cutoff[h]	-45 to -100	-45 to -100	-45 to -100	volts
Typical Electrode Currents:				
Grid No.6 & 3	1.7	2.5	3	μa
Grid No.5	0.05	0.20	0.30	μa
Grid No.4	0.0015	0.006	0.008	μa
Grid No.2	375	450	500	μa
Lag[j]				
Maximum value.	20	20	20	%
Typical value.	15	15	15	%
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 & 0.2 μa. .	0.65	-	-	
Minimum Peak-to-Peak Blanking Voltage:				
Applied to grid-No.1. .	75	-	-	volts
Applied to cathode. . .	20	-	-	volts
Limiting Resolution at picture center.	600	700	750	TV lines
Amplitude Response to a 400 TV Line Square Wave Test Pattern at picture center.	20	25	30	%
Field Strength of Adjustable Alignment Coil[k]	0 to 1	0 to 1	0 to 1	gauss

World Radio History

Average-Sensitivity Operation

Under typical operating conditions specified for either low- or high-voltage operation

Faceplate Illumination (Highlight)	1	fc
Target Voltage[m,n]	20 to 40	volts
Dark Current[p]	0.02	μa
Signal-Output Current[q]	0.2	μa

High-Sensitivity Operation

Under typical operating conditions specified for either low- or high-voltage operation[r]

Faceplate Illumination (Highlight)	0.1	fc
Target Voltage[m,n]	30 to 60	volts
Dark Current[p]	0.10	μa
Signal-Output Current[q]	0.10	μa

[a] The precision outer-diameter bulb permits the use of low-power, close-fitting deflecting yokes of small size and low impedance.

[b] This capacitance, which effectively is the output impedance of the 8567 is increased when the tube is mounted in the deflecting-yoke assembly. The resistive component of the output impedance is in order of 100 megohms.

[c] Proper orientation of quality rectangle is obtained when the horizontal scan is essentially parallel to the straight sides of the masked portions of the faceplate. The straight sides are parallel to the plane passing through the tube axis and short pin.

[d] Cleveland Electronics Incorporated, 1974 East 61st Street, Cleveland Ohio. This component is not designed to withstand severe environmental conditions. It is recommended that custom components be used in such service.

[e] Cinch Manufacturing Corporation, 1026 South Homan Avenue, Chicago 24, Illinois.

[f] The maximum voltage difference between grids No. 6 & 3 and No. 5 should not exceed 500 volts.

[g] Video amplifiers must be designed properly to handle peak target currents of this magnitude to avoid amplifier overload or picture distortion.

[h] With no blanking voltage on grid No. 1.

[j] Defined as the per cent of initial value of signal-output current 1/20 second after illumination is removed. Values shown are for initial signal-output current of 0.2 microampere and a dark current of 0.02 microampere.

[k] The alignment coil should be located on the tube so that its center is at a distance of 4-15/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube and the deflecting yoke.

[m] Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

[n] The target voltage for each 8567 must be adjusted to that value which gives the desired operating dark current.

[p] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

[q] Defined as the component of the highlight target current after the dark-current component has been subtracted.

[r] Operation at this higher sensitivity level will result in a decrease in the resolution capability of the 8567.

ENVIRONMENTAL TESTS

The 8567 is designed to withstand the following operational and non-operational environmental tests.

World Radio History

OPERATIONAL TESTS

Rejection Criteria

Tubes are operated as specified under *Typical Operation, Low-Voltage Operation*. Throughout these tests, the amplitude of any generated spurious signals must not exceed 80 per cent of the maximum white-signal value and the tube must provide a resolution of at least 200 TV lines.

Sinusoidal Vibration

These tests are performed on apparatus which applies variable-sinusoidal frequency vibration to the tube. The tube is vibrated in each of three orthogonal axes, one axis being parallel to the major axis of the tube, according to the schedule specified below. A vibration cycle has a duration of 4.5 minutes per axis in which time the frequency is varied from 20 to 1000 and back to 20 cycles per second. One vibration cycle is performed for each axis and the total test period is 13.5 minutes.

Double Amplitude inches	Peak Acceleration g's	Sweep Frequencies cps	Sweep Cycle Duration per Axis minutes
0.250	-	20 to 40	4.5
-	20	40 to 400	
-	Decreased linearly from 20 to 3	400 to 1000	
-	Increased linearly from 3 to 20	1000 to 400	
-	20	400 to 40	
0.250	-	40 to 20	

Random Vibration

The 8567 is also subjected to random vibration having a spectral density of 0.1 g^2/cps in a bandwidth of 20 to 1000 cycles per second (10 g's — rms value) for a period of 3 minutes in each of the three orthogonal axes specified above. The total test period for each tube is 9 minutes.

NON-OPERATIONAL TESTS

Rejection Criteria

After completion of these tests, tubes will meet the performance characteristics specified under *Typical Operation*.

Shock

These tests are performed on apparatus which provides half-wave sinusoidal shock pulses. The 8567 is subjected to three impact shocks in each direction of the three orthogonal axes specified above. The peak acceleration of the impact shock is 30 g's and the time duration is 11 milliseconds. Each tube is subjected to a total of 18 impact shocks.

World Radio History

Sinusoidal Vibration

These tests are performed on apparatus which applies variable sinusoidal frequency vibration to the tube. The tube is vibrated in each of the three orthogonal axes previously specified. A vibration cycle has a duration of 30 minutes per axis in which time the frequency is varied from 5 to 2000 and back to 5 cycles per second. One vibration cycle is performed for each axis and the total test period is 90 minutes.

Double Amplitude inches	Peak Acceleration g's	Sweep Frequencies cps	Sweep Cycle Duration per Axis minutes
0.250	–	5 to 20	30
–	5	20 to 2000	
–	5	2000 to 20	
0.250	–	20 to 5	

Random Vibration

The 8567 is also subjected to random vibration having a spectral density of 0.05 g^2/cps in a bandwidth of 20 to 2000 cycles per second (10 g's — rms value) for a period of 10 minutes in each of the three orthogonal axes specified above. The total test period for each tube is 30 minutes.

Acoustical Noise

The 8567 is subjected to an overall external noise of 140 db for a period of 5 minutes.

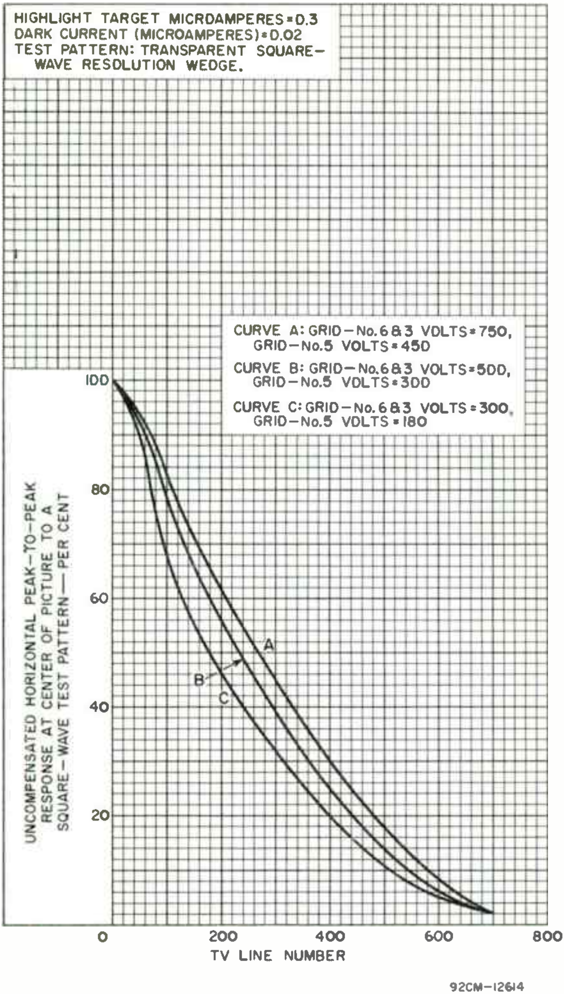
Static Acceleration

The 8567 is subjected to a static acceleration of 20 g's in each of the three orthogonal axes specified above for a period of 5 minutes. The total test period for each tube is 15 minutes.

**DIMENSIONAL OUTLINE,
RECOMMENDED LOCATION OF DEFLECTING YOKE AND ALIGNMENT COIL,
DARK-CURRENT RANGE,
TYPICAL LIGHT-TRANSFER CHARACTERISTICS,
TYPICAL SPECTRAL-SENSITIVITY CHARACTERISTIC,
TYPICAL PERSISTENCE CHARACTERISTICS,
and
TYPICAL HORIZONTAL-DEFLECTION-CURRENT-CHARACTERISTIC
shown under Type 8134 also apply to the 8567**

World Radio History

UNCOMPENSATED HORIZONTAL SQUARE-WAVE RESPONSE



RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

World Radio History

Photomultiplier Tube[a]

S-4 RESPONSE

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

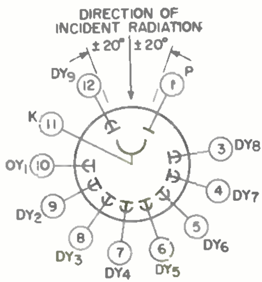
TESTED FOR SHOCK, VIBRATION, CONSTANT ACCELERATION, AND TEMPERATURE CYCLING

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

World Radio History

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, Perfection 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.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

World Radio History

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.

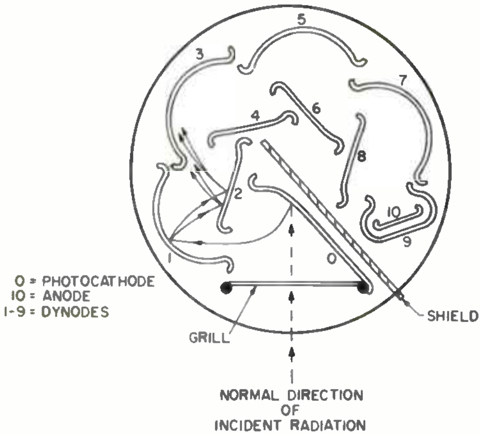
Double Amplitude inches	Accelera-tion g's	Fre-quency c/s	Total Sweep Duration Per Axis minutes
0.45	-	5-30	30
-	20	30-2000	
-	20	2000-30	
0.45	-	30-5	

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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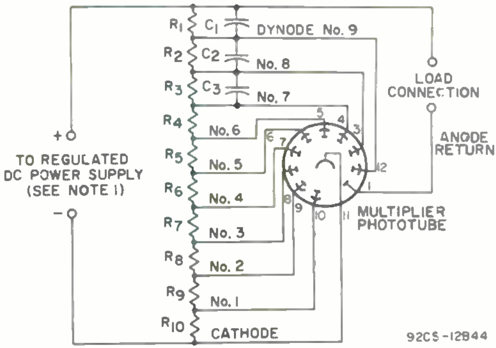
TYPICAL VOLTAGE-DIVIDER ARRANGEMENT

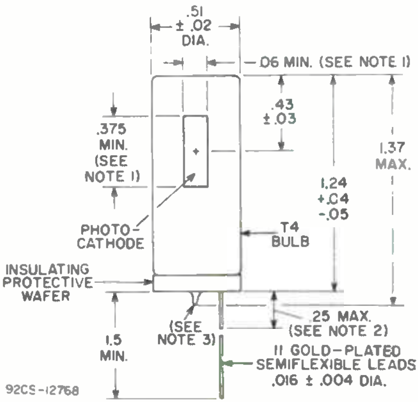


R_1 through R_{10} = 20,000 to 5,000,000 ohms.

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



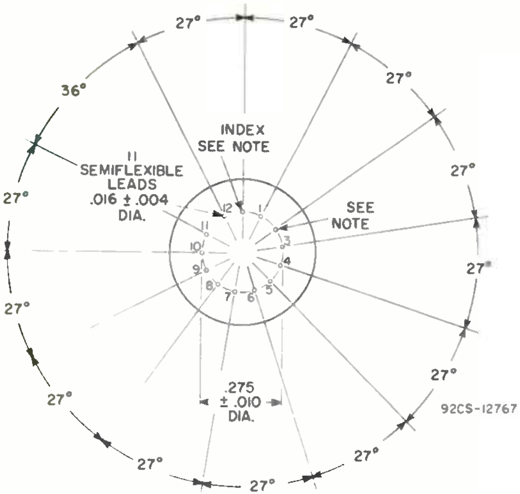
DIMENSIONS IN INCHES

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.

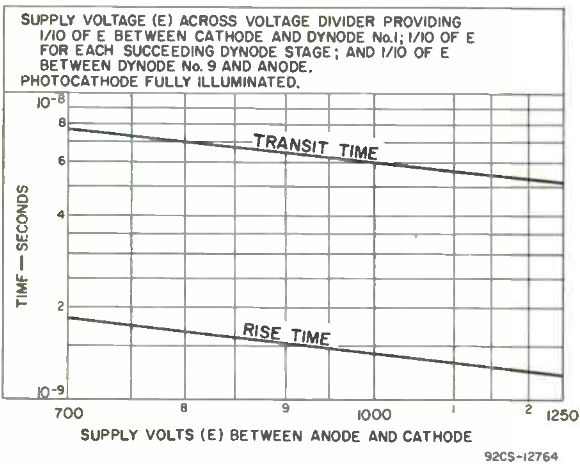
NOTE 3: A 0.15 inch minimum hole diameter should be provided in circuit boards or similar mounting arrangements to allow for clearance of the exhaust tip of the 8571.

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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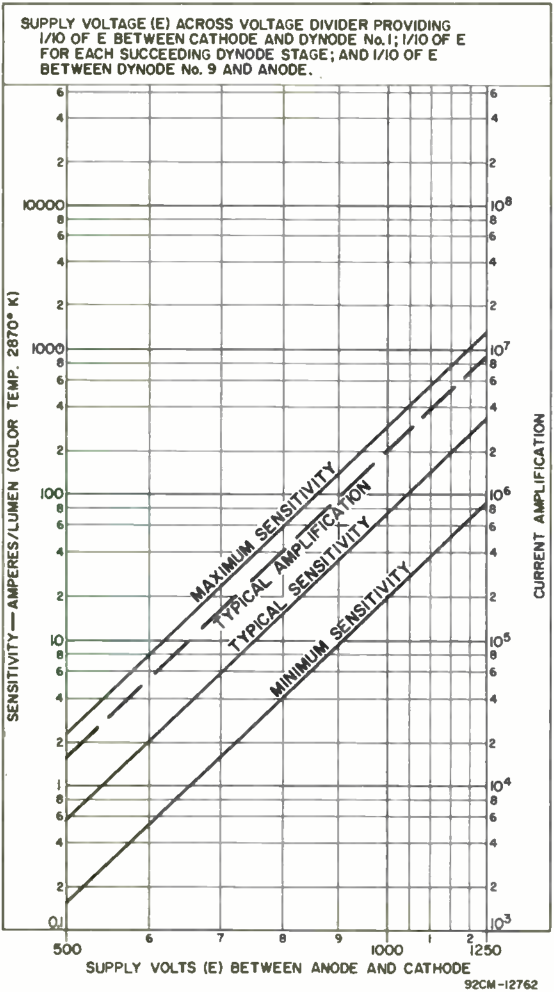
Average Anode Characteristics

Typical Sensitivity and Current Amplification Characteristics



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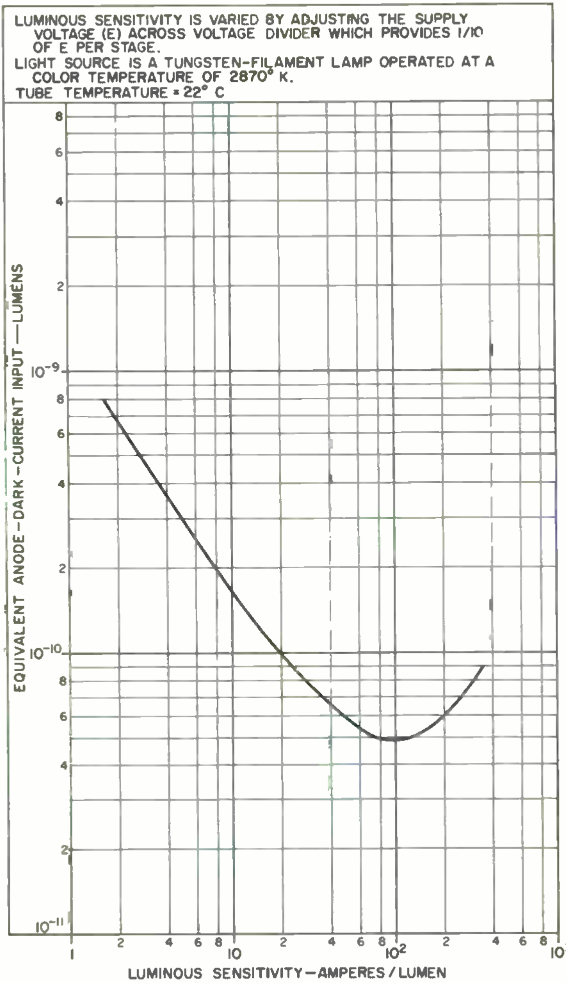
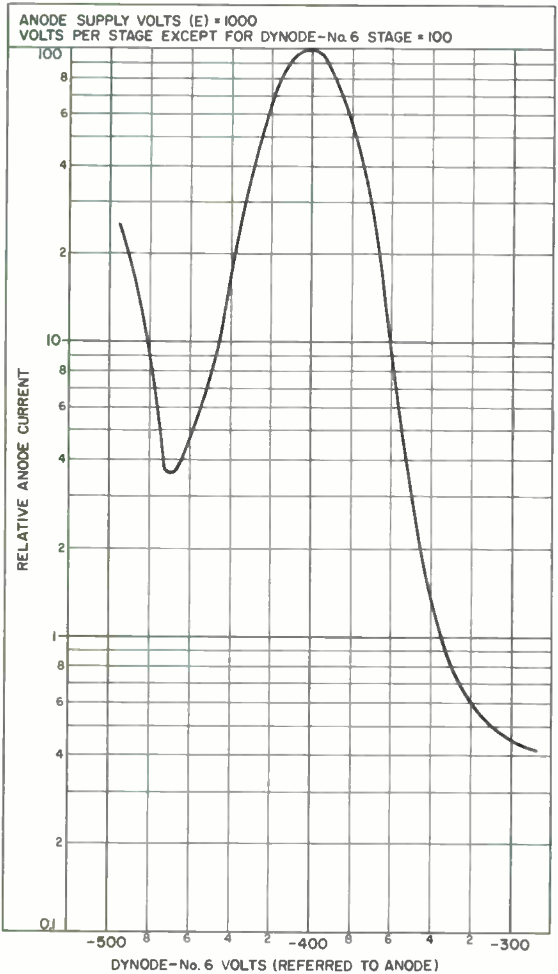
Typical Anode-Dark-Current Characteristic



World Radio History

Typical Anode Current Modulation Characteristic



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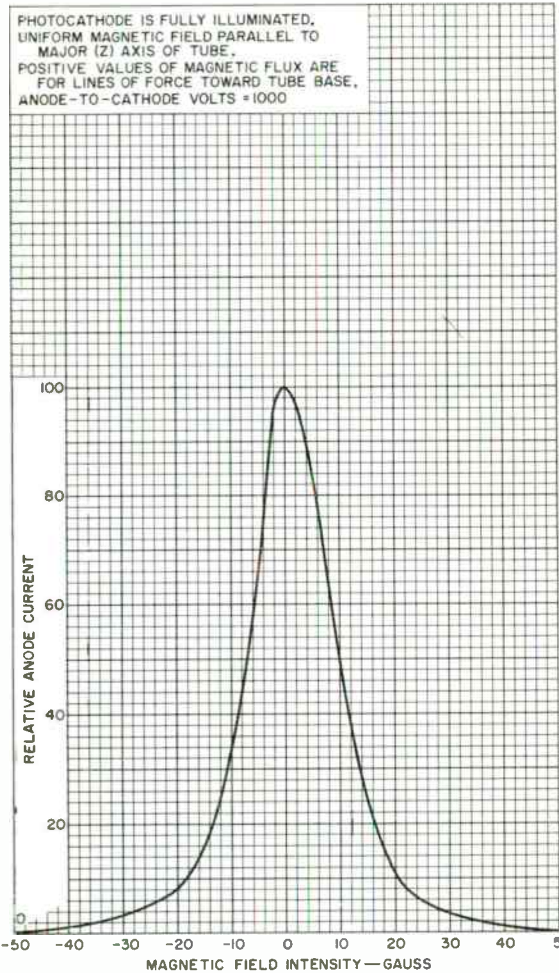
world radio history

Typical Effect of Magnetic Field on Anode Current



92CM-13015

World Radio History

Vidicon

MAGNETIC FOCUS   1" - DIAMETER   MAGNETIC DEFLECTION

For High-Resolution Film Pickup with Black-and-White or Color Cameras. Grid No.3 and Grid No.4 Have Separate Base Terminals.

General:

Heater, for Unipotential Cathode:

Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp

Direct Interelectrode Capacitance:[a]

Target to all other electrodes	4.6	pf

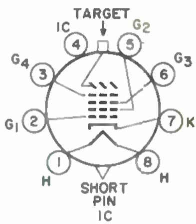
Spectral Response . . . . . See accompanying *Typical Spectral Sensitivity Characteristic Curves*

Photoconductive Layer:

Maximum useful diagonal of rectangular image (4 x 3 aspect ratio)[b] . . . 0.62"

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	6.250" ± 0.125"
Greatest Diameter	1.125" ± 0.010"
Operating Position	Any
Weight (Approx.)	2 oz
Bulb	T8
Focusing Coil	Cleveland Electronics[c,d] No.VF-115-12, or equivalent
Deflecting Yoke	Cleveland Electronics[c,d] No.VY-111-3, or equivalent
Alignment Coil	Cleveland Electronics[c,d] No.VA-118, or equivalent
Socket	Cinch[e] No.54A18088, or equivalent
Base	Small-Button Ditetrar 8-Pin, (JEDEC No.E8-11)
Basing Designation for BOTTOM VIEW	8ME

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.4
Pin 4 - Do Not Use
Pin 5 - Grid No.2
Pin 6 - Grid No.3
Pin 7 - Cathode
Pin 8 - Heater
Flange - Target
Short Pin - Do Not Use



Maximum Ratings, *Absolute-Maximum Values:*

For scanned area of 1/2" x 3/8"

Grid-No.4 Voltage	1000	volts
Grid-No.3 Voltage	1000	volts
Grid-No.2 Voltage	750	volts

World Radio History

Grid-No.1 Voltage:		
Negative bias value	300	volts
Positive bias value	0	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	125	volts
Heater positive with respect to cathode	10	volts
Target Voltage	125	volts
Dark Current	0.25	μa
Peak Target Current[f]	0.55	μa
Faceplate:		
Illumination	1000	fc
Temperature	71	°C

Typical Operation and Performance Data:

For scanned area of 1/2" x 3/8" and faceplate temperature of 30° to 35° C

	Low-Voltage	High-Voltage	
Grid-No.4 (Decelerator) Voltage	500	750	volts
Grid-No.3 (Beam-Focus Electrode) Voltage[g]	300[h]	450[h]	volts
Grid-No.2 (Accelerator) Voltage	300	300	volts
Grid-No.1 Voltage for Picture Cutoff[j]	-45 to -100	-45 to -100	volts
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μa and 0.2 μa	0.65	0.65	
Visual Equivalent Signal-to-Noise Ratio (Approx.)[k]	300:1	300:1	
Lag[m]-Typical Value for minimum lag operation	7.5	7.5	%
Minimum Peak-to-Peak Blanking Voltage:			
When applied to grid No.1	75	75	volts
When applied to cathode	20	20	volts
Limiting Resolution:			
At center of picture	900	1000	TV lines
At corner of picture	600	700	TV lines
Field Strength at Center of Focusing Coil[g]	41 ± 4	52 ± 4	gauss
Amplitude Response to a 400 TV Line Square-Wave Test Pattern at Center of Picture	35	45	%
Peak Deflecting-Coil Current:			
Horizontal	180	220	ma
Vertical	33	40	ma
Field Strength of Adjustable Alignment Coil[n]	0 to 4	0 to 4	gauss

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World Radio History

Average-Sensitivity Operation for Live-Scene Pickup
10 Footcandles on Faceplate

Faceplate Illumination (Highlight)	10	fc
Target Voltage[p,q]	25 to 60	volts
Dark Current[r]	0.02	μa
Signal-Output Current[s] (Typical)	0.3	μa

Minimum-Lag Operation for Film Pickup
100 Footcandles on Faceplate

Faceplate Illumination (Highlight)	100	fc
Target Voltage[p,q]	12 to 30	volts
Dark Current[r]	0.004	μa
Signal-Output Current[s] (Typical)	0.3	μa

[a] This capacitance, which effectively is the output impedance of the 8572 is increased when the tube is mounted in the deflecting-yoke and focus-ing-alignment assembly. The resistive component of the output impedance is in the order of 100 megohms.

[b] Proper orientation of quality rectangle is obtained when the horizontal scan is essentially parallel to the plane passing through the axis and short pin. The masking is for orientation only and does not define the proper scanned area of photoconductive layer. Final orientation should be such that the image also fit inside of any internal mask of the mesh assembly.

[c] Cleveland Electronics Inc., 1974 East 61st St., Cleveland, Ohio.

[d] These components are chosen to provide tube operation with minimum beam-landing error when mounted in the recommended position along the tube axis.

[e] Cinch Manufacturing Corporation, 1025 S. Homan Avenue, Chicago 24, Illinois.

[f] Video amplifiers must be designed to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

[g] Beam focus is usually attained by varying the focus-coil current to obtain a field-strength value within the range shown under *Typical Operation and Performance Data*. If the field-strength of the focus coil is fixed, beam focus is obtained within a ± 10 per cent range of the grid-No.4 and grid-No.3 voltages. However, the recommended ratio of 0.6 between grid No.3 and grid No.4 must be maintained as these voltages are varied.

[h] In general, grid No.3 should be operated above 250 volts and be 0.6 of grid-No.4 voltage.

[j] With no blanking voltage on grid No.1.

[k] Measured with high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc and a peak signal-output current of 0.35 microampere. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of the highlight video-signal current to rms noise current, multiplied by a factor of 3.

[m] Defined as the per cent of initial value of signal-output current 1/20 second after illumination is removed. Values shown are for initial signal-output current of 0.3 microampere and a dark current of 0.004 microampere.

[n] The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

[p] The target voltage for each 8572 must be adjusted to that value which gives the desired operating dark current.

[q] Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

[r] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

[s] Defined as the component of the highlight target current after the dark-current component has been subtracted.

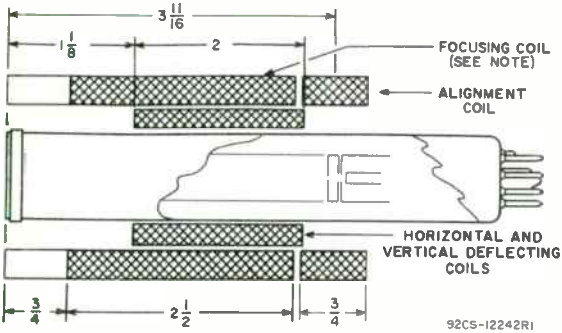
World Radio History

OPERATING CONSIDERATIONS

The *target connection* is made by a suitable spring contact bearing against the edge of the metal ring at the face end of the tube. This spring contact may conveniently be provided as part of the focusing-coil design.

COMPONENT LOCATIONS

Recommended Location and Length of Deflecting, Focusing, and Alignment Components to obtain Minimum Beam-Landing Error



DIMENSIONS IN INCHES

Note: Cross-hatching indicates wound portion of focusing coil.

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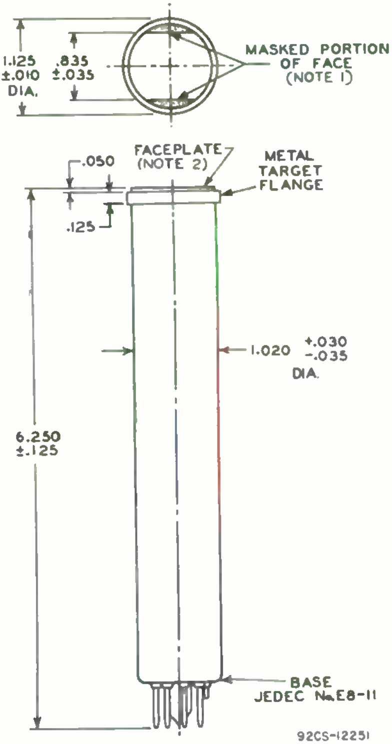
World Radio History

DIMENSIONAL OUTLINE



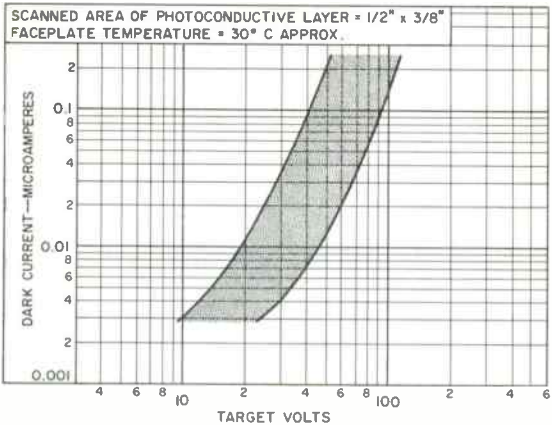
DIMENSIONS IN INCHES

Note 1: Straight sides of masked portions are parallel to the plane passing through tube axis and short index pin.

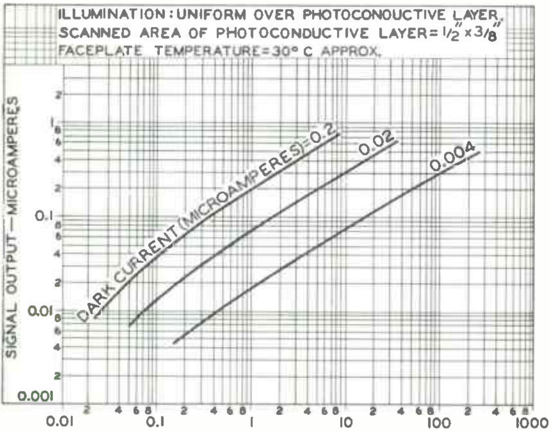
Note 2: Faceplate thickness is 0.094" ± 0.012".

World Radio History

RANGE OF DARK CURRENT

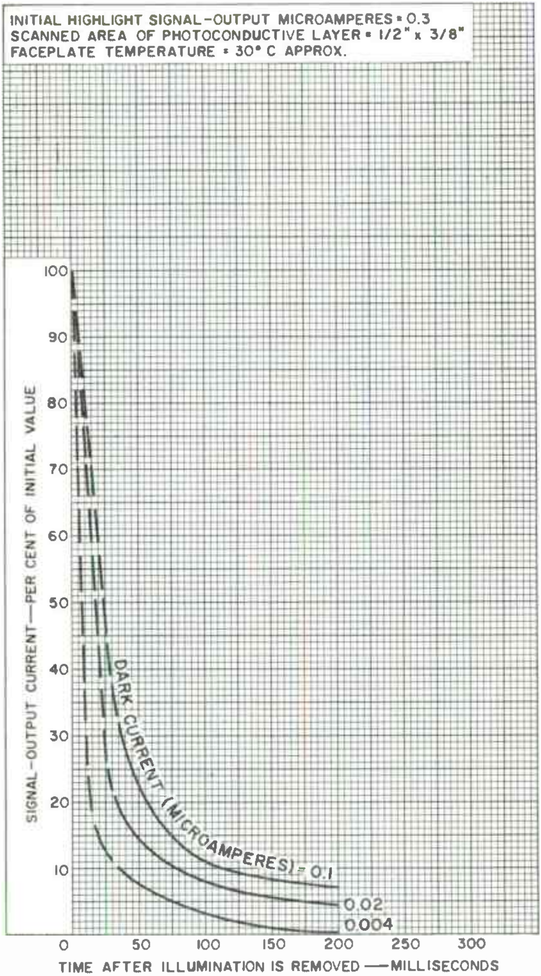


LIGHT TRANSFER CHARACTERISTICS



World Radio History

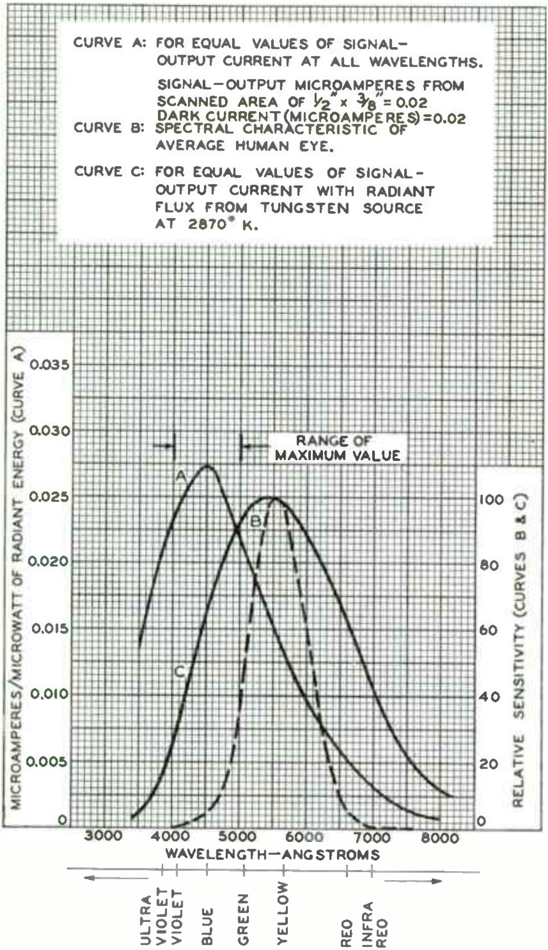
TYPICAL PERSISTENCE CHARACTERISTICS



92CM-12580

World Radio History

TYPICAL SPECTRAL SENSITIVITY CHARACTERISTIC



92CM-7783R2

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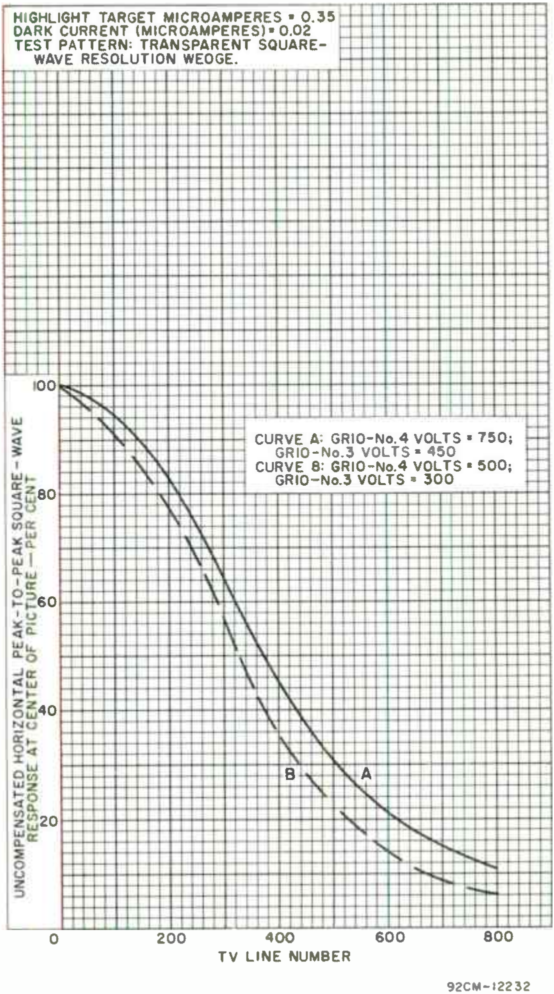
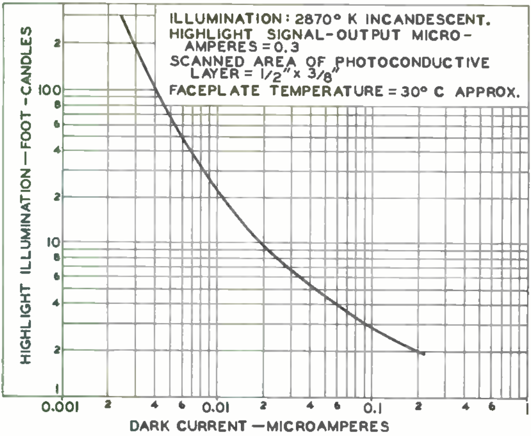
World Radio History

UNCOMPENSATED HORIZONTAL SQUARE-WAVE RESPONSE



TYPICAL CHARACTERISTIC



92CS-9493

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World Radio History

Vidicon

LOW-POWER (0.6-WATT) "DARK HEATER" MAGNETIC FOCUS — 1"-DIAMETER MAGNETIC DEFLECTION

For Live-Scene Pickup in Industrial Closed-Circuit TV in Compact Transistorized Black-and-White or Color Cameras. Features High Resolution with High Sensitivity and Low Lag. Grid No.3 and Grid No.4 Have Separate Base Terminals.

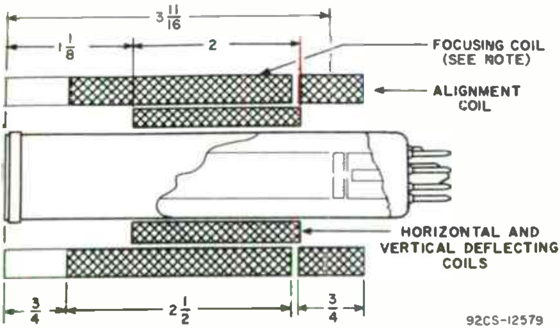
The 8573 is the same as the 8507 except for the following:

General:

Heater, for Unipotential Cathode:		
Current at 6.3 volts.	0.095	amp
Overall Length.	5.12" ± 0.06"	

RECOMMENDED LOCATION AND LENGTH OF DEFLECTING, FOCUSING, AND ALIGNMENT COMPONENTS

For Minimum Beam-Landing Error

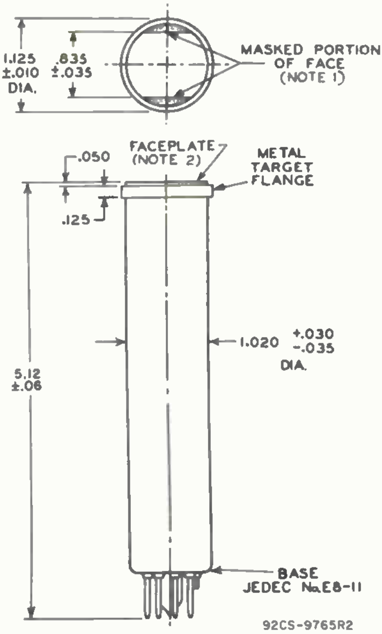


DIMENSIONS IN INCHES

Note: Cross-hatching indicates wound portion of focusing coil.

World Radio History

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Note 1: Straight sides of masked portions are parallel to the plane passing through tube axis and short index pin.

Note 2: Faceplate thickness is 0.094" ± 0.012".

World Radio History

Photomultiplier Tube

12-STAGE, HEAD-ON TYPE

BIALKALI PHOTOCATHODE OF HIGH QUANTUM EFFICIENCY
IN-LINE ELECTROSTATICALLY-FOCUSED DYNODE STRUCTURE

For use in pulse counting applications such as counting of low-activity radioactive materials releasing low-energy particles when used in conjunction with suitable scintillators.

GENERAL

Spectral Response	See accompanying *Spectral Response Characteristics*
Wavelength of Maximum Response	3850 ± 500 angstroms
Cathode, Semitransparent	Cs-K Antimonide (Bialkali)
Shape	Spherical Section
Minimum projected area	2.54 sq in
Minimum diameter	1.80 in
Window	Pyrex, Corning[a] No.7740, or equivalent
Shape	Plano-Concave
Index of refraction at 5893 angstroms	1.47
Dynodes	
Substrate	Copper-Beryllium
Secondary-emitting surface	Beryllium-Oxide
Structure	In-Line Electrostatic-Focus Type
Direct Interelectrode Capacitances (Approx.)	
Anode to dynode No.12	5 pF
Anode to all other electrodes	6 pF
Maximum Overall Length	5.71 in
Seated Length	4.98 ± 0.08 in
Maximum Diameter	2.10 in
Operating Position	Any
Weight (Approx.)	6 oz
Bulb	T16
Socket	RCA Part No.DP2118[b] or No.DP2124[b]
Magnetic Shield	See *footnote (c)*

MAXIMUM AND MINIMUM RATINGS, ABSOLUTE-MAXIMUM VALUES

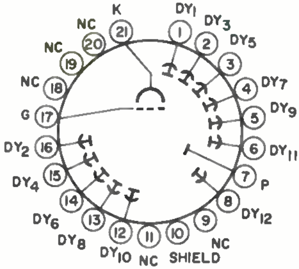
DC Supply Voltage		
Between anode and cathode:		
With *Voltage Distribution I* shown in Table I	3000 max 800 min	V V
With *Voltage Distribution II* shown in Table I	3500 max 800 min	V V
Between anode and dynode No.12	800 max	V
Between dynode No.12 and dynode No.11	800 max	V
Between consecutive dynodes	400 max	V
Between dynode No.1 and cathode	800 max 300 min	V V
Between focusing electrode and cathode	800 max	V
Average Anode Current[d]	0.2 max	mA
Ambient-Temperature Range[e]	-100 to +85	°C

World Radio History

BASING DIAGRAM

Basing Designation for Bottom View. 21B

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 - Dynode No.11
Pin 7 - Anode
Pin 8 - Dynode No.12
Pin 9 - Do Not Use
Pin 10 - Electron Multiplier Shield
Pin 11 - Do Not Use
Pin 12 - Dynode No.10
Pin 13 - Dynode No.8
Pin 14 - Dynode No.6
Pin 15 - Dynode No.4
Pin 16 - Dynode No.2
Pin 17 - Focusing Electrode
Pin 18 - Do Not Use
Pin 19 - Do Not Use
Pin 20 - Do Not Use
Pin 21 - Photocathode



21B
DIRECTION OF RADIATION:
INTO END OF BULB

CHARACTERISTICS RANGE VALUES

Under conditions with dc supply voltage (E) across a voltage divider providing electrode voltages shown in Table I.

With E = 1100 V (Except as noted)

Voltage Distribution I of Table I

	Min	Typ	Max	
Sensitivity				
Radiant, at 3850 angstroms. .	-	880	-	A/W
Cathode radiant, at 3850 angstroms.	-	0.088	-	A/W
Luminous[f]	-	0.8	-	A/lm
Cathode luminous:				
With tungsten light source[g]	-	7.7×10^{-5}	-	A/lm
With blue light source[h] . .	8×10^{-10}	10×10^{-10}	-	A
Cathode quantum efficiency at 3850 angstroms	-	28	-	%
Current Amplification	-	1×10^4	-	
Anode Dark Current[j]	-	1×10^{-9}	4×10^{-9}	A
Equivalent Anode-Dark-Current Input.	-	5×10^{-12}[k]	-	lm
	-	4.4×10^{-15}[m]	-	W
Pulse Height[n,p]	-	0.15	-	V
Pulse Height Resolution[p]. . . .	-	7.5	8.0	%
Dark Noise Spectrum[q].	-	z	-	
Pulse Height Spectrum with Fe^{55} Source[r].	-	aa	-	
Mean Gain Deviation[s]				
With count rate change of 10,000 to 1,000 c/s[t]. . . .	-	1	-	%
For a period of 16 hours at a count rate of 1,000 c/s[u]. .	-	1	-	%

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With E = 2000 V (Except as noted)

Voltage Distribution I of Table I

	Min	Typ	Max	
Sensitivity				
Radiant, at 3850 angstroms . .	-	3.5×10^{5}	-	A/W
Cathode radiant, at 3850 angstroms.	-	0.088	-	A/W
Luminous[f]	100	300	3000	A/lm
Cathode luminous:				
With tungsten light source[g]	-	7.7×10^{-5}	-	A/lm
With blue light source[h] . .	$.8\times10^{-10}$	10×10^{-10}	-	A
Cathode quantum efficiency at 3850 angstroms	-	28	-	%
Current Amplification	-	4×10^{6}	-	
Anode Dark Current[j]	-	1×10^{-9}	4×10^{-9}	A
Equivalent Anode-Dark-Current Input.	-	5×10^{-12}[k]	-	lm
	-	4.4×10^{-15}[m]	-	W
Anode-Pulse Rise Time[v].	-	2.7×10^{-9}	-	s
Electron Transit Time[w].	-	3.7×10^{-8}	-	s

With E = 2500 V (Except as noted)

Voltage Distribution I of Table I

	Min	Typ	Max	
Sensitivity				
Radiant, at 3850 angstroms. .	-	3.2×10^{6}	-	A/W
Cathode radiant, at 3850 angstroms.	-	0.088	-	A/W
Luminous[f]	-	2.8×10^{3}	-	A/lm
Cathode luminous:				
With tungsten light source[g]	-	7.7×10^{-5}	-	A/lm
With blue light source[h] . .	$.8\times10^{-10}$	10×10^{-10}	-	A
Cathode quantum efficiency at 3850 angstroms	-	28	-	%
Current Amplification	-	3.6×10^{7}	-	
Anode Dark Current[j]	-	1×10^{-9}	4×10^{-9}	A
Equivalent Anode-Dark-Current Input.	-	5×10^{-12}[k]	-	lm
	-	4.4×10^{-15}[m]	-	W
Anode-Pulse Rise Time[v].	-	2.3×10^{-9}	-	s
Electron Transit Time[w].	-	3.3×10^{-8}	-	s

With E = 3000 V

Voltage Distribution II of Table I

	Min	Typ	Max	
Pulse Current				
Space-charge limited (Saturated)[x].	-	0.75	-	A
Linear[y]	-	0.25	-	A

World Radio History

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

b A socket is supplied with each 8575. The DP2118 is a molded teflon socket while the DP2124 is a printed-circuit board socket on a teflon base material. Additional sockets may be obtained from RCA, Photomultiplier Marketing, Lancaster, Pa.

c Magnetic shielding in the form of foil or tape as available from the Magnetic Shield Division, Perfection Mica Company, 1322 North Elston, Chicago 24, Illinois, or equivalent. The shielding must be operated at cathode potential and be insulated from the tube envelope by material such as Scotch Electrical, Type 33, manufactured by Minnesota Mining and Manufacturing Company, St. Paul 6, Minnesota, or equivalent.

d Averaged over any interval of 30 seconds maximum.

e Tube operation at room temperature or below is recommended.

f 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 0.1 microlumen is used.

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 100 microlumens and 500 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, 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 100 microlumens and 500 volts are applied between cathode and all other electrodes connected as anode.

j At a tube temperature of 22° C. Light incident on the cathode is transmitted through a blue filter (Corning C.S. No.5-58, polished to one-half stock thickness). The light flux incident on the filter is 0.1 microlumen. The supply voltage E is adjusted to obtain an anode current of 2.6 microamperes. Sensitivity of the 8575 under these conditions is approximately equivalent to 200 amperes per lumen. Dark current is measured with light source removed.

k With supply voltage E adjusted to give an equivalent luminous sensitivity of 200 amperes per lumen.

m At 3850 angstroms.

n Pulse height is defined as the amplitude of the anode pulse voltage (referred to anode) measured across a 100 kilohm resistor and a total capacitance of 100 ± 3% pF in parallel. Under pulse conditions, the interstage voltages of the 8575 should not deviate more than 2% from the interstage voltage values during no-signal conditions. The 662 keV photon from an isotope of cesium having an atomic mass of 137 (Cs^{137}) and a cylindrical 2" x 2" thallium-activated sodium-iodide scintillator [NaI(Tl)-type 3D8S50, Serial No.AJ651, or equivalent] are used. This scintillator is manufactured by the Harshaw Chemical Corporation, 1945 East 97th Street, Cleveland 6, Ohio, and is rated by the manufacturer as having a resolving capability of 8.2 per cent to 8.3 per cent. The Cs^{137} source is in direct contact with the metal end of the scintillator. The faceplate end of the crystal is coupled to the 8575 by a coupling fluid such as Dow Corning Corp. Type DC200 (Viscosity of 60,000 centistokes) - manufactured by the Dow Corning Corp., Midland, Michigan, or equivalent.

p Pulse height resolution is defined as the quotient of the full width of the photopeak at half height by the pulse height at maximum count rate under the conditions of (n).

q Measured under the following conditions: The light source is a tungsten-filament lamp having a lime-glass envelope. It is operated at a low color temperature to assure the high probability of single photoelectron emission from the photocathode of the 8575. The intensity of the light source is adjusted for approximately 50 per cent counting loss. A Nuclear Data Model No.ND-130A Multichannel Pulse-Height Analyzer is used to measure photoelectron pulse height.

r Measured using a Harshaw Type HG 0.005" beryllium window NaI(Tl) scintillator, 0.04" thick and 7/8" in diameter and an isotope of iron having an atomic mass of 55 (Fe^{55}) and an activity rate of one microcurie.

s Mean gain deviation is defined as the percentage change, regardless of sign, from the average pulse height for a given radiation source and scintillator over a specified time or count rate interval.

t Under the following conditions: The scintillator and Cs^{137} radiation source of (n) are employed. The radiation source is initially centered, on the major axis of the tube and the scintillator, at a point providing a pulse count rate of 10,000 c/s. The pulse height of the photopeak is measured under this condition. Next, the radiation source is

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moved rapidly, in approximately 30 seconds, to a new position that is equivalent to a count rate of 1,000 c/s. The new position is also centered in the major axis of the tube. The pulse height under this condition is measured. The difference in pulse height between these two measurements is typically 1 per cent.

u Under the same conditions as (t) except the count rate position of 1,000 c/s is maintained for 16 hours and the pulse height is sampled at 1 hour intervals.

v 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.

w 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.

x The interstage voltages of the 8575 do not deviate more than 2 per cent from the recommended voltage distribution shown by *Voltage Distribution I of Table I*. Capacitors are connected across the individual resistors making up the voltage-divider arrangement to insure the operating condition.

y Maximum deviation from linearity is 2 per cent.

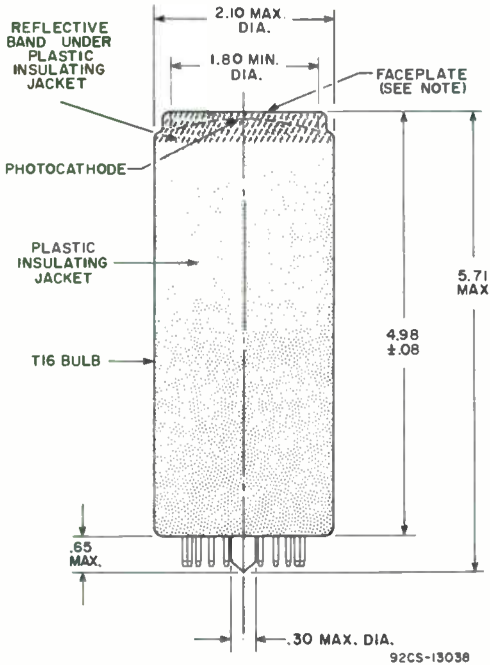
z See accompanying *Typical Noise Spectra*.

aa See accompanying *Differential Fe55 Spectrum*.

TABLE I

VOLTAGE TO BE PROVIDED BY DIVIDER		
Between	Distribution I 6.1% of Supply Voltage (E) multiplied by	Distribution II 4.6% of Supply Voltage (E) multiplied by
Cathode and Dynode No. 1	4.0	4.0
Dynode No. 1 and Dynode No. 2	1.0	1.0
Dynode No. 2 and Dynode No. 3	1.4	1.4
Dynode No. 3 and Dynode No. 4	1.0	1.0
Dynode No. 4 and Dynode No. 5	1.0	1.0
Dynode No. 5 and Dynode No. 6	1.0	1.0
Dynode No. 6 and Dynode No. 7	1.0	1.0
Dynode No. 7 and Dynode No. 8	1.0	1.0
Dynode No. 8 and Dynode No. 9	1.0	1.0
Dynode No. 9 and Dynode No. 10	1.0	1.5
Dynode No. 10 and Dynode No. 11	1.0	2.0
Dynode No. 11 and Dynode No. 12	1.0	4.0
Dynode No. 12 and Anode	1.0	2.0
Anode and Cathode	16.4	21.9
Focusing Electrode is connected to arm of potentiometer between cathode and dynode No. 1. The focusing-electrode voltage is varied to give maximum current amplification. Multiplier shield is operated at Dynode-No. 5 potential.		

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Note: Within 1.80" minimum diameter, deviation from flatness of external surface of faceplate will not exceed 0.010" from peak to valley.

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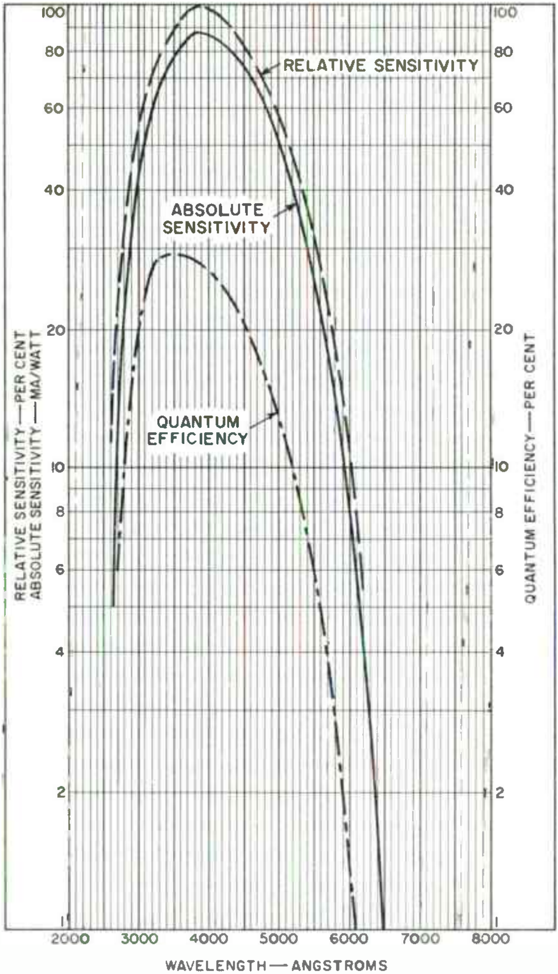
Spectral Response Characteristics

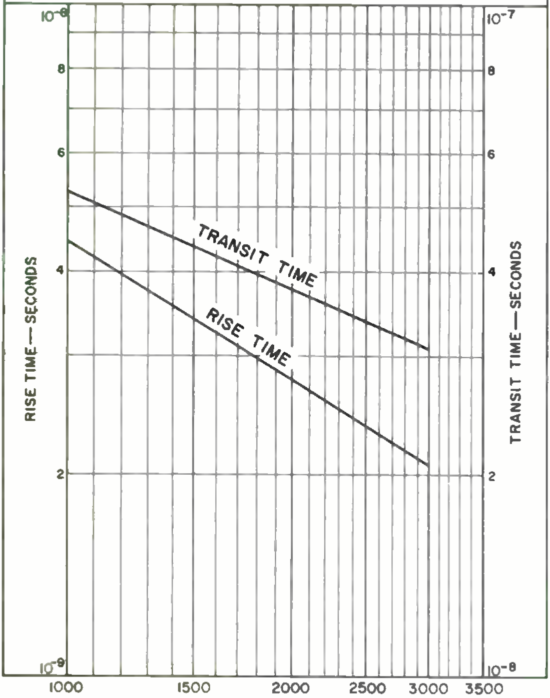


Typical Time-Resolution Characteristics

THE SUPPLY VOLTAGE (E) IS ACROSS A VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	6.1% OF E MULTIPLIED BY
CATHODE AND DYNODE No. 1	4.0
DYNODE No. 1 AND DYNODE No. 2	1.0
DYNODE No. 2 AND DYNODE No. 3	1.4
EACH SUCCEEDING DYNODE-STAGE VOLTS	1.0
ANODE AND CATHODE	16.4

FOCUSING ELECTRODE IS CONNECTED TO DYNODE-No. 1 POTENTIAL.
ELECTRON MULTIPLIER SHIELD IS CONNECTED TO DYNODE-No. 5 POTENTIAL.
PHOTOCATHODE IS FULLY ILLUMINATED.



SUPPLY VOLTS (E) BETWEEN ANODE AND CATHODE

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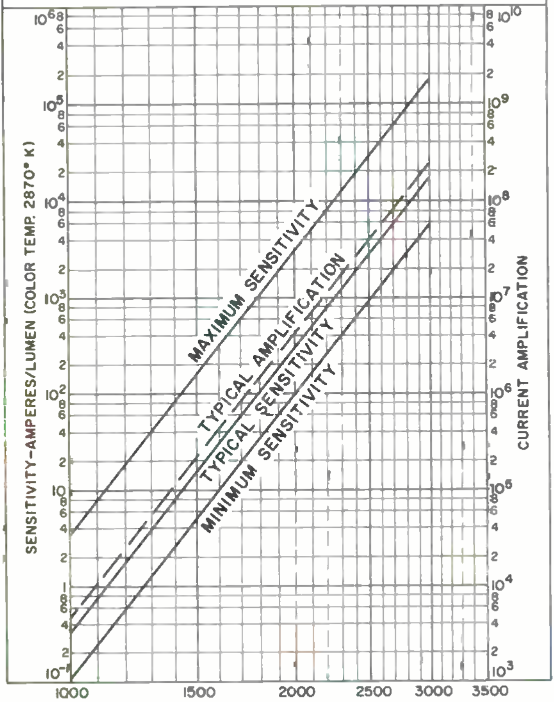
Typical Sensitivity and Current Amplificatian Characteristics

THE SUPPLY VOLTAGE (E) IS ACROSS A VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	6.1% OF E MULTIPLIED BY
CATHODE AND DYNODE No. 1	4.0
DYNODE No. 1 AND DYNODE No. 2	1.0
DYNODE No. 2 AND DYNODE No. 3	1.4
EACH SUCCEEDING DYNODE-STAGE VOLTS	1.0
ANODE AND CATHODE	16.4

FOCUSING ELECTRODE IS CONNECTED TO DYNODE-No. 1 POTENTIAL. ELECTRON MULTIPLIER SHIELD IS CONNECTED TO DYNODE-No. 5 POTENTIAL.



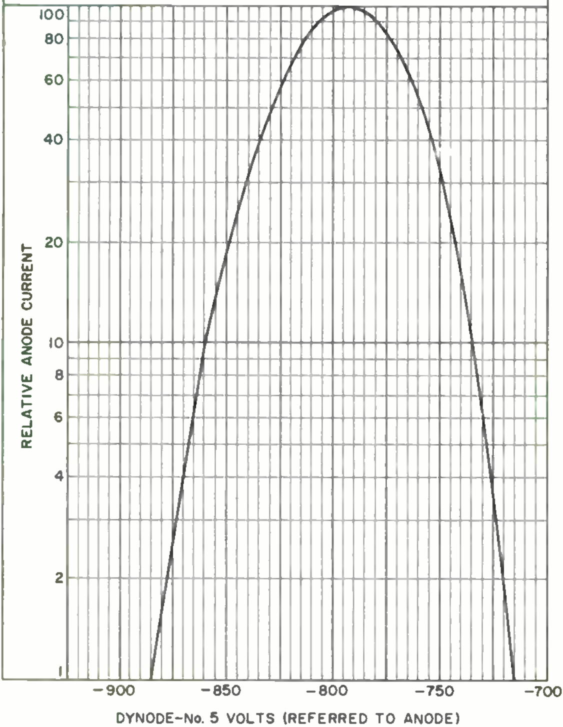
92CM-13043

Typical Dynode Modulation Characteristic

THE SUPPLY VOLTAGE (E) IS ACROSS A VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	6.1% OF E MULTIPLIED BY
CATHODE AND DYNODE No. 1	4.0
DYNODE No. 1 AND DYNODE No. 2	1.0
DYNODE No. 2 AND DYNODE No. 3	1.4
EACH SUCCEEDING DYNODE-STAGE VOLTS	1.0
ANODE AND CATHODE	16.4

FOCUSING ELECTRODE IS CONNECTED TO DYNODE-No. 1 POTENTIAL.
ELECTRON MULTIPLIER SHIELD IS CONNECTED TO DYNODE-No. 5 POTENTIAL.
CATHODE IS AT GROUND POTENTIAL.



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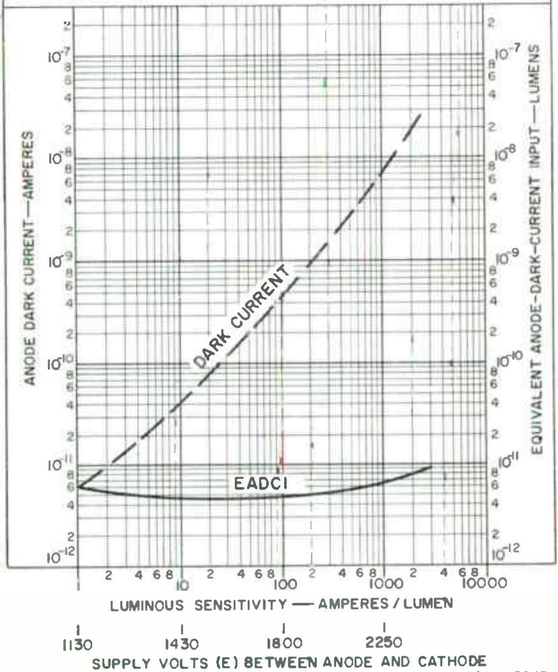
Typical Dark Current and EADCI Characteristics

LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS A VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	6.1% OF E MULTIPLIED BY
CATHODE AND DYNODE No. 1	4.0
DYNODE No. 1 AND DYNODE No. 2	1.0
DYNODE No. 2 AND DYNODE No. 3	1.4
EACH SUCCEEDING DYNODE-STAGE VOLTS	1.0
ANODE AND CATHODE	16.4

ELECTRON MULTIPLIER SHIELD IS CONNECTED TO DYNODE-No. 5 POTENTIAL.
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED FOR MAXIMUM CURRENT AMPLIFICATION.
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.
TUBE TEMPERATURE = 22° C



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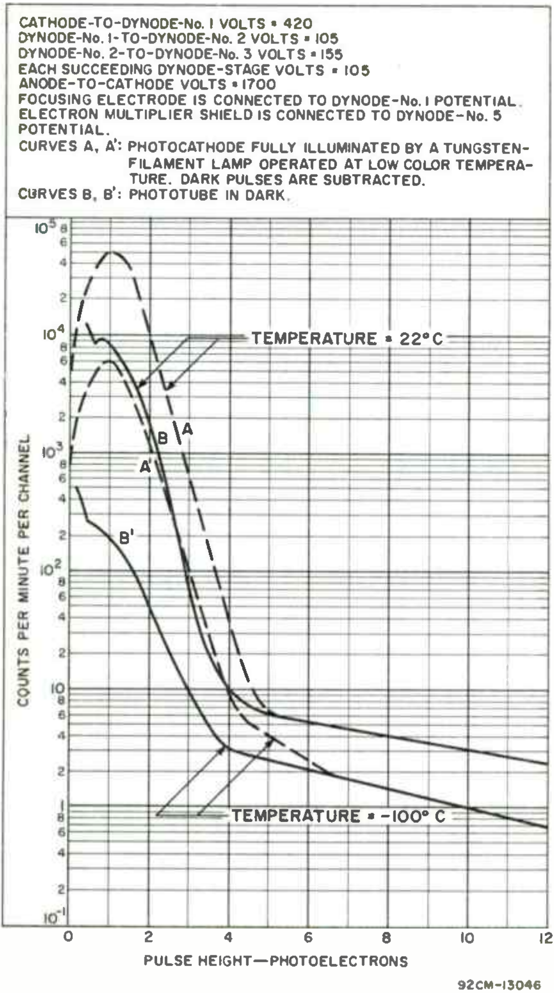
Typical Noise Spectra



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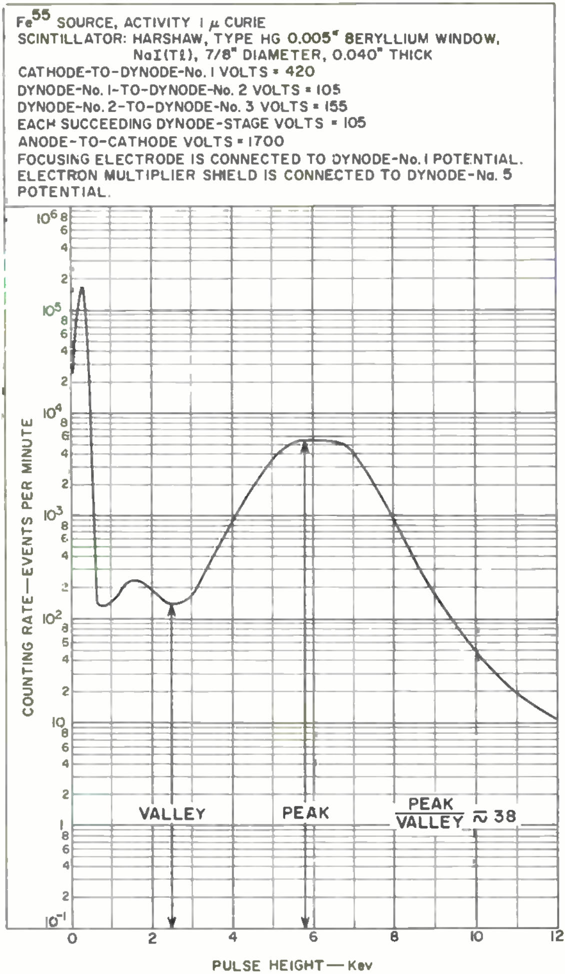
Differential Fe^{55} Spectrum



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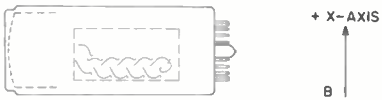
Typical Effect of Magnetic Field on Anode Current

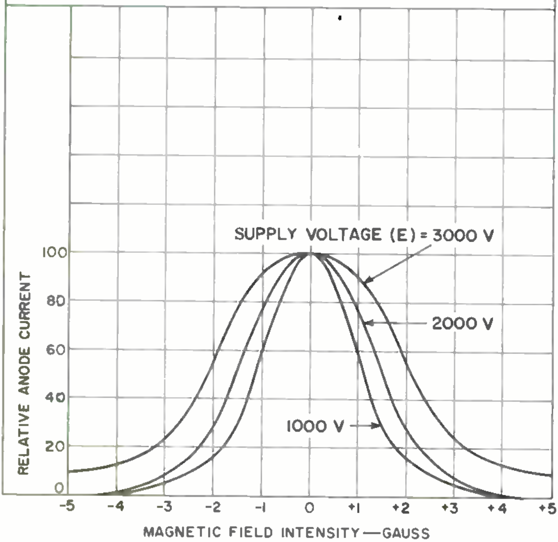
THE SUPPLY VOLTAGE (E) IS ACROSS A VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	6.1% OF E MULTIPLIED BY
CATHODE AND DYNODE No. 1	4.0
DYNODE No. 1 AND DYNODE No. 2	1.0
DYNODE No. 2 AND DYNODE No. 3	1.4
EACH SUCCEEDING DYNODE-STAGE VOLTS	1.0
ANODE AND CATHODE	16.4

FOCUSING ELECTRODE IS CONNECTED TO DYNODE-No. 1 POTENTIAL.
ELECTRON MULTIPLIER SHIELD IS CONNECTED TO DYNODE-No. 5 POTENTIAL.
PHOTOCATHODE IS FULLY ILLUMINATED.



POSITIVE VALUES OF MAGNETIC FLUX (B) ARE FOR LINES OF FORCE IN INDICATED DIRECTION.



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World Radio History

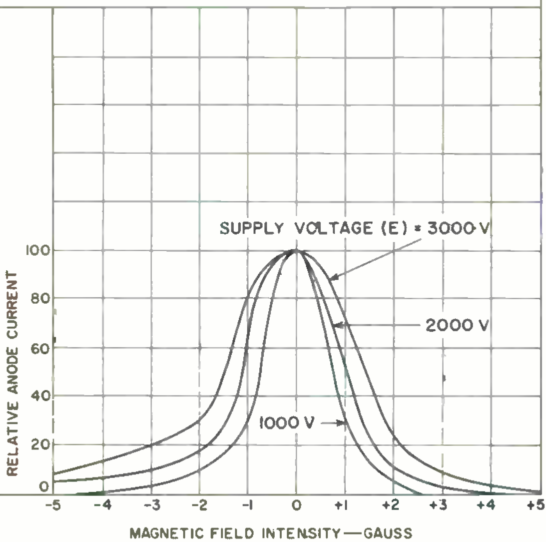
Typical Effect of Magnetic Field on Anode Current

THE SUPPLY VOLTAGE (E) IS ACROSS A VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	6.1% OF E MULTIPLIED BY
CATHODE AND DYNODE No. 1	4.0
DYNODE No. 1 AND DYNODE No. 2	1.0
DYNODE No. 2 AND DYNODE No. 3	1.4
EACH SUCCEEDING DYNODE-STAGE VOLTS	1.0
ANODE AND CATHODE	16.4

FOCUSING ELECTRODE IS CONNECTED TO DYNODE-No. 1 POTENTIAL.
ELECTRON MULTIPLIER SHIELD IS CONNECTED TO DYNODE-No. 5 POTENTIAL.
PHOTOCATHODE IS FULLY ILLUMINATED.

POSITIVE VALUES OF MAGNETIC FLUX (B) ARE FOR LINES OF FORCE OUT OF PAPER.



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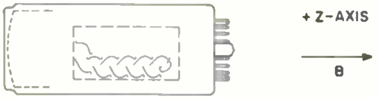
World Radio History

Typical Effect of Magnetic Field on Anode Current

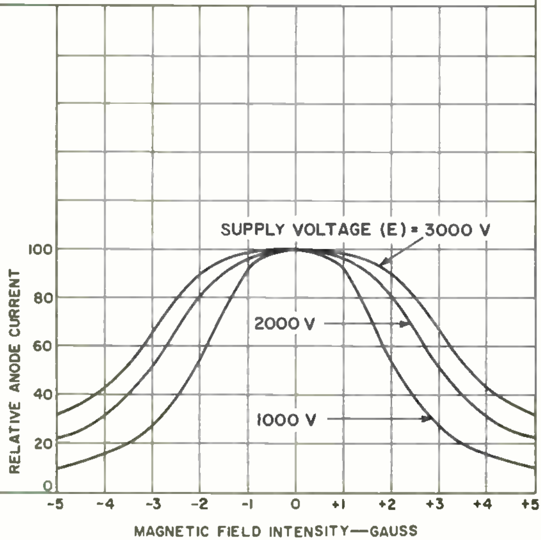
THE SUPPLY VOLTAGE (E) IS ACROSS A VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	6.1% OF E MULTIPLIED BY
CATHODE AND DYNODE No. 1	4.0
DYNODE No. 1 AND DYNODE No. 2	1.0
DYNODE No. 2 AND DYNODE No. 3	1.4
EACH SUCCEEDING DYNODE-STAGE VOLTS	1.0
ANODE AND CATHODE	16.4

FOCUSING ELECTRODE IS CONNECTED TO DYNODE-No. 1 POTENTIAL.
ELECTRON MULTIPLIER SHIELD IS CONNECTED TO DYNODE-No. 5 POTENTIAL.
PHOTOCATHODE IS FULLY ILLUMINATED.



POSITIVE VALUES OF MAGNETIC FLUX (B) ARE FOR LINES OF FORCE TOWARD TUBE BASE.



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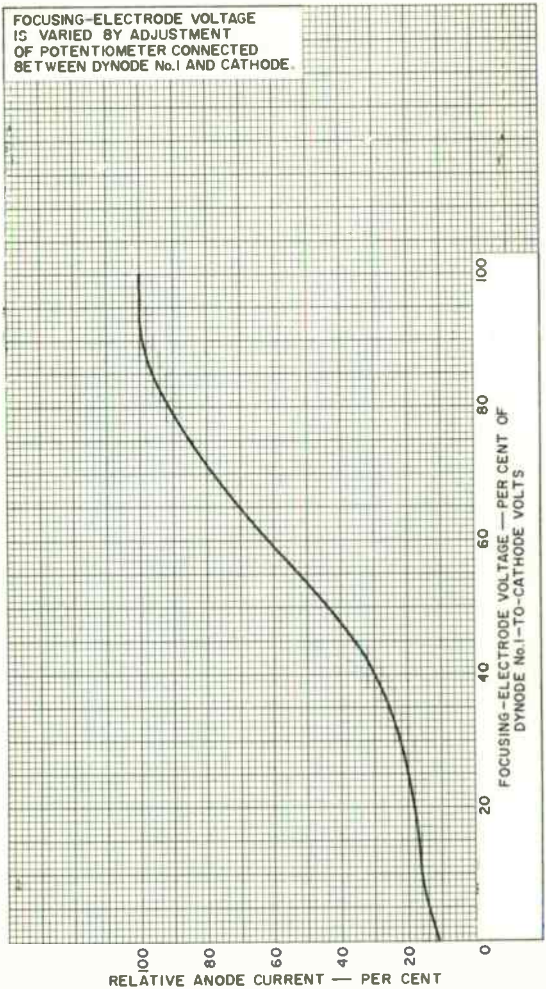
Typical Focusing-Electrode Characteristic



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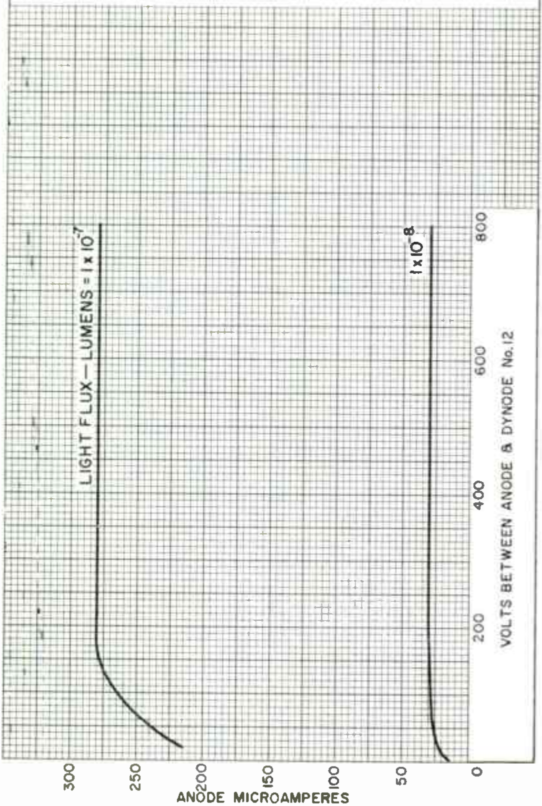
Typical Anode Characteristics

CATHODE-TO-DYNODE-No. 1 VOLTS = 600
DYNODE-No. 1-TO-DYNODE-No. 2 VOLTS = 150
DYNODE-No. 2-TO-DYNODE-No. 3 VOLTS = 210
EACH SUCCEEDING DYNODE-STAGE VOLTS = 150
ANODE-TO-CATHODE VOLTS = 2500

FOCUSING ELECTRODE IS CONNECTED TO DYNODE-No. 1 POTENTIAL.
ELECTRON MULTIPLIER SHIELD IS CONNECTED TO DYNODE-No. 5 POTENTIAL.

LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.



92CM-13052

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Photomultiplier Tubes

S-20 RESPONSE 3/4-INCH DIAMETER, 10-STAGE, HEAD-ON TYPES

MULTIALKALI PHOTOCATHODES OF HIGH QUANTUM EFFICIENCIES

IN-LINE ELECTROSTATICALLY-FOCUSED DYNODE STRUCTURES

For Miniaturized Low-Level Light Detection and Measurement Systems and Laser Detection Equipment to 8000 Angstroms (Typical Quantum Efficiency is 2.5% at 6943 Angstroms)

GENERAL

Spectral Response S-20
Wavelength of Maximum Response. . . . . . . 4200 ± 500 angstroms
Cathode, Semitransparent. . . . . .K-Na-Cs-Sb (Multialkali)
  Shape . . . . Spherical Section
  Minimum area. . . . . 0.2 sq in
  Minimum diameter. . . . . 0.5 in
Window. . . . . Borosilicate, Corning[a] No.7056, or equivalent
  Shape . . . . Plano-Concave
  Index of refraction at 5893 angstroms 1.49
Dynodes
  Substrate . . . . .Copper-Beryllium
  Secondary-emitting surface. . . . . Beryllium-Oxide
  Structure . . . . .In-Line Electrostatic-Focus Type
Direct Interelectrode Capacitances (Approx.)
  Anode to dynode No.10 . . . . 2.4 pF
  Anode to all other electrodes . . . . 3.6 pF
Maximum Overall Length (Excluding leads)
  8644. . . . . 3.8 in
  8645. . . . . 4.55 in
Maximum Diameter
  8644. . . . . 0.78 in
  8645. . . . . 0.93 in
Operating Position. . . . . Any
Weight (Approx.)
  8644
    With base attached. . . . . 1.7 oz
    Without base. . . . . 0.8 oz
  8645. . . . . 4.5 oz
Bulb. T6
Magnetic Shield . . . . .See footnote (b)

ABSOLUTE-MAXIMUM RATINGS

	8644	8645	
Supply Voltage (DC or Peak AC)			
Between anode and cathode	2100	1800	V
Between anode and dynode No.10.	300	300	V
Between consecutive dynodes	200	-	V
Between dynode No.1 and cathode	400	-	V
Average Anode Current[c].	0.5	0.5	mA
Ambient Temperature[d].	85	85	°C

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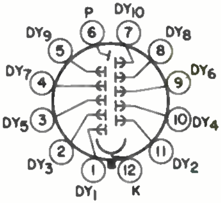
TERMINAL DIAGRAMS (Bottom View)
8644

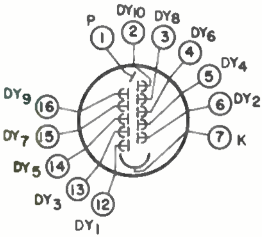
With Base Attached

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



DIRECTION OF LIGHT:
INTO END OF BULB

With Base Removed



DIRECTION OF LIGHT:
INTO END OF BULB

Lead 1 – Anode
Lead 2 – Dynode No. 10
Lead 3 – Dynode No. 8
Lead 4 – Dynode No. 6
Lead 5 – Dynode No. 4
Lead 6 – Dynode No. 2
Lead 7 – Photocathode
Lead 12 – Dynode No. 1
Lead 13 – Dynode No. 3
Lead 14 – Dynode No. 5
Lead 15 – Dynode No. 7
Lead 16 – Dynode No. 9

92LS-1184

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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. This voltage is provided by the integral voltage-divider network of type 8645.

With E = 1500 volts dc (Except as noted)

For Both Types	*Min*	*Typ*	*Max*	
Sensitivity				
Radiant, at 4200 angstroms	-	5.1×10^{3}	-	A/W
Cathode radiant, at 4200 angstroms	-	0.064	-	A/W
Luminous[e]	4	12	60	A/lm
Cathode luminous:				
With tungsten light source[f]	1.2×10^{-4}	1.5×10^{-4}	-	A/lm
With blue light source[g]	5.5×10^{-8}	8.5×10^{-8}	-	A
With red light source[h]	4×10^{-7}	5.2×10^{-7}	-	A
Current Amplification	-	8×10^{4}	-	
Equivalent Anode-Dark-Current Input[j,k]	-	4×10^{-11}	6×10^{-10}	lm
	-	9.4×10^{-14}[m]	1.4×10^{-12}[m]	W
Anode Dark Current	-	6×10^{-10}	-	A
Equivalent Noise Input[n]	-	2.5×10^{-12}	-	lm
	-	6×10^{-15}[m]	-	W
Anode-Pulse Rise Time[p]	-	1.8×10^{-9}	-	s
Electron Transit Time[q]	-	2×10^{-8}	-	s

With E = 2000 volts dc (Except as noted)

For Type 8644 Only	*Min*	*Typ*	*Max*	
Sensitivity				
Radiant, at 4200 angstroms	-	4.7×10^{4}	-	A/W
Cathode radiant, at 4200 angstroms	-	0.064	-	A/W
Luminous[e]	-	110	-	A/lm
Cathode luminous:				
With tungsten light source[f]	1.2×10^{-4}	1.5×10^{-4}	-	A/lm
With blue light source[g]	5.5×10^{-8}	8.5×10^{-8}	-	A
With red light source[h]	4×10^{-7}	5.2×10^{-7}	-	A
Current Amplification	-	7.3×10^{5}	-	
Equivalent Anode-Dark-Current Input[j,k]	-	4×10^{-11}	6×10^{-10}	lm
	-	9.4×10^{-14}[m]	1.4×10^{-12}[m]	W
Anode Dark Current	-	5×10^{-9}	-	A
Anode-Pulse Rise Time[p]	-	1.5×10^{-9}	-	s
Electron Transit Time[q]	-	1.7×10^{-8}	-	s

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

[b] Magnetic shielding material, for type 8644, in the form of foil or tape as available from the Magnetic Shield Division, Perfection Mica Company, 1322 North Elston, Chicago 24, Illinois, or equivalent. Type 8645 has an integral magnetic shield.

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

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

[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 1 microlumen is used.

[f] 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. This characteristic can not be measured after type 8645 is encapsulated in its potting compound.

[g] 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 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected as anode. This characteristic can not be measured after type 8645 is encapsulated in its potting compound.

[h] 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 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected as anode. This characteristic can not be measured after type 8645 is encapsulated in its potting compound.

[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 30 amperes per lumen.

[m] At 4200 angstroms. This value is calculated using a conversion factor of 428 lumens per watt.

[n] Under the following conditions: Supply voltage (E) is as shown, 22° 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] 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.

[q] 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.

OPERATING CONSIDERATIONS

Terminal Connections and Mounting Considerations

Type 8644

The 8644 is supplied with a small-shell duodecal base attached to semiflexible leads to facilitate testing. After testing, the attached base should be removed prior to installing the 8644 in a given system.

The *semiflexible leads* of the 8644 may be soldered or welded into the associated circuit. However, extreme caution must be exercised when making such connections to the leads to prevent tube destruction due to thermal stress of the glass-metal seals. A heat sink placed in contact with the semi-

World Radio History

flexible leads between the point being soldered, or welded, and the glass button is recommended.

Excessive bending of the leads—especially in the region close to the glass button—must be avoided.

Direct clamping to the bulb for mounting purposes is not recommended. It is suggested that a resilient material, such as Silastic[r] RTV 881, RTV 882, or equivalent, be used between the bulb and clamp.

The application of high voltage, with respect to cathode, to insulating or other materials supporting or shielding the 8644 at the photocathode end of the tube should not be permitted unless such materials are chosen to limit leakage current to the tube envelope to 1×10^{-12} ampere or less. In addition to increasing dark current and noise output because of voltage gradients developed across the bulb wall, such high voltage may produce minute leakage current to the cathode through the tube envelope and insulating materials which can permanently damage the tube.

Type 8645

Support for the 8645 may be effected by clamping directly to the magnetic shield. However, only that amount of uniformly distributed pressure necessary to hold the tube firmly in position should be employed.

Shielding

Type 8644

Electrostatic and magnetic shielding of the 8644 is usually required. When a shield is used it must be at cathode potential.

The accompanying *Typical Effect of Magnetic Field on Anode Current (8644)* curve shows the effect of magnetic fields on anode current of the 8644 under the conditions indicated. The effects of hysteresis due to residual magnetism of the materials used in the tube structure have been neglected.

Type 8645

The 8645 is encapsulated with an insulating plastic potting compound in a magnetic shield and has an integral voltage-divider network. The magnetic shield is electrically connected to the photocathode.

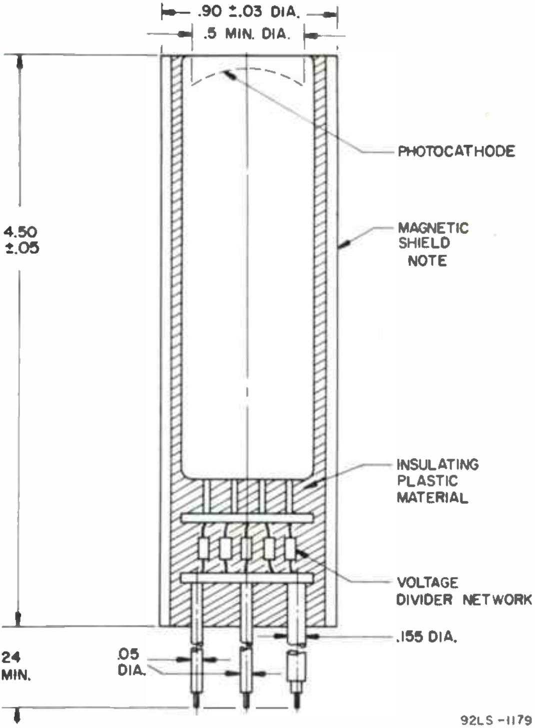
The accompanying *Typical Effect of Magnetic Field on Anode Current (8645)* curve shows the effect of magnetic fields on anode current of the 8645 under the conditions indicated. The effects of hysteresis due to residual magnetism of the materials used in the tube have been neglected.

The voltage-divider network and supply voltage connections for the 8645 are shown under accompanying *Integral Voltage-Divider Network (8645)*.

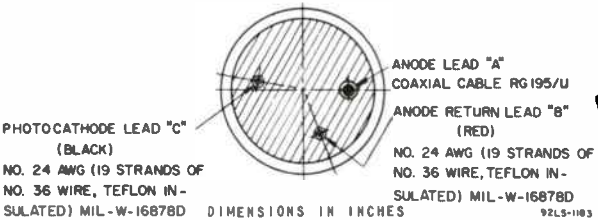
[r] Trademark of Dow Corning Corporation, Midland, Michigan.

World Radio History

DIMENSIONAL OUTLINE
8645



92LS-1179



DIMENSIONS IN INCHES

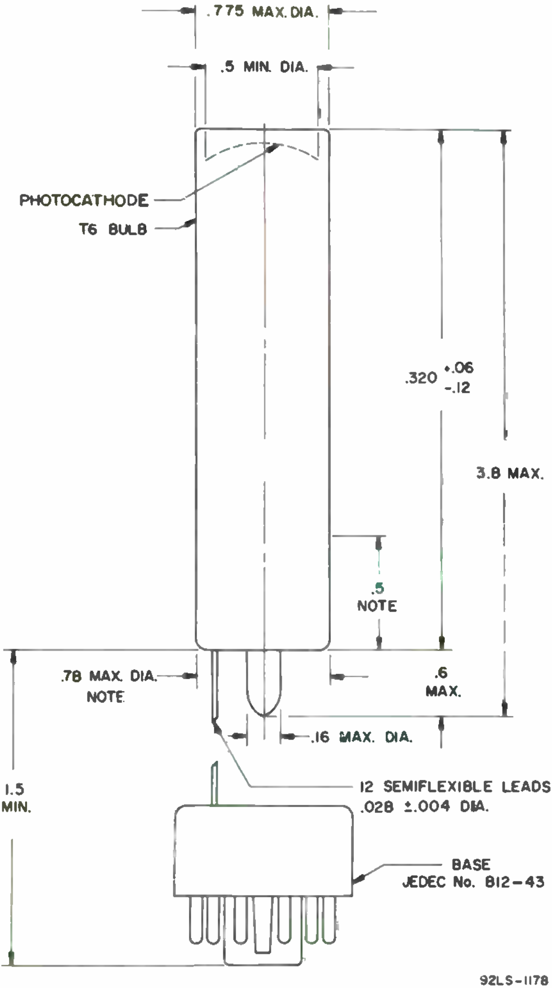
92LS-1183

Note: Wall thickness of magnetic shield is 0.020" Netic[s] and 0.014" Conetic[s].

[s] Made by Magnetic Shield Division, Perfection Mica Company, 1322 North Elaston, Chicago 24, Illinois, or equivalent material.

World Radio History

DIMENSIONAL OUTLINE
8644



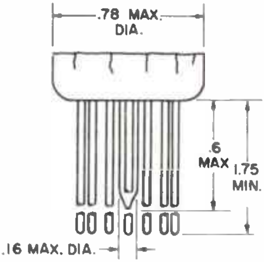
DIMENSIONS IN INCHES

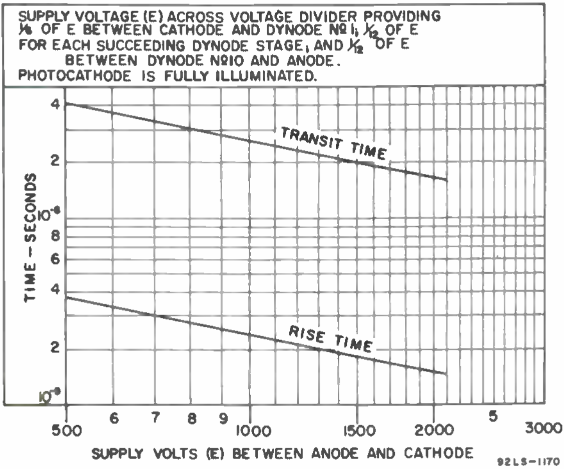
Note: Within this length, maximum diameter of tube is 0.78 inch.

World Radio History

Typical Time-Resolution Characteristics

DIMENSIONAL OUTLINE
8644
Detail with Base Removed





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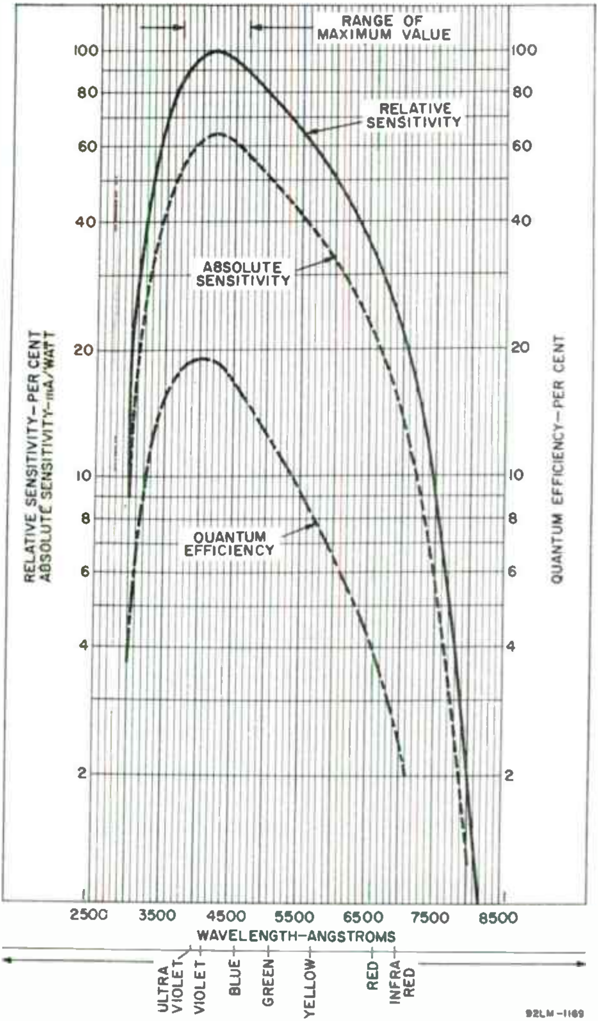
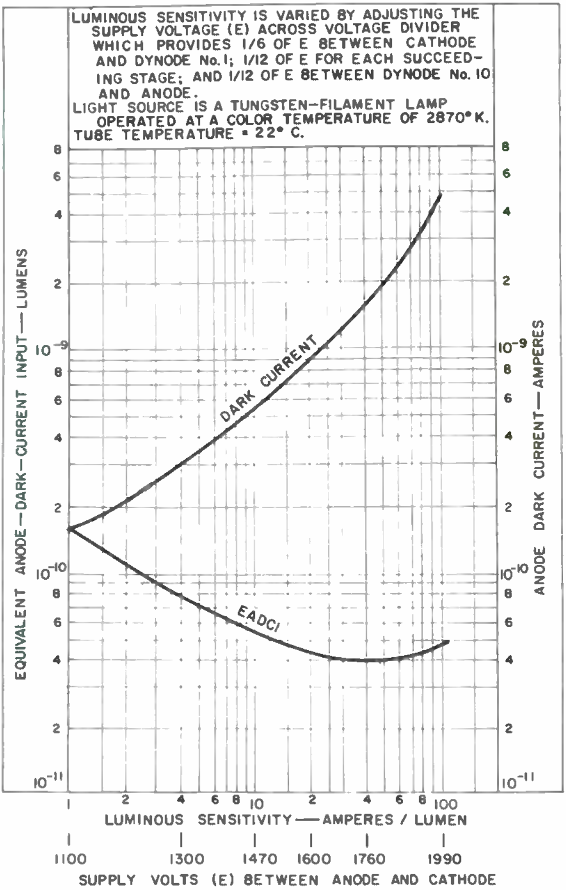
World Radio History

Spectral Response Characteristics



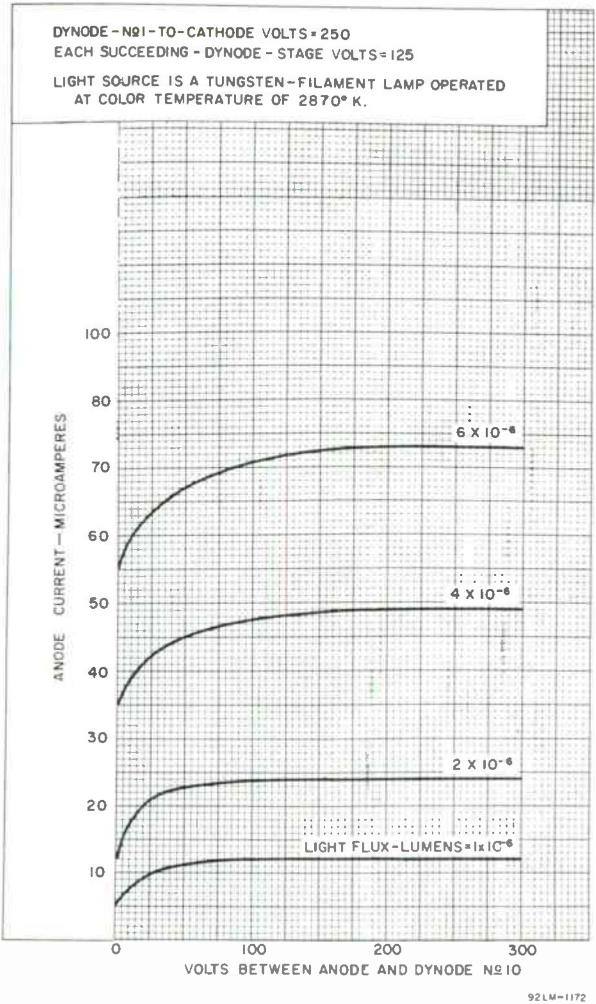
World Radio History

Typical Dark Current and EADCI Characteristics



World Radio History

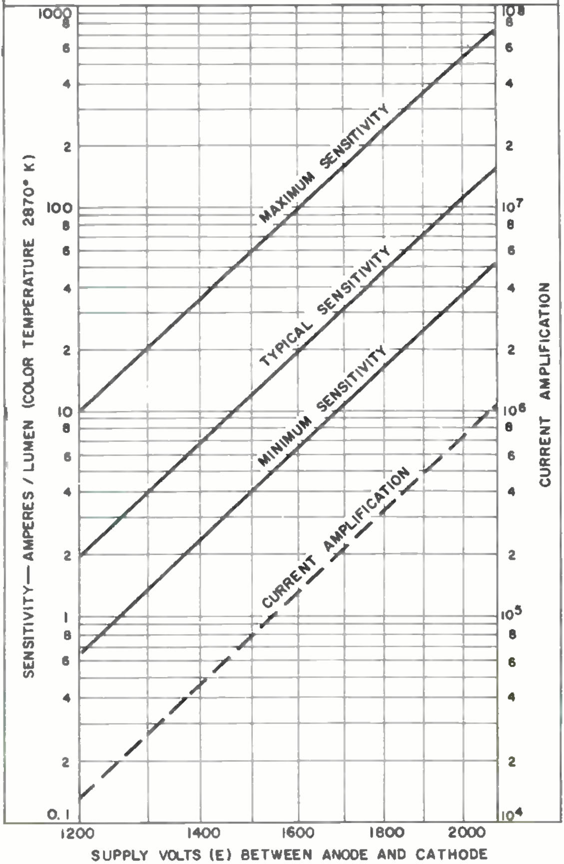
Average Anode Characteristics 8644



World Radio History

Typical Sensitivity and Current Amplification 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.



92LM-1171

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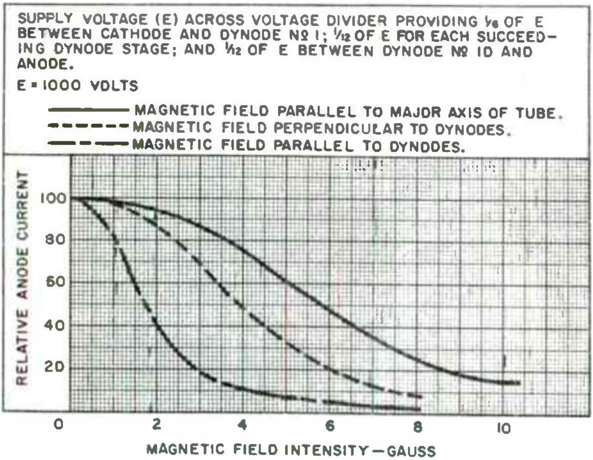
Typical Effect of Magnetic Field on Anode Current 8644



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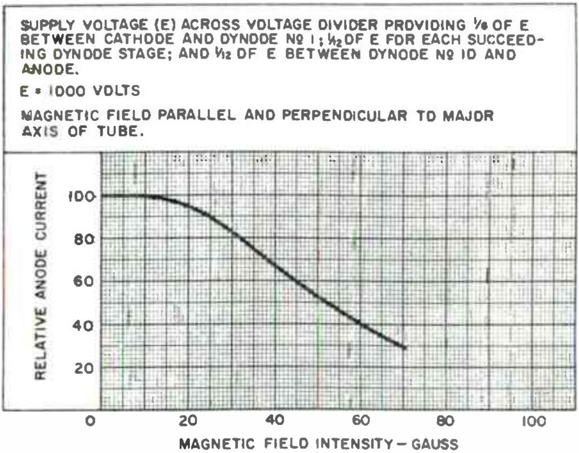
Typical Effect of Magnetic Field on Anode Current 8645



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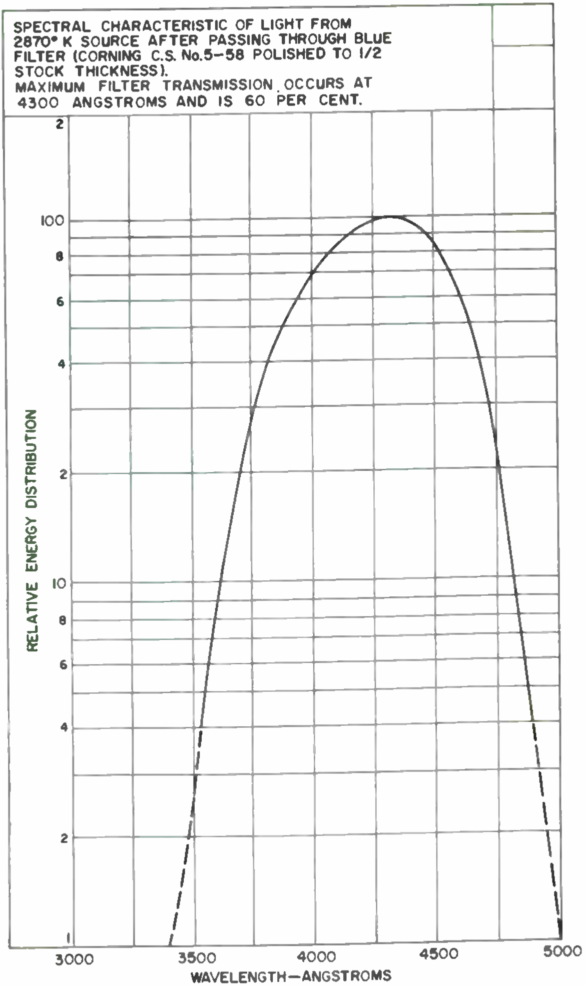
World Radio History

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



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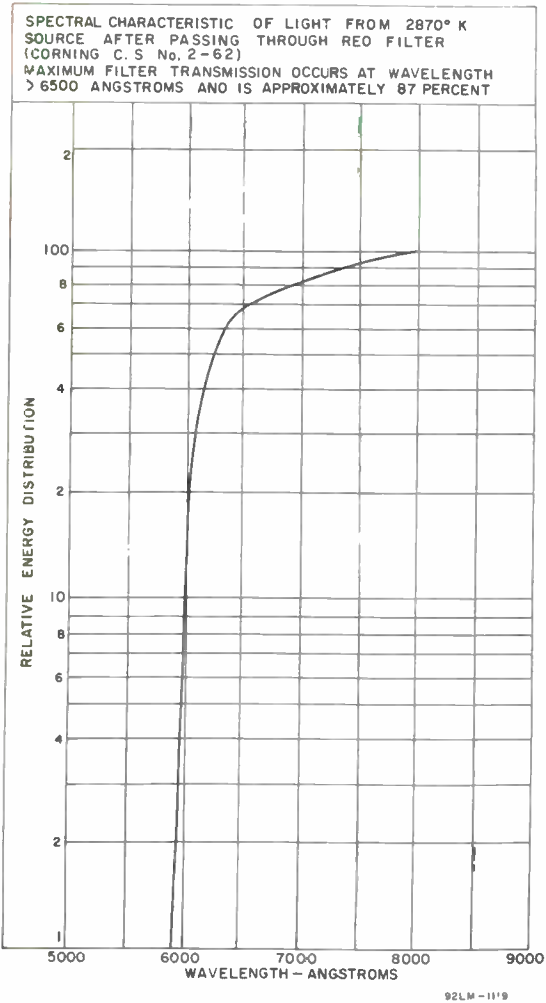
World Radio History

Spectral Energy Distribution of 2870° K Light Source After Passing through Indicated Filters



World Radio History

World Radio History

Thyratrons, Ignitrons, & Glow-Discharge Tubes

RCA TUBE
HANDBOOK
HB-3

THYRATRON, IGNITRON, & GLOW-DISCHARGE TUBE SECTION

This Section contains data on thyratrons, ignitrons, and glow-discharge (cold-cathode) tubes used for voltage-regulator, relay, and voltage-reference applications.

For further Technical Information, write to Commercial Engineering, Tube Division, Radio Corporation of America, Harrison, N. J.

World Radio History

World Radio History

GLOW-DISCHARGE TUBES

Average DC Operating Volts	DC Operating Current Range Ma.	Average DC Starting Volts	RCA Type
Voltage-Regulator Types			
59	0.4 to 2	67	991
75	5 to 30	105	□0C2
75	5 to 40	100	0A3
78	5 to 40	100	0A3A
108	5 to 30	115	□0B2
108	5 to 30	115	□6074[a]
108	5 to 40	115	0C3
110	5 to 40	115	0C3A
150	5 to 40	160	0D3A
151	5 to 40	156	□0A2
151	5 to 30	156	6073[b]
153	5 to 40	160	0D3
Voltage-Reference Types			
86.5	1.5 to 3.5	107	□5651A[c]
87	1.5 to 3.5	107	□5651

Relay Types

Maximum Peak Inverse Anode Volts	Maximum Cathode Milliamperes		RCA Type
	Peak	Average	
180	100	25	1C21[d]
200	100	25	□5823[e]
225	100	25	0A4G[e]

a "Premium" version of OB2 intended for applications critical to shock and vibration.
b "Premium" version of OA2 intended for applications critical to shock and vibration.
c Like the 5651 but has greater voltage stability.
d For operation from a dc supply.
e For operation from an ac supply.
□ Miniature

THYRATRON, GLOW-DISCHARGE, IGNITRON, and VACUUM-GAUGE TUBES

THYRATRON, GLOW-DISCHARGE, IGNITRON, and VACUUM-GAUGE TUBES

IGNITRONS

MAXIMUM RATINGS For power-supply frequencies of 25 to 60 cps						RCA Type
Anode Current[a]						
Av Amp	for Time Intervals Sec	Peak Amp	Demand Power KVA	RMS Supply Volts	Peak Anode Inverse or Forward Volts	
Resistance-Welding Control Service[b]						
4.86	27.8	846	150	250	-	5550
4.86	11.6	354	150	600	-	5550
12.1	22	1692	300	250	-	5550
12.1	9.2	708	300	600	-	5550
30.2	18	3400	600	250	-	5551A
30.2	7.5	1410	600	600	-	5551A
56	18	1130	200	250	-	5551A
56	7.5	466	200	600	-	5551A
75.6	14	6800	1200	250	-	5552A
75.6	5.8	2830	1200	600	-	5552A
140	14	2260	400	250	-	5552A
140	5.8	945	400	600	-	5552A
192	11	13600	2400	250	-	5553B
192	4.6	5660	2400	600	-	5553B
355	11	4530	800	250	-	5553B
355	4.6	1890	800	600	-	5553B
Intermittent Rectifier Service and Frequency-Changer Welder Service						
4	10	480	-	-	1500	5551A
5	10	600	-	-	1200	5551A
40	6	700	-	-	500	5551A
100	6	1600	-	-	500	5552A[c]
32	6.25	2400	-	-	1500	5553B
40	6.25	3000	-	-	1200	5553B
54	6.25	4000	-	-	600	5553B
Resistance-Welding-Capacitor Discharge Service						
8	1.25	500	60 dischgs sec		d	5550
15	0.66	500	60 dischgs sec		3000	5550

a Per tube. b Two tubes in inverse-parallel circuit.
c Intermittent Rectifier Service only.
d Forward volts = 6000, inverse volts = 3000.

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Electronic Components and Devices Harrison N J

World Radio History

Selection Guide for

RCA THYRATRON, GLOW-DISCHARGE, IGNITRON, and VACUUM-GAUGE TUBES

THYRATRONS

Triodes

MAXIMUM RATINGS				Filament-F or Heater-H		RCA Type
Anode Current		Tempera-ture Range °C	Peak Inverse Anode Volts			
Av Amp	Peak Amp			Volts	Amp	
Mercury-Vapor Types						
0.5	2	40 to 80	5000	2.5 F	5	5557
0.64	2.5	25 to 70	2500	2.5 F	6	627
1.8	10	25 to 55	15000	5.0 F	10	5563A
2.5	15	40 to 80	1000	5.0 H	4.5	5559
4	16	30 to 50	10000	5.0 H	10	677
6.4	40	40 to 80	2500	5.0 H	10	676
Gas Types						
0.04	0.2	-40 to +70	350	2.5 H	2.6	629
0.045	35	-50 to +90	3000	6.3 H	2.3	6130/3C45
0.075	0.3	-75 to +90	350	6.3 H	0.6	884
0.075	0.3	-75 to +90	350	2.5 H	1.5	885
1	8	-55 to +75	1250	2.5 F	6.3	C1K/6014
2.5	30	-55 to +75	1250	2.5 F	9	C3J/5632
2.5	30	-55 to +75	1250	2.5 F	9	C3JA/5684
2.5	30	-55 to +75	1250	2.5 F	9	C3JL
6.4	77	-55 to +75	1250	2.5 F	21	C6J/5C21
6.4	77	-55 to +75	1250	2.5 F	21	C6JA/5685
18	100	-55 to +75	1250	2.5 F	31	C16J/5665
Gas and Mercury-Vapor Types						
1	3	-40 to +80	1250	2.5 F	5	714/7021
1	8	-40 to +80	1250	2.5 F	6.3	716/6855
1.5	6	-40 to +80	1250	2.5 F	7	3C23
2.5	30	-40 to +80	1500	2.5 F	9	710/6011
6.4	77	-40 to +80	1500	2.5 F	21	760/6858

THYRATRONS

Tetrodes

MAXIMUM RATINGS				Filament-F or Heater-H		RCA Type
Anode Current		Tempera-ture Range °C	Peak Inverse Anode Volts			
Av Amp	Peak Amp			Volts	Amp	
Mercury-Vapor Types						
2.5	15	40 to 80	1000	5 H	4.5	5560
2.5	30	40 to 80	1500	5 H	5	632B
3.2	40	40 to 80	2500	5 H	5	672A
6.4	40	40 to 80	2000	5 H	10	172
6.4	40	40 to 80	2500	5 H	10	105
Gas Types						
0.025	0.1	-55 to +90	500	6.3 H	0.15	□5696
0.1	0.5	-75 to +90	1300	6.3 H	0.6	□2D21
0.1	0.5	-75 to +150	1300	6.3 H	0.6	□5727
0.1	1	-55 to +90	1300	6.3 H	0.6	502A
0.1	1	-75 to +90	1300	6.3 H	0.6	2050
0.1	1	-75 to +90	1300	6.3 H	0.6	2050A
0.5	5	-75 to +90	1300	6.3 H	2.6	6012
0.8	8	-75 to +90	1500	6.3 H	2.6	3D22A

VACUUM-GAUGE TUBES

Gas Pressure Range		Gauge Type	RCA Type
in mm of Hg (Torr)	in microns		
1 to 0.0001 1 to 0.001*	1000 to 0.1 1000 to 1*	Thermo-couple	1946
1.5 to below 0.01 0.5 to 0.01*	1500 to below 10 500 to 10*	Pirani	1947
0.001 to below 0.0001 0.001 and below*	1 to below 0.1 0.1 and below*	Ionization (Hard Glass)	1949

* Range of greatest sensitivity.

□ Miniature

World Radio History

RCA

GRID-CONTROLLED RECTIFIER CIRCUITS

Numerical Relationships Among Electrical Quantities

E = Trans. Sec. Voltage (RMS)
E_{av} = Average DC Output Voltage
E_{bmi} = Peak Inverse Anode Voltage
E_m = Peak DC Output Voltage
E_r = Major Ripple Voltage (RMS)
f = Supply Frequency
f_r = Major Ripple Frequency

I_{av} = Average DC Output Current
I_b = Average Anode Current
I_p = Anode Current (RMS)
I_{pm} = Peak Anode Current
P_{al} = Line Volt-Amperes
P_{ap} = Trans. Pri. Volt-Amperes
P_{as} = Trans. Sec. Volt-Amperes

P_{dc} = DC Power ($E_{av} \times I_{av}$)

Note: Conditions assumed involve sine-wave supply; zero voltage drop in tubes; no losses in transformer and circuit; no back emf in the load circuit; and no phase-back.

RATIO	Fig. 1	Fig. 2	Fig. 3	Fig. 4	Fig. 5*	Fig. 6	Fig. 7	Fig. 8
Voltage Ratios								
E/E_{av}	2.22	1.11	1.11	0.854	0.854	0.427	0.785	0.74
E_{bmi}/E	1.41	2.83	1.41	2.45	2.45	2.45	2.83	2.83
E_{bmi}/E_{av}	3.14	3.14	1.57	2.09	2.09	1.05	2.22	2.09
E_m/E_{av}	3.14	1.57	1.57	1.21	1.05	1.05	1.11	1.05
E_r/E_{av}	1.11	0.472	0.472	0.177	0.04	0.04	0.106	0.04
Frequency Ratio								
f_r/f	1	2	2	3	6	6	4	6
Current Ratios								
I_p/I_{av}	1.57	0.785	0.785	0.578	0.289	0.578	0.5	0.408
I_b/I_{av}	1	0.5	0.5	0.33	0.167	0.33	0.25	0.167
Resistive Load								
I_{pm}/I_{av}	3.14	1.57	1.57	1.21	0.52	1.05	1.11	1.05
I_{pm}/I_b	3.14	3.14	3.14	3.63	3.14	3.14	4.5	6.3
Inductive Load■								
I_{pm}/I_{av}	—	1	1	1	0.5	1	1	1
Power Ratios								
Resistive Load								
P_{as}/P_{dc}	3.49	1.74	1.24	—	—	—	—	—
P_{ap}/P_{dc}	2.69	1.23	1.24	—	—	—	—	—
P_{al}/P_{dc}	2.69	1.23	1.24	—	—	—	—	—
Inductive Load■								
P_{as}/P_{dc}	—	1.57	1.11	1.71	1.48	1.05	1.57	1.81
P_{ap}/P_{dc}	—	1.11	1.11	1.21	1.05	1.05	1.11	1.29
P_{al}/P_{dc}	—	1.11	1.11	1.21	1.05	1.05	1.11	1.05

* Bleeder current of 2% full-load current will provide exciting current for balance coil and thus avoid poor regulation at light loading.

■ The use of a large filter-input choke is assumed.

World Radio History

GRID-CONTROLLED RECTIFIER CIRCUITS

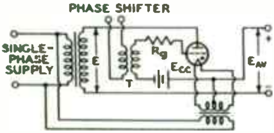


FIG. I HALF-WAVE SINGLE-PHASE

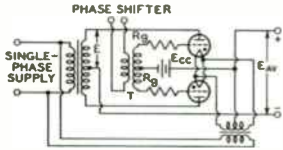


FIG. 2 FULL-WAVE SINGLE-PHASE

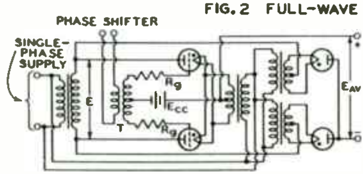


FIG. 3 SERIES SINGLE-PHASE

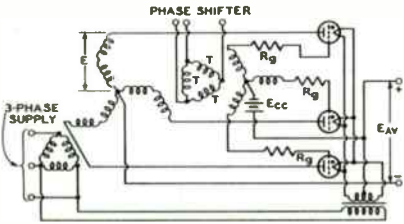


FIG. 4 HALF-WAVE THREE-PHASE

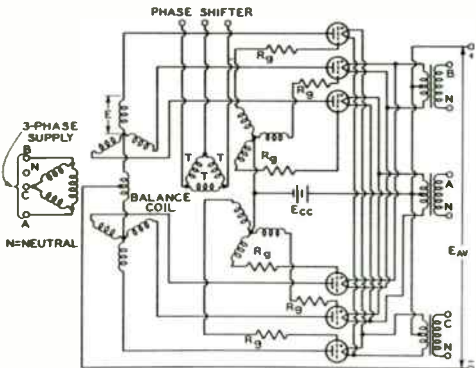


FIG. 5 PARALLEL THREE-PHASE (QUADRATURE OPERATION)

Devices and arrangements shown or described herein may use patents of RCA or others. Information contained herein is furnished without responsibility by RCA for its use and without prejudice to RCA's patent rights.

World Radio History

RCA

GRID-CONTROLLED RECTIFIER CIRCUITS

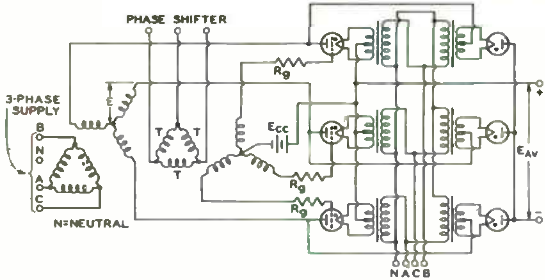


FIG. 6 SERIES THREE-PHASE (QUADRATURE OPERATION)

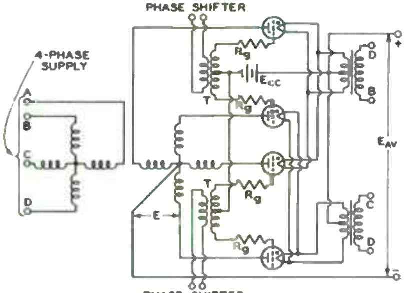


FIG. 7 HALF-WAVE FOUR-PHASE (QUADRATURE OPERATION)

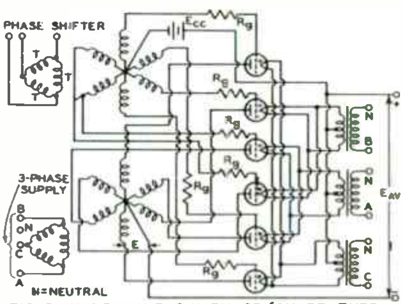


FIG. 8 HALF-WAVE SIX-PHASE (QUADRATURE OPERATION)

NOTE
T = PEAKING TRANSFORMER

92CL-8340

World Radio History

World Radio History

RCA

OA2

VOLTAGE REGULATOR

MINIATURE GLOW-DISCHARGE TYPE

GENERAL DATA

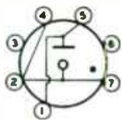
Electrical:

Cathode. . . . . Cold

Mechanical:

Mounting Position.	Any
Maximum Overall Length	2-5/8"
Maximum Seated Length.	2-3/8"
Length, Base Seat to Bulb Top (Excluding tip)	2" ±3/32"
Maximum Diameter	3/4"
Weight (Approx.)	0.3 oz
Bulb	T-5-1/2
Base	Small-Button Miniature 7-Pin (JETEC No.E7-1)
Basing Designation for BOTTOM VIEW	5BO

Pin 1 - Anode
Pin 2 - Cathode
Pin 3 - Internal Connection-Do Not Use
Pin 4 - Cathode



Pin 5 - Anode
Pin 6 - Internal Connection-Do Not Use
Pin 7 - Cathode

Maximum and Minimum Ratings, ***Absolute Values*:**

AVERAGE STARTING CURRENT♦	75 max.	ma
DC CATHODE CURRENT	30 max.	ma
	5 min.	ma
FREQUENCY	0 max.	cps
AMBIENT-TEMPERATURE RANGE	-55 to +90	°C

Circuit Values:

Shunt Capacitor	0.1 max.	μμf
Series Resistor	*See Operating Considerations*	

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	*Av.*	*Max.*	
DC Anode-Supply Voltage	185■	-	-	volts
Anode Breakdown Voltage	-	156	185*	volts
Anode Voltage Drop	140●	151	168*	volts
Regulation (5 to 30 ma)	-	2	6*	volts

♦ Averaged over starting period not exceeding 10 seconds. This starting period must be followed by a steady-state operating condition of at least 20 minutes, or tube performance will be impaired.

■ Not less than indicated supply voltage should be provided to insure "starting" throughout tube life.

* Maximum individual tube value during useful life.

● Minimum individual tube value during useful life.

←Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

OA2

VOLTAGE REGULATOR

OPERATING CONSIDERATIONS

Sufficient resistance must always be used in series with the OA2 to limit the current through the tube. The value for the series resistor is dependent on the maximum anode-supply voltage and the ratio of the current through the load to the operating current of the OA2, and should be chosen to limit the operating current through the tube to 30 milliamperes at all times after the starting period.

The maximum load current that can be regulated by the OA2 is determined by the minimum and maximum values of the supply voltage. After the value of series resistor for the maximum supply voltage has been calculated as indicated above, it is then in order to determine if this value will permit adequate starting voltage when the supply voltage falls to its minimum value. If adequate starting voltage is not obtained, a new load current of lower value must be used and the calculations repeated. It will be apparent from such calculations that the higher the minimum supply voltage and the smaller the difference between its minimum and maximum values, the higher will be the load current that can be regulated.

When equipment utilizing the OA2 is "turned on", a starting current in excess of the average operating current is permissible as indicated under Maximum Ratings. When the tube is subjected to such high starting currents, the regulated voltage may require up to 20 minutes to drop to its normal operating value. This performance is characteristic of voltage-regulator tubes of the glow-discharge type. Similarly, the regulation is affected by changes in current within the operating current range. For example, the regulation of a tube operated for a protracted period at 5 milliamperes and then changed to 25 milliamperes, may be somewhat different from the value that will be obtained after a long period of operation at 25 milliamperes. Likewise, the regulation may change somewhat after a long idle period.

In order to handle more load current, two or more OA2's may be operated in parallel, but such parallel operation requires that a resistance of approximately 100 ohms be used in series with each OA2 in order to equalize division of the current between the paralleled tubes. The disadvantage of this method, of course, is that the use of resistors impairs the regulation which can be obtained.

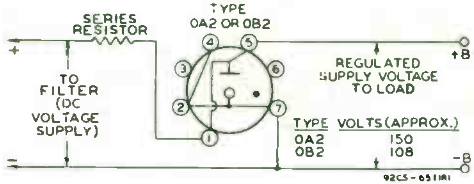
If the associated circuit has a capacitor in shunt with the OA2, the capacitor should be limited in value to 0.1 μf. A larger value may cause the OA2 to oscillate and thus give unstable regulation performance.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

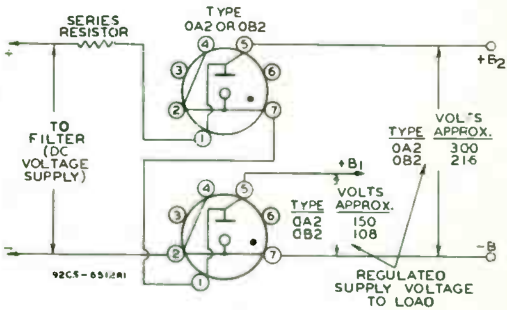
World Radio History

RCA

OA2
VOLTAGE REGULATOR



Typical circuit to provide regulated supply voltage of approximately 150 or 108 volts to load. Removal of tube from socket removes voltage from load.



Typical circuit using two OA2's or two OB2's to provide regulated supply voltages of approximately 300 or 216 volts and 150 or 108 volts to load. Socket connections are so made that voltage on load is removed when either tube is taken from its socket.

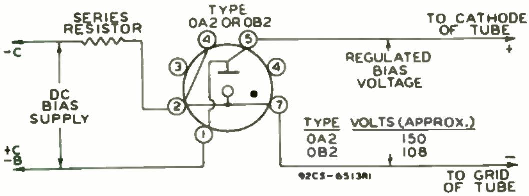
CIRCUIT FOR BIAS-SUPPLY REGULATION IS SHOWN ON NEXT PAGE.

Many of the devices and arrangements shown or described herein use inventions of patents owned by RCA or others. Information contained herein is furnished without assuming any responsibility for its use.

World Radio History

RCA

OA2
VOLTAGE REGULATOR



Typical circuit for bias-supply regulation. Removal of tube from socket opens B-supply circuit of regulated tubes.

World Radio History

OA3

VOLTAGE REGULATOR

GLOW-DISCHARGE TYPE

GENERAL DATA

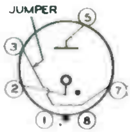
Electrical:

Cathode . . . . .Cold

Mechanical:

Mounting Position	Any
Maximum Overall Length	4-1/8"
Seated Length	3-3/8" ± 3/16"
Maximum Diameter	1-9/16"
Dimensional Outline	*See General Section*
Weight (Approx.)	1.3 oz
Bulb	ST-12
Base	Small-Shell Octal 6-Pin (JETEC No. B6-3)
Basing Designation for BOTTOM VIEW	4AJ

Pin 1 - No Connection
Pin 2 - Cathode
Pin 3 - Jumper▲



Pin 5 - Anode
Pin 7 - Jumper▲
Pin 8 - No Connection

Maximum and Minimum Ratings, ***Absolute Values:***

AVERAGE STARTING CURRENT♦	100 max.	ma
DC CATHODE CURRENT	40 max.	ma
	5 min.	ma
FREQUENCY	0 max.	cps
AMBIENT-TEMPERATURE RANGE	-55 to +90	°C

Circuit Values:

Shunt Capacitor	0.1 max.	μf
Series Resistor	*See Operating Considerations*	

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	*Av.*	*Max.*	
DC Anode-Supply Voltage	105■	-	-	volts
Anode Breakdown Voltage	-	100	105*	volts
Anode Voltage Drop	68●	75	85*	volts
Regulation (5 to 40 ma)	-	5	6.5*	volts

▲ With suitable socket connections, jumper within base acts as a switch to open power-supply circuit when voltage regulator tube is removed from socket.

♦ Averaged over starting period not exceeding 10 seconds. This starting period must be followed by a steady-state operating condition of at least 20 minutes, or tube performance will be impaired.

■ Not less than indicated supply voltage should be provided to insure "starting" throughout tube life.

* Maximum individual tube value during useful life.

● Minimum individual tube value during useful life.

← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

OA3

VOLTAGE REGULATOR

→

OPERATING CONSIDERATIONS

Sufficient resistance must always be used in series with the OA3 to limit the current through the tube. The value for the series resistor is dependent on the maximum anode-supply voltage and the ratio of the current through the load to the operating current of the OA3, and should be chosen to limit the operating current through the tube to 40 milliamperes at all times after the starting period.

The maximum load current that can be regulated by the OA3 is determined by the minimum and maximum values of the supply voltage. After the value of series resistor for the maximum supply voltage has been calculated as indicated above, it is then in order to determine if this value will permit adequate starting voltage when the supply voltage falls to its minimum value. If adequate starting voltage is not obtained, a new load current of lower value must be used and the calculations repeated. It will be apparent from such calculations that the higher the minimum supply voltage and the smaller the difference between its minimum and maximum values, the higher will be the load current that can be regulated.

When equipment utilizing the OA3 is "turned on", a starting current in excess of the average operating current is permissible as indicated under Maximum Ratings. When the tube is subjected to such high starting currents, the regulated voltage may require up to 20 minutes to drop to its normal operating value. This performance is characteristic of voltage-regulator tubes of the glow-discharge type. Similarly, the regulation is affected by changes in current within the operating-current range. For example, the regulation of a tube operated for a protracted period at 5 milliamperes and then changed to 35 milliamperes, may be somewhat different from the value that will be obtained after a long period of operation at 35 milliamperes. Likewise, the regulation may change somewhat after a long idle period.

In order to handle more load current, two or more OA3's may be operated in parallel, but such parallel operation requires that a resistance of approximately 100 ohms be used in series with each OA3 in order to equalize division of the current between the paralleled tubes. The disadvantage of this method, of course, is that the use of resistors impairs the regulation which can be obtained.

If the associated circuit has a capacitor in shunt with the OA3, the capacitor should be limited in value to 0.1 μf. A larger value may cause the OA3 to oscillate and thus give unstable regulation performance.

→ Indicates a change.

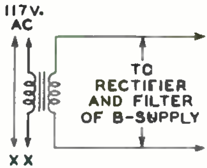
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

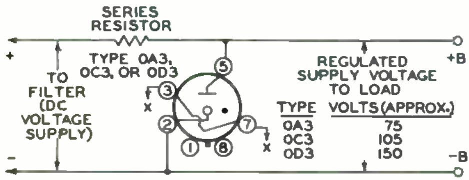
World Radio History

OA3

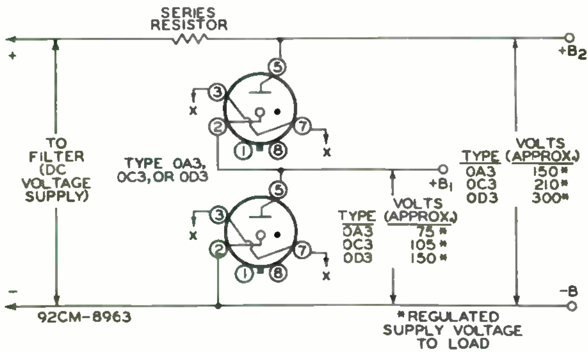
OA3

VOLTAGE REGULATOR





Typical circuit to provide regulated supply voltage of approximately 75, 105, or 150 volts to load. Removal of tube from socket removes voltage from load.



Typical circuit using two OA3's, two OC3's, or two OD3's to provide regulated supply voltages of approximately 150, 210, or 300 volts and 75, 105, or 150 volts to load. Socket connections are so made that voltage on load is removed when either tube is taken from its socket.

Devices and arrangements shown or described herein may use patents of RCA or others. Information contained herein is furnished without responsibility by RCA for its use and without prejudice to RCA's patent rights.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

World Radio History

0A3A

Voltage-Regulator

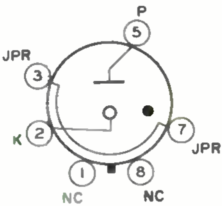
GLOW-DISCHARGE TYPE — **75 VOLTS**

For Applications Requiring a Relatively Constant DC Output Voltage, Independent of Load and Supply-Voltage Variations

Mechanical:

Operating Position	Any
Type of Cathode	Cold
Maximum Overall Length	3-1/16"
Maximum Seated Length	2-1/2"
Maximum Diameter	1-9/32"
Dimensional Outline	See *General Section*
Bulb	T9
Base	Intermediate-Shell Octal 6-Pin, Arrangement 1 (JEDEC Group 1, No.B6-8)
Basing Designation for BOTTOM VIEW	4AJ

Pin 1 – No Internal Connection
Pin 2 – Cathode
Pin 3 – Jumper[a]
Pin 5 – Anode
Pin 7 – Jumper[a]
Pin 8 – No Internal Connection



VOLTAGE REGULATOR

Maximum and Minimum Ratings, *Absolute-Maximum Values:*

Average Cathode Starting Current[b]	100 max.	ma
DC Cathode Current	40 max.	ma
	5 min.	ma
DC or AC Jumper Current	2 max.	amp
Ambient-Temperature Range	-55 to +90	°C

Circuit Values:

Shunt Capacitor	0.1 max.	µf
Series Resistor	See *Operating Considerations*	

[a] With suitable socket connections, the jumper within the tube base (between pins 3 and 7) provides for opening the power-supply circuit to protect circuit components when the voltage-regulator tube is removed from its socket.

[b] Averaged over starting period not exceeding 10 seconds. When starting currents greatly in excess of the maximum dc-cathode-current rating of 40 milliamperes are encountered, it may be necessary to operate these tubes as much as 20 minutes under steady-state conditions to assure stable operation.

World Radio History

0A3A

CHARACTERISTICS RANGE VALUES

Values are initial unless otherwise specified

	Note	Min.	Av.	Max.	
DC Anode Supply Voltage				See *Note 1*	
DC Anode Starting Voltage in:					
Total darkness	-	-	-	160	volts
Normal ambient light (5 to 50 footcandles). . . .	-	-	100	105	volts
Anode Voltage Drop for dc cathode current of:					
5 ma..	-	70	-	-	volts
30 ma.	-	70	76	79	volts
40 ma.	-	70	78	81	volts
Regulation for dc-cathode-current range of:					
5 to 30 ma..	2	-	3	4.5	volts
5 to 40 ma..	2	-	5	6.5	volts
Tube Noise for dc cathode current of 40 ma.	-	-	-	5	rms mv
DC Leakage Current for dc anode supply voltage of 50 volts and anode resistor of 3000 ohms	-	-	-	10	μa

Note 1: The minimum value to insure starting throughout useful tube life must be equal to the dc anode starting voltage plus the voltage drop across the series resistor at the maximum value of the load current.

Note 2: The maximum values for the specified regulation range apply throughout useful tube life.

OPERATING CONSIDERATIONS

In any given application, the following two considerations must be met to assure safe and reliable operation:

1. The dc cathode current must be kept within the minimum (I_{kmin}) and maximum (I_{km}) ratings.
2. The dc anode starting voltage, E_b (stg), must be available under the worst probable conditions.

Instantaneous cathode starting currents in excess of the maximum dc-cathode-current rating (40 milliamperes) are permissible as indicated under *Maximum and Minimum Ratings*. When the tubes are subjected to such high starting currents, as much as 20 minutes may be required for the regulated dc voltage to reach its normal operating value. The regulated dc voltage may also change after long idle periods. To assure a constant regulated voltage a single value of operating current should be maintained.

Another effect associated with VR tubes is "spot jump", sometimes referred to as "jitter". This phenomenon is an instantaneous shift of the glow on the surface of the cathode and is responsible for small instantaneous changes in anode voltage drop. These changes can be minimized by operating the voltage-regulator tubes at dc cathode currents sufficiently above the minimum dc-cathode-current rating (5 milliamperes)

World Radio History

to assure that the glow covers a substantial portion of the cathode surface.

The level of ambient radiation directly affects the dc anode starting voltage of VR tubes. The maximum values required to start any tube under normal ambient-light conditions and in total darkness are given under *Characteristics Range Values*. Shielding should be considered when VR tubes are operated in the presence of strong, varying, magnetic, or nuclear-radiation fields to assure proper performance.

Ambient temperature should be kept relatively constant to minimize voltage drift.

Coupling effects can be minimized by shunting the VR tube with a capacitor not larger than 0.1 μf.

Series connection of VR tubes may be employed to obtain dc regulated voltages greater than those obtainable from a single tube. Different types may be used provided the series current is kept within the maximum dc-cathode-current rating of the lowest-rated tube.

Parallel connection of VR tubes may be employed where it is necessary to obtain dc load currents greater than those obtainable from a single tube but at a loss in regulation. This loss in regulation results from the requirement that a resistor be used in series with each VR tube when in parallel operation.

Combinations of regulated dc voltages may also be obtained by series connection of VR tubes with tapped output as shown in *Typical Circuit 1*.

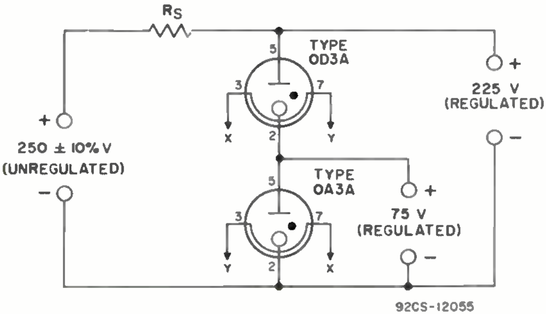
To determine the value of the series resistor for small load currents in a circuit of this type, disconnect the loads and adjust the series resistor for a tube current of not more than 40 milliamperes.

Regulated bias voltages may also be obtained as shown in *Typical Circuit 2*. In this circuit, a single 0A3A can supply a regulated dc voltage of -75 volts.

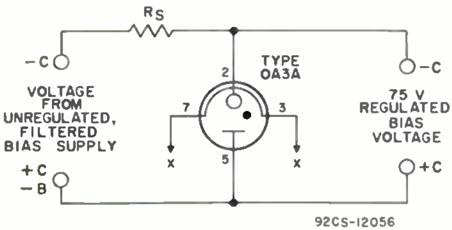
The *jumper* between pins 3 and 7 inside the base makes it possible with suitable socket connections, to open power-supply circuits to protect circuit components when one of the VR tubes is removed from its socket.

World Radio History

TYPICAL CIRCUIT 1



TYPICAL CIRCUIT 2



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World Radio History

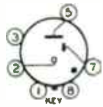
0A4-G

GAS-TRIODE

COLD-CATHODE STARTER-ANODE TYPE

Maximum Overall Length	4-1/8"
Maximum Diameter	1-9/16"
Bulb	ST-12
Base	Small Shell Octal 6-Pin

Pin 1 - No Connection
Pin 2 - Cathode
Pin 3 - No Connection



BOTTOM VIEW

Pin 5 - Anode
Pin 7 - Starter-Anode
Pin 8 - No Connection

CHARACTERISTICS

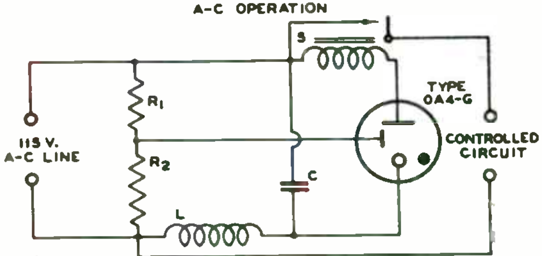
Peak Anode Breakdown Voltage (Starter anode tied to cathode)	225 min.	volts
Peak Positive Starter-Anode Breakdown Voltage	70 min.	volts
	90 max.	volts
Starter-Anode Current (For transition of discharge to anode at 140 volts peak)	100 max.	μamp.
Starter-Anode Drop	60 approx.	volts
Anode Drop	70 approx.	volts

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

Relay Service

Peak Cathode Current	100 max.	ma.
D-C Cathode Current	25 max.	ma.
Typical Operation with A-C Supply:		
Anode-Supply Voltage (RMS)	105 - 130	volts
A-C Starter-Anode Voltage (peak)	70 max.	volts
R-F Starter-Anode Voltage (peak)	55 min.	volts
Sum of A-C and R-F Starter-Anode Voltages (peak)	110 min.	volts

SCHEMATIC RELAY CIRCUIT USING TYPE 0A4-G
A-C OPERATION



$\left.\begin{matrix}C\\L\end{matrix}\right\}$ = HIGH-Q TUNED CIRCUIT FOR R-F SIGNAL

R_1 = 15000 OHMS (½ WATT)

R_2 = 10000 OHMS (½ WATT)

S = RELAY — CHOSEN FOR DESIGN REQUIREMENTS

The license extended to the purchaser of tubes appears in the License Notice accompanying them. Information contained herein is furnished without assuming any obligations.

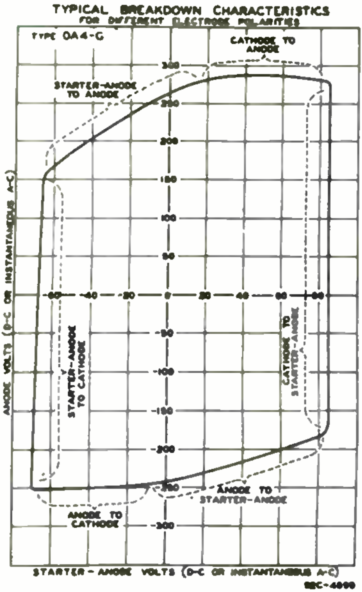
APRIL 20, 1938 TENTATIVE DATA

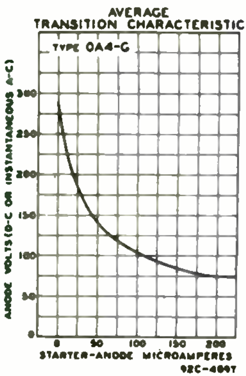
RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC

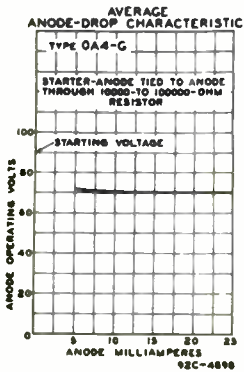
World Radio History

OA4-G

0A4-G
GAS-TRIODE







APRIL 20, 1938

92C-4897, 4898, 4899

World Radio History

OB2

VOLTAGE REGULATOR

MINIATURE GLOW-DISCHARGE TYPE

GENERAL DATA

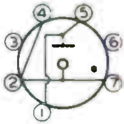
Electrical:

Cathode. . . . . Cold

Mechanical:

Mounting Position. . . . . Any
Maximum Overall Length . . . . 2-5/8"
Maximum Seated Length. . . . . 2-3/8"
Length, Base Seat to Bulb Top (Excluding tip). . . 2" ± 3/32"
Maximum Diameter . . . . 3/4"
Weight (Approx.) . . . . 0.3 oz ←
Bulb T-5-1/2
Base . . . . . . Small-Button Miniature 7-Pin (JETEC No.E7-1) ←
Basing Designation for BOTTOM VIEW 5BO

Pin 1 – Anode
Pin 2 – Cathode
Pin 3 – Internal Connection–Do Not Use
Pin 4 – Cathode



Pin 5 – Anode
Pin 6 – Internal Connection–Do Not Use
Pin 7 – Cathode

Maximum and Minimum Ratings, ***Absolute Values:***

AVERAGE STARTING CURRENT♦	75 max.	ma
DC CATHODE CURRENT	30 max.	ma
	5 min.	ma
FREQUENCY.	0 max.	cps ←
AMBIENT-TEMPERATURE RANGE.	-55 to +90	°C

Circuit Values:

Shunt Capacitor.	0.1 max.	μμf
Series Resistor.	*See note below*	

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN ←

	Min.	*Av.*	*Max.*	
DC Anode-Supply Voltage. . . .	133■	–	–	volts
Anode Breakdown Voltage. . . .	–	115	133*	volts
Anode Voltage Drop	101•	108	114*	volts
Regulation (5 to 30 ma.) . . .	–	1	4*	volts

♦ Averaged over starting period not exceeding 10 seconds. This starting period must be followed by a steady-state operating condition of at least 20 minutes, or tube performance will be impaired.

■ Not less than indicated supply voltage should be provided to insure "starting" throughout tube life.

* Maximum individual tube value during useful life.

• Minimum individual tube value during useful life.

The operating considerations and circuit information shown under Type OA2 also apply to Type OB2

← Indicates a change.

World Radio History

RCA

OC2

VOLTAGE REGULATOR

7-PIN MINIATURE, 75-VOLT, GLOW-DISCHARGE TYPE

GENERAL DATA

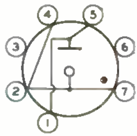
Electrical:

Cathode . . . . Cold

Mechanical:

Operating Position . . . . .Any
Maximum Overall Length . . . . 2.63"
Maximum Seated Length. . . . . 2.38"
Length, Base Seat to Bulb Top (Excluding tip). 2.00" ± 0.09"
Maximum Diameter . . . . 0.75"
Dimensional Outline. . . . . *See General Section*
Bulb T5-1/2
Base . . . . Small-Button Miniature 7-Pin (JETEC No.E7-1)
Basing Designation for BOTTOM VIEW. 5BO

Pin 1 – Anode
Pin 2 – Cathode
Pin 3 – Internal Connection— Do Not Use
Pin 4 – Cathode



Pin 5 – Anode
Pin 6 – Internal Connection— Do Not Use
Pin 7 – Cathode

Maximum and Minimum Ratings, ***Absolute Values:***

AVERAGE STARTING CURRENT▲.	75 max.	ma
DC CATHODE CURRENT	30 max.	ma
	5 min.	ma
FREQUENCY.	0 max.	cps
AMBIENT-TEMPERATURE RANGE.	-55 to +90	°C

Maximum Circuit Values:

Shunt Capacitance.	0.1 max.	μf

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	*Av.*	*Max.*	
DC Anode-Supply Voltage.	*	–	–	volts
Anode Breakdown Voltage:				
Under total darkness	–	–	145**	volts
Under normal ambient light conditions	–	105	115**	volts
Anode Voltage Drop	68●	75	83	volts
Regulation (5 to 30 ma.)	–	3	4.5	volts

▲ Averaged over starting period not exceeding 10 seconds. This starting period must be followed by a steady-state operating condition of at least 20 minutes, or tube performance will be impaired.

* The minimum value to insure "starting" throughout tube life must be equal to the anode breakdown voltage plus the voltage drop across the series resistor at the maximum value of the load current.

** Maximum individual tube value during useful life.

● Minimum individual tube value during useful life.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

World Radio History

RCA

OC2

VOLTAGE REGULATOR

OPERATING CONSIDERATIONS

Sufficient resistance must always be used in series with the OC2 to limit the current through the tube.

The value for the series resistor is dependent on the dc supply voltage, anode voltage drop, load current, and cathode current and should be chosen to limit the operating current through the tube to 30 milliamperes at all times after the starting period.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

OC3

VOLTAGE REGULATOR

GLOW-DISCHARGE TYPE

GENERAL DATA

Electrical:

Cathode . . . . .Cold

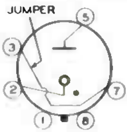
Mechanical:

Mounting Position	Any
Maximum Overall Length.	4-1/8"
Seated Length	3-3/8" ± 3/16"
Maximum Diameter.	1-9/16"
Dimensional Outline	*See General Section*
Weight (Approx.).	1.3 oz
Bulb.	ST-12
Base.	Small-Shell Octal 6-Pin (JETEC No.B6-3)
Basing Designation for BOTTOM VIEW.	4AJ

Pin 1 - No Connection

Pin 2 - Cathode

Pin 3 - Jumper▲



Pin 5 - Anode

Pin 7 - Jumper▲

Pin 8 - No Connection

Maximum and Minimum Ratings, ***Absolute Values:***

AVERAGE STARTING CURRENT♦	100 max.	ma
DC CATHODE CURRENT.	40 max.	ma
	5 min.	ma
FREQUENCY	0 max.	cps
AMBIENT-TEMPERATURE RANGE	-55 to +90	°C

Circuit Values:

Shunt Capacitor	0.1 max.	μf
Series Resistor	*See note below*	

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	*Av.*	*Max.*	
DC Anode-Supply Voltage	133■	-	-	volts
Anode Breakdown Voltage	-	115	133*	volts
Anode Voltage Drop.	103•	108	116*	volts
Regulation (5 to 40 ma)	-	2	4*	volts

▲ With suitable socket connections, jumper within base acts as a switch to open power-supply circuit when voltage regulator tube is removed from socket.

♦ Averaged over starting period not exceeding 10 seconds. This starting period must be followed by a steady-state operating condition of at least 20 minutes, or tube performance will be impaired.

■ Not less than indicated supply voltage should be provided to insure "starting" throughout tube life.

* Maximum individual tube value during useful life.

• Minimum individual tube value during useful life.

The operating considerations and circuit information shown under Type OA3 also apply to Type OC3

← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

OD3
VOLTAGE REGULATOR

GLOW-DISCHARGE TYPE

GENERAL DATA

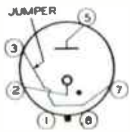
Electrical:

Cathode . . . . Cold

Mechanical:

Mounting Position . . . . Any
Maximum Overall Length. . . . . 4-1/8"
→ Seated Length . . . . 3-3/8" ± 3/16"
Maximum Diameter. . . . . 1-9/16"
Dimensional Outline . . . . *See General Section*
→ Weight (Approx.). . . . . 1.3 oz
Bulb ST-12
→ Base . . . . Small-Shell Octal 6-Pin (JETEC No.B6-3)
Basing Designation for BOTTOM VIEW. 4AJ

Pin 1 – No Connection
Pin 2 – Cathode
Pin 3 – Jumper▲



Pin 5 – Anode
Pin 7 – Jumper▲
Pin 8 – No Connection

Maximum and Minimum Ratings, ***Absolute Values:***

AVERAGE STARTING CURRENT♦	100 max.	ma
DC CATHODE CURRENT.	40 max.	ma
	5 min.	ma
→ FREQUENCY	0 max.	cps
AMBIENT-TEMPERATURE RANGE	-55 to +90	°C

→ **Circuit Values:**

Shunt Capacitor	0.1 max.	μf
Series Resistor	*See note below*	

→ **CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN**

	Min.	*Av.*	*Max.*	
DC Anode-Supply Voltage	185■	–	–	volts
Anode Breakdown Voltage	–	160	185•	volts
Anode Voltage Drop.	142●	153	165•	volts
Regulation (5 to 40 ma)	–	4	5.5•	volts

▲ With suitable socket connections, jumper within base acts as a switch to open power-supply circuit when voltage regulator tube is removed from socket.

♦ Averaged over starting period not exceeding 10 seconds. This starting period must be followed by a steady state operating condition of at least 20 minutes, or tube performance will be impaired.

■ Not less than indicated supply voltage should be provided to insure "starting" throughout tube life.

• Maximum individual tube value during useful life.

● Minimum individual tube value during useful life.

The operating considerations and circuit information shown under Type OA3 also apply to Type OD3

→ Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

Voltage-Regulator

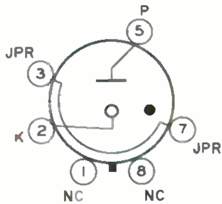
GLOW-DISCHARGE TYPE **105 VOLTS**

For Applications Requiring a Relatively Constant DC Output Voltage, Independent of Load and Supply-Voltage Variations

Mechanical:

Operating Position	Any
Type of Cathode	Cold
Maximum Overall Length	3-1/16"
Maximum Seated Length	2-1/2"
Maximum Diameter	1-9/32"
Dimensional Outline	See *General Section*
Bulb	T9
Base	Intermediate-Shell Octal 6-Pin, Arrangement 1 (JEDEC Group 1, No.B6-8)
Basing Designation for BOTTOM VIEW	4AJ

Pin 1 - No Internal Connection
Pin 2 - Cathode
Pin 3 - Jumper[a]
Pin 5 - Anode
Pin 7 - Jumper[a]
Pin 8 - No Internal Connection



VOLTAGE REGULATOR

Maximum and Minimum Ratings, ***Absolute-Maximum Values:***

Average Cathode Starting Current[b]	100 max.	ma
DC Cathode Current	40 max.	ma
	5 min.	ma
DC or AC Jumper Current	2 max.	amp
Ambient-Temperature Range	-55 to +90	°C

Circuit Values:

Shunt Capacitor	0.1 max.	μf
Series Resistor	See *Operating Considerations*	

[a] With suitable socket connections, the jumper within the tube base (between pins 3 and 7) provides for opening the power-supply circuit to protect circuit components when the voltage-regulator tube is removed from its socket.

[b] Averaged over starting period not exceeding 10 seconds. When starting currents greatly in excess of the maximum dc-cathode-current rating of 40 milliamperes are encountered, it may be necessary to operate these tubes as much as 20 minutes under steady-state conditions to assure stable operation.

World Radio History

CHARACTERISTICS RANGE VALUES

Values are initial unless otherwise specified

	Note	Min.	Av.	Max.	
DC Anode Supply Voltage				See *Note 1*	
DC Anode Starting Voltage in:					
Total darkness	–	–	–	210	volts
Normal ambient light (5 to 50 footcandles)	–	–	115	127	volts
Anode Voltage Drop for dc cathode current of:					
5 ma	–	105	–	–	volts
30 ma	–	105	109	111	volts
40 ma	–	105	110	112	volts
Regulation for dc-cathode-current range of:					
5 to 30 ma	2	–	1	2	volts
5 to 40 ma	2	–	2	4	volts
Tube Noise for dc cathode current of 40 ma	–	–	–	15	rms mv
DC Leakage Current for dc anode supply voltage of 50 volts and anode resistor of 3000 ohms	–	–	–	10	μa

Note 1: The minimum value to insure starting throughout useful tube life must be equal to the dc anode starting voltage plus the voltage drop across the series resistor at the maximum value of the load current.

Note 2: The maximum values for the specified regulation range apply throughout useful tube life.

OPERATING CONSIDERATIONS

shown under Type 0A3A also apply to the 0C3A

World Radio History

Voltage-Regulator

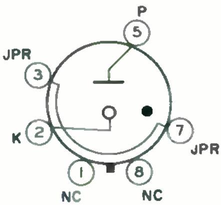
GLOW-DISCHARGE TYPE — 150 VOLTS

For Applications Requiring a Relatively Constant DC Output Voltage, Independent of Load and Supply-Voltage Variations

Mechanical:

Operating Position	Any
Type of Cathode	Cold
Maximum Overall Length	3-1/16"
Maximum Seated Length	2-1/2"
Maximum Diameter	1-9/32"
Dimensional Outline	See *General Section*
Bulb	T9
Base	Intermediate-Shell Octal 6-Pin, Arrangement 1 (JEDEC Group 1, No.B6-8)
Basing Designation for BOTTOM VIEW	4AJ

Pin 1 - No Internal Connection
Pin 2 - Cathode
Pin 3 - Jumper[a]
Pin 5 - Anode
Pin 7 - Jumper[a]
Pin 8 - No Internal Connection



VOLTAGE REGULATOR

Maximum and Minimum Ratings, ***Absolute-Maximum Values:***

Average Cathode Starting Current[b]	100 max.	ma
DC Cathode Current	40 max.	ma
	5 min.	ma
DC or AC Jumper Current	2 max.	amp
Ambient-Temperature Range	-55 to +90	°C

Circuit Values:

Shunt Capacitor	0.1 max.	µf
Series Resistor	See *Operating Considerations*	

[a] With suitable socket connections, the jumper within the tube base (between pins 3 and 7) provides for opening the power-supply circuit to protect circuit components when the voltage-regulator tube is removed from its socket.

[b] Averaged over starting period not exceeding 10 seconds. When starting currents greatly in excess of the maximum dc-cathode-current rating of 40 milliamperes are encountered, it may be necessary to operate these tubes as much as 20 minutes under steady-state conditions to assure stable operation.

World Radio History

0D3A

CHARACTERISTICS RANGE VALUES

Values are initial unless otherwise specified

	Note	Min.	Av.	Max.	
DC Anode Supply Voltage.				See *Note 1*	
DC Anode Starting Voltage in:					
Total darkness	–	–	–	225	volts
Normal ambient light (5 to 50 footcandles). . . .	–	–	160	180	volts
Anode Voltage Drop for dc cathode current of:					
5 ma..	–	145	–	–	volts
30 ma.	–	145	149	160	volts
40 ma.	–	145	150	162	volts
Regulation for dc-cathode-current range of:					
5 to 30 ma..	2	–	2	4	volts
5 to 40 ma..	2	–	4	5.5	volts
Tube Noise for dc cathode current of 40 ma.	–	–	–	15	rms mv
DC Leakage Current for dc anode supply voltage of 50 volts and anode resistor of 3000 ohms	–	–	–	10	μa

Note 1: The minimum value to insure starting throughout useful tube life must be equal to the dc anode starting voltage plus the voltage drop across the series resistor at the maximum value of the load current.

Note 2: The maximum values for the specified regulation range apply throughout useful tube life.

OPERATING CONSIDERATIONS

shown under Type 0A3A also apply to the 0D3A

World Radio History

1C21

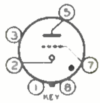
1C21

GAS-TRIODE

COLD-CATHODE GLOW-DISCHARGE TYPE

Maximum Overall Length	2-5/8"
Maximum Seated Height	2-1/16"
Maximum Diameter	1-5/16"
Bulb	T-9
Base	Intermed. Sh. Octal 6-Pin

Pin 1 – No Connection
Pin 2 – Cathode
Pin 3 – No Connection
Pin 5 – Anode



Pin 7 – Grid
Pin 8 – No Connection
● – Gas Tube Type

Mounting Position — BOTTOM VIEW (G-4V) — Any

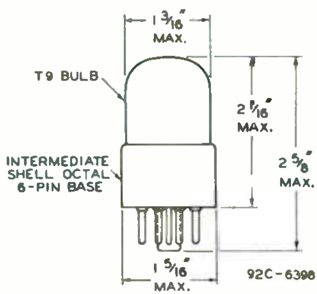
CHARACTERISTICS

Peak Anode Breakdown Voltage (Grid tied to cathode)	180 min.	volts
Peak Positive Grid Breakdown Voltage	{ 66 min.	volts
	80 max.	volts
D-C Anode Extinction Voltage	73 approx.	volts
Grid Current (For transition of discharge to anode at 100 volts peak)	{ 25 av.	μamp.
	50 max.	μamp.
Anode Voltage-Drop	73 approx.	volts
Grid Voltage-Drop	55 approx.	volts

Maximum Ratings Are Design-Center Values

MAXIMUM RATINGS

Peak Cathode Current	100 max.	ma.
D-C Cathode Current	25 max.	ma.
Typical Operation as Relay Tube:		
D-C Anode-Supply Voltage	125 - 145	volts
Peak Positive Grid-Bias Voltage	66 max.	volts
Peak Grid-Signal Voltage	40 min.	volts
Sum of Grid-Bias and Grid-Signal Voltages (Peak)	100 min.	volts
D-C Grid Current	100	μamp.



Dec. 1, 1942

TENTATIVE DATA

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

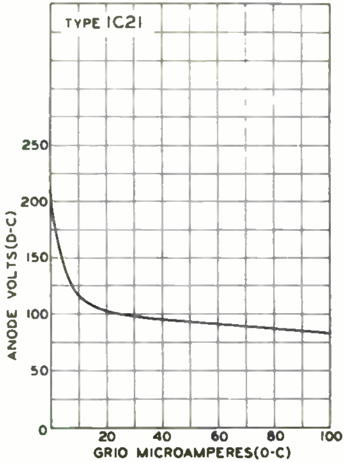
World Radio History

1C21

1C21

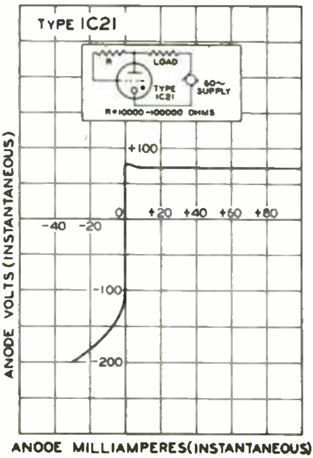
GAS-TRIODE

AVERAGE TRANSITION CHARACTERISTIC



92C-6419R1

AVERAGE ANODE CHARACTERISTIC



92C-6420

Dec. 1, 1942

92C-6419R1
92C-6420

World Radio History

2D21
THYRATRON

GAS TETRODE, MINIATURE TYPE

GENERAL DATA

Electrical:

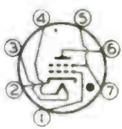
	Min.	Av.	Max.	
Heater, for Unipotential Cathode:				
Voltage (AC or DC).	5.7	6.3	6.9	volts
Current, with heater volts = 6.3	0.54	0.60	0.66	amp
Cathode:				
Heating Time, prior to tube conduction. . .	10	-	-	sec
Direct Interelectrode Capacitances (Approx.):°				
Grid No.1 to Anode.			0.026	μμf
Input			2.4	μμf
Output.			1.6	μμf
Ionization Time (Approx.):				
For conditions: dc anode volts = 100; grid-No.1 square-pulse volts = 50; peak anode amp. during conduction = 0.5			0.5	μsec
Deionization Time (Approx.):				
For conditions: dc anode volts = 125; grid-No.1 volts = -100, grid-No.1 resistor (ohms) = 1000; dc anode amp. = 0.1			35	μsec
For conditions: dc anode volts = 125; grid-No.1 volts = -10; grid-No.1 resistor (ohms) = 1000; dc anode amp. = 0.1			75	μsec
Maximum Critical Grid Current, with ac anode-supply volts (rms) = 460, and average anode amp. = 0.1			0.5	μamp
Anode Voltage Drop (Approx.).			8	volts
Grid-No.1 Control Ratio (Approx.) with grid-No.1 resistor (megohms) = 0; grid-No.2 volts = 0				250
Grid-No.2 Control Ratio (Approx.) with grid-No.1 resistor (megohms) = 0; grid-No.2 resistor (megohms) = 0; grid-No.1 volts = 0				1000

° Without external shield.

Mechanical:

Mounting Position . . . . Any
Maximum Overall Length. . . . . 2-1/8"
Maximum Seated Length . . . . 1-7/8"
Length, Base Seat to Bulb Top (excluding tip). . 1-1/2" ± 3/32"
Maximum Diameter. . . . . 3/4"
Bulb. T-5-1/2
Base. . . . . Small-Button Miniature 7-Pin
Basing Designation for BOTTOM VIEW. 7BN

Pin 1 - Grid No.1
Pin 2 - Cathode
Pin 3 - Heater
Pin 4 - Heater



Pin 5 - Grid No.2
Pin 6 - Anode
Pin 7 - Grid No.2

← Indicates a change.

World Radio History

2D21
THYRATRON

RELAY and GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, ***Absolute Values:***

PEAK ANODE VOLTAGE:			
Forward	650	max.	volts
Inverse	1300	max.	volts
GRID-No. 2 (SHIELD-GRID) VOLTAGE:			
Peak, before anode conduction	-100	max.	volts
→ Average, during anode conduction■	-10	max.	volts
GRID-No. 1 (CONTROL-GRID) VOLTAGE:			
Peak, before anode conduction	-100	max.	volts
→ Average, during anode conduction■	-10	max.	volts
CATHODE CURRENT:			
Peak	0.5	max.	amp
Average■	0.1	max.	amp
→ Surge, for duration of 0.1 sec. max.	10	max.	amp
GRID-No. 2 CURRENT:			
→ Average■	+0.01	max.	amp
GRID-No. 1 CURRENT:			
→ Average■	+0.01	max.	amp
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	100	max.	volts
Heater positive with respect to cathode	25	max.	volts
→ AMBIENT TEMPERATURE RANGE	-75 to +90		°C

→ **Typical Operating Conditions for Relay Service:**

RMS Anode Voltage	117	400	volts
Grid-No. 2 Voltage	0	0	volts
RMS Grid-No. 1 Bias Voltage□	5	-	volts
DC Grid-No. 1 Bias Voltage	-	-6	volts
Peak Grid-No. 1 Signal Voltage	5	6	volts
Grid-No. 1-Circuit Resistance	1.0	1.0	megohm
Anode-Circuit Resistance#	1200	2000	ohms

Maximum Circuit Values:

Grid-No. 1-Circuit Resistance	10 max.	megohms

■ Averaged over any interval of 30 sec. max.

□ Approximately 180° out of phase with the anode voltage.

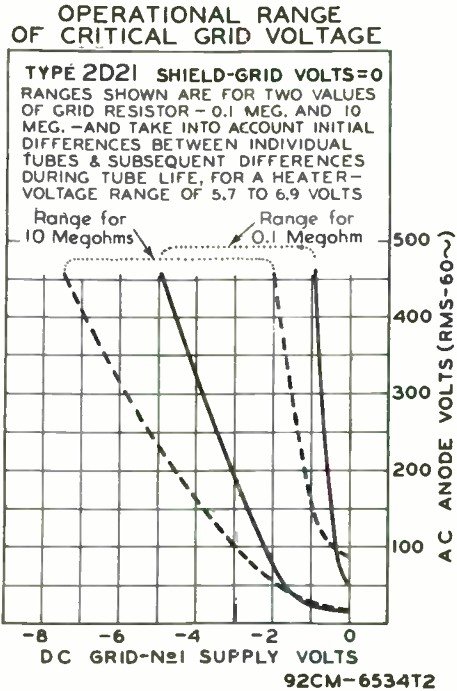
Sufficient resistance, including the tube load, must be used under any conditions of operation to prevent exceeding the current ratings.

→ Indicates a change.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

2D21 THYRATRON

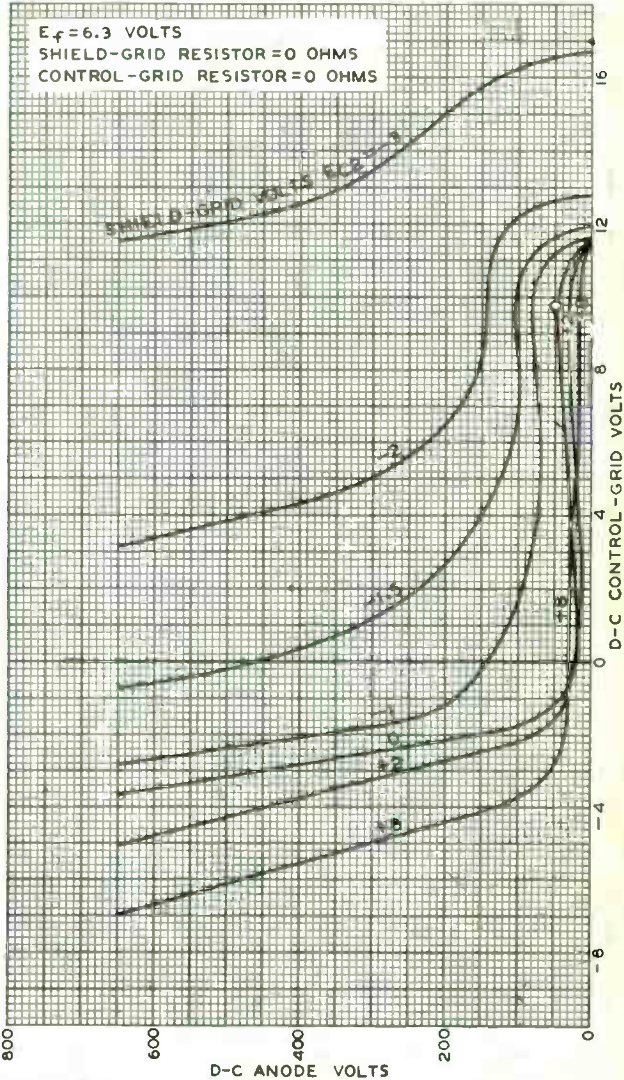


World Radio History

World Radio History

2D21

AVERAGE CONTROL CHARACTERISTICS

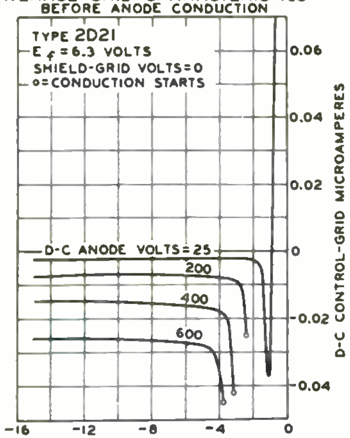


MAY 2, 1944

2D21

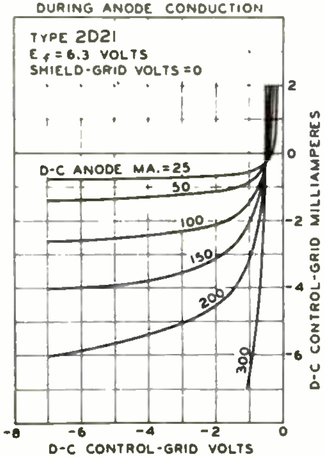
THYRATRON

AVERAGE GRID CHARACTERISTICS
BEFORE ANODE CONDUCTION



92CM-6532T1

AVERAGE GRID CHARACTERISTICS
DURING ANODE CONDUCTION



92CM-6533T

World Radio History

RCA

3C23

GAS-AND-MERCURY-VAPOR THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

GENERAL DATA

Electrical:

Filament, Coated:		
Voltage	2.5 ± 5%	ac or dc volts
Current at 2.5 volts. . .	7	amp
Minimum heating time prior to tube conduction	15	sec
Direct Interelectrode Capacitance (Approx.):°		
Grid to anode	1.8	μμf
Ionization Time (Approx.):		
For conditions: dc anode volts = 100, peak grid volts = +30, and peak anode amperes = 6	3	μsec
Deionization Time (Approx.):		
For conditions: dc anode volts = 120, dc grid-supply volts = -20, grid resistor (ohms) = 10000, and dc anode amperes = 1.5	360	μsec
For conditions: dc anode volts = 120, dc grid-supply volts = -500, grid resistor (ohms) = 100000, and dc anode amperes = 1.5	60	μsec
Anode Voltage Drop (Approx.).	15	volts

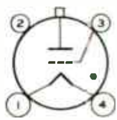
Mechanical:

Mounting Position	Vertical, base down
Maximum Overall Length.	6-1/8"
Seated Length	5-1/4" ± 1/4"
Maximum Diameter	2-1/16"
Cooling	Natural circulation of air around tube
Weight (Approx.)	3 oz
Bulb.	ST-16
Cap	Medium (JETEC No.C1-5)
Base.	Medium-Shell Small 4-Pin with Bayonet (JETEC No.A4-10)
Basing Designation for BOTTOM VIEW	3G

Pin 1 - Filament

Pin 2 - No Connection

Pin 3 - Grid



Pin 4 - Filament

Cap - Anode

CONTROL SERVICE

Maximum Ratings, *Absolute Values: For supply frequency up to 400 cps*

	Operating Condensed-Mercury Temperature Range: -40° to $+100^{\circ}C$	-40° to $+80^{\circ}C$	
PEAK ANODE VOLTAGE:			
Forward	200 max.	1250 max.	volts
Inverse	200 max.	1250 max.	volts

° Without external shield.

← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

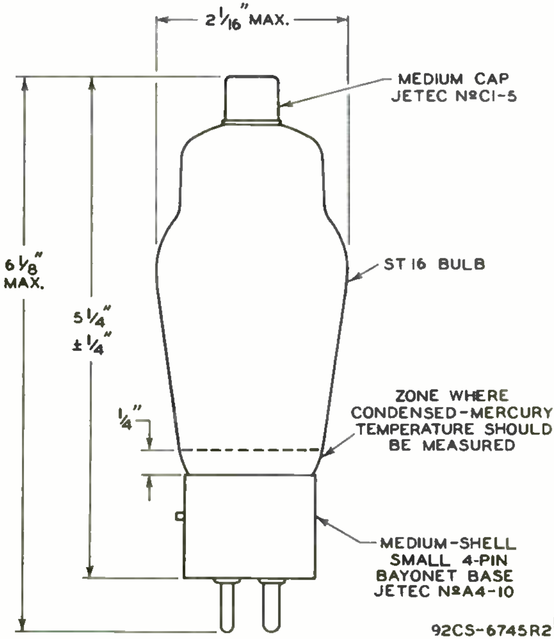
World Radio History

3C23

GAS-AND-MERCURY-VAPOR THYRATRON

	Operating Condensed-Mercury Temperature Range -40° to +100°C	-40° to +80°C	
GRID VOLTAGE:			
·Peak or DC, before tube conduction	-500 max.	-500 max.	volts
Average▲, during tube conduction	-10 max.	-10 max.	volts
ANODE CURRENT:			
Peak	6 max.	6 max.	amp
Average●	1.5 max.	1.5 max.	amp
Fault, for duration of 0.1 second max.	120 max.	120 max.	amp
GRID CURRENT:			
Average♦	+0.01 max.	+0.01 max.	amp

▲ Averaged over one conducting period.
● Averaged over any interval of 5 seconds maximum.
♦ Averaged over period of grid conduction.

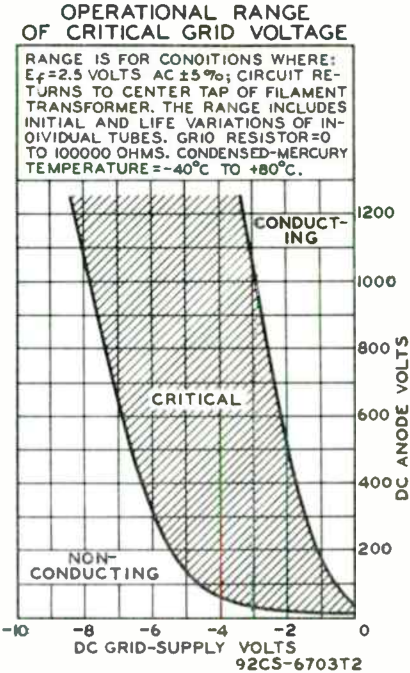


TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

3C23

GAS-AND-MERCURY-VAPOR THYRATRON



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

World Radio History

3D22-A

3D22-A
GAS THYRATRON

NEGATIVE-CONTROL TETRODE TYPE

Supersedes Type 3D22

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:

	Min.	Av.	Max.	
Voltage	5.7	6.3	6.9	ac or dc volts
Current at 6.3 volts	–	2.6	2.85	amp

Cathode:		
Minimum heating time prior to tube conduction	30	sec
Maximum outage time without reheating	3	sec
Direct Interelectrode Capacitances (Approx.):°		
Grid No.1 to anode*	0.1	μμf
Grid No.1 to cathode, grid No.2, base shell, and heater	8.5	μμf
Anode to cathode, grid No.2, base shell, and heater	4.6	μμf
Ionization Time (Approx.):		
For conditions: dc anode volts = 100, grid-No.1 square-pulse volts = +100, and peak anode amperes during conduction = 8	0.5	μsec
Deionization Time (Approx.):		
For conditions: dc anode volts = 125, dc grid-No.1 volts = −200, grid-No.1 resistor (ohms) = 1000, and dc anode amperes = 0.8	150	μsec
For conditions: dc anode volts = 125, dc grid-No.1 volts = −14.8, grid-No.1 resistor (ohms) = 1000, and dc anode amperes = 0.8	400	μsec
Maximum Critical Grid-No.1 Current:		
For conditions: ac anode-supply volts = 460 (rms), and average anode amperes = 0.8	0.8	μamp
Anode Voltage Drop (Approx.)	10	volts
Grid-No.1 Control Ratio (Approx.):		
For conditions: grid-No.1 resistor (megohms) = 0 to 0.1, grid-No.2 resistor (megohms) = 0, and grid-No.2 volts = 0	150	
Grid-No.2 Control Ratio (Approx.):		
For conditions: grid-No.1 resistor (megohms) = 0, grid-No.2 resistor (megohms) = 0 to 0.1, and grid-No.1 volts = −3	650	

° Without external shield.

* With all other electrodes and base shell connected to ground.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

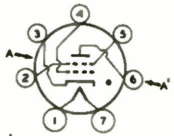
RCA

3D22-A
GAS THYRATRON

Mechanical:

Mounting Position	Any
Maximum Overall Length	4-5/8"
Maximum Seated Length	4"
Maximum Diameter	2-3/8"
Weight (Approx.)	5 oz
Bulb	T-16
Base	Medium-Metal-Shell Giant 7-Pin with Bayonet (JETEC No.A7-17)
Basing Designation for BOTTOM VIEW	7BV

Pin 1 - Heater
Pin 2 - Grid No.2
Pin 3 - Cathode
Pin 4 - Grid No.1



AA' = PLANE OF ELECTRODES

Pin 5 - Grid No.2
Pin 6 - Anode
Pin 7 - Heater

RELAY AND GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, ***Absolute Values:***

PEAK ANODE VOLTAGE:		
Forward	650 max.	volts
Inverse	1500 max.	volts
GRID-No.2 (SHIELD-GRID) VOLTAGE:		
Peak, before tube conduction	-100 max.	volts
Average#, during tube conduction	-10 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:		
Peak or DC, before tube conduction	-200 max.	volts
Average#, during tube conduction	-10 max.	volts
CATHODE CURRENT:		
Peak	8 max.	amp
Average#	0.8 max.	amp
Fault, for duration of 0.1 second max.	30 max.	amp
AVERAGE GRID-No.2 CURRENT#	+0.1 max.	amp
AVERAGE GRID-No.1 CURRENT#	+0.05 max.	amp
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	100 max.	volts
Heater positive with respect to cathode	25 max.	volts
AMBIENT-TEMPERATURE RANGE	-75 to +90	°C

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	2 max.	megohms

Averaged over any interval of 30 seconds maximum.

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GAS THYRATRON

SPECIAL PERFORMANCE TESTS

Made in conformance with indicated sections of MIL-E-1B Specifications dated 2 May 1952

4.9.19.2 (F-66) High-Frequency Vibration:

The tube is rigidly mounted on a table vibrating with simple harmonic motion at a frequency of 50 ± 2 cps with a fixed amplitude of 0.040" ± 0.0025" (total excursion is double the amplitude). Maximum acceleration is 10g. No voltage is applied during vibration. Tube is vibrated for 10 minutes in such manner that table motion is along shortest line between anode and cathode. This test will not cause tube to be inoperative.

4.10.19 (F-64) Thyratron High-Voltage Operation:

	Min.	Max.	
Grid-No.1 Supply Voltage (1)	-4.4	-9.2	volts

This test is made after two light taps with a felt hammer (similar to type used for noise tests) in direction from cathode to anode under the following conditions: heater voltage of 6.3 volts rms, anode supply voltage of 500 volts rms, grid No.2 tied to cathode, load resistance of 2000 ohms, and grid-No.1 circuit-resistance of 2 megohms. Tube conduction is indicated by an oscilloscope connected between anode and cathode and ceases when the grid-No.1 supply voltage is increased negatively within indicated range.

	Min.	Max.	
Grid-No.1 Supply Voltage (2)	-4.4	-9.2	volts

This test is made as for Grid-No.1 Supply Voltage (1), except that the taps are made in direction from anode to cathode.

	Min.	Max.	
Voltage Difference	-	1	volt

The difference between the value of grid-No.1 supply voltage in the first and second grid-No.1 supply voltage tests will not exceed the specified value.

OPERATING CONSIDERATIONS

Sufficient *anode-circuit resistance*, including the tube load, must be used under any conditions of operation to prevent exceeding the current ratings of the tube.

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GRID-CONTROLLED RECTIFIER CIRCUITS

DC Voltage Control

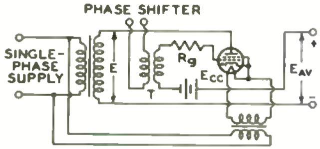

FIG. 1 HALF-WAVE SINGLE-PHASE

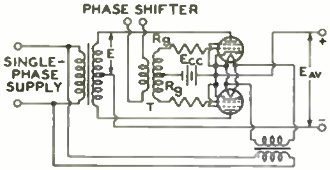

FIG. 2 FULL-WAVE SINGLE-PHASE

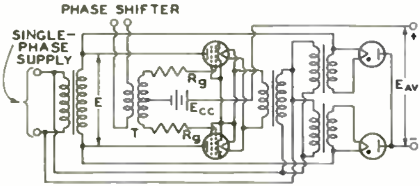

FIG. 3 SERIES SINGLE-PHASE

AC Voltage Control

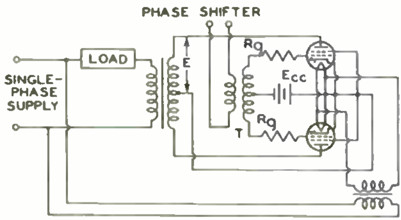

FIG.4 FULL-WAVE SINGLE-PHASE

NOTES

92CL-8596

T = PEAKING TRANSFORMER

IN FIG. 3, THE RECTIFIER TUBES MAY BE 3D22-A's USED AS DIODES. THE 3D22-A IS USED AS A DIODE BY CONNECTING GRIDS No 2 AND No 1 TO CATHODE (PIN 3)

Devices and arrangements shown or described herein may use patents of RCA or others. Information contained herein is furnished without responsibility by RCA for its use and without prejudice to RCA's patent rights.

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GRID-CONTROLLED RECTIFIER CIRCUITS

Numerical Relationships Among Electrical Quantities

E = Trans. Sec. Voltage (RMS)
E_{av} = Average DC Output Voltage
E_{bmf} = Peak Forward Anode Voltage
E_{bmi} = Peak Inverse Anode Voltage
E_m = Peak DC Output Voltage
E_r = Major Ripple Voltage (RMS)
f = Supply Frequency
f_r = Major Ripple Frequency
I_{av} = Average DC Output Current
I_b = Average Anode Current
I_p = Anode Current (RMS)
I_{pm} = Peak Anode Current
P_{ac} = Load Volt-Amperes
P_{al} = Line Volt-Amperes
P_{ap} = Trans. Pri. Volt-Amperes
P_{as} = Trans. Sec. Volt-Amperes
P_{dc} = DC Power ($E_{av} \times I_{av}$)

Note: Conditions assumed involve sine-wave supply; zero voltage drop in tubes; no losses in transformer and circuit; no back emf in the load circuit; and no phase-back.

RATIO	Fig. 1	Fig. 2	Fig. 3	Fig. 4
Voltage Ratios				
E/E_{av}	2.22	1.11	1.11	-
E_{bmi}/E	1.41	2.83	1.41	1.41
E_{bmi}/E_{av}	3.14	3.14	1.57	-
E_m/E_{av}	3.14	1.57	1.57	-
E_r/E_{av}	1.11	0.472	0.472	-
E_{bmf}/E:				
Resistive Load	1.41	1.41	1.41	1.41
Inductive Load■	1.41	2.83	1.41	1.41
Frequency Ratio				
f_r/f	1	2	2	-
Current Ratios				
I_p/I_{av}	1.57	0.785	0.785	-
I_b/I_{av}	1	0.5	0.5	-
Resistive Load				
I_{pm}/I_{av}	3.14	1.57	1.57	-
I_{pm}/I_b	3.14	3.14	3.14	3.14
Inductive Load■				
I_{pm}/I_{av}	--	1	1	-
Power Ratios				
P_{ac}/I_bE_{bmf}	--	-	-	1.57
Resistive Load				
P_{as}/P_{dc}	3.49	1.74	1.24	-
P_{ap}/P_{dc}	2.69	1.23	1.24	-
P_{al}/P_{dc}	2.69	1.23	1.24	-

■: See next page.

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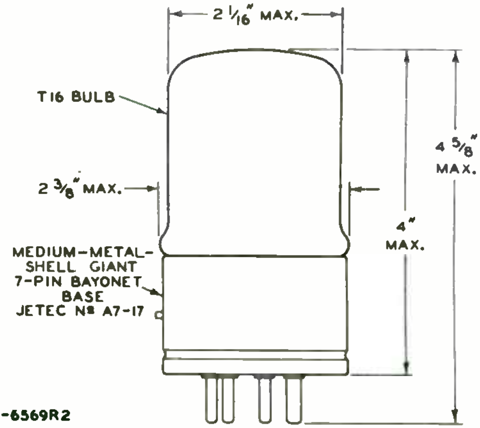
GAS THYRATRON

RATIO	Fig.1	Fig.2	Fig.3	Fig.4
Power Ratios (Cont'd)				
Inductive Load■				
P_{as}/P_{dc}	--	1.57	1.11	-
P_{ap}/P_{dc}	--	1.11	1.11	-
P_{al}/P_{dc}	--	1.11	1.11	-

■ The use of a large filter-input choke is assumed, except for the circuit in Fig.4.

CIRCUIT Single-Phase	MAX. TRANS. SEC. VOLTS (RMS) E	APPROX. DC OUTPUT VOLTS TO FILTER E_{av}	MAX. DC OUTPUT AMPERES I_{av}	MAX. DC OUTPUT WATTS TO FILTER P_{dc}	MAX. AC OUTPUT VOLT-AMPERES P_{ac}
Fig.1 Half-Wave	460	205	0.8	165	-
Fig.2 Full-Wave:					
Resistive Load	460	410	1.6	660	-
Inductive Load	230	205	1.6	330	-
Fig.3 Series	460	410	1.6	660	-
Fig.4 Full-Wave	460	-	-	-	800



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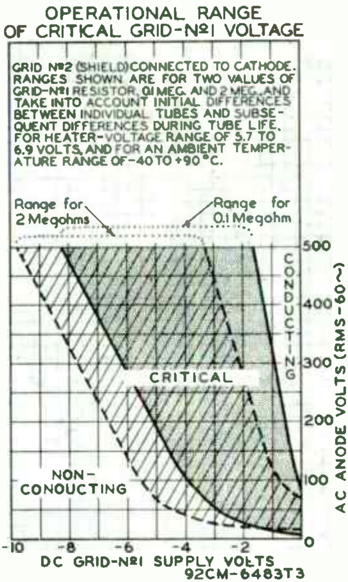

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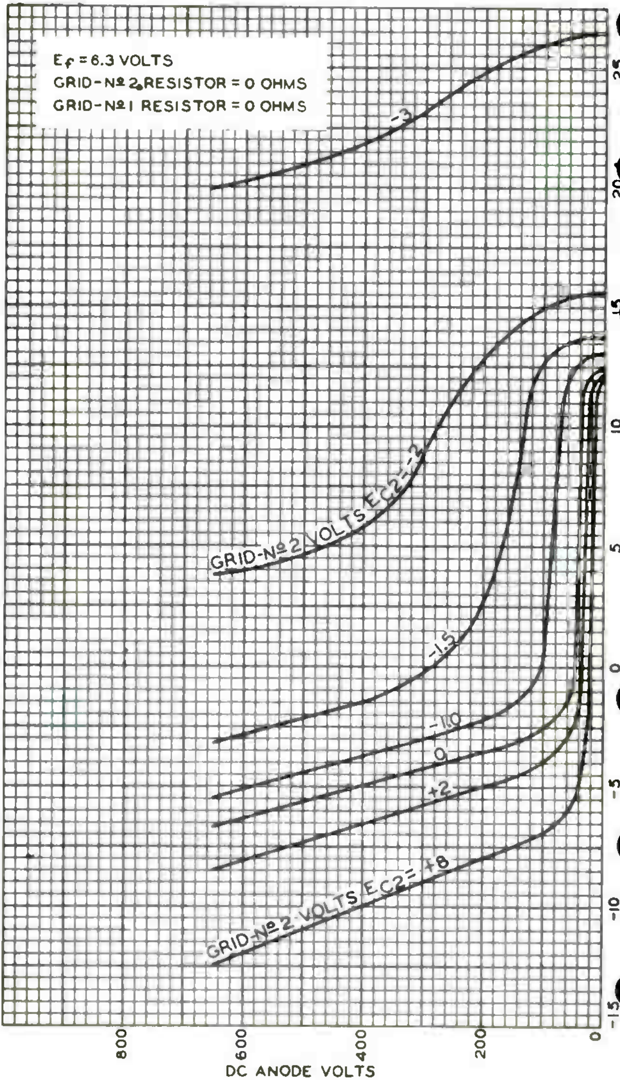
AVERAGE CONTROL CHARACTERISTICS



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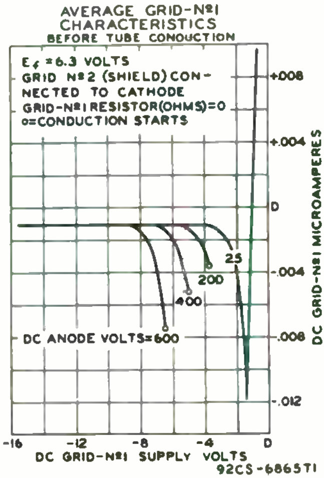
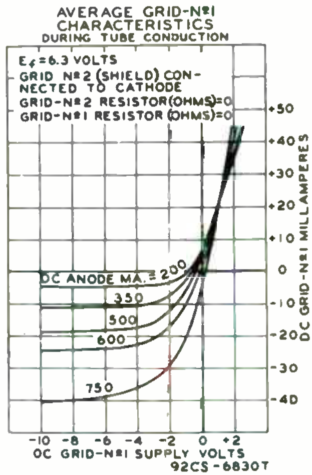
CHARACTERISTIC CURVES





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THYRATRON

MERCURY-VAPOR TETRODE

DATA

Electrical:

	Continuous Service		Intermittent Service		
Heater, for Unipotential Cathode:					
Voltage*	5.0	5.0	5.5	5.0	volts
Current.	10.0	10.0	11.0	10.0	amp
Direct Interelectrode Capacitance:					
Grid-No.1 to Anode (Approx.)	0.3	0.3	0.3	0.3	μμf
Peak Voltage Drop (Approx.). .	16	16	16	16	volts
Approx. Control Characteristics:					
Anode Voltage.	100	1000	100	1000	volts
Grid-No.2 Voltage.	0	0	0	0	volts
Grid-No.1 Voltage.	+1	-9	+1	-9	volts
Ionization Time (Approx.). . .	10	10	10	10	μsec.
Deionization Time (Approx.). .	1000	1000	1000	1000	μsec.

Mechanical:

Mounting Position.	Vertical, Base Down
Overall Length	11" ± 1/4"
Seated Length.	10-1/4" ± 1/4"
Greatest Radius.	2-13/16"
Bulb	ST-30
Caps	No. 3917
Base	Super-Jumbo 4-Pin, with Bayonet

Maximum Ratings, Absolute Values:

	Continuous Service	Intermittent Service		
PEAK FORWARD ANODE VOLT.	2500	750	10000	max.volts
PEAK INVERSE ANODE VOLT.	2500	750	10000	max.volts
GRID-No.1 (CONT.GRID) VOLT.:				
Before Conduction. . .	-1000	-1000	-1000	max.volts
During Conduction. . .	-10	-10	-10	max.volts
GRID-No.2 (SH'LD GRID) VOLT.:				
Before Conduction. . .	-500	-500	-500	max.volts
During Conduction. . .	-10	-10	-10	max.volts
INSTANTANEOUS ANODE CUR.:				
Below 25 Cycles. . . .	12.8	5.0	8.0	max.amp
25 Cycles and Higher .	40	77	16	max.amp
AVERAGE ANODE CURRENT. .	6.4	2.5	4.0	max.amp
SURGE ANODE CUR., for 0.1 sec., max.	400	400	160	max.amp
INSTANTANEOUS GRID-No.1 CUR.	1.0	1.0	1.0	max.amp
AVERAGE GRID-No.1 CUR. .	0.25	0.25	0.25	max.amp
INSTANTANEOUS GRID-No.2 CUR.	2.0	2.0	2.0	max.amp
AVERAGE GRID-No.2 CUR. .	0.5	0.5	0.5	max.amp
TIME OF AVERAGING CURRENT	15	5	15	max.sec
COND.-MERCURY TEMP. RANGE▲	40-80	30-95	25-50	°C

* Must be applied 5 minutes before anode voltage is applied.
▲ Recommended condensed-mercury temperature = 40°C.

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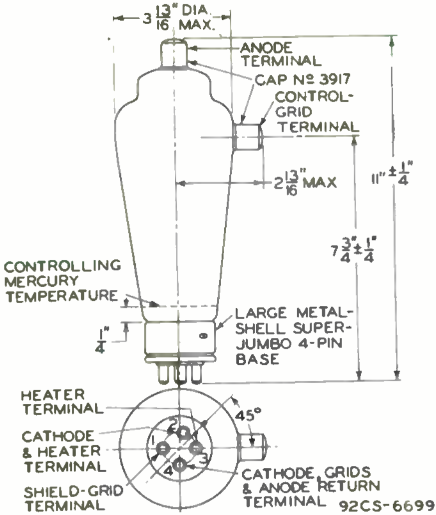
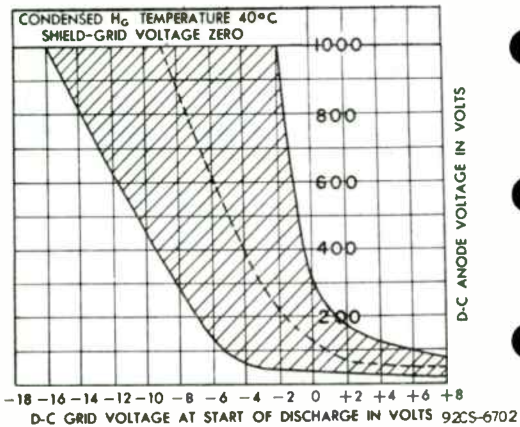
THYRATRON



OPERATIONAL REGION OF CRITICAL GRID VOLTAGE



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THYRATRON

METAL MERCURY-VAPOR TETRODE

DATA

Electrical:

	Continuous Service		Welder-Control Service		
Heater, for Unipotential Cathode:					
Voltage*	5.0	5.0	5.0	5.5	volts
Current	10.0	10.0	10.0	11.0	amp
Direct Interelectrode Capacitance (Approx.):					
Grid No.1 to Anode	0.07	0.07	0.07	0.07	μμf
Peak Voltage Drop	16	16	16	16	volts
Approx. Control Characteristics:					
Anode Voltage	100	2000	100	2000	volts
Grid-No.1 Voltage	+1.0	-14	+1.0	-14	volts
Grid-No.2 Voltage	0	0	0	0	volts
Ionization Time (Approx.)	10	10	10	10	μsec
Deionization Time (Approx.)	1000	1000	1000	1000	μsec

Mechanical:

Mounting Position . . . . Vertical, Radiator Down
Overall Rigid Length. . . . . 10-11/16" ± 1/16"
Greatest Radius . . . . 2-5/8"
Terminals . . . . See Outline Drawing

Maximum Ratings, Absolute Values:

	Continuous Service	Welder-Control Service	
PEAK FORWARD ANODE VOLT.	2000 max.	750 max.	volts
PEAK INVERSE ANODE VOLT.	2000 max.	750 max.	volts
GRID-No.1 (CONT. GRID) VOLT.:			
Before Conduction	-1000 max.	-1000 max.	volts
During Conduction	-10 max.	-10 max.	volts
GRID-No.2 (SHL'D GRID) VOLT.:			
Before Conduction	-300 max.	-300 max.	volts
During Conduction	-5.0 max.	-5.0 max.	volts
INSTANTANEOUS ANODE CUR.:			
Below 25 Cycles	13.0 max.	13.0 max.	amp
25 Cycles and Higher	40 max.	77 max.	amp
AVERAGE ANODE CURRENT**	6.4 max.	2.5 max.	amp
SURGE ANODE CURRENT for 0.1 sec. max.	400 max.	400 max.	amp
INSTANTANEOUS GRID-No.1 CUR.	1.0 max.	1.0 max.	amp
AVERAGE GRID-No.1 Cur.**	0.25 max.	0.25 max.	amp
INSTANTANEOUS GRID-No.2 CUR.	2.0 max.	2.0 max.	amp
AVERAGE GRID-No.2 CUR.**	0.5 max.	0.5 max.	amp
COND.-MERCURY TEMP. RANGE▲	40 - 80	30 - 95	°C

* Must be applied at least 5 minutes before anode voltage is applied.
** Averaged over any 15-second interval.
▲ Recommended condensed-mercury temperature 40°C.

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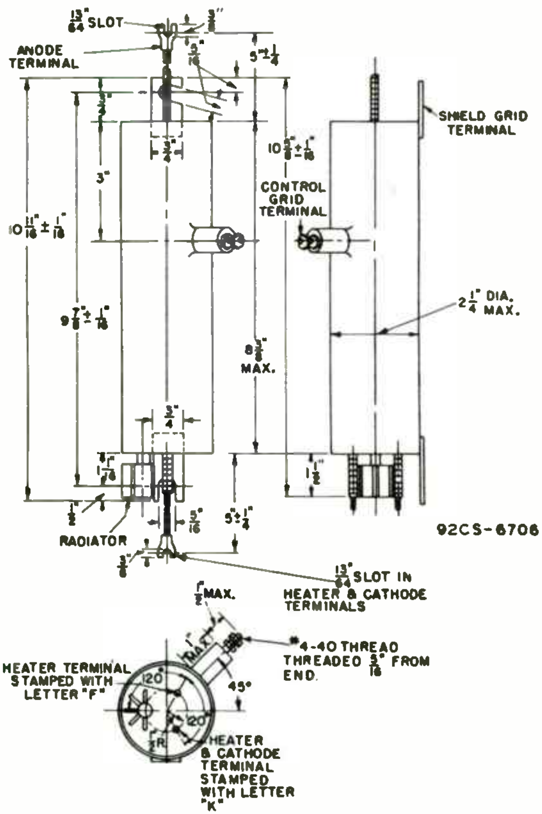
THYRATRON



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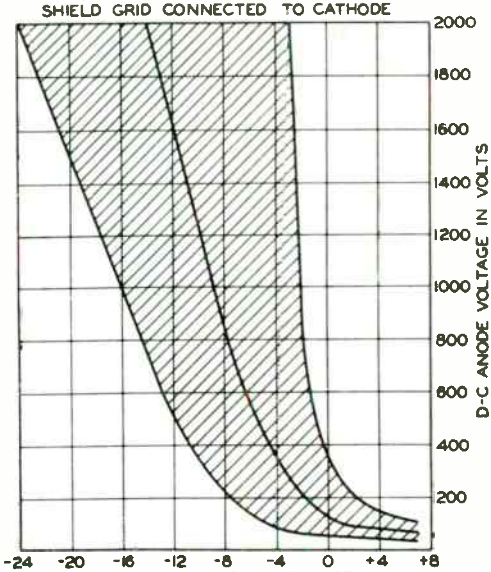
THYRATRON

TYPICAL CONTROL CHARACTERISTIC
SHADED AREA SHOWS RANGE OF CHARACTERISTIC
CONDENSED-MERCURY TEMP. 40°C
SHIELD GRID CONNECTED TO CATHODE



92CS-6698

World Radio History

World Radio History

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GAS THYRATRON

NEGATIVE-CONTROL TETRODE TYPE WITH METAL SHELL

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:

	Min.	*Av.*	*Max.*	
Voltage	5.7	6.3	7	ac or dc volts
Current at 6.3 volts .	–	0.6	0.66	. . . . . . amp

Cathode:		
Minimum heating time prior to tube conduction	10	sec
Direct Interelectrode Capacitances:		
Grid No.1 to anode	0.2	μμf
Grid No.1 to cathode & shell, grid No.2, and heater	2.5	μμf
Ionization Time (Approx.).	0.5	μsec
Deionization Time (Approx.):		
For conditions: dc anode ma = 100, grid-No.1-circuit resistor (ohms) = 1000, and dc grid-No.1 supply volts = –250	10	μsec
For conditions: dc anode ma = 100, grid-No.1-circuit resistor (ohms) = 1000, and dc grid-No.1 supply volts = –15	150	μsec
Maximum Critical Grid-No.1 Current:		
For conditions: anode volts (rms) = 460, and dc grid-No.1 volts adjusted to cutoff	2	μamp
Anode Voltage Drop	8	volts

Mechanical:

Mounting Position	Any
Maximum Overall Length	2-5/8"
Seated Length.	1-31/32" ± 3/32"
Maximum Diameter	1-5/16"
Weight (Approx.)	2 oz
Bulb	Metal Shell MT8G
Base	Small-Wafer Octal 8-Pin (JETEC No.B8-21)

BOTTOM VIEW

Pin 1 – No Connection
Pin 2 – Heater
Pin 3 – Anode
Pin 4 – No Connection

Pin 5 – Grid No.1
Pin 6 – Grid No.2
Pin 7 – Heater
Pin 8 – Cathode, Shell

RELAY and GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, *Absolute Values*:

PEAK ANODE VOLTAGE:			
Forward.	180 max.	650 max.	volts
Inverse.	360 max.	1300 max.	volts

← Indicates a change.

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GAS THYRATRON

GRID-No.2 (SHIELD-GRID) VOLTAGE:			
Peak, before tube conduction	-100 max.	-100 max.	volts
Average■, during tube conduction	-5 max.	-5 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:			
Peak, before tube conduction	-250 max.	-250 max.	volts
Average■, during tube conduction	-10 max.	-10 max.	volts
CATHODE CURRENT:			
Peak	1.0 max.	1.0 max.	amp
Average●	0.2 max.	0.1 max.	amp
Fault, for duration of 0.1 second max.	10 max.	10 max.	amp
GRID-No.2 CURRENT:			
Average■	+0.01 max.	+0.01 max.	amp
GRID-No.1 CURRENT:			
Average■	+0.01 max.	+0.01 max.	amp
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode . . .	100 max.	100 max.	volts
Heater positive with respect to cathode . . .	25 max.	25 max.	volts
AMBIENT-TEMPERATURE RANGE. .	-55 to +90	-55 to +90	°C

■ Averaged over 1 cycle.

● Averaged over any interval of 30 seconds maximum.

For Dimensional Outline, see GENERAL SECTION

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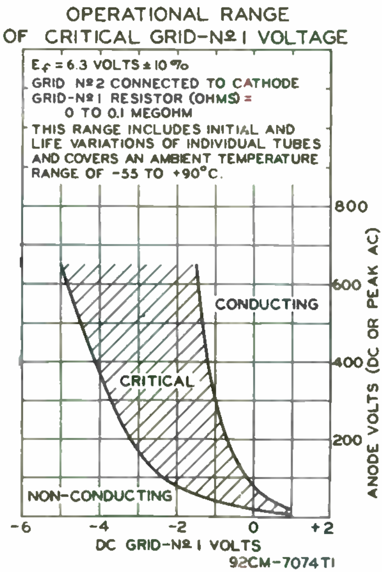
GAS THYRATRON



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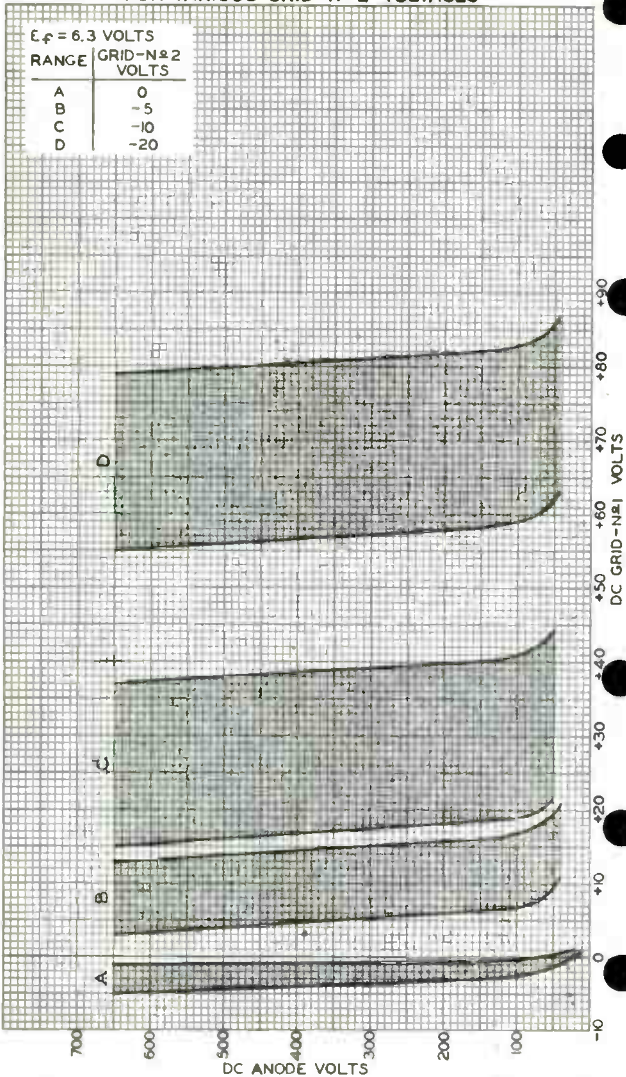
OPERATIONAL RANGES OF CRITICAL GRID-№1 VOLTAGE FOR VARIOUS GRID-№2 VOLTAGES



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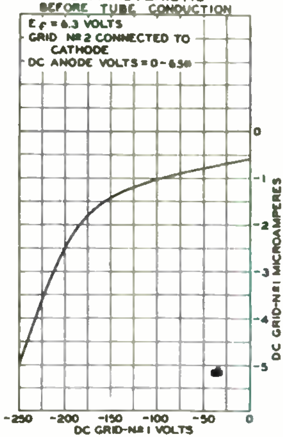
CHARACTERISTIC CURVES

MAXIMUM GRID-№1
CHARACTERISTIC
BEFORE TUBE CONDUCTION



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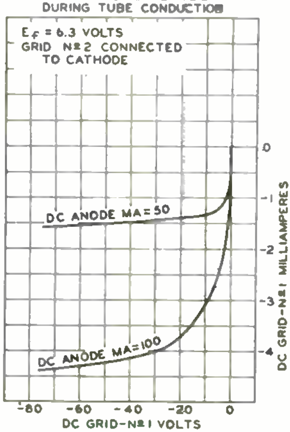
AVERAGE GRID-№1
CHARACTERISTICS
DURING TUBE CONDUCTION



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World Radio History

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THYRATRON
MERCURY-VAPOR TRIODE

DATA

Electrical:

Filament:		
Voltage*	2.5	volts
Current	6.0	amp
Direct Interelectrode Capacitance:		
Anode to Grid (Approx.)	2.5	μμf
Peak Voltage Drop	12	volts
Control Characteristic	Negative	
Ionization Time (Approx.)	10	μseconds
Deionization Time (Approx.)	1000	μseconds

Mechanical:

Mounting Position	Vertical, Base Down
Overall Length	6-3/8" ± 1/4"
Seated Length	6" ± 1/4"
Maximum Diameter	2-1/16"
Bulb	S-19
Cap	Medium Metal
Base	Small Shell Super-Jumbo 4-Pin

Maximum Ratings, Absolute Values:
For frequencies up to 150 cycles

PEAK FORWARD ANODE VOLTAGE	1250 max.	volts
PEAK INVERSE ANODE VOLTAGE	2500 max.	volts
PEAK GRID VOLT. (Before Conduction)	-500 max.	volts
PEAK ANODE CURRENT	2.5 max.	amp
AVERAGE ANODE CURRENT**	0.64 max.	amp
SURGE ANODE CURRENT for 0.1 sec. max.	25 max.	amp
GRID CURRENT, Before Conduction (Grid Neg.)	4 max.	μamp
PEAK GRID CURRENT	0.25 max.	amp
AVERAGE GRID CURRENT**	0.06 max.	amp
COND.-MERCURY TEMPERATURE RANGE ▲	25-70	°C

* Filament voltage must be applied at least 10 seconds before start of tube conduction.

** Averaged over any 30-second interval.

▲ Recommended Condensed-Mercury Temperature 40 to 45°C.

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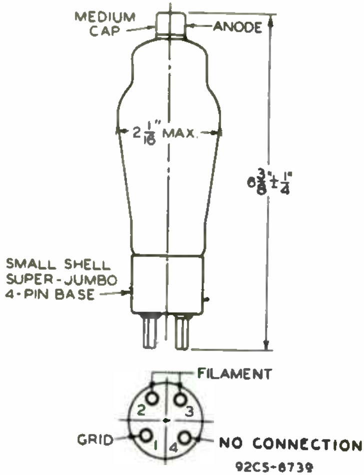
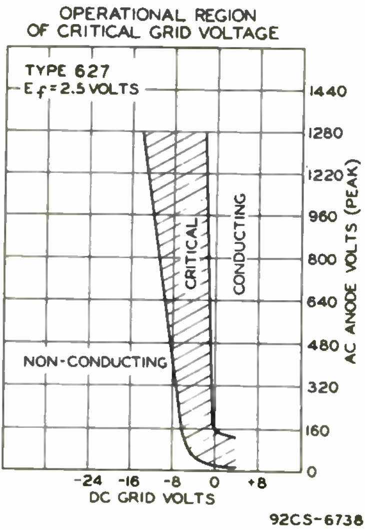
THYRATRON





World Radio History

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THYRATRON
GAS TRIODE

DATA

Electrical:

Heater, for Unipotential Cathode:

Voltage*	2.5	volts
Current	2.6	amp

Direct Interelectrode Capacitances (Approx.):

Grid to Anode	3.3	μμf
Grid to Cathode	3.3	μμf
Anode to Cathode	1.8	μμf
Peak Voltage Drop	15	volts
Control Characteristic	Negative	
Ionization Time (Approx.)	10	μseconds
Deionization Time (Approx.)	1000	μseconds

Mechanical:

Mounting Position	Any
Maximum Overall Length	4-1/4"
Maximum Seated Length	3-5/8"
Maximum Diameter	1-9/16"
Bulb	ST-12
Base	Small 5-Pin

Maximum Ratings, Absolute Values:

PEAK FORWARD ANODE VOLTAGE	350 max.	volts
PEAK INVERSE ANODE VOLTAGE	350 max.	volts
PEAK GRID VOLTAGE	-90 max.	volts
PEAK ANODE CURRENT	0.2 max.	amp
AVERAGE ANODE CURRENT**	0.04 max.	amp
SURGE ANODE CURRENT for 0.1 sec. max.	2.0 max.	amp
GRID CURRENT, Before Conduction	2.5 max.	μamp
PEAK GRID CURRENT	20 max.	ma.
AVERAGE GRID CURRENT**	0.4 max.	ma.
DC HEATER-CATHODE POTENTIAL RANGE	-45 to +5	volts
AMBIENT TEMPERATURE RANGE	-40 to +70	°C

* Heater voltage must be applied at least 30 seconds before start of tube conduction.

** Averaged over any 10-second interval.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
World Radio History

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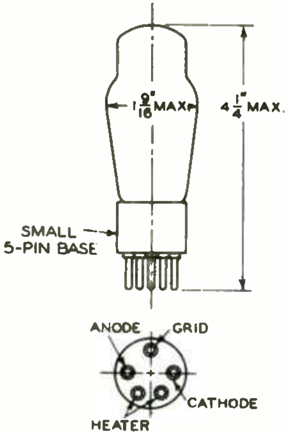
THYRATRON



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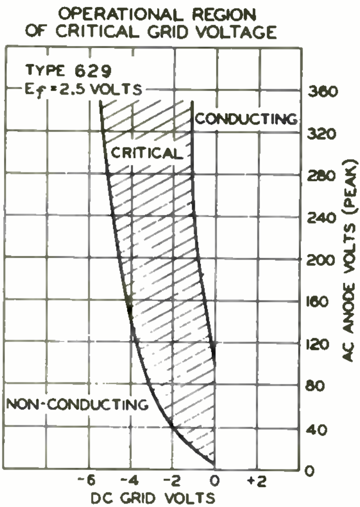


92CS-6736

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

632-B

632-B

MERCURY-VAPOR THYRATRON

NEGATIVE-CONTROL TETRODE TYPE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:

Voltage	5●	ac or dc volts
Current	5	amp

Cathode:

Minimum heating time prior to tube conduction	5	minutes

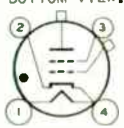
Direct Interelectrode Capacitances (Approx.):

Grid No.1 to anode	0.04	μμf
Grid No.2 to anode	3	μμf
Ionization Time (Approx.)	10	μsec
Deionization Time (Approx.)	1000	μsec
Maximum Critical Grid-No.1 Current	2	μamp
Anode Voltage Drop (Approx.)	12	volts

Mechanical:

Mounting Position	Vertical, base down
Maximum Overall Length	8-5/16"
Seated Length	7-1/2" ± 1/4"
Maximum Radius (Including side cap)	1-3/4"
Weight (Approx.)	9 oz
Bulb	T-18
Top Cap	Skirted Medium (JETEC No.C1-29)
Side Cap	Saddle Medium
Base	Skirted-Medium-Shell Small 4-Pin with Bayonet (JETEC No.A4-71)
Basing Designation for BOTTOM VIEW	4CD

Pin 1 – Heater
Pin 2 – Cathode, Circuit Returns
Pin 3 – Grid No.2



Pin 4 – Heater, Cathode
Top Cap – Anode
Side Cap – Grid No.1

Temperature Control:

Heating--When the ambient temperature is so low that the normal rise of condensed-mercury temperature above the ambient temperature will not bring the condensed-mercury temperature up to the minimum value of the operating range specified under *Maximum Ratings*, some form of heat-conserving enclosure or auxiliary heater will be required.

Cooling--When the operating conditions are such that the maximum value of the operating condensec-mercury temperature is exceeded, provision should be made for forced-air cooling sufficient to prevent exceeding the maximum value.

● Under operating conditions where the average anode current does not exceed 0.5 ampere, the heater voltage may be increased to 5.5 volts.

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

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MERCURY-VAPOR THYRATRON

IGNITOR-FIRING AND GRID-CONTROLLED RECTIFIER SERVICE

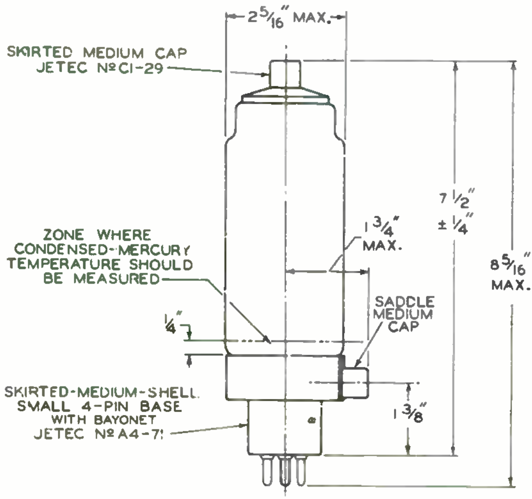
Maximum Ratings, *Absolute Values:*

For anode-supply frequency of 60 cps

	Operating Condensed-Mercury Temperature Range 40° to 80°C■	
PEAK ANODE VOLTAGE:		
Forward	1500 max.	volts
Inverse	1500 max.	volts
GRID-No.2 (SHIELD-GRID) VOLTAGE:		
Peak, before tube conduction	-300 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:		
Peak, before tube conduction	-1000 max.	volts
CATHODE CURRENT:		
Peak	30 max.	amp
Average#	2.5 max.	amp
Fault, for duration of 0.1 second max.	150 max.	amp
AVERAGE GRID-No.2 CURRENT#	+0.25 max.	amp
AVERAGE GRID-No.1 CURRENT#	+0.25 max.	amp

■ Recommended temperature range of condensed mercury is 45° to 50°C.

\# Averaged over any interval of 30 seconds maximum.



 TENTATIVE DATA

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

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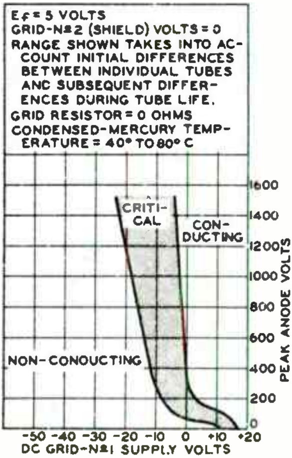
MERCURY-VAPOR THYRATRON

OPERATIONAL RANGES OF CRITICAL GRID-No.1 VOLTAGE



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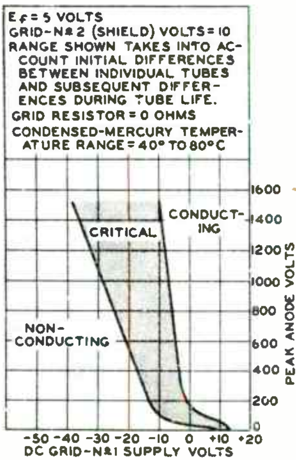

92CS-9007T

World Radio History

World Radio History

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THYRATRON

MERCURY-VAPOR TETRODE

Supersedes Type 872

GENERAL DATA

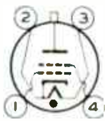
Electrical:

Heater, for Unipotential Cathode:		
Voltage	5	ac or dc volts
Current	5	amp
Cathode:		
Min. Heating Time, prior to tube conduction		5 minutes
Direct Interelectrode Capacitances:		
Grid No.1 to Anode		0.04 μμf
Grid No.2 to Anode		3 μμf
Ionization Time (Approx.)		10 μsec
Deionization Time (Approx.)		1000 μsec
Maximum Critical Grid Current		2 μamp
Anode Voltage Drop (Approx.)		12 volts

Mechanical:

Mounting Position	Vertical, Base Down
Overall Length	7-7/8" ± 1/4"
Seated Length	7-1/8" ± 1/4"
Maximum Diameter	2-5/16"
Bulb	T-18
Cap	Skirted Medium
Base	Large-Shell Super-Jumbo 4-Pin, Bayonet
Basing Designation for BOTTOM VIEW	4CE

Pin 1 - Grid No.1
Pin 2 - Heater, Cathode



Pin 3 - Heater
Pin 4 - Grid No.2
Cap - Anode

GRID-CONTROLLED RECTIFIER SERVICE

For frequencies up to 150 cycles

Maximum Ratings, *Absolute Values:*

PEAK ANODE VOLTAGE:		
Forward	2500 max.	volts
Inverse	2500 max.	volts
GRID-No.2 (SHIELD-GRID) VOLTAGE:		
Peak, before anode conduction	-300 max	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:		
Peak, before anode conduction	-1000 max.	volts
CATHODE CURRENT:		
Peak	40 max.	amp
Average■	3.2 max.	amp
Surge, for duration of 0.1 sec. max.	150 max.	amp

■ See next page.

(continued on next page)

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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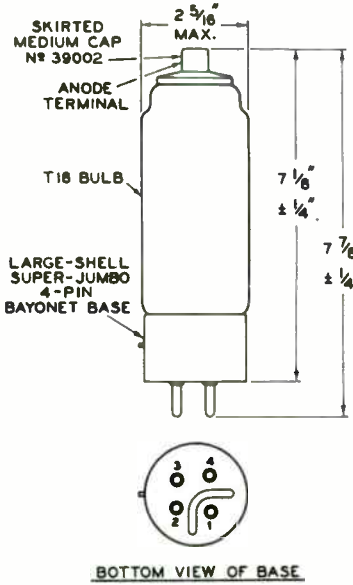
THYRATRON

GRID-No. 2 CURRENT:		
Peak	1 max.	amp
Average■	0.25 max.	amp
GRID-No. 1 CURRENT:		
Peak	1 max.	amp
Average■	0.25 max.	amp
COND.-MERCURY TEMPERATURE RANGE▲	40 to 80	°C

■ Averaged over any interval of 15 sec. max.

▲ Recommended condensed-mercury temperature is between 45° and 50°C.



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World Radio History

RCA

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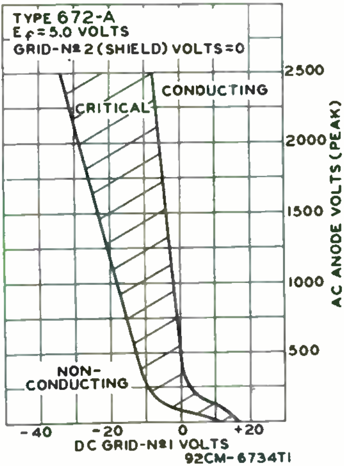
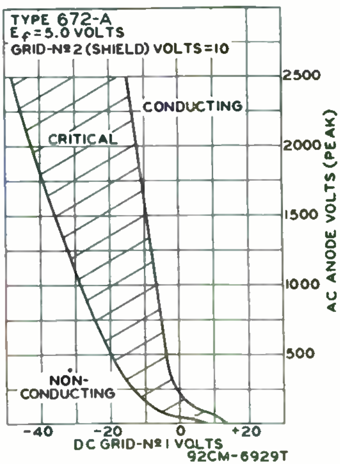
THYRATRON

OPERATIONAL RANGES OF CRITICAL GRID-№1 VOLTAGE





World Radio History

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THYRATRON

MERCURY-VAPOR TRIODE

DATA

Electrical:

Heater, for Unipotential Cathode:			
Voltage*	5		volts
Current	10		amp
Direct Interelectrode Capacitance:			
Grid to Anode (Approx.)	5		μμf
Peak Voltage Drop	12		volts
Control Characteristic	Negative		
Ionization Time (Approx.)	10		μseconds
Deionization Time (Approx.)	1000		μseconds

Mechanical:

Mounting Position	Vertical, Base Down
Overall Length	11-1/4" ± 1/2"
Maximum Diameter	3-13/16"
Bulb	ST-30
Cap	No.3985
Base	Large Shell Super-Jumbo 4-Pin

Maximum Ratings, Absolute Values:

For frequencies up to 150 cycles

	Continuous Service	Welder-Control Service	
PEAK FORWARD ANODE VOLTAGE	2500 max.	750 max.	volts
PEAK INVERSE ANODE VOLTAGE	2500 max.	750 max.	volts
PEAK GRID VOLTAGE:			
Before Conduction	-500 max.	-500 max.	volts
PEAK ANODE CURRENT	40 max.	77 max.	amp
AVERAGE ANODE CURRENT	6.4 max.	2.5 max.	amp
SURGE ANODE CURRENT for 0.1 sec. max.	200 max.	200 max.	amp
GRID CURRENT: Before conduction (Grid Negative)	5 max.	5 max.	μamp
PEAK GRID CURRENT	1 max.	1 max.	amp
AVERAGE GRID CURRENT	0.25 max.	0.25 max.	amp
TIME OF AVERAGING CURRENTS	15 max.	5 max.	sec
COND.-MERCURY TEMP. RANGE▲	40 - 80	40 - 90	°C

* Heater voltage must be applied for at least 5 minutes before anode voltage is applied.

▲ Recommended condensed-mercury temperature range, 45 - 55°C.

World Radio History

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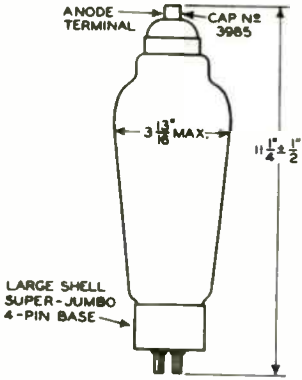
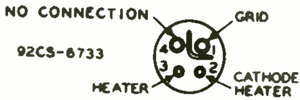
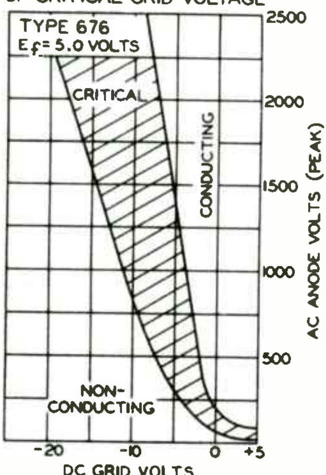
THYRATRON





92CS-6733

OPERATIONAL REGION OF CRITICAL GRID VOLTAGE



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THYRATRON
MERCURY-VAPOR TRIODE

DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage*	5	volts
Current	10	amp
Direct Interelectrode Capacitance:		
Grid to Anode (Approx.)	5	μμf
Peak Voltage Drop	12	volts
Control Characteristic	Negative	
Ionization Time (Approx.)	10	μseconds
Deionization Time (Approx.)	1000	μseconds

Mechanical:

Mounting Position	Vertical, Base Down
Overall Length	11-1/4" ± 1/2"
Maximum Diameter	3-13/16"
Bulb	ST-30
Cap	No. 3985
Base	Large Shell Super-Jumbo 4-Pin

Maximum Ratings, Absolute Values:

For frequencies up to 150 cycles

PEAK FORWARD ANODE VOLTAGE	10000 max.	volts
PEAK INVERSE ANODE VOLTAGE	10000 max.	volts
PEAK GRID VOLTAGE:		
Before Conduction	-500 max.	volts
Anode Negative	10 max.	volts
PEAK ANODE CURRENT	15 max.	amp
AVERAGE ANODE CURRENT**	4 max.	amp
SURGE ANODE CURRENT for 0.1 sec., max.	16 max.	amp
GRID CURRENT: Before Conduction (Grid Neg.)	5 max.	μamp
PEAK GRID CURRENT	1 max.	amp
AVERAGE GRID CURRENT**	0.25 max.	amp
COND.-MERCURY TEMPERATURE RANGE▲	30 – 50	°C

* Heater voltage must be applied for at least 5 minutes before anode voltage is applied.

** Averaged over any 15-second interval.

▲ Recommended condensed-mercury temp. range, 35 – 45°C.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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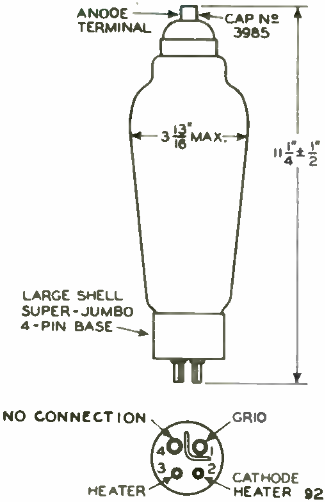
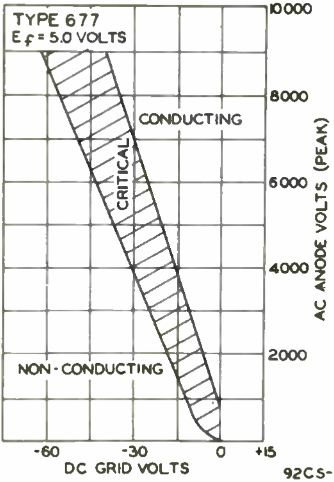
THYRATRON



92CS-6731

OPERATIONAL REGION OF CRITICAL GRID VOLTAGE



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World Radio History

Gas and Mercury-Vapor Thyratron

NEGATIVE-CONTROL TRIODE TYPE

GENERAL DATA

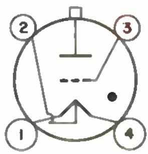
Electrical:

Filament, Coated:		
Voltage (AC or DC) between pins 1 and 4	2.5	volts
Current at 2.5 volts	9 ± 2	amp
Minimum heating time prior to tube conduction	20	sec
Direct Interelectrode Capacitances (Approx.):*		
Grid to anode	2	$\mu\mu f$
Grid to cathode	12	$\mu\mu f$
Ionization Time (Approx.)	10	μsec
Deionization Time (Approx.)	1000	μsec
Peak Tube Voltage Drop at anode amperes = 8	10	volts

Mechanical:

Operating Position	Vertical, base down
Maximum Overall Length	6-1/4"
Maximum Diameter	1-5/8"
Weight (Approx.)	4 oz
Bulb	T13
Cap	Medium (JEDEC No.C1-5)
Socket	Small 4-Contact
Base	Medium-Shell Small 4-Pin with Bayonet (JEDEC No.A4-10)
Basing Designation for BOTTOM VIEW	4CF

Pin 1 - Filament
Pin 2 - Filament Tap, Circuit Returns



Pin 3 - Grid
Pin 4 - Filament
Cap - Anode

Thermal:

Type of Cooling	Convection	
Temperature Rise of Condensed Mercury to Equilibrium Above Ambient Temperature (Approx.):		
No load	25	°C
Full load	30	°C

GRID-CONTROLLED-RECTIFIER SERVICE

Maximum and Minimum Ratings, ***Absolute-Maximum Values:***

For anode-supply frequency of 60 cps

PEAK ANODE VOLTAGE:		
Forward	1500 max.	volts
Inverse	1500 max.	volts

World Radio History

PEAK NEGATIVE GRID VOLTAGE:			
Before tube conduction.	500 max.	volts
During tube conduction.	10 max.	volts
CATHODE CURRENT:		
Peak.	30 max.	amp
Average[b].	2.5 max.	amp
Fault	250 max.	amp
CONDENSED-MERCURY TEMPERATURE RANGE (Operating)[c].	-40 to +80	°C

[a] Without external shield.

[b] Averaged over any interval of 5 seconds maximum.

[c] For longest life, the operating condensed-mercury temperature range after warm-up should be kept between +40° and +80° C which corresponds approximately to +10° to +50° C ambient.

World Radio History

Gas and Mercury-Vapor Thyratron

NEGATIVE-CONTROL TRIODE TYPE

GENERAL DATA

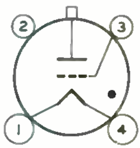
Electrical:[a]

Filament, Coated:		
Voltage (AC or DC)	2.5	volts
Current at 2.5 volts	5.0 ± 0.5	amp
Minimum heating time prior to tube conduction	5	sec
Direct Interelectrode Capacitance (Approx.):[b]		
Grid to anode	2	μμf
Ionization Time (Approx.)	10	μsec
Deionization Time (Approx.)	1000	μsec
Maximum Critical Grid Current	5	μa
Peak Tube Voltage Drop at anode amperes = 3	15	volts

Mechanical:

Operating Position	Vertical, base down
Maximum Overall Length	6-1/8"
Maximum Diameter	2-1/16"
Weight (Approx.)	3 oz
Bulb	ST16
Cap	Medium (JEDEC No.C1-5)
Socket	Small 4-Contact
Base	Medium-Shell Small 4-Pin with Bayonet (JEDEC No.A4-10)
Basing Designation for BOTTOM VIEW	3G

Pin 1 - Filament
Pin 2 - No Internal Connection



Pin 3 - Grid
Pin 4 - Filament
Cap - Anode

Thermal:

Type of Cooling	Convection	
Temperature Rise of Condensed Mercury to Equilibrium Above Ambient Temperature (Approx.)	15	°C

GRID-CONTROLLED-RECTIFIER SERVICE[a]

Maximum and Minimum Ratings, ***Absolute-Maximum Values:***

For anode-supply frequency of 60 cps

PEAK ANODE VOLTAGE:		
Forward	1250 max.	volts
Inverse	1250 max.	volts
PEAK NEGATIVE GRID VOLTAGE:		
Before tube conduction	500 max.	volts
During tube conduction	10 max.	volts

World Radio History

ANODE CURRENT:		
Peak.	3 max.	amp
Average[c].	1 max.	amp
Fault	50 max.	amp
CONDENSED-MERCURY TEMPERATURE RANGE (Operating)[d].	-40 to +80	°C

[a] With circuit returns to filament-transformer center-tap.

[b] Without external shield.

[c] Averaged over any interval of 5 seconds maximum.

[d] For longest life, the operating condensed-mercury temperature range after warm-up should be kept between +40° and +80° C which corresponds approximately to +10° to +50° C ambient.

World Radio History

Gas and Mercury-Vapor Thyratron

NEGATIVE-CONTROL TRIODE TYPE

GENERAL DATA

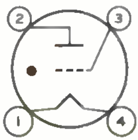
Electrical:[a]

Filament, Coated:		
Voltage (AC or DC)	2.5	volts
Current at 2.5 volts	6.3 ± 0.8	amp
Minimum heating time prior to tube conduction	15	sec
Direct Interelectrode Capacitance (Approx.):[b]		
Grid to anode	3	μμf
Ionization Time (Approx.)	10	μsec
Deionization Time (Approx.)	1000	μsec
Maximum Critical Grid Current	10	μa
Peak Tube Voltage Drop at anode amperes = 5	8	volts

Mechanical:

Operating Position	Vertical, base down
Maximum Overall Length	4-3/8"
Diameter	1.438" to 1.562"
Weight (Approx.)	3 oz
Bulb	T12
Socket	Small 4-Contact
Base	Medium-Shell Small 4-Pin with Bayonet (JEDEC No.A4-10)
Basing Designation for BOTTOM VIEW	4D

Pin 1 - Filament
Pin 2 - Anode



Pin 3 - Grid
Pin 4 - Filament

Thermal:

Type of Cooling		Convection
Temperature Rise of Condensed Mercury to Equilibrium Above Ambient Temperature (Approx.)	30	°C

GRID-CONTROLLED-RECTIFIER SERVICE[a]

Maximum and Minimum Ratings, ***Absolute-Maximum Values:***

For anode-supply frequency of 60 cps

PEAK ANODE VOLTAGE:		
Forward	1250 max.	volts
Inverse	1250 max.	volts
PEAK NEGATIVE GRID VOLTAGE:		
Before tube conduction	500 max.	volts
During tube conduction	10 max.	volts

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CATHODE CURRENT:[a]

Peak	8 max.	amp
Average[c]	1 max.	amp
Fault	80 max.	amp

CONDENSED-MERCURY TEMPERATURE

RANGE (Operating)[d]	-40 to +80	°C

[a] With circuit returns to filament-transformer center-tap.

[b] Without external shield.

[c] Averaged over any interval of 5 seconds maximum.

[d] For longest life, the operating condensed-mercury temperature range after warm-up should be kept between +40° and +80° C which corresponds approximately to +10° to +50° C ambient.

World Radio History

Gas and Mercury-Vapor Thyratron

NEGATIVE-CONTROL TRIODE TYPE

GENERAL DATA

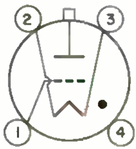
Electrical:[a]

Filament, Coated:		
Voltage (AC or DC)	2.5	volts
Current at 2.5 volts	21 ± 2	amp
Minimum heating time prior to tube conduction	60	sec
Direct Interelectrode Capacitance (Approx.):[b]		
Grid to anode	4	μμf
Ionization Time (Approx.)	10	μsec
Deionization Time (Approx.)	1000	μsec
Maximum Critical Grid Current	10	μa
Peak Tube Voltage Drop at anode amperes = 20	12	volts

Mechanical:

Operating Position	Vertical, base down
Maximum Overall Length	9-1/2"
Maximum Diameter	2-9/16"
Weight (Approx.)	9 oz
Cap	Medium (JEDEC No.C1-5)
Socket	Super-Jumbo 4-Contact
Base	Large-Metal-Shell Super-Jumbo 4-Pin with Bayonet (JEDEC No.A4-18)
Basing Designation for BOTTOM VIEW	4BZ

Pin 1 - Grid
Pin 2 - Filament
Pin 3 - Filament



Pin 4 - No Internal Connection
Cap - Anode

Thermal:

Type of Cooling	Convection	
Temperature Rise of Condensed Mercury to Equilibrium Above Ambient Temperature (Approx.)	30	°C

GRID-CONTROLLED-RECTIFIER SERVICE[a]

Maximum and Minimum Ratings, *Absolute-Maximum Values:*

For anode-supply frequency of 60 cps

PEAK ANODE VOLTAGE:		
Forward	1500 max.	volts
Inverse	1500 max.	volts
PEAK NEGATIVE GRID VOLTAGE:		
Before tube conduction	500 max.	volts
During tube conduction	10 max.	volts

World Radio History

CATHODE CURRENT:

Peak	77 max.	amp
Average[c]	6.4 max.	amp
Fault	770 max.	amp

CONDENSED-MERCURY TEMPERATURE RANGE

(Operating)[d]	-40 to +80	°C

[a] With circuit returns to filament-transformer center-tap.

[b] Without external shield.

[c] Averaged over any interval of 15 seconds maximum.

[d] For longest life, the operating condensed-mercury temperature range after warm-up should be kept between +40° and +80° C which corresponds approximately to +10° to +50° C ambient.

World Radio History

884 885

884, 885
THYRATRONS
TRIODE TYPES

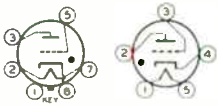
For new equipment design, RCA-884 is recommended.

GENERAL DATA

Electrical:	*Type 884*	*Type 885*	
Heater.	Coated Unipotential Cathode		
Voltage	6.3 ± 10%	2.5 ± 10%	a-c or d-c volts
Current	0.6	1.5	. . . . . . amp. ←
Direct Interelectrode Capacitances:			←
Grid to Anode . . .	6	6	. . . . . . μμf
Grid to Cathode . .	2	2	. . . . . . μμf
Anode to Cathode. .	0.6	0.6	. . . . . . μμf
Tube Voltage Drop . .	16	16	. . approx. volts

Physical:			
Mounting Position . .	Any	Any	
Maximum Overall Length	4-1/8	4-3/16	. . . . . . inches
Maximum Seated Length	3-9/16	3-9/16	. . . . . . inches
Maximum Diameter. . .	1-9/16	1-9/16	. . . . . . inches
Bulb.	ST-12	ST-12	
Base.	Small Shell Octal 6-Pin	Small 5-Pin	
Basing Designation	G-6O2	5A2	

Pin 1 - No Connection
Pin 2 - Heater
Pin 3 - Anode
Pin 5 - Grid
Pin 7 - Heater
Pin 8 - Cathode



BOTTOM VIEWS

Pin 1 - Heater
Pin 2 - Anode
Pin 3 - Grid
Pin 4 - Cathode
Pin 5 - Heater

RELAXATION OSCILLATOR — Sweep-Circuit Service△

Maximum Ratings, *Absolute Values*:

PEAK ANODE VOLTAGE.	300 *max.*	volts
PEAK CATHODE CURRENT ●.	300 *max.*	ma.
PEAK GRID CURRENT ▲	1 *max.*	ma. ←
PEAK VOLTAGE BETWEEN ANY TWO ELECTRODES OR BETWEEN ANY ELECTRODE AND HEATER . .	350 *max.*	volts
D-C HEATER-CATHODE POTENTIAL.	-100 to + 25	volts ←
AMBIENT TEMPERATURE RANGE	-75 to + 90	°C ←

△ For best life results, it is desirable to delay tube conduction for about 10 seconds after applying heater voltage in order to allow the cathode to reach normal operating temperature.

● In sweep circuits designed so that the peak cathode current of 300 milliamperes will not be exceeded during condenser discharge, the resultant average cathode current is so small in comparison with the average-current capability of the cathode that a maximum rating for average cathode current is omitted because it has no practical significance.

▲ The resistance of the grid resistor should be not less than 1000 ohms per maximum instantaneous volt applied to the grid. Resistance values in excess of 500000 ohms may cause circuit instability.

← Indicates a change.

884, 885

THYRATRONS

(continued from preceding page)

RELAY & GRID-CONTROLLED RECTIFIER SERVICE [□]
At Frequencies Below 75 Cycles per Second

Maximum Ratings, ***Absolute Values*****:**

PEAK ANODE VOLTAGE	350 *max.*	volts
PEAK CATHODE CURRENT	300 *max.*	ma.
AVERAGE CATHODE CURRENT #	75 *max.*	ma.
PEAK VOLTAGE BETWEEN ANY TWO ELECTRODES OR BETWEEN ANY ELECTRODE AND HEATER	350 *max.*	volts
→ D-C HEATER-CATHODE POTENTIAL	-100 to +25	volts
→ AMBIENT TEMPERATURE RANGE	-75 to +90	°C

□ The heater voltage should be applied for 10 seconds before tube conduction occurs.

For an averaging period of 30 seconds.

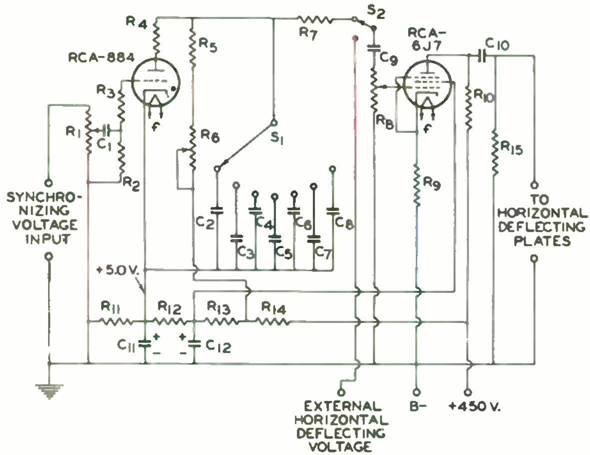
← ndicates a change.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
World Radio History

RCA

884

LINEAR SWEEP-CIRCUIT OSCILLATOR AND AMPLIFIER



C_1 = 0.25 µf OR GREATER
C_2 = 0.25 µf, 500 V.
C_3 = 0.1 µf, 500 V.
C_4 = 0.04 µf, 500 V.
C_5 = 0.015 µf, 500 V.
C_6 = 0.005 µf, 500 V.
C_7 = 0.002 µf, 500 V.
C_8 = 0.0008 µf, 500 V.
C_9 = 0.5 µf, 250 V.
C_{10} = 0.5 µf, 500 V.
C_{11} = 25 µf, 15 V.
C_{12} = 8 µf, 200 V.
R_1 = 5000 OHM (MAX.) POTENTIOMETER
R_2 = NOT GREATER THAN 50000 OHMS
R_3 = 2000-3000 OHMS, 0.5 WATT
R_4 = 350-500 OHMS, 0.5 WATT
R_5 = 0.3-0.5 MEGOHM, 0.5 WATT
R_6 = 1 MEGOHM POTENTIOMETER
R_7 = 1 MEGOHM, 0.5 WATT
R_8 = 0.5 MEGOHM POTENTIOMETER
R_9 = 850 OHMS, 0.5 WATT
R_{10} = 0.1 MEGOHM, 0.5 WATT
R_{11} = 1500 OHMS, 0.5 WATT
R_{12} = 25000 OHMS, 1.0 WATT
R_{13} = 60000 OHMS, 1.0 WATT
R_{14} = 60000 OHMS, 1.0 WATT
R_{15} = 2.0 MEGOHMS, 1.0 WATT
S_1 = 7-CONTACT S.P. SWITCH
S_2 = S.P.D.T. SWITCH

92CM-4875R1

APPROXIMATE FREQUENCY RANGE (CYCLES/SEC.)

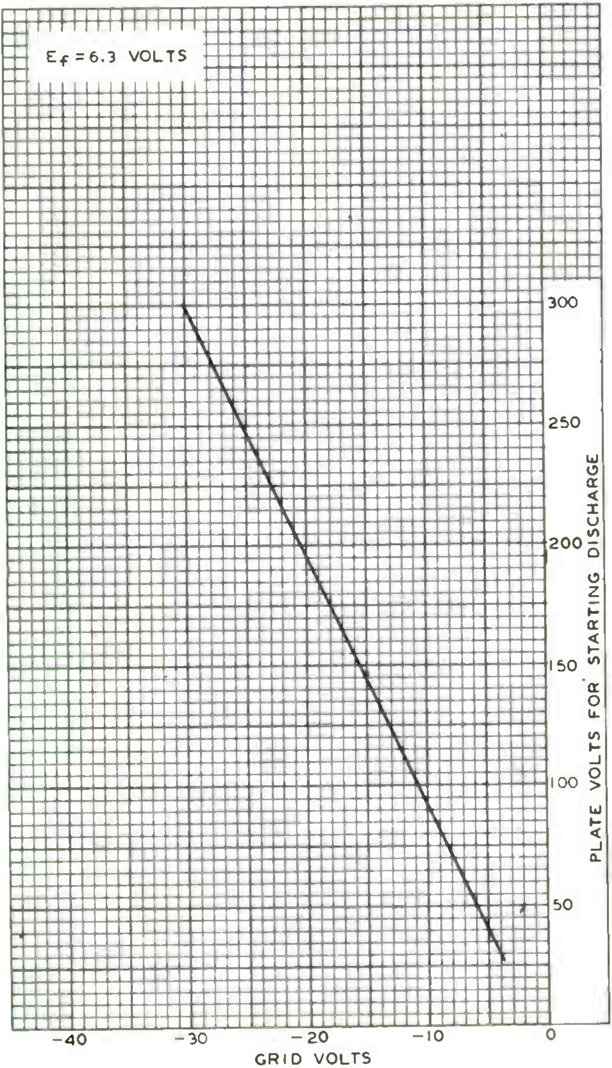
SWITCH (S_1) ON		C_2	C_3	C_4	C_5	C_6	C_7	C_8
R_6 AT	MAX.	20	40	110	280	670	1500	3600
	MIN.	60	130	340	880	2200	4900	11400

The license extended to the purchaser of tubes appears in the License Notice accompanying them. Information contained herein is furnished without assuming any obligations. ← Indicates a change.

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

884

AVERAGE CONTROL CHARACTERISTIC



JAN. 4, 1945

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-4883R1

World Radio History

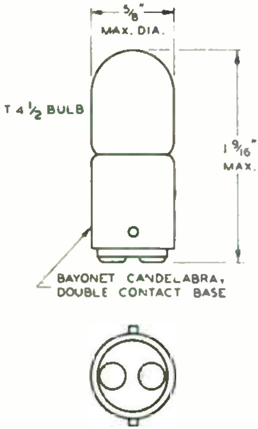
RCA

991

VOLTAGE REGULATOR

Type	Glow Discharge
Maximum Overall Length	1-9/16"
Maximum Diameter	5/8"
Bulb	T-4-1/2
Base	Bayonet Candelabra, Double Contact
Operating Conditions:	
Starting-Supply Voltage (D.C.)	87 min. volts
Peak Current *	3 max. ma.
Continuous Current (D.C.) **	2 max. ma.
Operating Voltage△	67 max. volts 48 min. volts

* If the 991 is used with a pulsating or alternating supply voltage, the peak current should be limited to 3 ma.
** Sufficient resistance must always be used in series with this tube to limit its d-c current to 2 ma.
△ For d-c operating current between 0.4 and 2 ma.

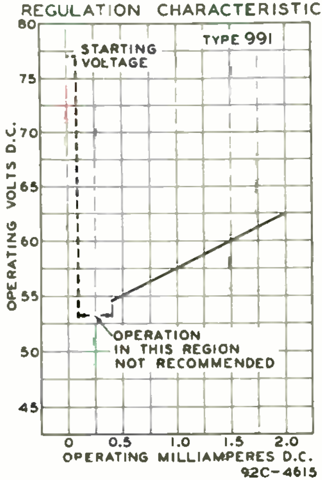


BOTTOM VIEW OF BASE

92C 4614

TUBE MOUNTING POSITION
VERTICAL OR HORIZONTAL

REGULATION CHARACTERISTIC



RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

World Radio History

World Radio History

RCA

1946
VACUUM-GAUGE TUBE

THERMOCOUPLE TYPE

DATA

General:

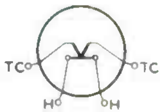
Heater, for Thermocouple:

Voltage (Approx.)	1	ac or dc volts
Current	0.070	amp
Resistance of Thermocouple	5 approx.	ohms
Maximum Overall Length (with tubulation)		6-1/4"
Maximum Diameter		1-11/16"
Bulb		T-12
Tubulation		3/8" Diameter Hard Glass, Corning Code 772 Nonex
Mounting Position		Any
Terminal Arrangement		See Outline Drawing

Terminal Connections:

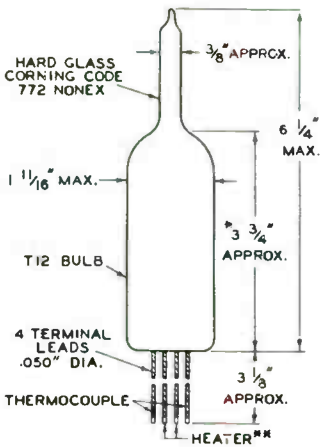
H – Heater

TC – Thermocouple



Calibration:

See next page.



*MEASURED FROM BULB END TO BULB-TOP LINE AS DETERMINED BY RING GAUGE OF 1/2" I.D.

**BROWN HEATER LEAD SHOULD BE CONNECTED TO POSITIVE TERMINAL OF DC HEATER SUPPLY. 92CS-6815

World Radio History

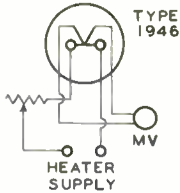
RCA

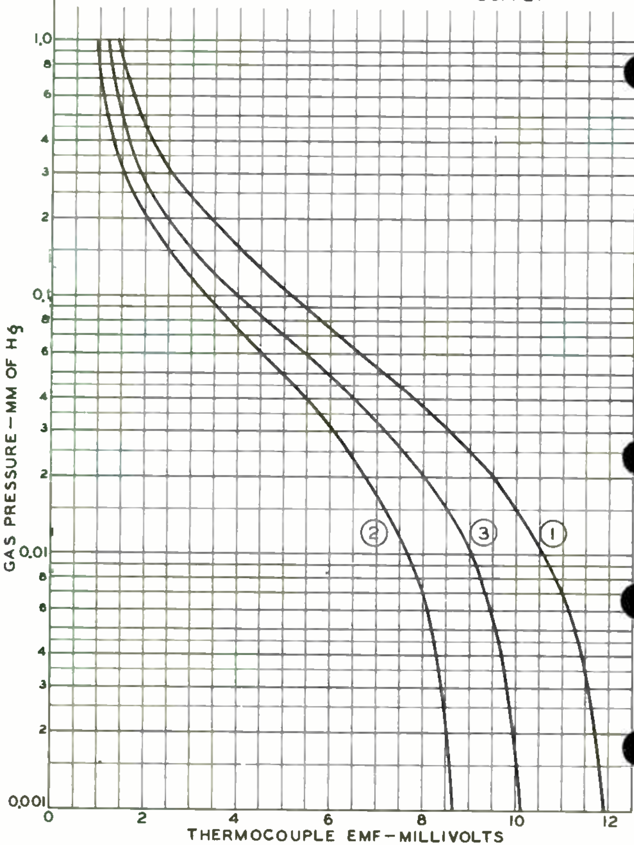
1946

CALIBRATION CURVES

CURVE	HEATER		
	BROWN LEAD	UNMARKED LEAD	CURRENT AMP.
1	+	−	0.070 DC
2	−	+	0.070 DC
3	±	∓	0.070 RMS

GAS = DRY AIR
TO CONVERT MM TO MICRONS, MULTIPLY VALUES BY 1000





1947
VACUUM-GAUGE TUBE

PIRANI TYPE

DATA

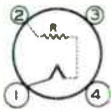
General:

Filament, Platinum Iridium:

Voltage (Approx.)	10	dc volts
Current (Varies with Gas Pressure)	70 – 100	ma.
Resistance between base pins No.1 & No.2 under vacuum better than 3×10^{-5} mm of mercury	135.8	ohms
Maximum Overall Length (including tubulation)		7-9/16"
Maximum Diameter		1-3/16"
Bulb		T-9
Tubulation		7/32" Diameter Soft Glass, Corning Code 001 Lead
Mounting Position		Any
Base		Small-Shell Small 4-Pin

BOTTOM VIEW

Pin 1 – Filament
Pin 2 – Filament
Pin 3 – No Connection
Pin 4 – Internal Connection – Do Not Use



R – Series Filament-Calibrating Resistor in base of tube

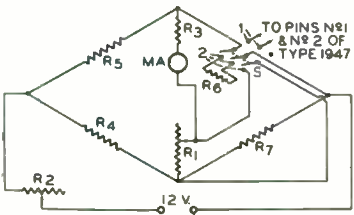
Maximum Ratings, *Absolute Values*:

FILAMENT VOLTAGE	16 max.	volts

Calibration for 1947 in Accompanying Circuit:

See curve on following sheet.

PIRANI GAUGE BRIDGE CIRCUIT



92CS-6853

R1: 50 Ohms	R3 + METER: 15 Ohms	R6: 120.7 Ohms
R2: 25 Ohms	R4 R5: 10 Ohms each	R7: 135.8 Ohms

STEP 1: With switch S in position 2, adjust R2 so that meter reads 2.5 milliamperes.

STEP 2: With switch S in position 1, and with dry air at atmospheric pressure in the 1947, adjust R1 so that meter reads 5.0 milliamperes.

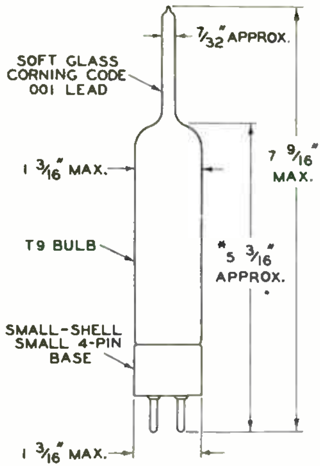
STEP 3: With no further adjustments and with switch S in position 1, proceed to use gauge.

World Radio History

1947

1947

VACUUM-GAUGE TUBE



*MEASURED FROM END OF BASE PINS TO BULB-TOP LINE AS DETERMINED BY RING GAUGE OF 1/2" I.D.

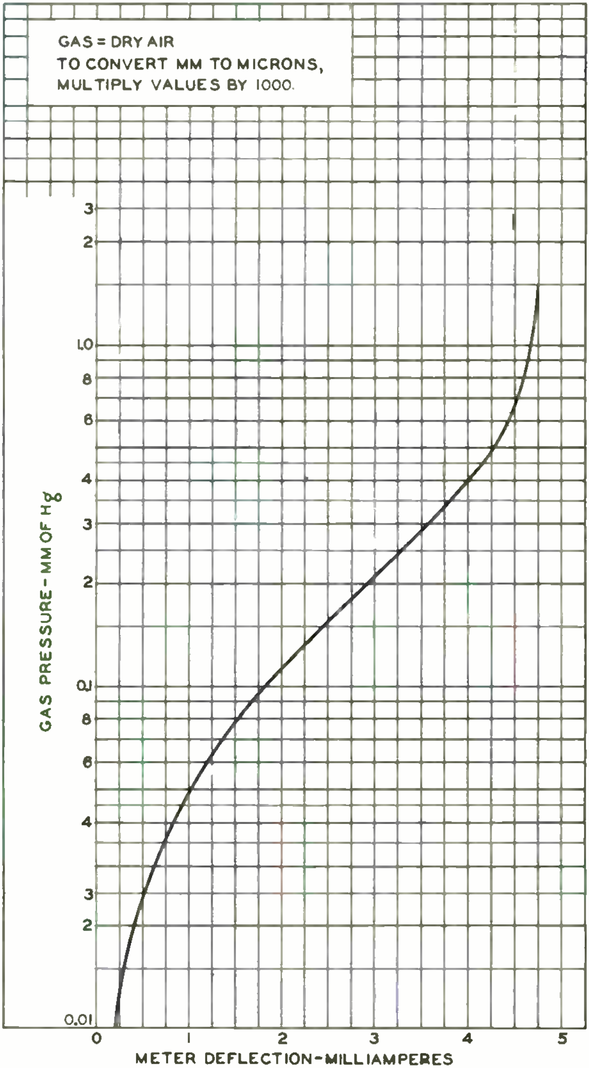
92CS-6816

World Radio History

1947

1947

CALIBRATION CURVE
FOR USE WITH CIRCUIT ON DATA PAGE



MARCH 10, 1947 TUBE DEPARTMENT 92CM-6849

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

1949

1949
VACUUM-GAUGE TUBE

HARD-GLASS BULB, IONIZATION TYPE

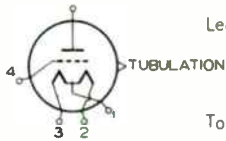
DATA

General:

Filament, Tungsten:*		
Voltage (Approx.)	5	ac or dc volts
Current (Approx.)	3.5	amp
Maximum Tube Length (Including tubulation)		11-1/2"
Maximum Tube Radius		2-3/16"
Maximum Bulb Length		5-1/8"
Maximum Bulb Diameter		2-1/16"
Bulb		T-16
Tubulation		1/2" Diameter Hard Glass, Corning Code 772 Nonex
Operating Position		Vertical with tubulation up or down; Horizontal, with stem press in vertical plane
Terminal Arrangement		See Outline Drawing

Terminal Lead Connections:

Lead 1 – Common Lead to Filaments
Lead 2 – Filament
Lead 3 – Filament (Spare)



Lead 4 – Grid
Top Lead – Plate

Maximum Ratings, ***Absolute Values:***

FILAMENT VOLTAGE	6.5 max.	volts
DC PLATE VOLTAGE DURING OPERATION . .	-100 max.	volts
DC GRID VOLTAGE DURING OPERATION . .	+200 max.	volts
VOLTAGE ON GRID & PLATE TIED TOGETHER DURING DEGASSING (DC OR PEAK AC)	650 max.	volts
GRID & PLATE DISSIPATION (TOTAL) DURING DEGASSING . .	150 max.	watts
AMBIENT TEMPERATURE DURING OPERATION.	100 max.	°C
GAS PRESSURE	0.001 max.	mm of Hg

Typical Degassing Conditions:

	Grid Connected to Plate		
Filament Voltage (AC or DC) . . .	6	6	volts
Grid & Plate Voltage	350 rms	500 dc	volts
Grid & Plate Current (Average)	100	150	ma

Typical Operation:

DC Plate Voltage	-22.5	-22.5	-22.5	volts

*The 1949 contains two filaments, one of which is a spare. Values shown are for either filament operated alone. The filament voltage should be kept as low as possible during degassing because use of a low filament voltage materially increases filament life.

← Indicates a change

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

1949

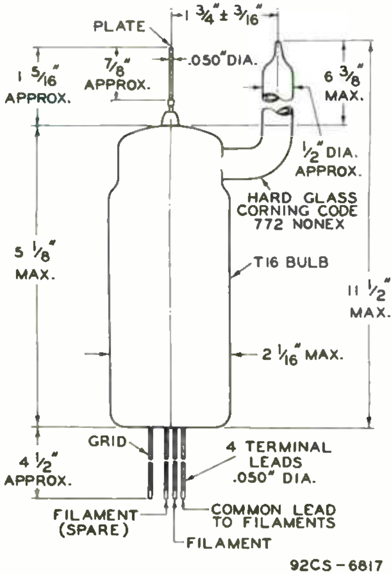
VACUUM-GAUGE TUBE

DC Grid Voltage	+80	+110	+160	volts
Grid Current	10	10	10	ma
Sensitivity	80	110	140	μa/micron▲

Calibration:

See curve on following sheet.

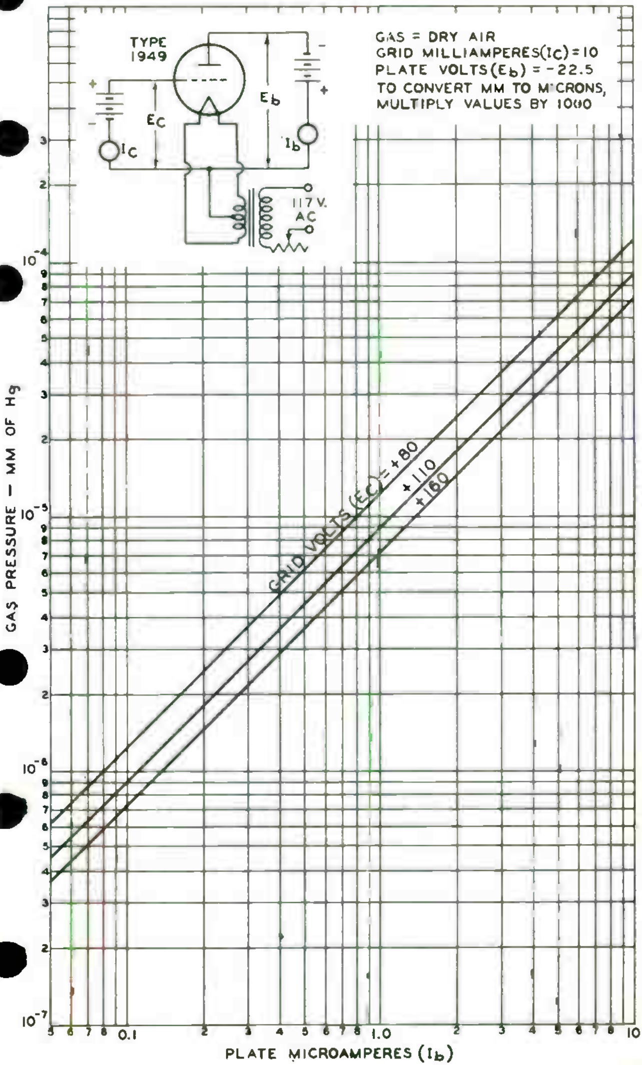
▲ 1 micron = 0.001 mm of mercury.



RCA

1949

CALIBRATION CURVES



RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

2050
THYRATRON
GAS TETRODE

GENERAL DATA

Electrical: ←

	Min.	Av.	Max.	
Heater, for Unipotential Cathode:				
Voltage (AC or DC)	5.7	6.3	6.9	volts
Current, with heater volts = 6.3	0.54	0.60	0.66	amp
Cathode:				
Heating Time, prior to tube conduction . . .	10	-	-	sec
Direct Interelectrode Capacitances (Approx.):●				
Grid No.1 to Anode			0.26	μμf
Input.			4.2	μμf
Output			3.6	μμf
Ionization Time (Approx.):				
For conditions: dc anode volts = 100; grid-No.1 square-pulse volts = 50; and peak anode amp. during conduction = 1.0			0.5	μsec
Deionization Time (Approx.):				
For conditions: dc anode volts = 125; grid-No.1 volts = -250; grid-No.1 resistor (ohms) = 1000; dc anode amp. = 0.1			50	μsec
For conditions: dc anode volts = 125; grid-No.1 volts = -10; grid-No.1 resistor (ohms) = 1000; dc anode amp. = 0.1			100	μsec
Maximum Critical Grid Current, with ac anode-supply volts (rms) = 460, and average anode amp. = 0.1			0.5	μamp
Tube Voltage Drop (Approx.)			8	volts
Grid-No.1 Control Ratio (Approx.) with grid-No.1 resistor (megohms) = 0; grid-No.2 volts = 0				250
Grid-No.2 Control Ratio (Approx.) with grid-No.1 resistor (megohms) = 0; grid-No.2 resistor (megohms) = 0; grid-No.1 volts = 0				800

● Without external shield.

Mechanical:

Mounting Position. . . . . Any
Maximum Overall Length . . . . 4-1/8"
Maximum Seated Length. 3-9/16"
Maximum Diameter . . . . 1-9/16"
Bulb ST-12
Base . . . . Small-Shell Octal 8-Pin
Basing Designation for BOTTOM VIEW 6BS

Pin 1 - No Connection
Pin 2 - Heater
Pin 3 - Anode
Pin 4 - No Connection

Pin 5 - Grid No.1
Pin 6 - Grid No.2
Pin 7 - Heater
Pin 8 - Cathode

← Indicates a change.

2050

2050
THYRATRON

RELAY and GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, *Absolute Values*:

PEAK ANODE VOLTAGE:			
Forward	180 max.	650 max.	volts
Inverse	360 max.	1300 max.	volts
GRID-No. 2 (SHIELD-GRID) VOLTAGE:			
Peak, before anode conduction	-100 max.	-100 max.	volts
Average, during anode conduction■	-10 max.	-10 max.	volts
GRID-No. 1 (CONTROL-GRID) VOLTAGE:			
Peak, before anode conduction	-250 max.	-250 max.	volts
Average, during anode conduction■	-10 max.	-10 max.	volts
CATHODE CURRENT:			
Peak	1.0 max.	1.0 max.	amp
Average■	0.2 max.	0.1 max.	amp
Surge, for duration of 0.1 sec. max.	10 max.	10 max.	amp
→ GRID-No. 2 CURRENT:			
Average■	+0.01 max.	+0.01 max.	amp
→ GRID-No. 1 CURRENT:			
Average■	+0.01 max.	+0.01 max.	amp
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	100 max.	100 max.	volts
Heater positive with respect to cathode	25 max.	25 max.	volts
AMBIENT TEMPERATURE RANGE	-75 to +90	-75 to +90	°C

→ **Typical Operating Conditions for Relay Service:**

RMS Anode Voltage	117	400	volts
Grid-No. 2 Voltage	0	0	volts
RMS Grid-No. 1 Bias Voltage	5□	-	volts
DC Grid-No. 1 Bias Voltage	-	-6	volts
Peak Grid-No. 1 Signal Voltage	5	6	volts
Grid-No. 1-Circuit Resistance	1.0	1.0	megohm
Anode-Circuit Resistance#	1200	2000	ohms

Maximum Circuit Values:

Grid-No. 1-Circuit Resistance:		
For average anode current below 0.1 amp.	10 max.	megohms
For average anode current above 0.1 amp.	2 max.	megohms

■ Averaged over any interval of 30 sec. max.

□ Approximately 180° out of phase with the anode voltage.

Sufficient resistance, including the tube load, must be used under any conditions of operation to prevent exceeding the current ratings.

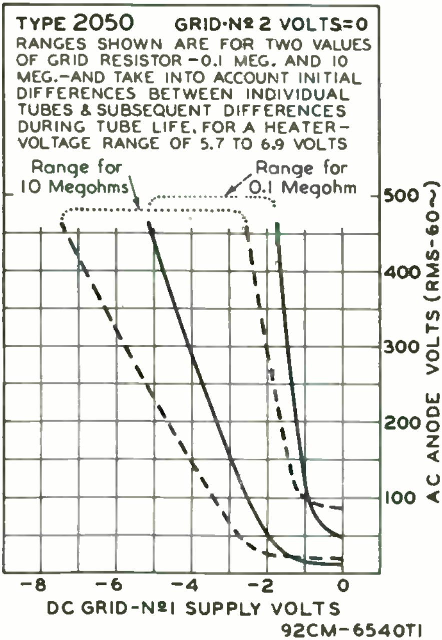
→ Indicates a change.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

2050 THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

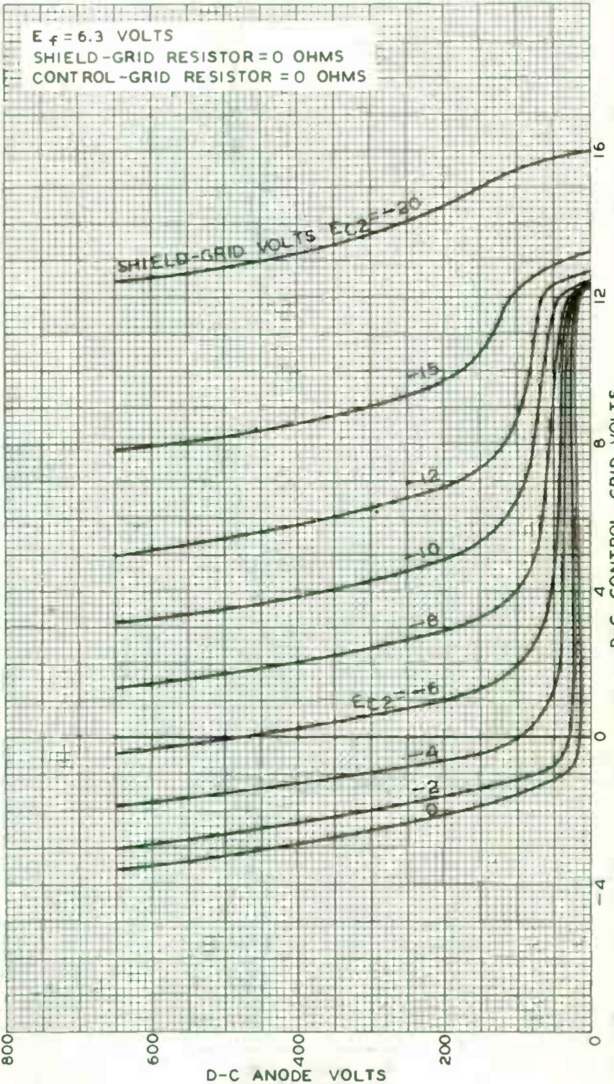


World Radio History

RCA

2050

AVERAGE CONTROL CHARACTERISTICS



MAY 3, 1944

RCA VICTOR DIVISION

RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

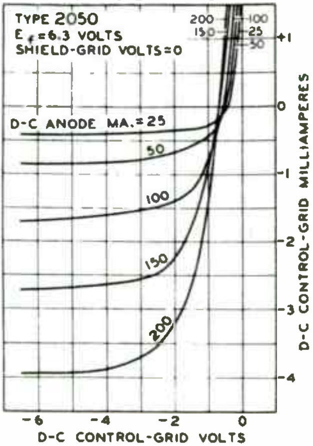
92CM-6274R1

World Radio History

2050

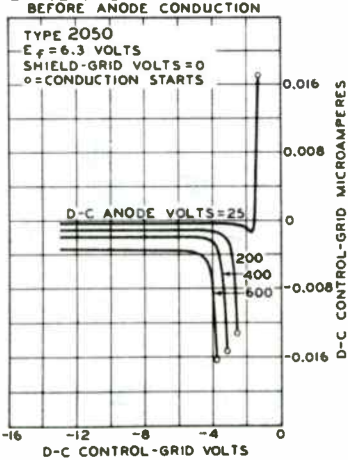
THYRATRON

AVERAGE GRID CHARACTERISTICS
DURING ANODE CONDUCTION



92CM-6275T

AVERAGE GRID CHARACTERISTICS
BEFORE ANODE CONDUCTION



92CM-6541T

World Radio History

Gas Thyratron

TETRODE TYPE

For Relay and Grid-Controlled-Rectifier Service

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Cathode:		
Minimum heating time prior to tube conduction	10	sec
Direct Interelectrode Capacitances (Approx.):*		
Grid No.1 to anode	0.15	μμf
Grid No.1 to cathode and grid No.2	2.2	μμf
Ionization Time (Approx.):		
For dc anode volts = 100, grid-No.1 volts (square-wave pulse) = 50, peak anode amperes during conduction = 1	0.5	μsec
Deionization Time (Approx.):		
With dc anode volts = 125, grid-No.1 volts = -250, grid-No.1 resistor (ohms) = 1000, dc anode amperes = 0.1	50	μsec
With dc anode volts = 125, grid-No.1 volts = -10, grid-No.1 resistor (ohms) = 1000, dc anode amperes = 0.1	100	μsec
Maximum Critical Grid-No.1 Current for dc anode supply volts (rms) = 460, average anode amperes = 0.1	0.5	μa
Anode Voltage Drop (Approx.)	8	volts
Grid-No.1 Control Ratio (Approx.) for grid-No.1 resistor (ohms) = 0, grid No.2 connected to cathode at socket	250	
Grid-No.2 Control Ratio (Approx.) for grid-No.1 resistor (ohms) = 0, grid-No.2 resistor (ohms) = 0, grid No.1 connected to cathode at socket	800	

Mechanical:

Operating Position	Any
Maximum Overall Length	3-1/16"
Maximum Seated Length	2-1/2"
Maximum Diameter	1-9/32"
Dimensional Outline	See *General Section*
Bulb	T9
Base	Intermediate-Shell Octal 6-Pin, Arrangement 3, with External Barriers (JEDEC Group 1, B6-229)

World Radio History

2050-A

Basing Designation for BOTTOM VIEW. 6BS

Pin 2 – Heater
Pin 3 – Anode
Pin 5 – Grid No.1

Pin 6 – Grid No.2
Pin 7 – Heater
Pin 8 – Cathode

RELAY AND GRID-CONTROLLED-RECTIFIER SERVICE

Maximum and Minimum Ratings, ***Absolute-Maximum Values:***

For anode supply frequency of 60 cps

PEAK ANODE VOLTAGE:					
Forward.	180	max.	650	max.	volts
Inverse.	360	max.	1300	max.	volts
GRID-No.2 (SHIELD-GRID) VOLTAGE:					
Peak, before tube conduction	-100	max.	-100	max.	volts
Average[b], during tube conduction	-10	max.	-10	max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:					
Peak, before tube conduction	-250	max.	-250	max.	volts
Average[b], during tube conduction	-10	max.	-10	max.	volts
CATHODE CURRENT:					
Peak	1	max.	1	max.	amp
Average[b]	0.2	max.	0.1	max.	amp
Fault, for duration of 0.1 second maximum	10	max.	10	max.	amp
GRID-No.2 CURRENT:					
Average[b]	+0.01	max.	+0.01	max.	amp
GRID-No.1 CURRENT:					
Average[b]	+0.01	max.	+0.01	max.	amp
PEAK HEATER-CATHODE VOLTAGE:					
Heater negative with respect to cathode . . .	100	max.	100	max.	volts
Heater positive with respect to cathode . . .	25	max.	25	max.	volts
AMBIENT-TEMPERATURE RANGE. .	-75 to +90		-75 to +90		°C

Typical Operation for Relay Service:

RMS Anode Voltage.	117	400	volts
Grid No.2.	*Connected to cathode at socket*		
RMS Grid-No.1 Bias Voltage[c].	5	–	volts
DC Grid-No.1 Bias Voltage. .	–	-6	volts
Peak Grid-No.1 Signal Voltage.	5	6	volts
Grid-No.1-Circuit Resistance	1	1	megohm
Anode-Circuit Resistance[d]. .	1200	2000	ohms

World Radio History

Maximum Circuit Values:

Grid-No.1-Circuit Resistance:

For average anode current below 0.1 ampere.	10 max.	megohms
For average anode current above 0.1 ampere.	2 max.	megohms

[a] Without external shield.
[b] Averaged over any interval of 30 seconds maximum.
[c] Approximately 180° out of phase with the anode voltage.
[d] Sufficient resistance, including the tube load, must be used under any conditions of operation to prevent exceeding the current ratings.

OPERATING CONSIDERATIONS

The *heater* is designed to operate on either ac or dc at 6.3 volts. Regardless of the heater-voltage supply used, *the heater voltage must never be allowed to deviate from its rated range.* Heater operation outside of this voltage range will impair tube performance and may cause tube failure. Low heater voltage causes low cathode temperature with resultant cathode sputtering and consequent destruction of the cathode; high heater voltage causes high cathode temperature with resultant heating of the grid and consequent grid emission which produces unpredictable shifts in the critical grid-No.1 voltage for conduction.

The *cathode* should be allowed to reach normal operating temperature before anode current is drawn. *The delay period should not be less than 10 seconds after application of heater voltage.* Unless this recommendation is followed, the cathode will be damaged.

The *shield grid* (grid No.2) is normally connected to the cathode at socket. It may, however, be used as a control electrode because the control characteristic of grid No.1 may be shifted by varying the potential of grid No.2. As grid No.2 is made negative, the grid-No.1 characteristic is shifted in the positive direction. The use of grid No.2 as the control electrode (with grid No.1 connected to cathode at socket) has the advantage of increased sensitivity but consideration must be given to the higher preconduction current, higher capacitance to anode, and less stability of operation.

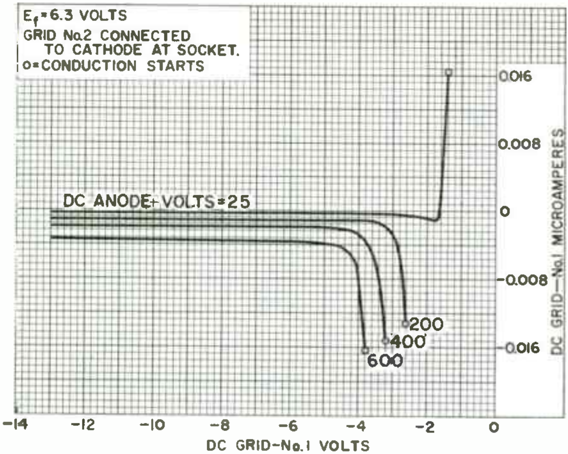
A *grid-No.1 resistor* having a value as high as 10 megohms to give circuit sensitivity can be used with the 2050-A because its control-grid current is very low. However, when a high value of grid resistor is used, care should be taken to keep the tube base and socket clean and dry in order to make the effect of leakage currents between the control-grid base pin and anode base pin very small.

Sufficient anode-circuit resistance, including the tube load, must be used under any conditions of operation to prevent exceeding the current ratings of the tube.

World Radio History

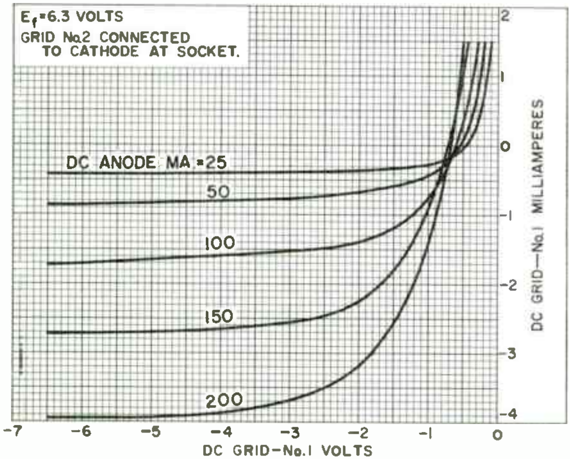
AVERAGE GRID-No.1 CHARACTERISTICS

Before Tube Conduction



92CS-6541R2

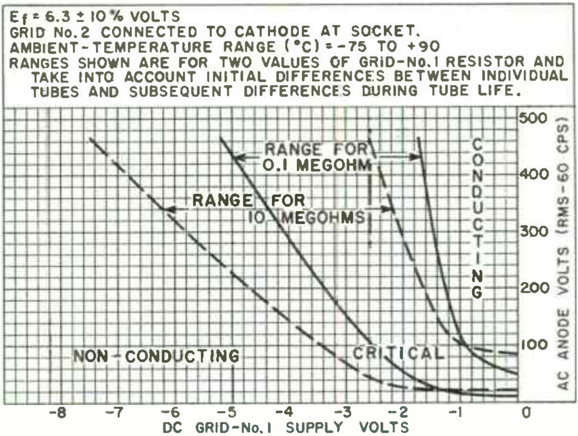
During Tube Conduction



92CS-6275R2

World Radio History

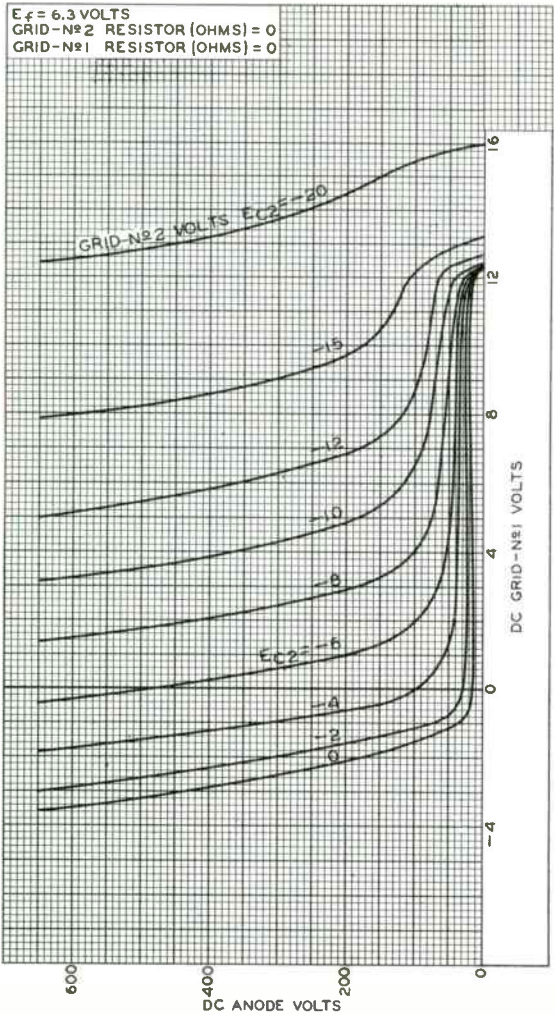
OPERATIONAL RANGE OF CRITICAL GRID-No.1 VOLTAGE



92CS-6540R3

World Radio History

AVERAGE CONTROL CHARACTERISTICS



92CM-6274R2

World Radio History

Ignitron

SEALED, CLAMP-COOLED, MERCURY-POOL-CATHODE TYPE

For Resistance-Welding Control

GENERAL DATA

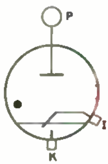
Electrical:

Cathode Excitation . . . . Cyclic
Cathode-Spot Starting . . . . By Ignitor
Minimum Requirements for Cathode Excitation:
  Peak ignitor voltage required to fire . . . . . . 200 volts
  Peak ignitor current required to fire . . . . . . 30 amp
  Starting time at required voltage or current . . 100 μsec
Tube Voltage Drop:
  At peak anode current of 1697 amperes . . . . . . 30 volts
  At peak anode current of 70.4 amperes . . . . . 12 volts

Mechanical:

Operating Position . . . . Vertical, flexible lead up
Maximum Overall Length (Including
  flexible lead) . . . . 17-5/8"
Maximum Diameter . . . . 2-1/2"
Weight (Approx.) . . . . 1.5 lbs
Terminal Diagram (See *Dimensional Outline*):

P – Anode Terminal (Flexible lead)
K – Cathode Terminal (Lower portion of shell)



I – Ignitor Terminal (Adjacent to exhaust tube)

Cooling:
  Type . . . . Air or water-cooled clamp
  Clamp height (Approx.) . . . . 1-7/8"
  Clamp location . . . . See *Dimensional Outline*

RESISTANCE-WELDING-CONTROL SERVICE[a]

Two Tubes in Inverse-Parallel Circuit

Maximum Ratings, ***Absolute-Maximum Values:***

For frequencies from 25 to 60 cps

Ratings I-A and I-B Apply to Operation with a Clamp-Temperature Range of 10° to 75° C

RATING I-A

	Column 1[b]	*Column 2*[b]	
SUPPLY VOLTAGE (RMS)	250 max.	250 max.	volts
DEMAND POWER (During conduction) .	50 max.	150 max.	kva

← indicates a change.

World Radio History

	Column 1[b]	Column 2[b]	
DUTY[c,d]	10 max.	1.8 max.	%
ANODE CURRENT (Per tube):			
Peak	282 max.	846 max.	amp
Demand (RMS, during conduction)[e]	200 max.	600 max.	amp
Average (Averaged over any interval of 27.8 seconds maximum)[e]	9 max.	4.86 max.	amp
Fault, for duration of 0.15 second maximum	1680 max.	1680 max.	amp

RATING I-B

	Column 1[b]	Column 2[b]	
SUPPLY VOLTAGE (RMS)	600 max.	600 max.	volts
DEMAND POWER (During conduction)	50 max.	150 max.	kva
DUTY[c,d]	24 max.	4.32 max.	%
ANODE CURRENT (Per tube):			
Peak	118 max.	354 max.	amp
Demand (RMS, during conduction)[e]	83 max.	250 max.	amp
Average (Averaged over any interval of 11.6 seconds maximum)[e]	9 max.	4.86 max.	amp
Fault, for duration of 0.15 second maximum	700 max.	700 max.	amp

Ratings II-A and II-B Apply to Operation with a Clamp-Temperature Range of 10° to 50° C

RATING II-A

	Column 1[b]	Column 2[b]	
SUPPLY VOLTAGE (RMS)	250 max.	250 max.	volts
DEMAND POWER (During conduction)	100 max.	300 max.	kva
DUTY[c,d]	12.4 max.	2.24 max.	%
ANODE CURRENT (Per tube):			
Peak	564 max.	1692 max.	amp
Demand (RMS, during conduction)[e]	400 max.	1200 max.	amp
Average (Averaged over any interval of 2.2 seconds maximum)[e]	22.4 max.	12.1 max.	amp
Fault, for duration of 0.15 second maximum	3360 max.	3360 max.	amp

RATING II-B

	Column 1[b]	Column 2[b]	
SUPPLY VOLTAGE (RMS)	600 max.	600 max.	volts
DEMAND POWER (During conduction)	100 max.	300 max.	kva
DUTY[c,d]	30 max.	5.4 max.	%

World Radio History

ANODE CURRENT (Per tube):			
Peak	236 max.	708 max.	amp
Demand (RMS, during conduction)●	167 max.	500 max.	amp
Average (Averaged over any interval of 9.2 seconds maximum)●	22.4 max.	12.1 max.	amp
Fault, for duration of 0.15 second maximum	1400 max.	1400 max.	amp

RESISTANCE-WELDING CAPACITOR-DISCHARGE SERVICE ←

Maximum Ratings, ***Absolute-Maximum Values:***

RATING I

CLAMP TEMPERATURE	70 max.	40 max.	°C
NUMBER OF DISCHARGES PER SECOND	60 max.	60 max.	
PEAK ANODE VOLTAGE:			
Forward	3000 max.	3000 max.	volts
Inverse	3000 max.	3000 max.	volts
ANODE CURRENT:			
Peak	500 max.	500 max.	amp
Average[f]	3 max.	15 max.	amp
Averaging time-interval[f]	3.3 max.	0.66 max.	sec
DURATION OF CATHODE-SPOT PER DISCHARGE	0.02 max.	0.02 max.	sec

RATING II

CLAMP TEMPERATURE	60 max.	40 max.	°C
NUMBER OF DISCHARGES PER SECOND	60 max.	60 max.	
PEAK ANODE VOLTAGE:			
Forward	6000 max.	6000 max.	volts
Inverse	3000 max.	3000 max.	volts
ANODE CURRENT:			
Peak	500 max.	500 max.	amp
Average[f]	2.5 max.	8 max.	amp
Averaging time-interval[f]	4 max.	1.25 max.	sec
DURATION OF CATHODE-SPOT PER DISCHARGE	0.02 max.	0.02 max.	sec

IGNITOR ←

Maximum Ratings, ***Absolute-Maximum Values:***

PEAK IGNITOR VOLTAGE:		
Positive	900 max.	volts
Negative	5 max.	volts
IGNITOR CURRENT:		
Peak	100 max.	amp
Average (Averaged over any interval of 5 seconds maximum)	1 max.	amp
RMS	10 max.	amp

← Indicates a change.

World Radio History

[a] RMS voltage, current, and demand kva are on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used.

[b] *Column 1* represents operation at maximum average anode current; *Column 2* represents operation at maximum demand power.

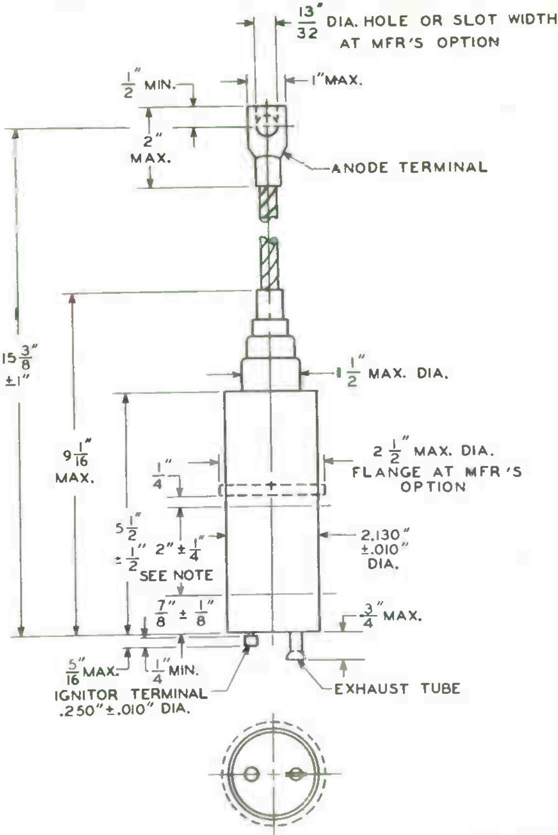
[c] Defined as (cycles "on")/(cycles "on" + cycles "off") during the specified averaging time.

[d] For supply voltages between 250 volts and 600 volts, duty is proportional to supply voltage. For supply voltages lower than 250 volts, the values for 250 volts apply.

[e] For supply voltages between 250 volts and 600 volts, demand anode current and averaging time are each inversely proportional to supply voltage. For supply voltages lower than 250 volts, the values for 250 volts apply.

[f] With the use of log-log paper, straight-line interpolation between tabulated points may be used to obtain average-anode-current and maximum-averaging-time ratings at clamp temperatures between the two tabulated values.

World Radio History



92CS-10843

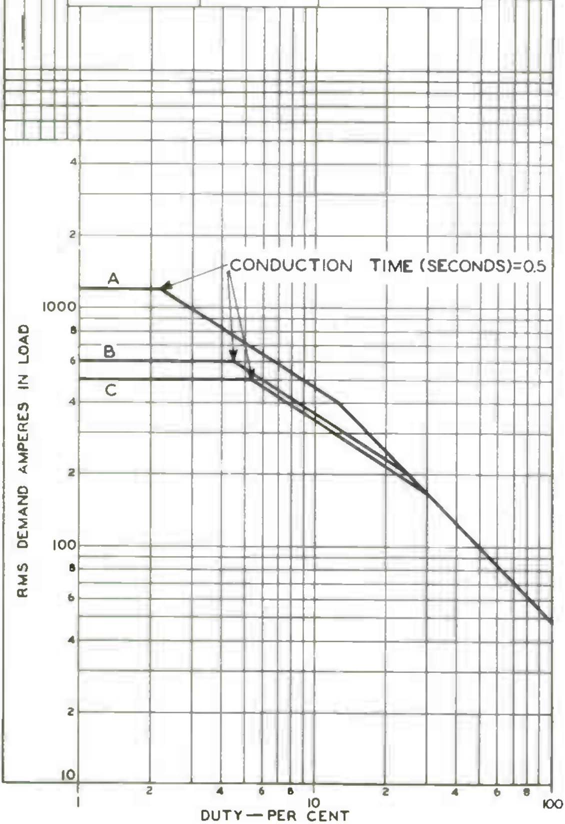
NOTE: CATHODE TERMINAL AND CLAMP-COOLED AREA.

World Radio History

RATING CHART 1
Resistance-Welding-Control Service

TWO TUBES CONNECTED IN INVERSE PARALLEL.
CLAMP TEMPERATURE (°C)=10 TO 50

CURVE	RMS ANODE SUPPLY VOLTS	MAXIMUM AVERAGING TIME—SECONDS
A	250	22
B	500	11
C	600	9.2



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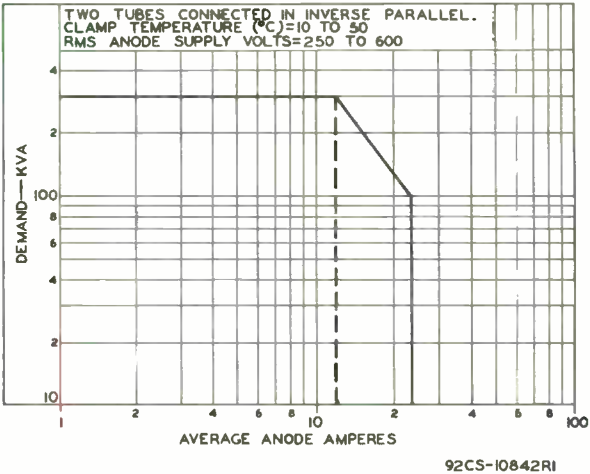
World Radio History

RATING CHART 2
Resistance-Welding-Control Service



World Radio History

World Radio History

5551-A
IGNITRON

WATER-COOLED, STEEL-JACKETED, MERCURY-POOL-CATHODE TYPE HAVING MOUNTING PLATE FOR THERMOSTATIC CONTROL

For resistance-welding control

GENERAL DATA

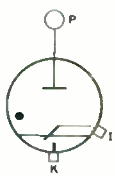
Electrical:

Cathode Excitation. . . . . .Cyclic		
Cathode-Spot Starting . . . . .By Ignitor		
Minimum Requirements for Cathode Excitation:		
Peak ignitor voltage required to fire	200	volts
Peak ignitor current required to fire	30	amp
Starting time at required voltage or current.	100	μsec
Tube Voltage Drop:		
At peak anode current of 3400 amperes	26	volts
At peak anode current of 176 amperes.	13	volts

Mechanical:

Operating Position. . . . . .Vertical, flexible lead up
Maximum Overall Length (Including flexible lead). . . . . 23-1/4"
Maximum Radius (Including water connections). . . . . 2-7/8"
Weight. . . . . 3.6 lbs
Terminal Connections *(See Dimensional Outline)*:

P – Anode Terminal (Flexible lead)
K – Cathode Terminal (Bar opposite anode terminal)



I – Ignitor Terminal (Within jacket skirt at cathode end)

Cooling:

Type. . . . . Water		
Minimum inlet water temperature	10	°C
Maximum outlet water temperature.	40	°C
Minimum water flow.	1	gpm
Maximum water-temperature rise.	4	°C
Maximum pressure drop	2.5	psi

INTERMITTENT RECTIFIER SERVICE
and
FREQUENCY-CHANGER WELDER SERVICE

Maximum Ratings, ***Absolute-Maximum Values:***

For zero phase-control angle and frequencies from 50 to 60 cps

RATING I

PEAK ANODE VOLTAGE:		
Forward.	500 max.	volts
Inverse.	500 max.	volts

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5551-A
IGNITRON

ANODE CURRENT:		
Peak	700 max.	amp
Average (Averaged over any interval of 6 seconds maximum)	40 max.	amp
Fault, for duration of 0.15 second maximum	8750 max.	amp

RATING II

PEAK ANODE VOLTAGE:			
Forward	1200 max.	1200 max.	volts
Inverse	1200 max.	1200 max.	volts
ANODE CURRENT:			
Peak	135 max.	600 max.	amp
Average (Averaged over any interval of 10 seconds maximum)	22.5 max.	5 max.	amp
Average (Averaged over any interval of 0.2 second maximum)	22.5 max.	100 max.	amp
Fault, for duration of 0.15 second maximum	7500 max.	7500 max.	amp

RATING III

PEAK ANODE VOLTAGE:			
Forward	1500 max.	1500 max.	volts
Inverse	1500 max.	1500 max.	volts
ANODE CURRENT:			
Peak	108 max.	480 max.	amp
Average (Averaged over any interval of 10 seconds maximum)	18 max.	4 max.	amp
Average (Averaged over any interval of 0.2 second maximum)	18 max.	80 max.	amp
Fault, for duration of 0.15 second maximum	6000 max.	6000 max.	amp

RESISTANCE-WELDING-CONTROL SERVICE●

Two Tubes in Inverse-Parallel Circuit

Maximum Ratings, *Absolute-Maximum Values:*

For frequencies from 25 to 60 cps

Ratings I-A and I-B Apply to Operation Either (1) Without Water-Saving Thermostat, or (2) With Water-Saving Thermostat Shunted by Auxiliary Contactor

RATING I-A

SUPPLY VOLTAGE (RMS)	250 max.	250 max.	volts
DEMAND POWER (During conduction)	200 max.	600 max.	kva

●: See next page.

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IGNITRON

DUTY▲†	15 max.	2.8 max.	%
ANODE CURRENT (Per tube):			
Peak	1130 max.	3400 max.	amp
Demand (RMS, during conduction)#.	800 max.	2400 max.	amp
Average (Averaged over any interval of 18 seconds maximum)#	56 max.	30.2 max.	amp
Fault, for duration of 0.15 second maximum	6720 max.	6720 max.	amp

RATING I-B

SUPPLY VOLTAGE (RMS)	600 max.	600 max.	volts
DEMAND POWER (During conduction)	200 max.	600 max.	kva
DUTY▲†	37 max.	6.7 max.	%
ANODE CURRENT (Per tube):			
Peak	466 max.	1410 max.	amp
Demand (RMS, during conduction)#.	333 max.	1000 max.	amp
Average (Averaged over any interval of 7.5 seconds maximum)#	56 max.	30.2 max.	amp
Fault, for duration of 0.15 second maximum	2800 max.	2800 max.	amp

Ratings II-A and II-B Apply to Operation with Water-Saving Thermostat Not Shunted by Auxiliary Contactor

RATING II-A

SUPPLY VOLTAGE (RMS)	250 max.	250 max.	volts
DEMAND POWER (During conduction)	200 max.	600 max.	kva
DUTY▲†	9.7 max.	1.9 max.	%
ANODE CURRENT (Per tube):			
Peak	1130 max.	3400 max.	amp
Demand (RMS, during conduction)#.	800 max.	2400 max.	amp
Average (Averaged over any interval of 25.6 seconds maximum)#	36 max.	21 max.	amp
Fault, for duration of 0.15 second maximum	6720 max.	6720 max.	amp

RATING II-B

SUPPLY VOLTAGE (RMS)	600 max.	600 max.	volts
DEMAND POWER (During conduction)	200 max.	600 max.	kva
DUTY▲†	23 max.	4.7 max.	%

●,▲,†,#: See next page.

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IGNITRON

ANODE CURRENT (Per tube):			
Peak	466 max.	1410 max.	amp
Demand (RMS, during conduction)#.	333 max.	1000 max.	amp
Average (Averaged over any interval of 10.7 seconds maximum)#	36 max.	21 max.	amp
Fault, for duration of 0.15 second maximum	925 max.	2800 max.	amp

IGNITOR

Maximum Ratings, *Absolute-Maximum Values:*

PEAK IGNITOR VOLTAGE:		
Positive	Equal to anode	volts
Negative	5 max.	volts
IGNITOR CURRENT:		
Peak	100 max.	amp
Average (Averaged over any interval of 5 seconds maximum).	1 max.	amp
RMS.	10 max.	amp

● RMS voltage, current, and demand kva are on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used.

▲ Defined as (cycles "on")/(cycles "on" + cycles "off") during the specified averaging time.

† For supply voltages between 250 volts and 600 volts, duty is proportional to supply voltage. For supply voltages lower than 250 volts, the values for 250 volts apply.

For supply voltages between 250 volts and 600 volts, demand anode current and averaging time are each inversely proportional to supply voltage. For supply voltages lower than 250 volts, the values for 250 volts apply.

OPERATING CONSIDERATIONS

The 5551-A is equipped for mounting a thermostatic control with a mounting plate calibrated either for controlling the flow of cooling water through the water jacket, or for protection of the ignitron against overheating.

When the cooling water is circulated successively through the water jackets of two or more ignitrons, the *water-saving thermostat*, if used should be mounted on the ignitron connected directly to the water supply.

The water-saving thermostat, which has normally open contacts, is calibrated to close a circuit energizing a solenoid valve in the water-supply line and thus permit water flow to start when the temperature of the thermostat mounting plate exceeds approximately 35° C. Because of the lag between the heating of the ignitron envelope and the functioning of the water-saving thermostat to start water flow through the water jackets, the ignitron may overheat before the flow of cooling water starts.

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IGNITRON

Such overheating can be prevented by the use of an auxiliary contactor shunted across the contacts of the water-saving thermostat and actuated by the welding-control switch. The contactor causes the solenoid valve in the water-supply line to open as soon as welding current flows.

If the water-saving thermostat is not shunted by an auxiliary contactor, it will be necessary to use a lower value of maximum average current than that which is specified when the auxiliary contactor is employed. The lower average current value is achieved by increasing the maximum averaging time and decreasing the maximum duty. Although the same maximum conduction time is permitted for both of these operating conditions, the use of the water-saving thermostat alone, without the auxiliary contactor requires a longer interval between successive welds than when the thermostat is shunted by the contactor.

When a *protective thermostat* is used, it should be mounted on an ignitron from which the cooling water discharges into the drain. The protective thermostat is calibrated to open a set of normally closed contacts at a jacket temperature of approximately 52° C. The opening of these contacts causes a protective device to function. This device may be a relay opening the ignitor firing controls, or preferably, a circuit breaker which removes power from the ignitrons.

Care must be taken to insure that the water jacket of each ignitron is completely filled before power is applied. Tube operation with a partially filled water jacket may cause abnormal heating of the tube envelope, with resultant arc-back which impairs tube life. It is also necessary to arrange the cooling system so as to prevent any draining of the water jackets when the flow of water ceases.

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RCA

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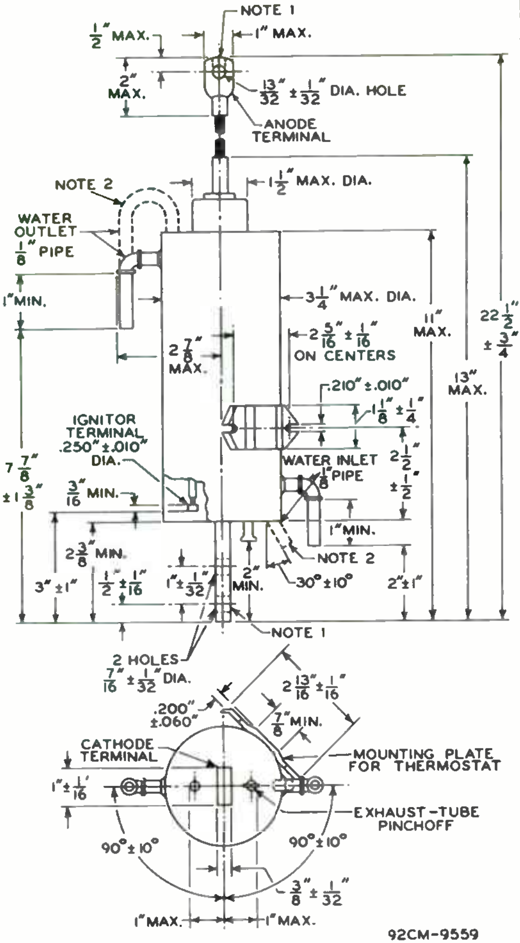
IGNITRON



NOTE 1: MAY BE SLOTTED.

NOTE 2: DASHED POSITION MANUFACTURER'S OPTION.

World Radio History

RCA

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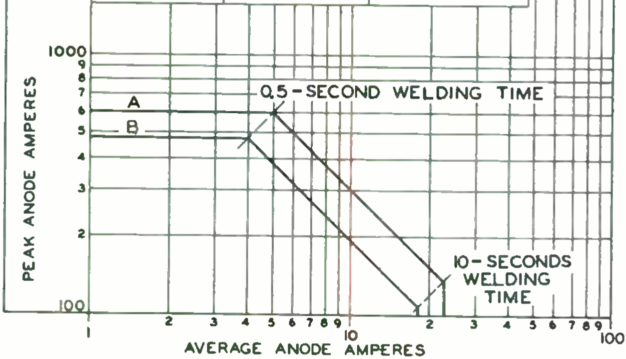
RATING CHARTS

FREQUENCY-CHANGER-WELDER SERVICE

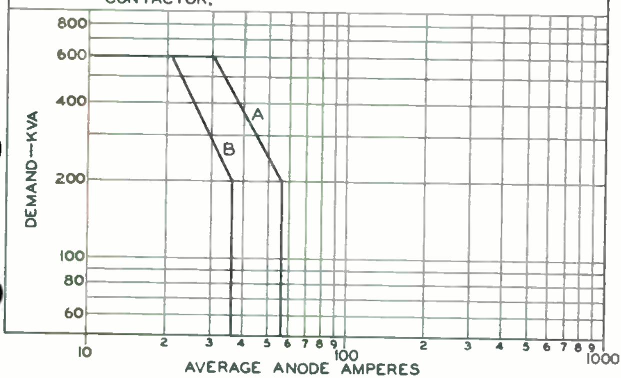
CURVE	PEAK ANODE VOLTS FORWARD OR INVERSE	MAXIMUM AVERAGING TIME—SECONDS
A	1200	10
B	1500	10



92CS-9695

RESISTANCE-WELDING-CONTROL SERVICE

TWO TUBES CONNECTED IN INVERSE PARALLEL.
RMS ANODE-SUPPLY VOLTS = 250 TO 600
CURVE A: NO WATER-SAVING THERMOSTAT, OR WATER-SAVING THERMOSTAT SHUNTED BY AUXILIARY CONTACTOR.
CURVE B: WATER-SAVING THERMOSTAT WITHOUT AUXILIARY CONTACTOR.



92CS-9698

World Radio History

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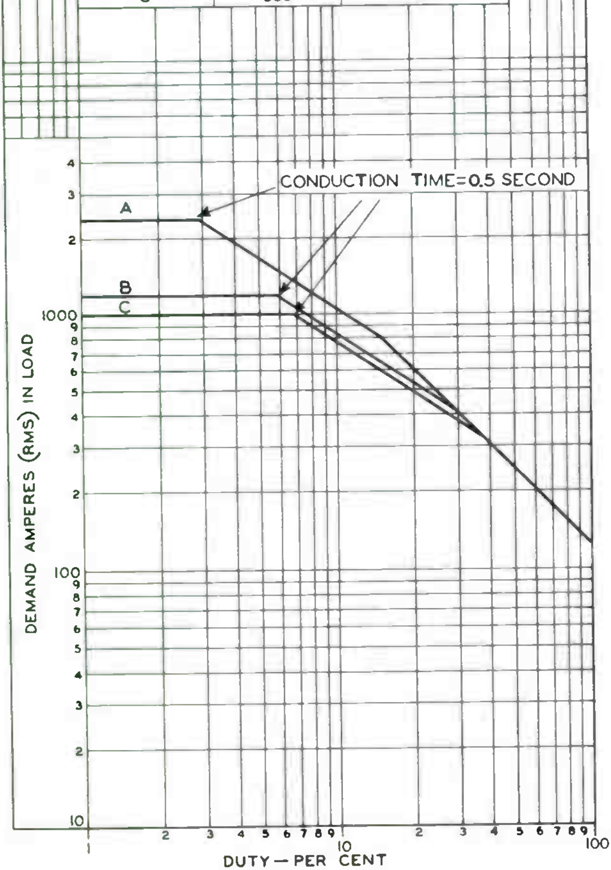
5551-A

RATING CHART

RESISTANCE-WELDING-CONTROL SERVICE

TWO TUBES CONNECTED IN INVERSE PARALLEL.
NO WATER-SAVING THERMOSTAT, OR WATER-SAVING THERMOSTAT SHUNTED BY AUXILIARY CONTACTOR.
PROTECTIVE THERMOSTAT OPTIONAL.

CURVE	RMS ANODE-SUPPLY VOLTS	MAXIMUM AVERAGING TIME—SECONDS
A	250	18
B	500	9
C	600	7.5



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RCA

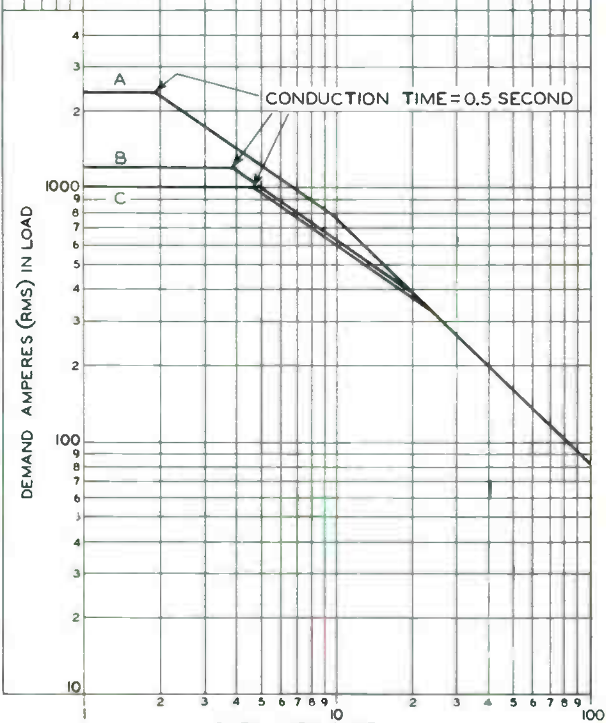
5551-A

RATING CHART

RESISTANCE-WELDING-CONTROL SERVICE

TWO TUBES CONNECTED IN INVERSE PARALLEL.
WATER-SAVING THERMOSTAT WITHOUT AUXILIARY CONTACTOR.
PROTECTIVE THERMOSTAT OPTIONAL.

CURVE	RMS ANODE-SUPPLY VOLTS	MAXIMUM AVERAGING TIME—SECONDS
A	250	25.6
B	500	12.8
C	600	10.7



ELECTRON TUBE DIVISION 92CM-9692

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

World Radio History

5552-A
IGNITRON

WATER-COOLED, STEEL-JACKETED, MERCURY-POOL-CATHODE TYPE HAVING MOUNTING PLATE FOR THERMOSTATIC CONTROL

For resistance-welding control

GENERAL DATA

Electrical:

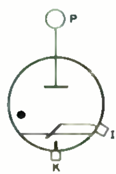
Cathode Excitation		Cyclic
Cathode-Spot Starting.		By Ignitor
Minimum Requirements for Cathode Excitation:		
Peak ignitor voltage required to fire. . .	200	volts
Peak ignitor current required to fire. . .	30	amp
Starting time at required voltage or current	100	μsec
Tube Voltage Drop:		
At peak anode current of 6800 amperes. . .	28	volts
At peak anode current of 440 amperes . . .	14	volts

Mechanical:

Operating Position	Vertical, flexible lead up
Maximum Overall Length (Including flexible lead)	27-1/4"
Maximum Radius (Including water connections)	3-5/8"
Weight	8 lbs

Terminal Connections *(See Dimensional Outline)*:

P – Anode Terminal (Flexible lead)
K – Cathode Terminal (Bar opposite anode terminal)



I – Ignitor Terminal (Within jacket skirt at cathode end)

Cooling:

Type		Water
Minimum inlet water temperature.	10	°C
Maximum outlet water temperature	40	°C
Minimum water flow	1.5	gpm
Maximum water-temperature rise	6	°C
Maximum pressure drop.	6	psi

INTERMITTENT RECTIFIER SERVICE

Maximum Ratings, *Absolute-Maximum Values:*

For zero phase-control angle and frequencies from 25 to 60 cps

PEAK ANODE VOLTAGE:		
Forward.	500 max.	volts
Inverse.	500 max.	volts

ELECTRON TUBE DIVISION
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IGNITRON

ANODE CURRENT:		
Peak	1600 max.	amp
Average (Averaged over any interval of 6 seconds maximum)	100 max.	amp
Fault, for duration of 0.15 second maximum	6000 max.	amp

RESISTANCE-WELDING-CONTROL SERVICE●

Two Tubes in Inverse-Parallel Circuit

Maximum Ratings, ***Absolute-Maximum Values:***

For frequencies from 25 to 60 cps

Ratings I-A and I-B Apply to Operation Either (1) Without Water-Saving Thermostat, or (2) With Water-Saving Thermostat Shunted by Auxiliary Contactor

RATING I-A

	Column 1*	Column 2*	
SUPPLY VOLTAGE (RMS)	250 max.	250 max.	volts
DEMAND POWER (During conduction)	400 max.	1200 max.	kva
DUTY▲†	19 max.	3.5 max.	%
ANODE CURRENT (Per tube):			
Peak	2260 max.	6800 max.	amp
Demand (RMS, during conduction)#	1600 max.	4800 max.	amp
Average (Averaged over any interval of 14 seconds maximum)#	140 max.	75.6 max.	amp
Fault, for duration of 0.15 second maximum	13450 max.	13450 max.	amp

RATING I-B

	Column 1*	Column 2*	
SUPPLY VOLTAGE (RMS)	600 max.	600 max.	volts
DEMAND POWER (During conduction)	400 max.	1200 max.	kva
DUTY▲†	47 max.	8.5 max.	%
ANODE CURRENT (Per tube):			
Peak	945 max.	2830 max.	amp
Demand (RMS, during conduction)#	666 max.	2000 max.	amp
Average (Averaged over any interval of 5.8 seconds maximum)#	140 max.	75.6 max.	amp
Fault, for duration of 0.15 second maximum	5600 max.	5600 max.	amp

●,▲,†,#,*: See next page.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
World Radio History

5552-A

IGNITRON

Ratings II-A and II-B Apply to Operation with Water-Saving Thermostat Not Shunted by Auxiliary Contactor

RATING II-A

	Column 1*	Column 2*	
SUPPLY VOLTAGE (RMS)	250 max.	250 max.	volts
DEMAND POWER (During conduction)	400 max.	1200 max.	kva
DUTY▲†	11 max.	2 max.	%
ANODE CURRENT (Per tube):			
Peak	2260 max.	6800 max.	amp
Demand (RMS, during conduction)#	1600 max.	4800 max.	amp
Average (Averaged over any interval of 23.5 seconds maximum)#	80 max.	43 max.	amp
Fault, for duration of 0.15 second maximum	13450 max.	13450 max.	amp

RATING II-B

	Column 1*	Column 2*	
SUPPLY VOLTAGE (RMS)	600 max.	600 max.	volts
DEMAND POWER (During conduction)	400 max.	1200 max.	kva
DUTY▲†	26 max.	4.8 max.	%
ANODE CURRENT (Per tube):			
Peak	945 max.	2830 max.	amp
Demand (RMS, during conduction)#	666 max.	2000 max.	amp
Average (Averaged over any interval of 10 seconds maximum)#	80 max.	43 max.	amp
Fault, for duration of 0.15 second maximum	5600 max.	5600 max.	amp

IGNITOR

Maximum Ratings, ***Absolute-Maximum Values:***

PEAK IGNITOR VOLTAGE:		
Positive	Equal to anode	volts
Negative	5 max.	volts
IGNITOR CURRENT:		
Peak	100 max.	amp
Average (Averaged over any interval of 5 seconds maximum)	1 max.	amp
RMS	10 max.	amp

●,▲,†,#,*: See next page.

World Radio History

RCA

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IGNITRON

● RMS voltage, current, and demand kva are on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used.

▲ Defined as (cycles "on")/(cycles "on" + cycles "off") during the specified averaging time.

† For supply voltages between 250 volts and 600 volts, duty is proportional to supply voltage. For supply voltages lower than 250 volts, the values for 250 volts apply.

For supply voltages between 250 volts and 600 volts, demand anode current and averaging time are each inversely proportional to supply voltage. For supply voltages lower than 250 volts, the values for 250 volts apply.

* Column 1 represents operation at maximum average anode current; Column 2 represents operation at maximum demand current.

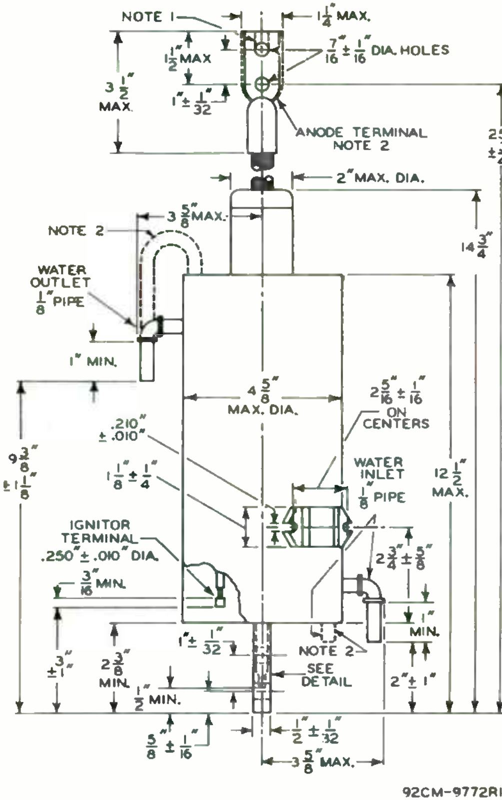
OPERATING CONSIDERATIONS
for the 5552-A are the same as
those shown for Type 5551-A

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

5552-A

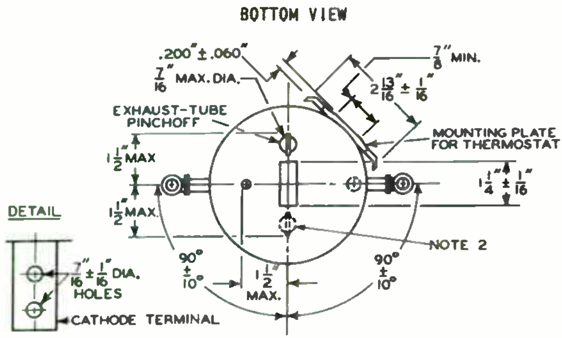
IGNITRON



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

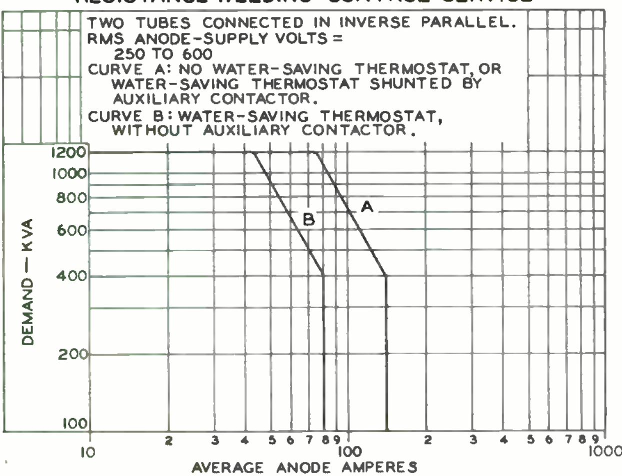
5552-A
IGNITRON



NOTE 1: MAY BE SLOTTED.
NOTE 2: DASHED POSITION AT MANUFACTURER'S OPTION.

4-59 CE-9772R1B

RATING CHART
RESISTANCE-WELDING-CONTROL SERVICE



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World Radio History

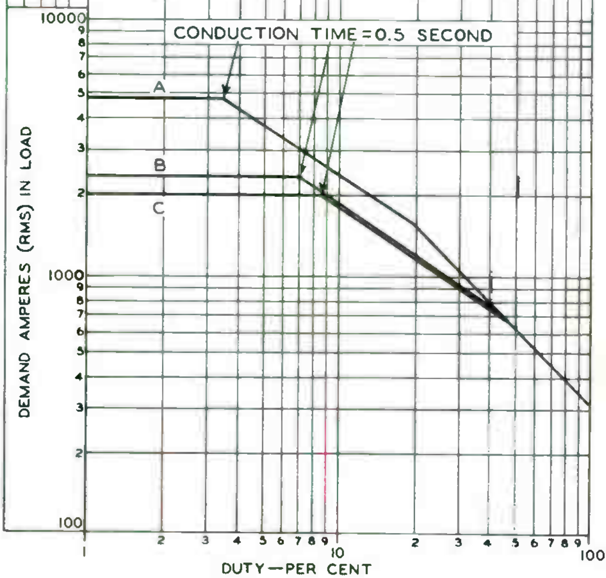
5552-A

RATING CHART

RESISTANCE-WELDING-CONTROL SERVICE

TWO TUBES CONNECTED IN INVERSE PARALLEL.
NO WATER-SAVING THERMOSTAT, OR WATER-SAVING THERMOSTAT SHUNTED BY AUXILIARY CONTACTOR
PROTECTIVE THERMOSTAT OPTIONAL.

CURVE	RMS ANODE-SUPPLY VOLTS	MAXIMUM AVERAGING TIME—SECONDS
A	250	14
B	500	7
C	600	5.8



ELECTRON TUBE DIVISION

92CM-9710

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

5552-A

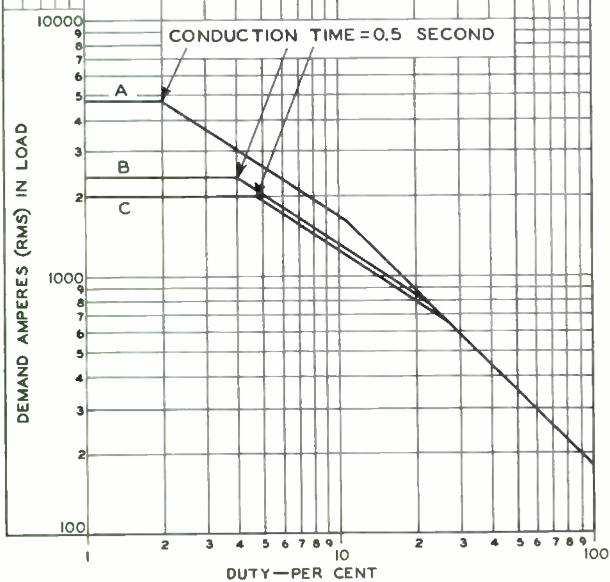
5552-A

RATING CHART

RESISTANCE-WELDING-CONTROL SERVICE

TWO TUBES CONNECTED IN INVERSE PARALLEL.
WATER-SAVING THERMOSTAT WITHOUT AUXILIARY CONTACTOR.
PROTECTIVE THERMOSTAT OPTIONAL.

CURVE	RMS ANODE-SUPPLY VOLTS	MAXIMUM AVERAGING TIME—SECONDS
A	250	23.5
B	500	11.8
C	600	10



ELECTRON TUBE DIVISION

92CM-9711

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

5553-B

5553-B
IGNITRON

WATER-COOLED, STEEL-JACKETED, MERCURY-POOL-CATHODE TYPE HAVING MOUNTING PLATE FOR THERMOSTATIC CONTROL

For resistance-welding control

GENERAL DATA

Electrical:

Cathode Excitation	Cyclic	
Cathode-Spot Starting	By Ignitor	
Minimum Requirements for Cathode Excitation:		
Peak ignitor voltage required to fire	200	volts
Peak ignitor current required to fire	30	amp
Starting time at required voltage or current	100	µsec
Tube Voltage Drop:		
At peak anode current of 13600 amperes	36	volts
At peak anode current of 1115 amperes	17	volts

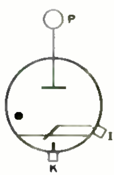
Mechanical:

Operating Position	Vertical, flexible lead up
Maximum Overall Length (Including flexible lead)	31-3/8"
Maximum Radius (Including water connections)	4-11/16"
Weight	21 lbs

Terminal Connections *(See Dimensional Outline)*:

P - Anode Terminal (Flexible lead)

K - Cathode Terminal (Bar opposite anode terminal)



I - Ignitor Terminal (Within jacket skirt at cathode end)

Cooling:

Type	Water	
Minimum inlet water temperature	10	°C
Maximum outlet water temperature	40	°C
Minimum water flow	3	gpm
Maximum water-temperature rise	9	°C
Maximum pressure drop	5.1	psi

INTERMITTENT RECTIFIER SERVICE and FREQUENCY-CHANGER WELDER SERVICE

Maximum Ratings, *Absolute-Maximum Values:*

For zero phase-control angle and frequencies from 50 to 60 cps

RATING I

PEAK ANODE VOLTAGE:			
Forward	600 max.	600 max.	volts
Inverse	600 max.	600 max.	volts

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TENTATIVE DATA 1

World Radio History

5553-B
IGNITRON

ANODE CURRENT:			
Peak.	1140 max.	4000 max.	amp
Average (Averaged over any interval of 6.25 seconds maximum)	190 max.	54 max.	amp
Average (Averaged over any interval of 0.2 second maximum).	190 max.	666 max.	amp
Fault, for duration of 0.15 second maximum.	50000 max.	50000 max.	amp

RATING II

PEAK ANODE VOLTAGE:			
Forward	1200 max.	1200 max.	volts
Inverse	1200 max.	1200 max.	volts
ANODE CURRENT:			
Peak.	840 max.	3000 max.	amp
Average (Averaged over any interval of 6.25 seconds maximum)	140 max.	40 max.	amp
Average (Averaged over any interval of 0.2 second maximum).	140 max.	500 max.	amp
Fault, for duration of 0.15 second maximum.	37500 max.	37500 max.	amp

RATING III

PEAK ANODE VOLTAGE:			
Forward	1500 max.	1500 max.	volts
Inverse	1500 max.	1500 max.	volts
ANODE CURRENT:			
Peak.	672 max.	2400 max.	amp
Average (Averaged over any interval of 6.25 seconds maximum)	112 max.	32 max.	amp
Average (Averaged over any interval of 0.2 second maximum).	112 max.	400 max.	amp
Fault, for duration of 0.15 second maximum.	30000 max.	30000 max.	amp

RESISTANCE-WELDING-CONTROL SERVICE*

Two Tubes in Inverse-Parallel Circuit

Maximum Ratings, *Absolute-Maximum Values:*

For frequencies from 25 to 60 cps

Ratings I-A and I-B Apply to Operation Either (1) Without Water-Saving Thermostat, or (2) With Water-Saving Thermostat Shunted by Auxiliary Contactor

RATING I-A

	*Column 1**	*Column 2**	
SUPPLY VOLTAGE (RMS).	250 max.	250 max.	volts

World Radio History

5553-B

IGNITRON

	Column 1*	Column 2*	
DEMAND POWER (During conduction)	800 max.	2400 max.	kva
DUTY•†.	24.6 max.	4.4 max.	%
ANODE CURRENT (Per tube):			
Peak.	4530 max.	13600 max.	amp
Demand (RMS, during conduction)#.	3200 max.	9600 max.	amp
Average (Averaged over any interval of 11 seconds maximum)#.	355 max.	192 max.	amp
Fault, for duration of 0.15 second maximum.	27000 max.	27000 max.	amp

RATING I-B

	Column 1*	Column 2*	
SUPPLY VOLTAGE (RMS).	600 max.	600 max.	volts
DEMAND POWER (During conduction)	800 max.	2400 max.	kva
DUTY•†.	59 max.	10.7 max.	%
ANODE CURRENT (Per tube):			
Peak.	1890 max.	5660 max.	amp
Demand (RMS, during conduction)#.	1330 max.	4000 max.	amp
Average (Averaged over any interval of 4.6 seconds maximum)#.	355 max.	192 max.	amp
Fault, for duration of 0.15 second maximum.	11200 max.	11200 max.	amp

Ratings II-A and II-B Apply to Operation with Water-Saving Thermostat Not Shunted by Auxiliary Contactor

RATING II-A

	Column 1*	Column 2*	
SUPPLY VOLTAGE (RMS).	250 max.	250 max.	volts
DEMAND POWER (During conduction)	800 max.	2400 max.	kva
DUTY•†.	12.2 max.	2.2 max.	%
ANODE CURRENT (Per tube):			
Peak.	4530 max.	13600 max.	amp
Demand (RMS, during conduction)#.	3200 max.	9600 max.	amp
Average (Averaged over any interval of 22.4 seconds maximum)#.	175 max.	96 max.	amp
Fault, for duration of 0.15 second maximum.	27000 max.	27000 max.	amp

⊕,•,†,*,#: See next page.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

5553-B

IGNITRON

RATING II-B

	Column 1*	Column 2*	
SUPPLY VOLTAGE (RMS)	600 max.	600 max.	volts
DEMAND POWER (During conduction)●	800 max.	2400 max.	kva
DUTY●†	29 max.	5.3 max.	%
ANODE CURRENT (Per tube):			
Peak	1890 max.	5660 max.	amp
Demand (RMS, during conduction)●#	1330 max.	4000 max.	amp
Average (Averaged over any interval of 9.4 seconds maximum)#	175 max.	96 max.	amp
Fault, for duration of 0.15 second maximum	11200 max.	11200 max.	amp

IGNITOR

Maximum Ratings, ***Absolute-Maximum Values:***

PEAK IGNITOR VOLTAGE:		
Positive	Equal to anode volts	
Negative	5 max.	volts
IGNITOR CURRENT:		
Peak	100 max.	amp
Average (Averaged over any interval of 5 seconds maximum)	1 max.	amp
RMS	10 max.	amp

⊕ RMS voltage, current, and demand kva are on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used.

● Defined as (cycles "on")/(cycles "on" + cycles "off") during the specified averaging time.

† For supply voltages between 250 volts and 600 volts, duty is proportional to supply voltage. For supply voltages lower than 250 volts, the values for 250 volts apply.

* Column 1 represents operation at maximum average anode current; Column 2 represents operation at maximum demand power.

\# For supply voltages between 250 volts and 600 volts, demand anode current and averaging time are each inversely proportional to supply voltage. For supply voltages lower than 250 volts, the values for 250 volts apply.

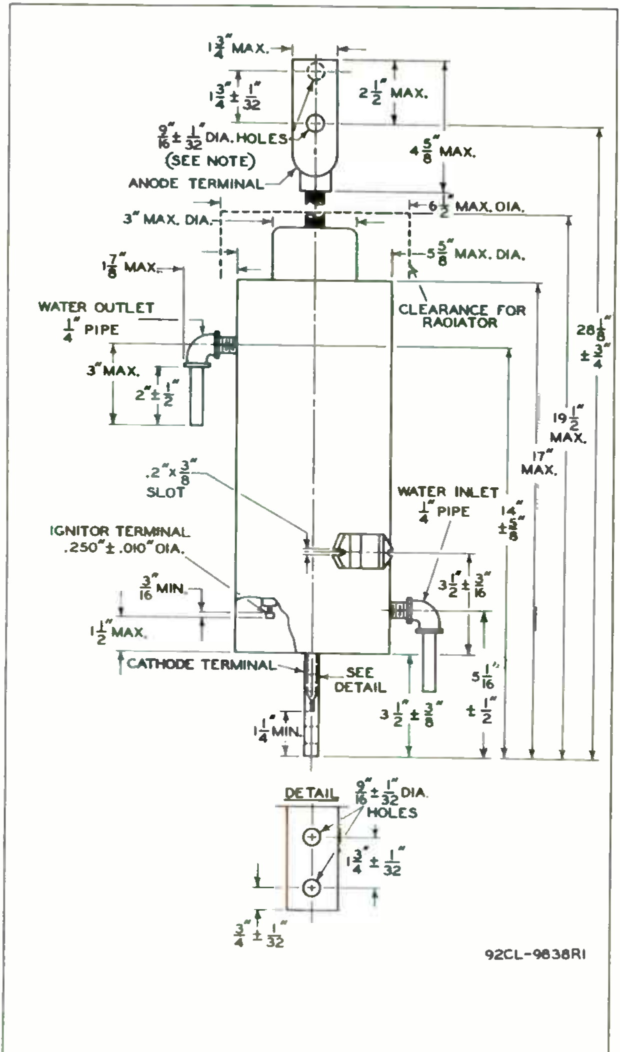
OPERATING CONSIDERATIONS
for the 5553-B are the same as those shown for Type 5551-A

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

5553-B

IGNITRON



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

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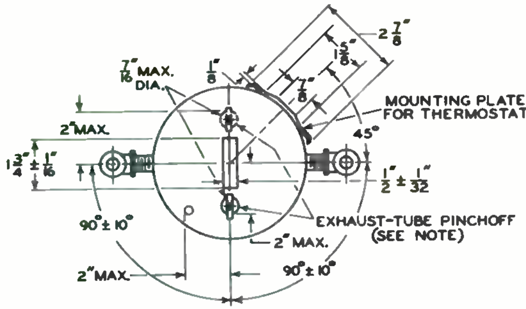
IGNITRON

BOTTOM VIEW



NOTE: DASHED POSITION AT MANUFACTURER'S OPTION.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

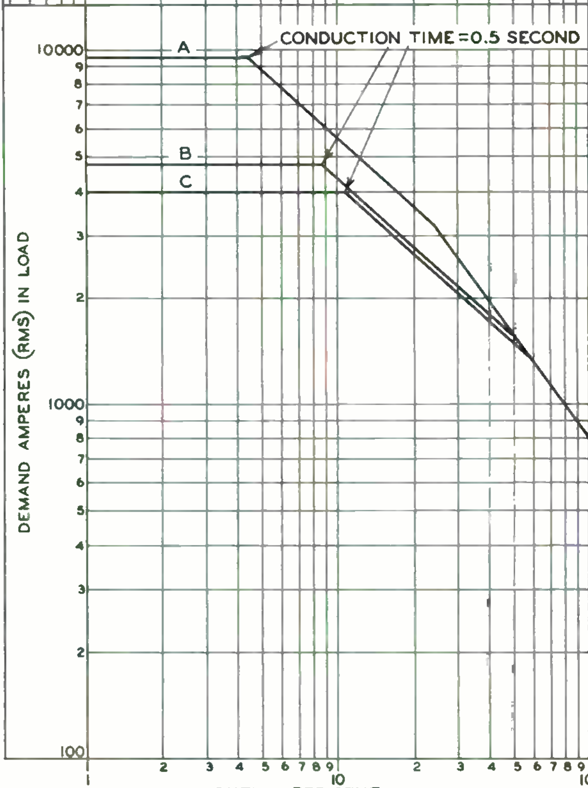
5553-B

RATING CHART

RESISTANCE-WELDING-CONTROL SERVICE

TWO TUBES CONNECTED IN INVERSE PARALLEL.
NO WATER-SAVING THERMOSTAT, OR WATER-SAVING THERMOSTAT SHUNTED BY AUXILIARY CONTACTOR.
PROTECTIVE THERMOSTAT OPTIONAL.

CURVE	RMS ANODE-SUPPLY VOLTS	MAXIMUM AVERAGING TIME—SECONDS
A	250	11
B	500	9.2
C	600	4.6



World Radio History

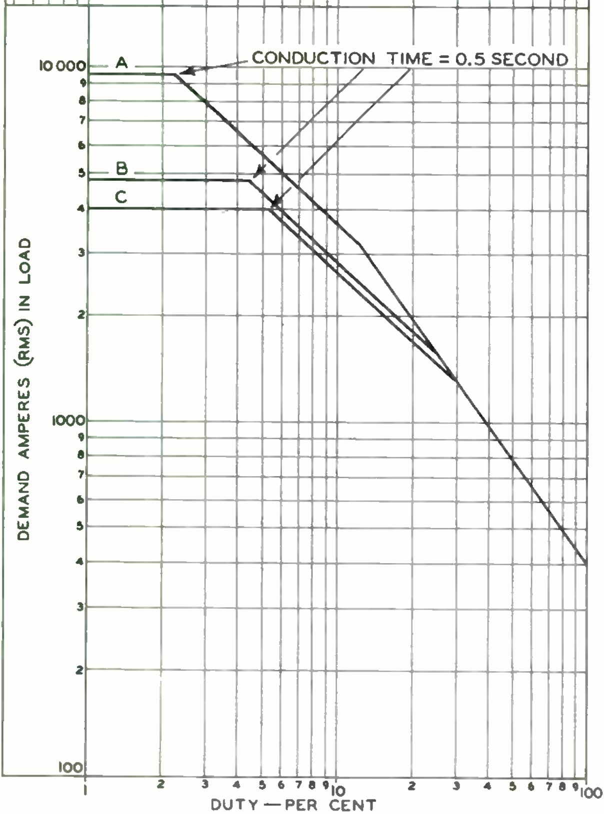
5553-B

RCA

5553-B
RATING CHART
RESISTANCE-WELDING-CONTROL SERVICE

TWO TUBES CONNECTED IN INVERSE PARALLEL.
WATER-SAVING THERMOSTAT WITHOUT AUXILIARY CONTACTOR.
PROTECTIVE THERMOSTAT OPTIONAL.

CURVE	RMS ANODE-SUPPLY VOLTS	MAXIMUM AVERAGING TIME—SECONDS
A	250	22.4
B	500	18.8
C	600	9.4



ELECTRON TUBE DIVISION 92CM-9823

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

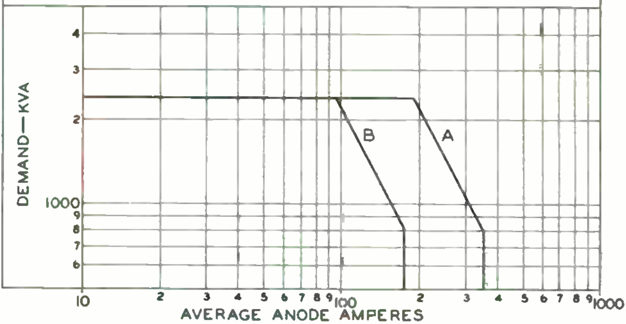
World Radio History

5553-B

RATING CHARTS

RESISTANCE-WELDING-CONTROL SERVICE

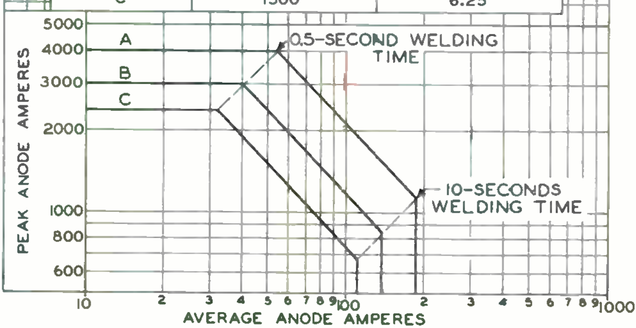
TWO TUBES CONNECTED IN INVERSE PARALLEL.
RMS ANODE-SUPPLY VOLTS = 250 TO 600
CURVE A: NO WATER-SAVING THERMOSTAT, OR WATER-SAVING THERMOSTAT SHUNTED BY AUXILIARY CONTACTOR.
CURVE B: WATER-SAVING THERMOSTAT WITHOUT AUXILIARY CONTACTOR.



92CS-9825

FREQUENCY-CHANGER WELDER SERVICE

CURVE	PEAK ANODE VOLTS FORWARD OR INVERSE	MAXIMUM AVERAGING TIME—SECONDS
A	600	6.25
B	1200	6.25
C	1500	6.25



92CS-9824

World Radio History

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5557

5557

MERCURY-VAPOR THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

GENERAL DATA

Electrical:

Filament, Coated:

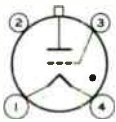
	Min.	*Av.*	*Max.*	
Voltage.	2.38	2.5	2.62	ac or dc volts
Current at 2.5 volts .	-	5.0	5.5	. . . . . . .amp

Minimum heating time prior to tube conduction.	5	sec
Direct Interelectrode Capacitances (Approx.):°		
Grid to anode.	2.5	μμf
Grid to cathode.	7	μμf
Ionization Time (Approx.).	10	μsec
Deionization Time (Approx.).	1000	μsec
Anode Voltage Drop (Approx.)	16	volts

Mechanical:

Operating Position . . . . .Vertical, base down
Maximum Overall Length . . . . 6-1/8"
Seated Length. . . . . 5-1/4" ± 1/4"
Maximum Diameter . . . . 2-1/16"
Weight (Approx.) . . . . 3 oz
Bulb ST16
Cap. . . . . Medium (JETEC No.C1-5)
Base . . . . Medium-Shell Small 4-Pin with Bayonet (JETEC No.A4-10)
Basing Designation for BOTTOM VIEW 3G

Pin 1 - Filament
Pin 2 - No Connection



Pin 3 - Grid
Pin 4 - Filament
Cap - Anode

Temperature Control:

Heating--When the ambient temperature is so low that the normal rise of condensed-mercury temperature above the ambient temperature will not bring the condensed-mercury temperature up to the minimum value of the operating ranges specified under *Maximum Ratings*, some form of heat-conserving enclosure or auxiliary heater will be required.

Cooling--When the operating conditions are such that the maximum value of the operating condensed-mercury temperature is exceeded, provision should be made for forced-air cooling sufficient to prevent exceeding the maximum value.

Temperature Rise of Condensed Mercury to Equilibrium Above Ambient Temperature (Approx.):*
No load. . . . . 17.5 °C

° Without external shield.

* With filament volts = 2.38 and no heat-conserving enclosure.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

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MERCURY-VAPOR THYRATRON

CONTROL SERVICE

Maximum Ratings, *Absolute Values:*

For anode-supply frequency of 60 cps

	Operating Condensed-Mercury-Temperature Range			
	40° to 90° C	40° to 80° C	40° to 60° C	
PEAK ANODE VOLTAGE:				
Forward.	1250 max.	2500 max.	5000 max.	volts
Inverse.	1250 max.	5000 max.	10000 max.	volts
GRID VOLTAGE:				
Peak or DC, before tube conduction.	-500 max.	-500 max.	-500 max.	volts
Average▲, during tube conduction.	-10 max.	-10 max.	-10 max.	volts
ANODE CURRENT:				
Peak	3 max.	2 max.	1 max.	amp
Average#	1 max.	0.5 max.	0.25 max.	amp
Fault, for duration of 0.1 second maximum.	40 max.	40 max.	40 max.	amp
GRID CURRENT:				
Average♦, positive with anode positive	0.05 max.	0.05 max.	0.05 max.	amp

▲ Averaged over one conducting period.
Averaged over any interval of 15 seconds maximum.
♦ Averaged over period of grid conduction.

DIMENSIONAL OUTLINE

for Type 5557 is the same as that shown for Type 3C23

→ Indicates a change.

World Radio History

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5557
RATE OF RISE OF CONDENSED-MERCURY TEMPERATURE

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9301T

World Radio History

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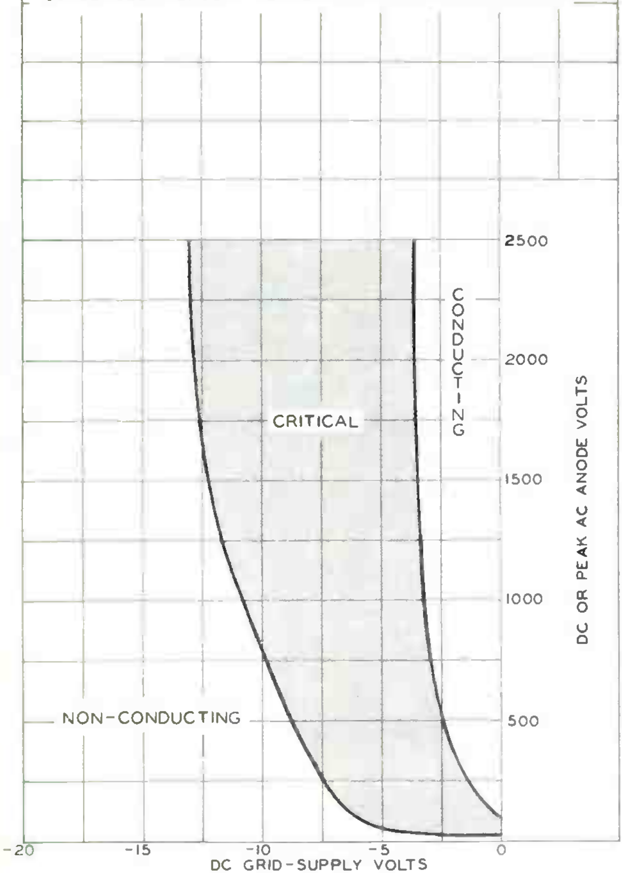
OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

RANGE IS FOR CONDITIONS WHERE:
- E_f = 2.5 VOLTS AC ± 5%
- CIRCUIT RETURNS TO FILAMENT TRANSFORMER CENTER-TAP.
- FILAMENT VOLTAGE AT PIN 1 IS (+) WHEN ANODE VOLTAGE IS (+).

THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES.
GRID RESISTOR (OHMS) = 1000
CONDENSED-MERCURY-TEMPERATURE RANGE = 40 TO 80 °C



TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON NEW JERSEY

92CM-9300T

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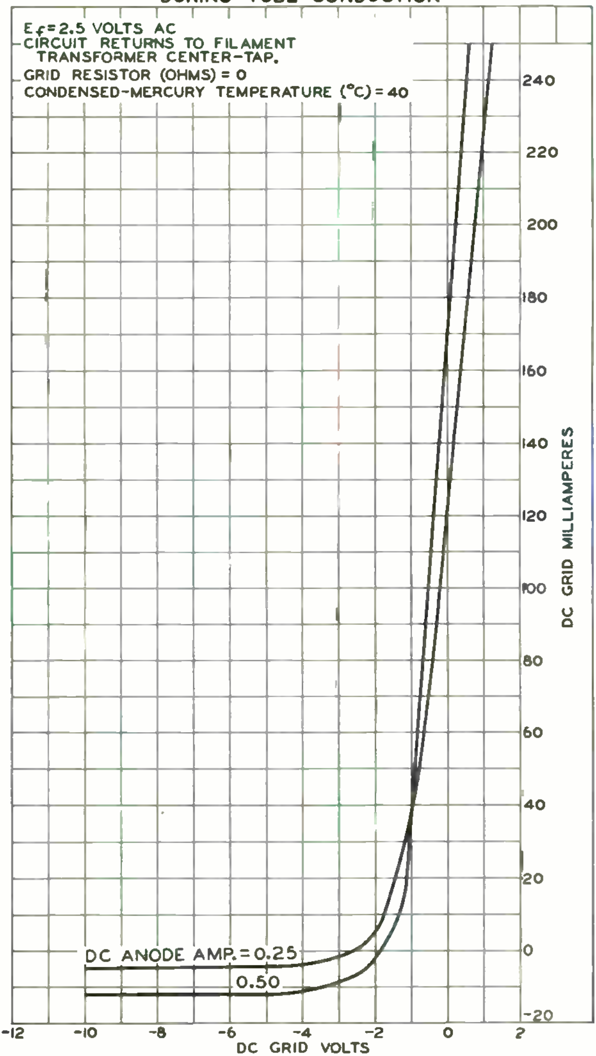
AVERAGE GRID CHARACTERISTICS
DURING TUBE CONDUCTION



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THYRATRON

MERCURY-VAPOR TRIODE

DATA

Electrical:

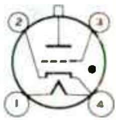
Heater, for Unipotential Cathode:		
Voltage	5.0	volts
Current	4.5	amp
Cathode:		
Minimum Heating Time, prior to tube conduction	5	minutes
Direct Interelectrode Capacitances (Approx.):		
Grid to Anode	2.5	μμf
Grid to Cathode	10	μμf
Ionization Time (Approx.)	10	μsec
Deionization Time (Approx.)	1000	μsec
Anode Voltage Drop (Approx.)	16	volts
Grid-No.1 Control Ratio (Approx.) with grid-No.1 resistor (megohms) = 0		220

Mechanical:

Mounting Position	Vertical, Base Down
Overall Length	7" ± 1/4"
Seated Length	6-3/8" ± 1/4"
Maximum Diameter	3"
Bulb	ST-23
Cap	Medium
Base	Medium-Shell Small 4-Pin, Bayonet
Basing Designation for BOTTOM VIEW	4BL

Pin 1 – Heater

Pin 2 – Cathode; Circuit Returns



Pin 3 – Grid

Pin 4 – Heater, Cathode

Cap – Anode

Maximum Ratings, *Absolute Values*:

PEAK ANODE VOLTAGE:		
Forward	1000 max.	volts
Inverse	1000 max.	volts
GRID VOLTAGE:		
Before Conduction	-500 max.	volts
During Conduction	-10 max.	volts
CATHODE CURRENT:		
Peak	15 max.	amp
Average**	2.5 max.	amp
Fault, for 0.1 sec. maximum	200 max.	amp
GRID CURRENT:		
Average**	+0.25 max.	amp
COND.-MERCURY TEMPERATURE RANGE▲	+40 to +80	°C
OPERATING FREQUENCY	150 max.	cps

** Averaged over any interval of 15 sec. max.

▲ Recommended operating temperature is 40°C.

← Indicates a change.

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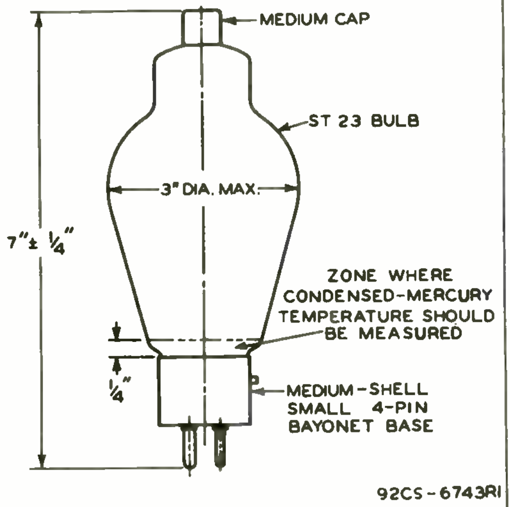
THYRATRON



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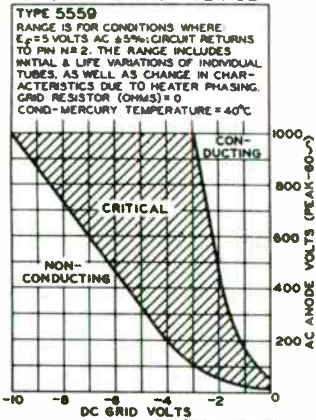
THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



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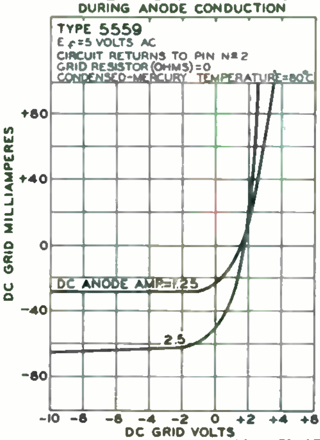
AVERAGE GRID CHARACTERISTICS DURING ANODE CONDUCTION



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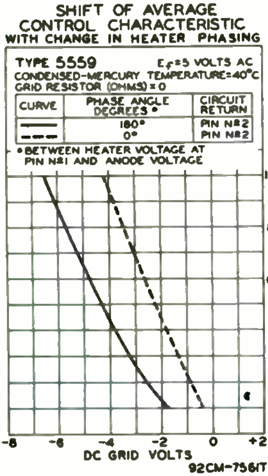
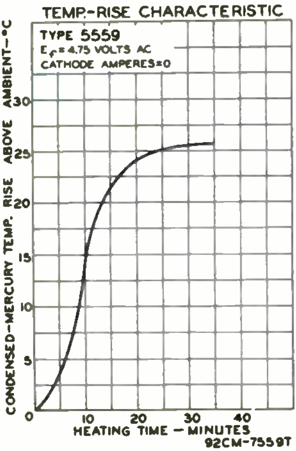
THYRATRON





TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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THYRATRON

MERCURY-VAPOR TETRODE

DATA

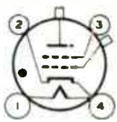
Electrical:

Heater, for Unipotential Cathode:
  Voltage . . . . 5.5○ 5.0 . . . . volts
  Current . . . . 5.0○ 4.5 . . . . amp
Cathode:
  Minimum Heating Time, prior to tube conduction . . . 5 . . . . minutes
Direct Interelectrode Capacitances (Approx.):
  Grid No.1 to Anode . . . . 0.2 . . . . $\mu\mu f$
  Grid No.1 to Cathode . . . 4.4 . . . . $\mu\mu f$ ←
Ionization Time (Approx.) . . 10 . . . . μsec
Deionization Time (Approx.) 1000 . . . . μsec
Anode Voltage Drop (Approx.) 16 . . . . volts
Grid-No.1 Control Ratio (Approx.) with grid-No.1 resistor (ohms) = 0; grid-No.1 and grid-No.2 volts = 0 . . 170 ←
Grid-No.2 Control Ratio (Approx.) with grid No.1 resistor (ohms) = 0; grid-No.1 and grid-No.2 volts = 0 . . . 300 ←

Mechanical:

Mounting Position . . . . Vertical, Base Down
Overall Length . . . . 7-11/16" ± 1/4"
Seated Length . . . . 7-1/16" ± 1/4" ←
Greatest Radius . . . . 2-1/4"
Bulb ST-23
Caps (Two) . . . . Medium
Base . . . . Medium-Shell Small 4-Pin, Bayonet
  Basing Designation for BOTTOM VIEW 4CD

Pin 1 - Heater
Pin 2 - Cathode; Circuit Returns
Pin 3 - Grid No.2



Pin 4 - Heater, Cathode
Top Cap - Anode
Side Cap - Grid No.1

Maximum Ratings, *Absolute Values*:

PEAK ANODE VOLTAGE:
  Forward . . . . 1000 max. volts
  Inverse . . . . 1000 max. volts
GRID-No.2 (SHIELD-GRID) VOLTAGE:
  Before Conduction . . . . -300 max. volts
  During Conduction . . . . -5 max. volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:
  Before Conduction . . . . -1000 max. volts
  During Conduction . . . . -10 max. volts ←
CATHODE CURRENT:
  Peak . . . . 30 max.○ 15 max. amp
  Average** . . . . 0.5 max.○ 2.5 max. amp
  Fault, for 0.1 sec. maximum . . . . 200 max. amp

○ **: See next page. ← Indicates a change.

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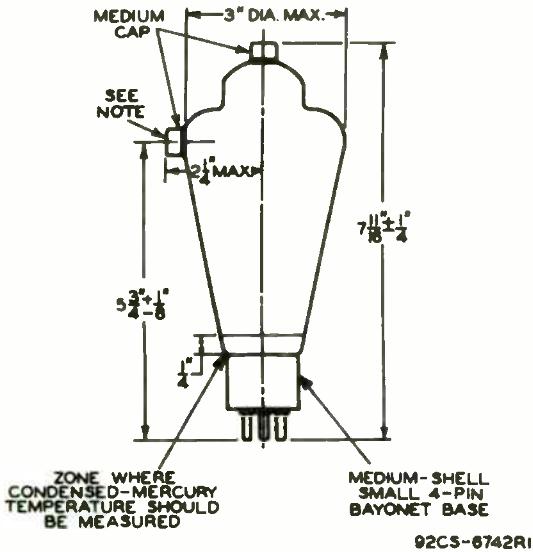
GRID-No.2 CURRENT:		
Average**	0.25 max.	amp
GRID No.1 CURRENT:		
Average**	0.25 max.	amp
COND.-MERCURY TEMPERATURE RANGE▲	+40 to +80	°C
OPERATING FREQUENCY.	150 max.	cps

□ Applies when this tube is used for igniter firing.
** Averaged over any interval of 15 sec. max.
▲ Recommended operating temperature is 40°C.



NOTE: THE PLANE THROUGH TUBE AXIS AND CENTER OF GRID-Nº1 CAP IS 45°±5° FROM THE PLANE THROUGH THE TUBE AXIS AND CENTER OF BAYONET PIN. GRID-Nº1 CAP IS ON SAME SIDE AS PIN Nº3.

TEMPERATURE-RISE CHARACTERISTIC of the 5560 is the same as that shown for Type 5559

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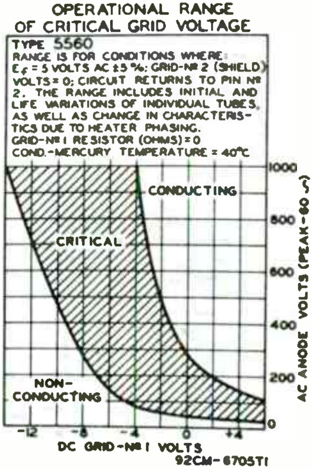
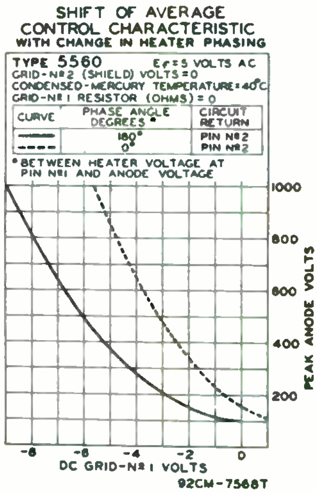
THYRATRON





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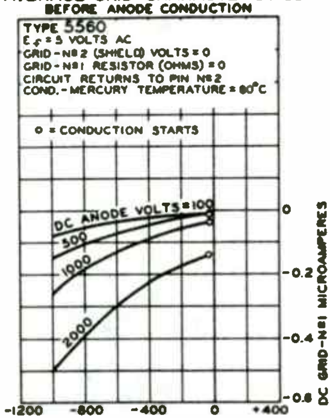
THYRATRON

AVERAGE GRID CHARACTERISTICS
BEFORE ANODE CONDUCTION



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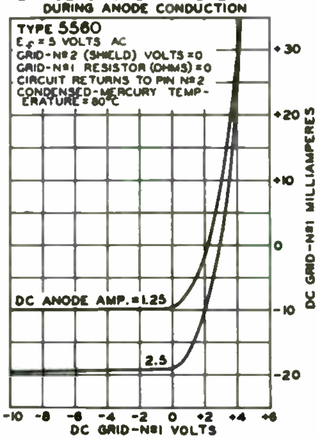
AVERAGE GRID CHARACTERISTICS
DURING ANODE CONDUCTION



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5563-A

MERCURY-VAPOR THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

Supersedes Type 5563

GENERAL DATA

Electrical:

Filament, Coated:

	Min.	*Av.*	*Max.*	
Voltage	4.75	5	5.25	volts
Current at 5 volts	–	10	11	amp

Minimum Heating Time:

On initial installation, with no voltage on grid or anode, for redistribution of mercury to lower part of tube	15	minutes
During subsequent operation, to allow filament to reach operating temperature prior to tube conduction	1	minute

Direct Interelectrode Capacitances:°

Grid to anode	4	μμf
Grid to cathode	16	μμf
Ionization Time (Approx.)	10	μsec
Deionization Time (Approx.)	1000	μsec
Maximum Critical Grid Current for instantaneous anode volts = 2000	50	μa ←

Anode Voltage Drop (Approx.):

At anode amperes = 11.5	15	volts
At anode amperes = 70	25	volts

Grid Control Ratio (Approx.):

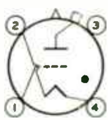
Under conditions: 10000-ohm grid resistor, circuit returns to pin 2, filament voltage at pin 4 out of phase with anode voltage by 180°, and condensed-mercury temperature of 40 °C	275

Mechanical:

Operating Position	Vertical, base down
Overall Length	10-3/32" ± 7/16"
Maximum Diameter	2-5/8" ←
Bulb	T20 ←
Weight (Approx.)	13 oz
Cap	Medium with Tubular Support (JETEC No.C1-39) ←
Socket	Johnson No.123-211, or equivalent ←
Base	Skirted Medium-Metal-Shell Jumbo 4-Pin with Bayonet (JETEC No.A4-69)

Basing Designation for BOTTOM VIEW . . . 3X ←

Pin 1 – Grid
Pin 2 – Filament, Internal Shield, Circuit Returns



Pin 3 – No Connection
Pin 4 – Filament
Cap – Anode

° Without external shield.

← Indicates a change.

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MERCURY-VAPOR THYRATRON

Temperature Control:

Heating--When the ambient temperature is so low that the normal rise of condensed-mercury temperature above the ambient temperature will not bring the condensed-mercury temperature up to the minimum value of the operating range specified under *Maximum Ratings*, some form of heat-conserving enclosure or auxiliary heater will be required.

Cooling--When the operating conditions are such that the maximum value of the operating condensed-mercury temperature for the applicable service rating is exceeded, provision should be made for forced-air cooling sufficient to prevent exceeding the maximum value.

Temperature Rise of Condensed Mercury to Equilibrium Above Ambient Temperature (Approx.):*

No load	13	°C
Full load	17	°C

CONTROL SERVICE--In-Phase Operation●

Maximum Ratings, *Absolute Values:*

For supply frequency of 25 to 60 cps

	Operating Condensed-Mercury-Temperature Range 25 to 55 °C	25 to 50 °C	
PEAK ANODE VOLTAGE:			
Forward	15000 max.	20000 max.	volts
Inverse	15000 max.	20000 max.	volts
GRID VOLTAGE:			
Peak or DC, before tube conduction	-500 max.	-500 max.	volts
Average▲, during tube conduction	-10 max.	-10 max.	volts
ANODE CURRENT:			
Peak	10 max.	6.4 max.	amp
Average●●	1.8 max.	1.6 max.	amp
→ Fault, for duration of 0.1 second maximum	70 max.	70 max.	amp
GRID CURRENT:			
→ Average positive●●	100 max.	100 max.	ma
Peak positive with anode negative	5 max.	5 max.	ma

Maximum Circuit Values:

Grid-Circuit Resistance	0.1 max.	0.1 max.	megohm

* With filament volts = 4.75 and no heat-conserving enclosure.

● Filament voltage has a phase angle of either 0° or 180° with respect to the anode voltage.

▲,●●: See next page.

→ Indicates a change.

World Radio History

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MERCURY-VAPOR THYRATRON

CONTROL SERVICE--Quadrature Operation°°

Maximum Ratings, *Absolute Values:*

For supply frequency of 25 to 60 cps

	Operating Condensed-Mercury-Temperature Range 25 to 55 °C	25 to 50 °C	
PEAK ANODE VOLTAGE:			
Forward	15000 max.	20000 max.	volts
Inverse	15000 max.	20000 max.	volts
GRID VOLTAGE:			
Peak or DC, before tube conduction	-500 max.	-500 max.	volts
Average▲, during tube conduction	-10 max.	-10 max.	volts
ANODE CURRENT:			
Peak	11.5 max.	11.5 max.	amp
Average●●	2.5 max.	2.5 max.	amp
Fault, for duration of 0.1 second maximum ←	70 max.	70 max.	amp
GRID CURRENT:			
Average positive●● ←	100 max.	100 max.	ma
Peak positive with anode negative	5 max.	5 max.	ma

Maximum Circuit Values:

Grid-Circuit Resistance	0.1 max.	0.1 max.	megohm

HIGH-SPEED LOAD-CIRCUIT PROTECTION SERVICE♦ ←

Maximum Ratings, *Absolute Values:*

	Operating Condensed-Mercury-Temperature Range 40 to 55 °C	40 to 50 °C	
PEAK ANODE VOLTAGE:			
Forward	15000 max.	20000 max.	volts
Inverse	15000 max.	20000 max.	volts
GRID VOLTAGE:			
Peak or DC, before tube conduction	-500 max.	-500 max.	volts
Average▲, during tube conduction	-10 max.	-10 max.	volts
ANODE CURRENT:			
Peak	100 max.	100 max.	amp
Average□	70 max.	70 max.	amp
Average§	1.05 max.	1.05 max.	amp

Maximum Circuit Values:

Grid-Circuit Resistance	0.1 max.	0.1 max.	megohm

▲,●●,°°,♦,□,§: See next page.

← Indicates a change.

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MERCURY-VAPOR THYRATRON

▲ Averaged over one grid-conducting period.

●● Averaged over any period of 20 seconds maximum.

○○ Filament voltage is 60° to 120° out of phase (leading or lagging) with the anode voltage.

♦ In this service, the faults may occur in quick succession or may be separated by several months.

□ Averaged over any period of 0.1 second maximum.

§ Averaged over any period of 20 seconds maximum. This average-anode-current value is specified to indicate the number of faults that are permissible within the 20-second interval. The number of faults that may occur in any 20-second interval depends on the value of anode current over the averaging period less than 0.1 second and may be determined by

$$\text{Number of Faults} = \frac{1.05 \times 20}{\text{Average Anode Current during fault} \times \text{Duration of Fault}}$$

Example:

Assume that the maximum average anode current is 70 amperes for the maximum duration of 0.1 second. On substitution of these values in the equation, the permissible number of faults is determined to be 3. If the average anode current is less than 70 amperes over an averaging period of less than 0.1 second, it will be obvious that a greater number of faults may occur.

OPERATING CONSIDERATIONS

X rays are produced when the 5563-A is operated with a peak inverse anode voltage above 16000 volts (absolute value). These rays can constitute a health hazard unless the tube is adequately shielded for X-ray radiation. Although relatively simple shielding should prove adequate, make sure it provides the required protection to the operator.

→ *Shields and rf filter circuits* should be provided for the 5563-A if it is subjected to extraneous high-frequency fields during operation. These fields tend to produce breakdown effects in mercury vapor and are detrimental to tube life and performance. When shields are used, special attention must be given to providing adequate ventilation and to maintaining normal condensed-mercury temperature. Radio-frequency filters are employed to prevent damage caused by rf currents which might otherwise be fed back into the 5563-A.

→ Indicates a change.

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MERCURY-VAPOR THYRATRON

For Circuit Figures, see Front of this Section

CIRCUIT	MAX. TRANS. SEC. VOLTS (RMS) E	APPROX. DC OUTPUT VOLTS TO FILTER E_{av}	MAX. DC OUTPUT AMPERES I_{av}	MAX. DC OUTPUT KW TO FILTER P_{dc}
Fig. 1 **Half-Wave** **Single-Phase** In-Phase Operation	14000□ 10600▲	6300 4700	1.6 1.8	10 8.5
Fig. 2 **Full-Wave** **Single-Phase** In-Phase Operation	7000□ 5300▲	6300 4700	3.2 3.6	20 17
Fig. 3 **Series** **Single-Phase** In-Phase Operation	14000□ 10600▲	12700 9500	3.2 3.6	40 34
Fig. 4 **Half-Wave** **Three-Phase** In-Phase Operation	8100□ 6100▲	9500 7100	4.8 5.4	45 38
Fig. 5 **Parallel** **Three-Phase** Quadrature Operation	8100□ 6100▲	9500 7100	15.0 15.0	143 106
Fig. 6 **Series** **Three-Phase** Quadrature Operation	8100□ 6100▲	19000 14200	7.5 7.5	143 106
Fig. 7 **Half-Wave** **Four-Phase** Quadrature Operation	7000□ 5300	9000 6700	*Resistive Load*: 10.0, 10.0 *Inductive Load*: 10.0, 10.0	*Resistive Load*: 90, 67 *Inductive Load*: 90, 67
Fig. 8 **Half-Wave** **Six-Phase** Quadrature Operation	7000□ 5300▲	9500 7100	*Resistive Load*: 11.0, 11.0 *Inductive Load*: 11.5, 11.5	*Resistive Load*: 105, 78 *Inductive Load*: 110, 81

□ For maximum peak inverse anode voltage of 20000 volts, and condensed-mercury-temperature range of 25 to 50 °C.

▲ For maximum peak inverse anode voltage of 15000 volts, and condensed-mercury-temperature range of 25 to 55 °C.

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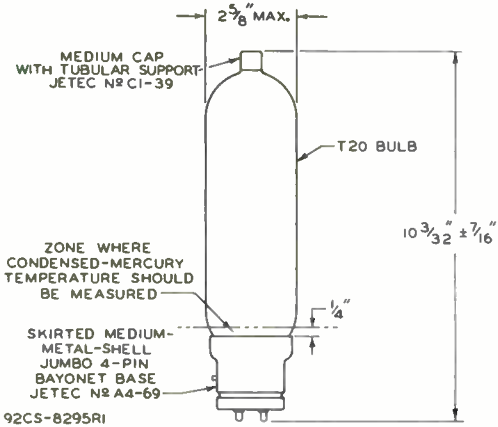
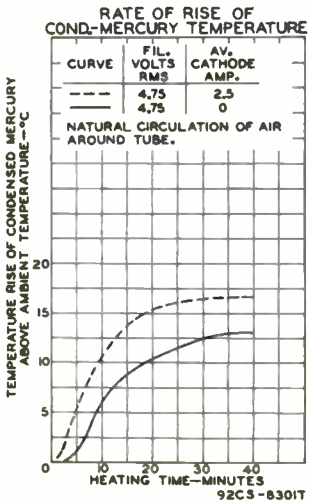
MERCURY-VAPOR THYRATRON





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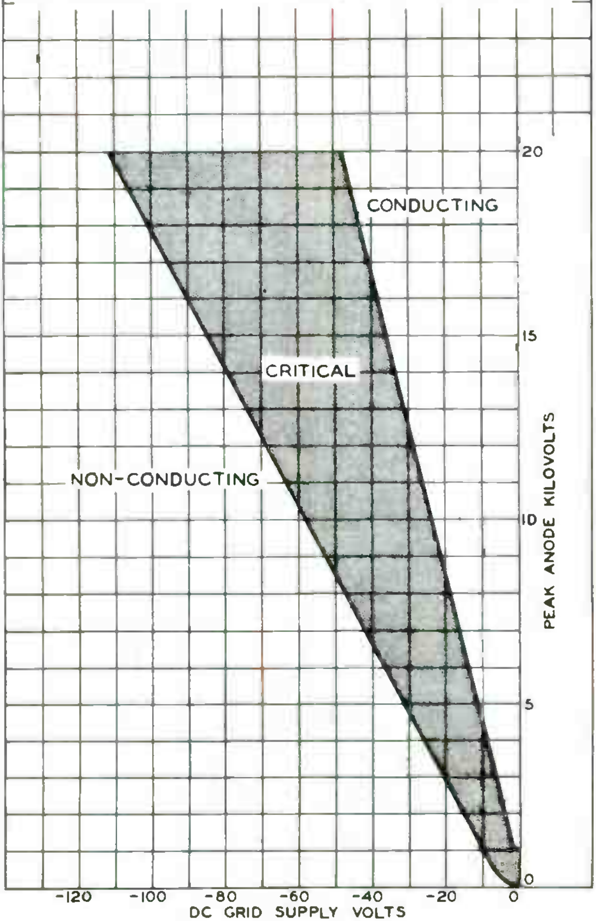
OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

RANGE IS FOR CONDITIONS WHERE:
E_f = 5.0 VOLTS AC ± 5%; CIRCUIT RETURNS TO PIN 2.
FILAMENT VOLTAGE AT PIN 4 IS (-) WHEN ANODE VOLTAGE IS (+).
THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES.
GRID RESISTOR = 10000 TO 100000 OHMS
CONDENSED-MERCURY TEMPERATURE RANGE = 25° TO 55°C



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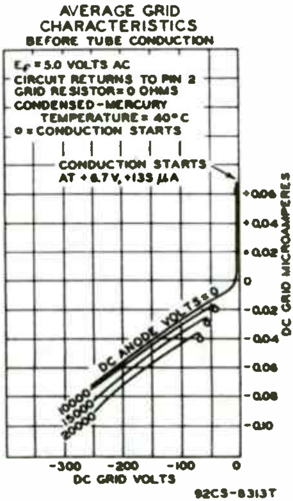
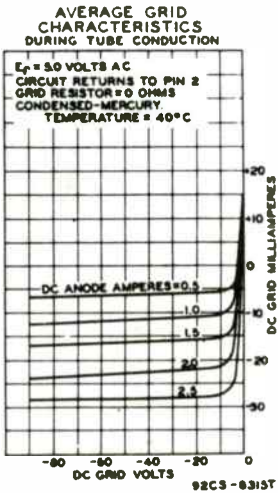
CHARACTERISTIC CURVES





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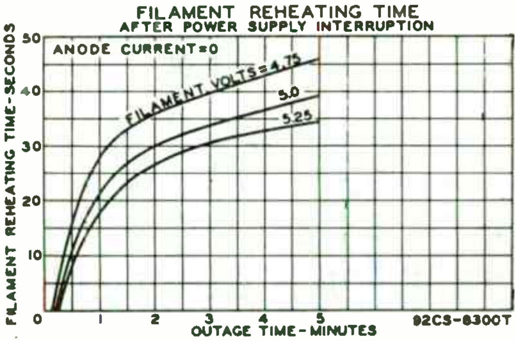
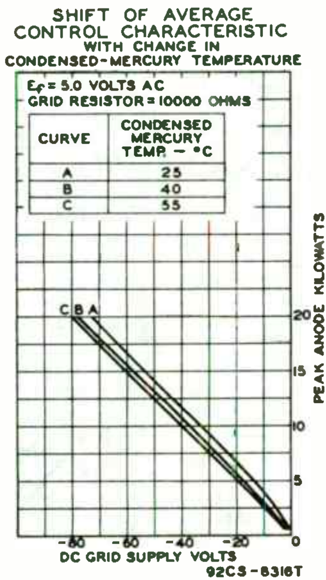
CHARACTERISTIC CURVES





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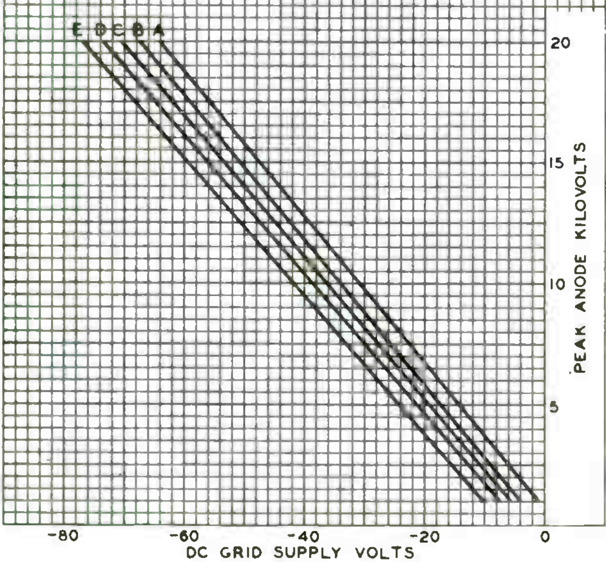
SHIFT OF AVERAGE CONTROL CHARACTERISTICS WITH CHANGE IN FILAMENT PHASING AND CIRCUIT RETURN

E_f = 5.0 VOLTS AC
GRID RESISTOR = 10000 OHMS
CONDENSED-MERCURY TEMPERATURE = 40°C

CURVE	PHASE ANGLE*	CIRCUIT RETURN
A	0°	PIN 2
B	0°	CT□
C	0°, 180° 90°	PIN 4 ANY •
D	180°	CT□
E	180°	PIN 2

*BETWEEN FILAMENT VOLTAGE AT PIN 4 AND ANODE VOLTAGE
□ CENTER TAP OF FILAMENT TRANSFORMER
• PIN 2, PIN 4, OR CT



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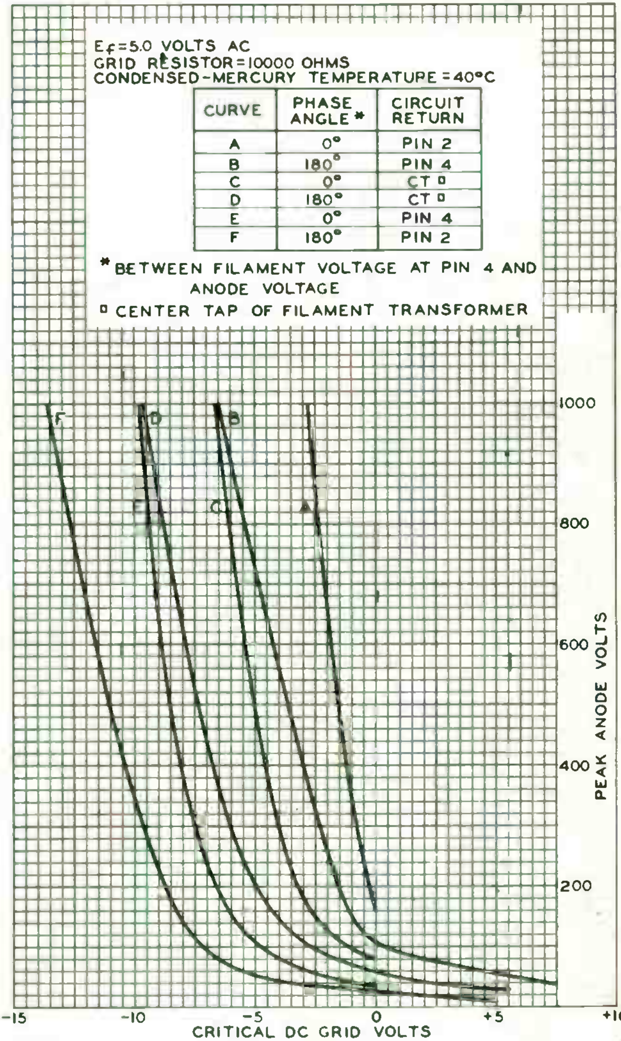
SHIFT OF AVERAGE CONTROL CHARACTERISTICS WITH CHANGE IN FILAMENT PHASING AND CIRCUIT RETURN AT LOW ANODE VOLTAGES



E_f=5.0 VOLTS AC
GRID RESISTOR=10000 OHMS
CONDENSED-MERCURY TEMPERATURE=40°C

CURVE	PHASE ANGLE *	CIRCUIT RETURN
A	0°	PIN 2
B	180°	PIN 4
C	0°	CT ▫
D	180°	CT ▫
E	0°	PIN 4
F	180°	PIN 2

* BETWEEN FILAMENT VOLTAGE AT PIN 4 AND ANODE VOLTAGE

▫ CENTER TAP OF FILAMENT TRANSFORMER

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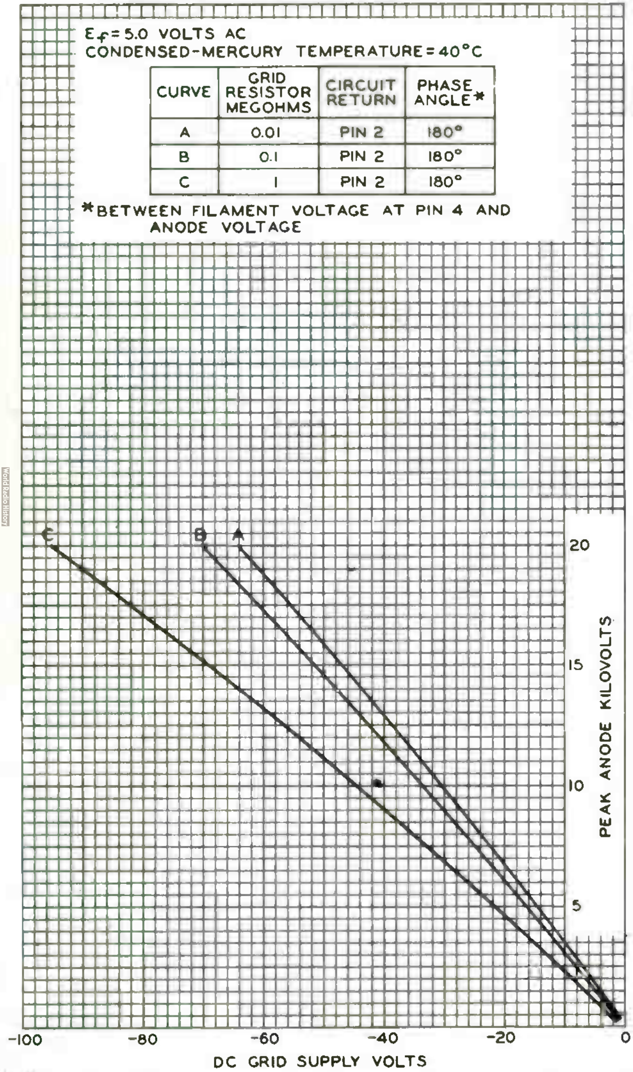
5563-A

SHIFT OF AVERAGE CONTROL CHARACTERISTICS WITH CHANGE IN GRID-RESISTOR VALUE



CURVE	GRID RESISTOR MEGOHMS	CIRCUIT RETURN	PHASE ANGLE*
A	0.01	PIN 2	180°
B	0.1	PIN 2	180°
C	1	PIN 2	180°

*BETWEEN FILAMENT VOLTAGE AT PIN 4 AND ANODE VOLTAGE

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5651

VOLTAGE-REFERENCE TUBE

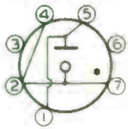
MINIATURE GLOW-DISCHARGE TYPE

DATA

General:

Cathode	Cold
Maximum Overall Length	2-1/8"
Maximum Seated Length	1-7/8"
Length from Base Seat to Bulb Top (excluding tip)	1-1/2" ± 3/32"
Maximum Diameter	3/4"
Bulb	T-5-1/2
Mounting Position	Any
Base	Small-Button Miniature 7-Pin
Basing Designation for BOTTOM VIEW	5BO

Pin 1 - Anode
Pin 2 - Cathode
Pin 3 - Internal Connection -Do Not Use
Pin 4 - Cathode



Pin 5 - Anode
Pin 6 - Internal Connection -Do Not Use
Pin 7 - Cathode

Maximum Ratings, *Absolute Values*:

DC OPERATING CURRENT (Continuous)	3.5 max.	ma
AMBIENT TEMPERATURE RANGE	-55 to +90	°C

Characteristics and Operation Range Values:

	Min.	*Av.*	*Max.*	
DC Starting Voltage	-	107	115•	volts
DC Operating Voltage	82	87	92	volts
DC Operating Current	1.5	-	3.5	ma
Regulation (1.5 ma. to 3.5 ma.)	-	-	3	volts
Stability□	-	-	0.1	volt

Circuit Values:

Shunt Capacitor	-	-	0.02	μf
Series Resistor	See NOTE Below			

• A supply voltage of not less than this value should be provided to insure "starting" throughout tube life.

□ Defined as the maximum voltage fluctuation at any current level within the operating current range.

NOTE: A series resistor must always be used with the 5651. The resistance value must be chosen so that (1) the maximum current rating of 3.5 ma. is not exceeded at the highest anode-supply voltage employed, and (2) the minimum current rating of 1.5 ma. is always exceeded when the anode-supply voltage is at its lowest value.

MAR. 15, 1948 TENTATIVE DATA

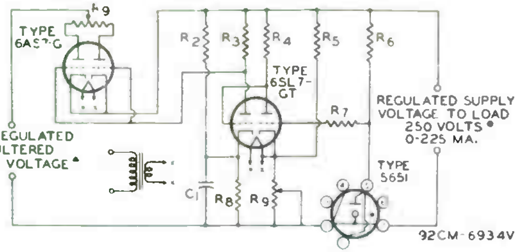
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

5651

5651
VOLTAGE-REFERENCE TUBE

SERIES TYPE OF STABILIZED VOLTAGE SUPPLY USING RCA-5651 AS VOLTAGE-REFERENCE TUBE



C_1 = 0.1 µf, 400 volts
R_1 = Plate current balancing potentiometer, 160 ohms, 10 watts
R_2 = 12000 ohms, 2 watts
R_3 = 470000 ohms, 0.5 watt
R_4 = 470000 ohms, 0.5 watt
R_5 = 12000 ohms, 2 watts
R_6 = 68000 ohms, 1 watt
R_7 = 1 megohm, 0.5 watt
R_8 = 15000 ohms, 2 watts
R_9 = Output voltage control potentiometer, 10000 ohms

▲ 375 volts approx. at zero load current; 325 volts approx. at 225 milliamperes load current.

● The voltage regulation of this supply operated at a fixed line voltage of 117 volts and an output voltage of 250 volts is less than 0.2 volt over the current range of 0 to 225 milliamperes. At full current, the regulation for a variation of ± 10 per cent in line voltage is less than 0.1 volt. Socket connections for the 5651 are made so that removal of the 5651 from its socket opens the load.

MAR. 15, 1948 TUBE DEPARTMENT CE-6934V

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

Voltage-Reference Tube

7-PIN MINIATURE, GLOW-DISCHARGE TYPE

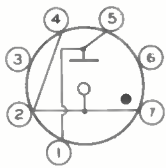
Especially Useful as a Voltage-Reference Tube in DC Power Supplies

DATA

General:

Cathode	Cold
Operating Position	Any
Maximum Overall Length	2-1/8"
Maximum Seated Length	1-7/8"
Length, Base Seat to Bulb Top (Excluding tip)	1-1/2" ± 3/32"
Diameter	0.650" to 0.750"
Dimensional Outline (See *General Section*)	JEDEC No.5-2
Bulb	T5-1/2
Base	Small-Button Miniature 7-Pin (JEDEC No.E7-1)
Basing Designation for BOTTOM VIEW	5BO

Pin 1 - Anode
Pin 2 - Cathode
Pin 3 - Do not use
Pin 4 - Cathode



Pin 5 - Anode
Pin 6 - Do not use
Pin 7 - Cathode

Maximum and Minimum Ratings, ***Absolute-Maximum Values:***

DC OPERATING CURRENT (Continuous)	3.5 max.	ma
DC OPERATING CURRENT (Continuous)	1.5 max.	ma
AMBIENT TEMPERATURE RANGE	-55 to 90	°C

Characteristics and Operation Range Values:

	Min.	*Av.*	*Max.*	
DC Starting Voltage	-	107	115[a]	volts
DC Operating Voltage (Variation from tube to tube):				
At 1.5 ma	83	85	87	volts
At 2.5 ma	83.5	85.5	87.5	volts
At 3.5 ma	84.5	86.5	88.5	volts
Regulation (1.5 ma to 3.5 ma)	-	-	3	volts
Temperature Coefficient of Operating Voltage (over ambient temperature range of -55 to 90° C)	-	-4	-	mv/°C
Percentage Variation of Operating Voltage:[b]				
During first 300 hours of life[c]	-	-	0.1	%
During subsequent 1000 hours of life	-	-	0.1	%

World Radio History

	Min.	Av.	Max.	
Short-term (100 hours)				
Variation of Operating Voltage after first 300 hours of life[b].	–	–	0.05	%
Instantaneous Voltage Fluctuation (Voltage jump)[d] . . .	–	–	0.1	volt

Circuit Values:

	Min.	Av.	Max.	
Shunt Capacitor	–	–	0.02	μf
Series Resistor		e		

a A dc supply voltage of 115 volts minimum should be provided to insure "starting" throughout tube life.

b DC operating current = 2.5 ma.

c After initial 3-minute warm-up period.

d Defined as the maximum instantaneous voltage fluctuation at any current level within the operating current range.

e A series resistor must always be used with the 5651A. The resistance value must be chosen so that (1) the maximum current rating of 3.5 ma is not exceeded at the highest anode-supply voltage employed, and (2) the minimum current rating of 1.5 ma is always exceeded when the anode-supply voltage is at its lowest value.

SPECIAL TESTS AND PERFORMANCE DATA

Stability Life Performance:

This test is performed on a sample lot of tubes to assure that the tubes have been properly stabilized. Life testing is performed under the following conditions: DC anode-supply volts = 135, dc operating milliamperes = 2.5, anode-circuit resistance (ohms) = 20000. At the end of 300 hours of operation, tubes will not show a change in dc operating voltage greater than 0.1 per cent from the initial dc operating voltage. At the end of 1300 hours of operation, tubes will not show a change in dc operating voltage greater than 0.1 per cent from the operating voltage at 300 hours. During any 100-hour interval between 300 and 1300 hours of operation, tubes will not show a change in dc operating voltage greater than 0.05 per cent from the dc operating voltage at the start of the interval.

INSTALLATION AND APPLICATION

Make no connections to pins 3 and 6. Any potentials applied to these pins may cause erratic tube performance. The three pin terminals for the cathode (pins 2, 4, and 7) and the two for the anode (pins 1 and 5) offer the equipment designer several different possibilities for connection of the 5651A. Any pair of interconnected pins can be used as a jumper connection to a circuit common to either the cathode or to the anode. The use of such a jumper connection provides a means for opening the circuit to protect circuit components when the 5651A is removed from its socket. *Under no circumstances should the current through any pair of interconnected pins exceed one ampere.*

World Radio History

If the load for the regulated power supply is disconnected either directly or by removing the 5651A from its socket, the rectifier capacitors will charge to the rectifier peak voltage. It is important, therefore, that these capacitors be rated to withstand such voltage.

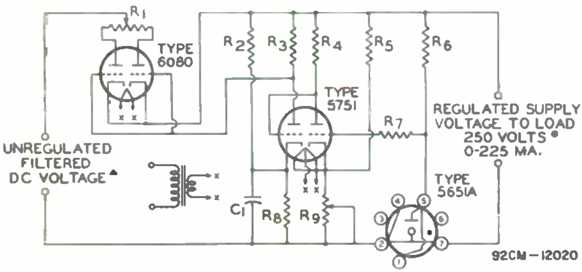
A warm-up period of 3 minutes should be allowed each time the equipment is turned on to insure minimum voltage drift of the 5651A.

When a shunt capacitor is used with the 5651A, its value should be limited to 0.02 μf. A large value of capacitance may cause the tube to oscillate and thus give unstable performance.

Shielding should be utilized for the 5651A to insure maximum stability when the tube is operated in the presence of strong rf or magnetic fields.

SERIES-TYPE STABILIZED-VOLTAGE SUPPLY-CIRCUIT Using RCA-5651A as Voltage-Reference Tube

The voltage regulation of this supply operated at a fixed line voltage of 117 volts and an output voltage of 250 volts is less than 0.2 volt over the current range of 0 to 225 milliamperes. At full current, the regulation for a variation of ±10 per cent in line voltage is less than 0.1 volt.



C_1 - 0.1 μf, 400 volts
R_1 - Plate current balancing potentiometer, 160 ohms, 10 watts
R_2 - 12000 ohms, 2 watts
R_3 - 470000 ohms, 1/2 watt
R_4 - 470000 ohms, 1/2 watt
R_5 - 12000 ohms, 2 watts
R_6 - 68000 ohms, 1 watt
R_7 - 1 megohm, 1/2 watt
R_8 - 15000 ohms, 2 watts
R_9 - Output voltage-control potentiometer, 10000 ohms

▲ 375 volts approx. at zero load current; 325 volts approx. at 225 milliamperes load current.

⊕ Socket connections are made so that removal of the 5651A from its socket opens the load.

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World Radio History

World Radio History

Xenon Thyratron

NEGATIVE-CONTROL TRIODE TYPE

GENERAL DATA

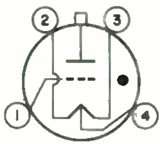
Electrical:

	Min.	*Av.*	*Max.*	
Filament, Coated and Mid-Tapped:				
Voltage (AC or DC) between pins 2 and 3.	2.4	2.5	2.6	volts
Current	7	9	11	amp
Minimum heating time prior to tube conduction.		30		sec
Direct Interelectrode Capacitances (Approx.):				
Grid to anode		2		$\mu\mu$f
Ionization Time (Approx.)		10		μsec
Deionization Time (Approx.)		1000		μsec
Maximum Critical Grid Current		10		μa
Anode Voltage Drop at peak anode amperes = 10.		10		volts
Maximum Commutation Factor[a] averaged over first 350 volts of inverse anode-voltage rise.		0.66		va/μsec^2

Mechanical:

Operating Position. . . . . Any
Maximum Overall Length. . . . . 6-3/4"
Maximum Seated Length . . . . 6"
Maximum Diameter. . . . . 2-3/16"
Weight (Approx.). . . . . 3 oz
Cap . . . . .Medium (JEDEC No.C1-5)
Base. . . . . Special Metal Shell
Terminal Diagram: BOTTOM VIEW

Pin 1 - Grid
Pin 2 - Filament
Pin 3 - Filament



Pin 4 - Filament Tap & Circuit Returns
Cap - Anode

GRID-CONTROLLED-RECTIFIER SERVICE

Maximum and Minimum Ratings, ***Absolute-Maximum Values:***

For anode supply frequency of 60 cps

PEAK ANODE VOLTAGE:		
Forward	900 max.	volts
Inverse	1250 max.	volts
PEAK NEGATIVE GRID VOLTAGE:		
Before tube conduction.	100 max.	volts
During tube conduction.	10 max.	volts

World Radio History

ANODE CURRENT:

Peak	30 max.	amp
Average[b]	2.5 max.	amp
Fault	300 max.	amp
AMBIENT-TEMPERATURE RANGE during operation	-55 to +75	°C

[a] Defined as the product of the rate of current decay in amperes per microsecond just before conduction ceases and the rate of inverse-voltage rise in volts per microsecond following current conduction.

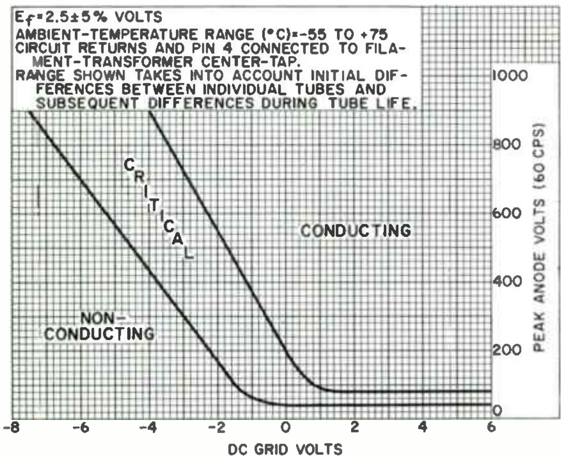
[b] Averaged over any period of 4.5 seconds.

OPERATING CONSIDERATIONS

Circuit returns should be connected to filament mid-tap (Pin 4).

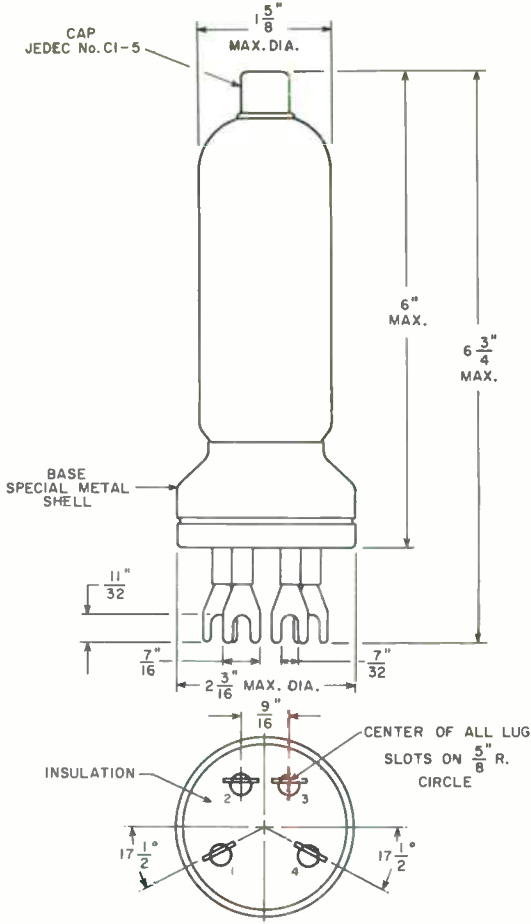
Sufficient *anode-circuit resistance*, including the tube load, must be used under any conditions of operation to prevent exceeding the maximum current ratings of the tube.

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



92CS-11323

World Radio History


CAP
JEDEC No. C1-5
$1\frac{5}{8}$"
MAX. DIA.
6"
MAX.
$6\frac{3}{4}$"
MAX.
BASE
SPECIAL METAL
SHELL
$\frac{11}{32}$"
$\frac{7}{16}$"
$\frac{7}{32}$"
$2\frac{3}{16}$" MAX. DIA.
$\frac{9}{16}$"
CENTER OF ALL LUG
SLOTS ON $\frac{5}{8}$" R.
CIRCLE
INSULATION
2
3
1
4
$17\frac{1}{2}$°
$17\frac{1}{2}$°

92CM-11314

World Radio History

5696

RCA

5696
THYRATRON

GAS-TETRODE, MINIATURE TYPE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:
- Voltage . . . . 6.3 . . . . ac or dc volts
- Current. . . . . 0.150 . . . . amp

Cathode:
- Minimum Heating Time, prior to tube conduction . . 10 . . . . sec

Direct Interelectrode Capacitances (Approx.):°
- Grid No.1 to Anode . . . 0.03 . . . . μμf
- Input. . . . . 1.8 . . . . μμf
- Output . . . . 0.54 . . . . μμf

Ionization Time (Approx.):
- For conditions: dc anode volts = 100; grid-No.1 square-pulse volts = +50; peak cathode amperes during conduction = 0.150. . . . . 0.5 μsec

Deionization Time (Approx.):
- For conditions: dc anode volts = 500; grid-No.1 volts = -100, grid-No.1 resistor (ohms) = 1000; dc cathode amperes = 0.025 . . . . . 25 μsec
- For conditions: dc anode volts = 500; grid-No.1 volts = -13; grid-No.1 resistor (ohms) = 1000; dc cathode amperes = 0.025 . . . . . 40 μsec

Maximum Critical Grid-No.1 Current, with ac anode-supply volts (rms) = 350, and average cathode amperes = 0.025 . . . . . 0.5 μamp

Anode Voltage Drop (Approx.) . . . . 10 volts

Grid-No.1 Control Ratio (Approx.) with grid-No.1 resistor (megohms) = 0; grid-No.2 volts = 0 250

Grid-No.2 Control Ratio (Approx.) with grid-No.1 volts = 0, grid-No.2 resistor (ohms) = 0 15

° Without external shield.

Mechanical:

- Mounting Position. . . . . Any
- Maximum Overall Length . . . . 1-3/4"
- Maximum Seated Length. . . . . 1-1/2"
- Length, Base Seat to Bulb Top (excluding tip). 1-1/8" ± 3/32"
- Maximum Diameter . . . . 3/4"
- Bulb T-5-1/2
- Base . . . . Small-Button Miniature 7-Pin
  - Basing Designation for BOTTOM VIEW 7BN

Pin 1 – Grid No.1
Pin 2 – Cathode
Pin 3 – Heater
Pin 4 – Heater

Pin 5 – Grid No.2
Pin 6 – Anode
Pin 7 – Grid No.2

FEB. 1, 1949

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE DATA

World Radio History

5696

5696
THYRATRON

RELAY and GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, *Absolute Values*:

PEAK ANODE VOLTAGE:		
Forward	500 max.	volts
Inverse	500 max.	volts
GRID-No.2 (SHIELD-GRID) VOLTAGE:		
Peak, before anode conduction	-50 max.	volts
Average, during anode conduction■	-10 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:		
Peak, before anode conduction	-100 max.	volts
Average, during anode conduction■	-10 max.	volts
CATHODE CURRENT:		
Peak	0.1 max.	amp
Average■	0.025 max.	amp
Surge, for duration of 0.1 sec. max.	2 max.	amp
GRID-No.2 CURRENT:		
Average■	+0.005 max.	amp
GRID-No.1 CURRENT:		
Average■	+0.005 max.	amp
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	100 max.	volts
Heater positive with respect to cathode	25 max.	volts
AMBIENT TEMPERATURE RANGE	-55 to +90	°C

Typical Operating Conditions for Relay Service:

RMS Anode Voltage	117	volts
Grid No.2	Connected to cathode at socket	
RMS Grid-No.1 Bias Voltage□	5	volts
Peak Grid-No.1 Signal Voltage	5	volts
Grid-No.1-Circuit Resistance	0.1	megohm
Anode-Circuit Resistance#	5000	ohms

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	10 max.	megohms

■ Averaged over any interval of 30 sec. max.

□ Approximately 180° out of phase with the anode voltage.

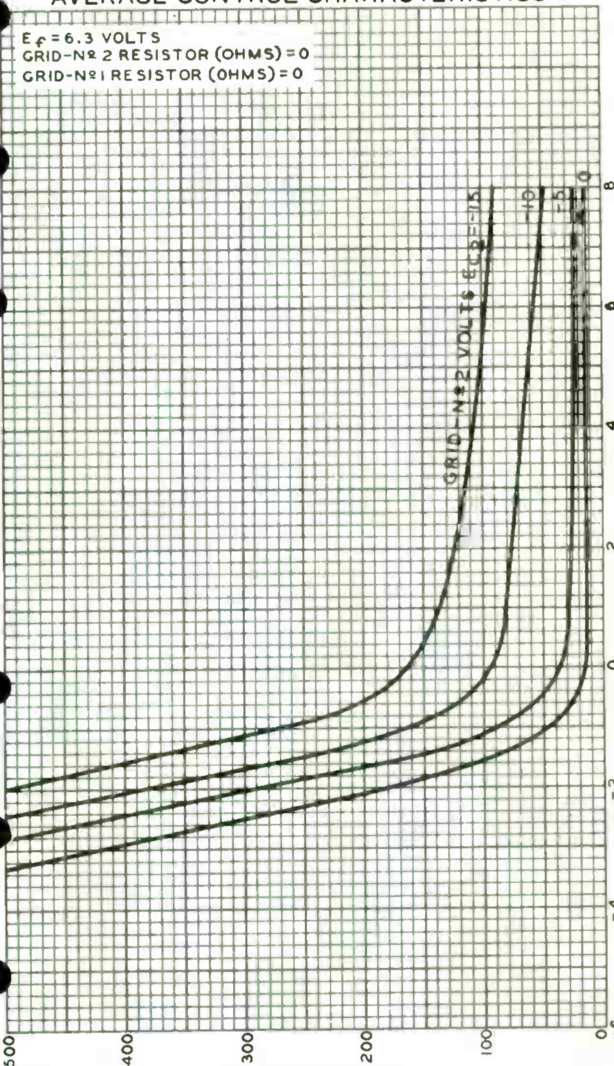
\# Sufficient resistance, including the tube load, must be used under any conditions of operation to prevent exceeding the current ratings.

World Radio History

5696

5696

AVERAGE CONTROL CHARACTERISTICS



AUG. 6, 1948

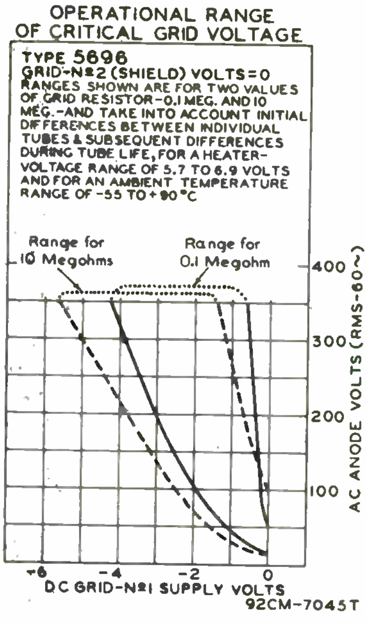
TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7044

5696

THYRATRON



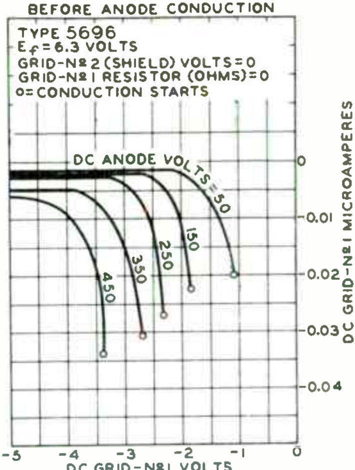
World Radio History

RCA

5696

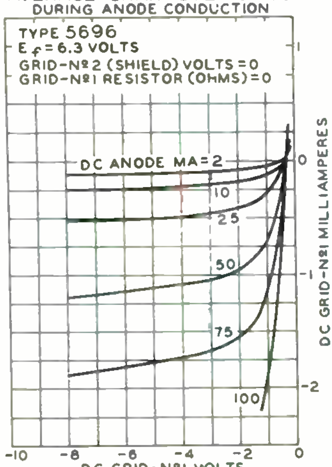
THYRATRON

AVERAGE CHARACTERISTICS
BEFORE ANODE CONDUCTION



92CM-7047T

AVERAGE CHARACTERISTICS
DURING ANODE CONDUCTION



92CM-7052T

World Radio History

World Radio History

5823
GLOW-DISCHARGE TRIODE
COLD-CATHODE, MINIATURE TYPE

GENERAL DATA

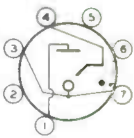
Electrical:

Cathode	Cold	
Ionization Time (Approx.):		
For conditions: Instantaneous anode volts = 185; peak positive starter-electrode pre-firing volts = 70; peak positive starter-electrode triggering volts = 50; anode-circuit series resistor (ohms) = 820; starter-electrode series resistor (ohms) = 100000	20	μsec
Deionization Time (Approx.):		
For conditions: (Same as for *Ionization Time*)	500	μsec
Anode Voltage Drop	62	volts
Starter-Electrode Voltage Drop	61	volts
Anode Breakdown Voltage	290	volts
Starter-Electrode Breakdown Voltage	80	volts
Required Transfer Current (DC or Instantaneous AC) for transition of discharge to anode at 140 volts peak	50	μamp

Mechanical:

Mounting Position	Any
Maximum Overall Length	2-1/8"
Maximum Seated Length	1-7/8"
Length, Base Seat to Bulb Top (excluding tip)	1-1/2" ± 3/32"
Maximum Diameter	3/4"
Bulb	T-5-1/2
Base	Small-Button Miniature 7-Pin
Basing Designation for BOTTOM VIEW	4CK

Pin 1 – Anode
Pin 2 – Internal Connection–Do Not Use
Pin 3 – Cathode
Pin 4 – Starter Electrode



Pin 5 – Internal Connection–Do Not Use
Pin 6 – Internal Connection–Do Not Use
Pin 7 – Cathode

Maximum Ratings▲, *Absolute Values:*

For First-Quadrant Operation Only

PEAK ANODE AND STARTER-ELECTRODE VOLTAGE:

Inverse	200 max.	volts
Forward	200 max.	volts

▲ These ratings apply to the 5823 when it is operated from a power supply having a frequency of 60 cycles per second. If a contemplated application involves higher supply frequencies, please write, stating the proposed operating frequency, to the attention of Commercial Engineering, RCA, Harrison, New Jersey for information as to required changes in maximum ratings and characteristics.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5823

5823
GLOW-DISCHARGE TRIODE

CATHODE CURRENT:		
Peak.	100 max.	ma
Average*.	25 max.	ma
PEAK STARTER-ELECTRODE CURRENT:		
With starter-electrode voltage positive .	100 max.	ma
AMBIENT TEMPERATURE	-60 to +75	°C

Typical Operating Conditions:

For Relay Service with 60-Cycle AC Supply

AC Anode Supply Voltage (RMS)	117	volts
AC Starter-Electrode Voltage:		
Max. Peak Positive Pre-Firing Voltage	70	volts
Min. Peak Positive Triggering Voltage	35	volts
Min. Firing Voltage (Sum of In-Phase Instantaneous Pre-Firing Voltage and Instantaneous Triggering Voltage)	105	volts

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

For First-Quadrant Operation Only

	Note	*Min.*	*Max.*	
Anode Breakdown Voltage . .	1	200	-	volts
Starter-Electrode Breakdown Voltage. .	2	73	105□	volts
Required Transfer Current (DC or Instantaneous AC) for transition of discharge to anode at 140 volts peak	3	-	400□	μamp
Anode Voltage Drop.	4	-	85□	volts
Starter-Electrode Voltage Drop. .	5	-	75□	volts

Note 1: With a variable dc anode voltage, dc starter-electrode voltage of 0 volts, anode-circuit series resistance of 3000 ohms, and starter-electrode series resistance of 50000 ohms.

Note 2: With dc anode voltage of 0 volts, variable dc starter-electrode voltage, anode-circuit series resistance of 3000 ohms, and starter-electrode series resistance of 50000 ohms.

Note 3: With a variable dc starter-electrode voltage, anode-circuit series resistance of 3000 ohms, and starter-electrode series resistance of 2 megohms.

Note 4: With dc anode voltage of 230 volts, dc starter-electrode voltage of 91 volts, dc cathode current of 50 milliamperes, anode-circuit series resistance of 3000 ohms, and starter-electrode series resistance of 50000 ohms.

Note 5: With dc anode voltage of 0 volts, variable dc starter-electrode voltage, dc starter-electrode current of 10 milliamperes, and starter-electrode series resistance of 3000 ohms.

* Averaged over any interval of 15 seconds maximum.

□ Maximum individual tube values during life.

5823

GLOW-DISCHARGE TRIODE

OPERATING NOTES

RCA-5823 is recommended for operation only in that part of the breakdown characteristic designated by Quadrant I. Operation in Quadrant II is satisfactory but changes in tube ratings are necessary. Operation in Quadrants III and IV is not recommended, because the anode and starter electrode are not designed for efficient cathode operation; their use in this manner will result in unstable operation and shorter tube life. The information given for Quadrants III and IV is of value to the equipment designer in that it indicates the need for precautions to be taken in order that the peak inverse voltage rating is not exceeded.

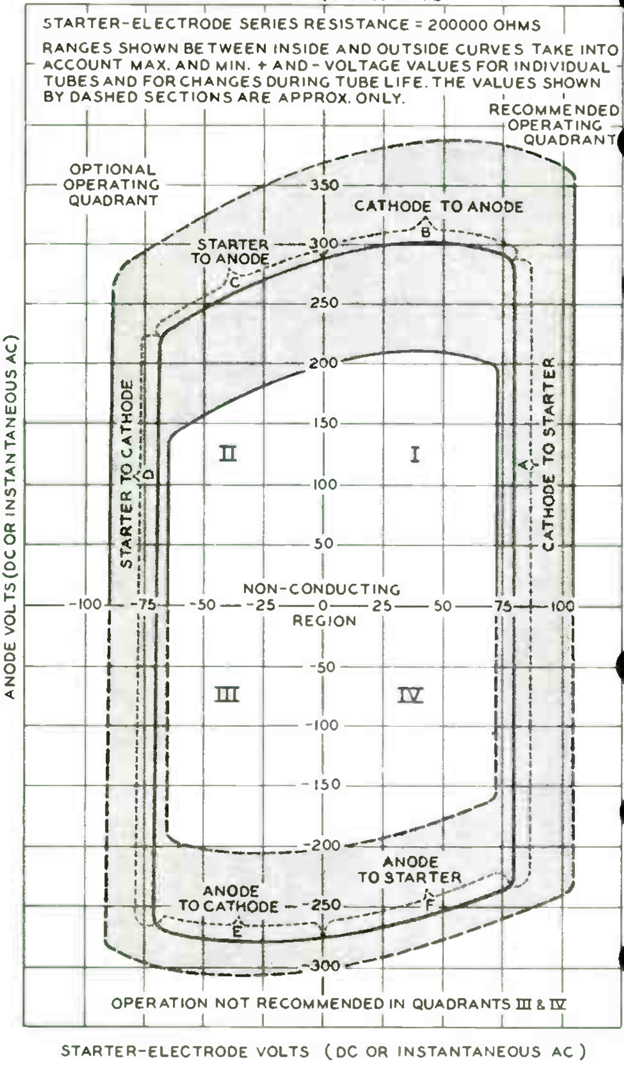
Because of the asymmetrical shape of its anode characteristic the 5823 can be used as a rectifier. When so used (with starter electrode connected through 50000-ohm resistor to anode), the 5823 has a maximum peak inverse anode voltage rating of 200 volts, a maximum peak cathode current of 100 milliamperes, and a maximum dc cathode current of 25 milliamperes. Operation at values of dc cathode current less than 8 milliamperes is not recommended because of resulting instability.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
World Radio History

5823

5823

BREAKDOWN CHARACTERISTICS
FOR ALL QUADRANTS



MAY 16, 1949 TUBE DEPARTMENT 92CM-7283

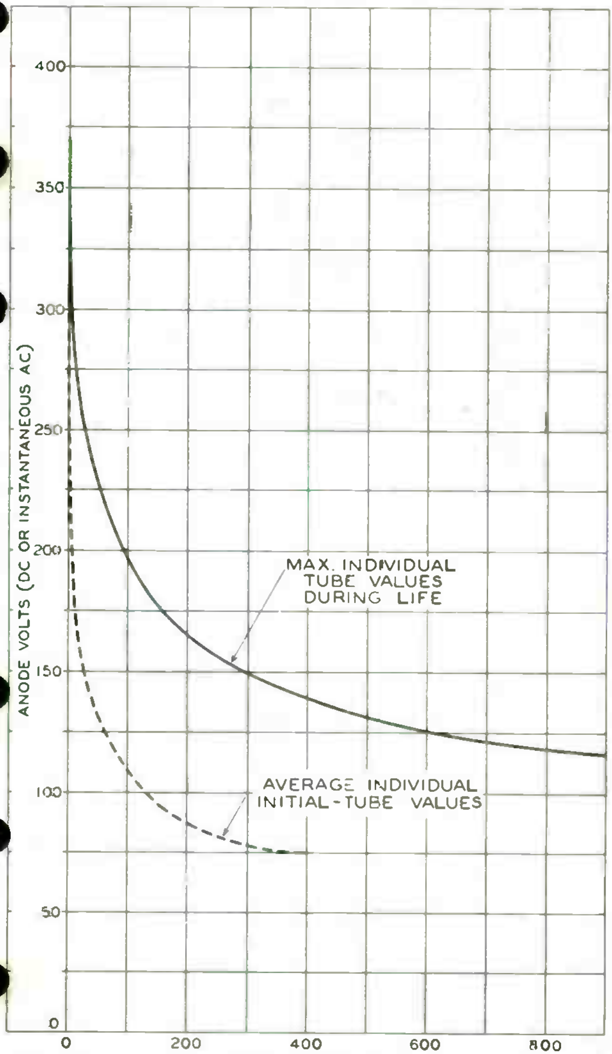
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5823

5823

TRANSITION CHARACTERISTIC



MAY 6,1949

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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World Radio History

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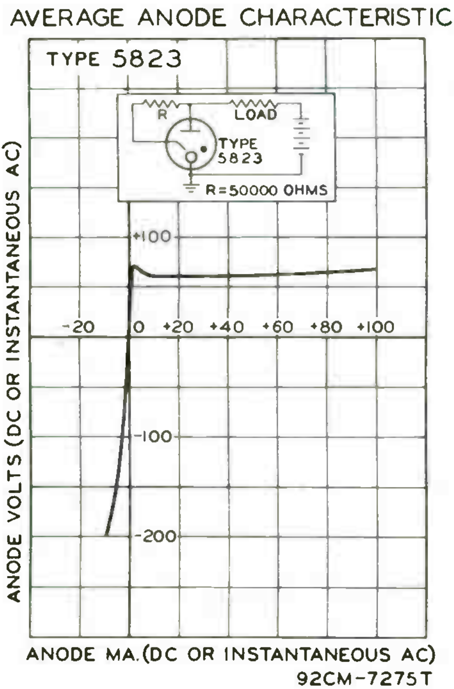
GLOW-DISCHARGE TRIODE



RCA

6012
GAS THYRATRON

NEGATIVE-CONTROL TETRODE TYPE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:

	Min.	Av.	Max.	
Voltage	5.7	6.3	6.9	ac or dc volts
Current at 6.3 volts	-	2.6	2.85	amp

Cathode:

Minimum heating time prior to tube conduction	30	sec
Maximum outage time without reheating	5	sec

Direct Interelectrode Capacitances (Approx.):°

Grid No.1 to anode	0.23	μμf
Grid No.1 to cathode, grid No.2, and heater	5.8	μμf
Anode to cathode, grid No.2, and heater	3.9	μμf

Ionization Time (Approx.):

For conditions: dc anode volts = 100, grid-No.2 volts = 0, grid-No.1 square-pulse volts = +50, and peak anode amperes during conduction = 5	0.5	μsec

Deionization Time (Approx.)	See Table I	

Maximum Critical Grid-No.1 Current:

For conditions: ac anode-supply volts = 450 (rms), and average anode amperes = 0.5	3	μamp
Anode Voltage Drop (Approx.)	10	volts

Grid-No.1 Control Ratio (Approx.):

For conditions: grid-No.1 resistor (megohms) = 0, grid-No.2 resistor (megohms) = 0, and grid-No.2 volts = 0	150

Grid-No.2 Control Ratio (Approx.):

For conditions: grid-No.1 resistor (megohms) = 0, grid-No.2 resistor (megohms) = 0, and grid-No.1 volts = 0	650

Mechanical:

Mounting Position	Any
Maximum Overall Length	3-7/8"
Maximum Seated Length	3-5/16"
Maximum Diameter	1-23/32"
Bulb	T-12
Base	Large-Wafer Octal 5-Pin with External Barriers and Sleeve (JETEC No.B6-100)

° Without external shield.

← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

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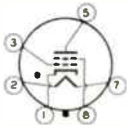
GAS THYRATRON

→ Basing Designation for BOTTOM VIEW 6CO

Pin 1 – Cathode
Pin 2 – Heater
Pin 3 – Grid No.1



Pin 5 – Anode
Pin 7 – Heater
Pin 8 – Grid No.2

RELAY AND GRID-CONTROLLED RECTIFIER SERVICE

For anode-supply frequency of 60 cps

Maximum Ratings, ***Absolute Values:***

PEAK ANODE VOLTAGE:		
Forward.	650 max.	volts
Inverse.	1300 max.	volts
GRID-No.2 (SHIELD-GRID) VOLTAGE:		
Peak, before tube conduction	-100 max.	volts
Average#, during tube conduction	-10 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:		
Peak, before tube conduction	-200 max.	volts
Average#, during tube conduction	-10 max.	volts
CATHODE CURRENT:		
Peak	5 max.	amp
Average#	0.5 max.	amp
Fault, for duration of 0.1 second max. .	20 max.	amp
AVERAGE GRID-No.2 CURRENT#	+0.05 max.	amp
AVERAGE GRID-No.1 CURRENT#	+0.05 max.	amp
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	100 max.	volts
Heater positive with respect to cathode.	25 max.	volts
AMBIENT-TEMPERATURE RANGE.	-75 to +90	°C

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	2 max.	megohms

Averaged over any interval of 30 seconds maximum.

→ Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

6012

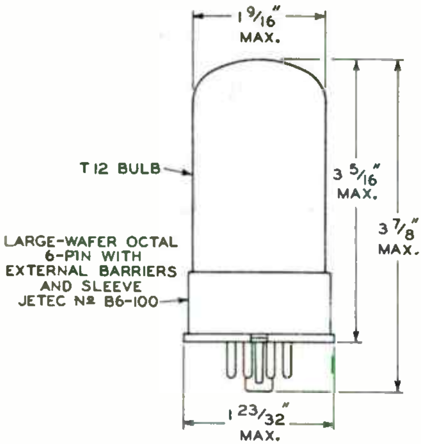
GAS THYRATRON

TABLE I

E_{cc_1} = DC Grid-No.1 Supply Voltage (Volts)
E_{cc_2} = DC Grid-No.2 Supply Voltage (Volts)
R_{g_1} = Grid-No.1 Resistor (Megohms)
R_{g_2} = Grid-No.2 Resistor (Ohms)

DC Anode Volts	125		250		R_{g_1}	E_{cc_1}	R_{g_2}*	E_{cc_2}
DC Anode Amperes	0.5	1.0	0.5	1.0				
DEIONIZATION TIME µsec (Approx.)	175	225	250	275	0.001	-13	1000	0
	350	375	450	475	0.1			
	650	700	1100	1200	2			
	100	125	100	125	0.001	-100	1000	0
	125	150	150	175	0.1			
	250	275	275	300	2			

* Series resistor between grid No.2 and cathode.



92CS-7635R1

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

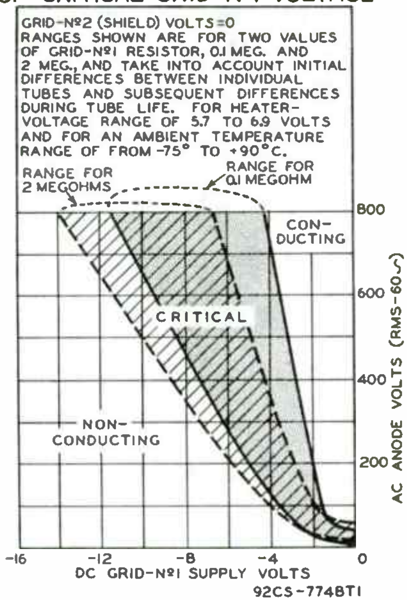
World Radio History

6012

6012

GAS THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID-No. 1 VOLTAGE



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

6012

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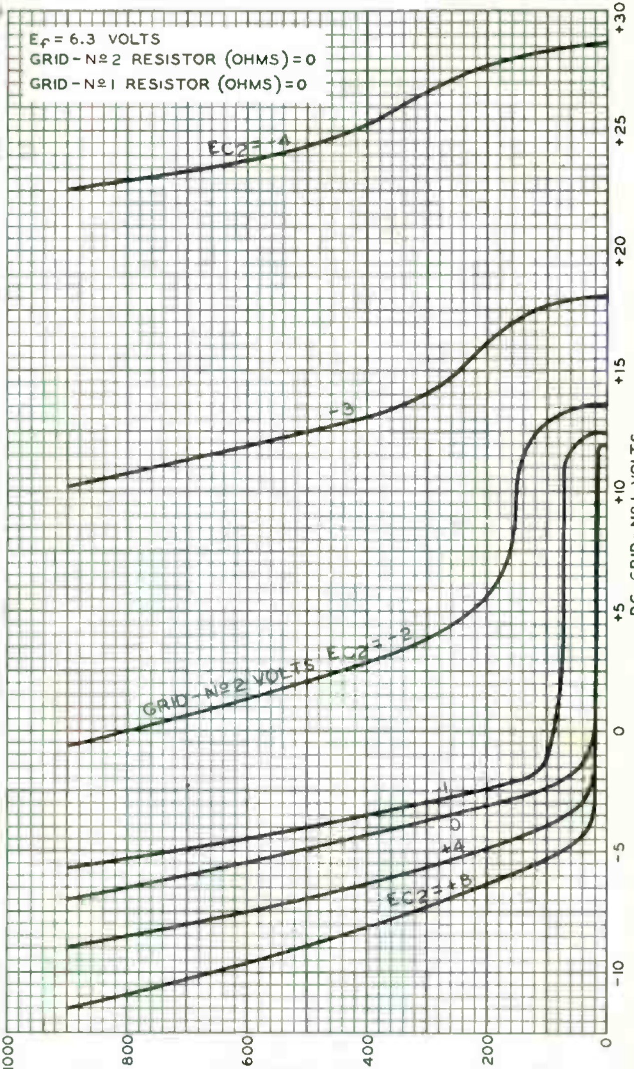
AVERAGE CONTROL CHARACTERISTICS



TUBE DIVISION

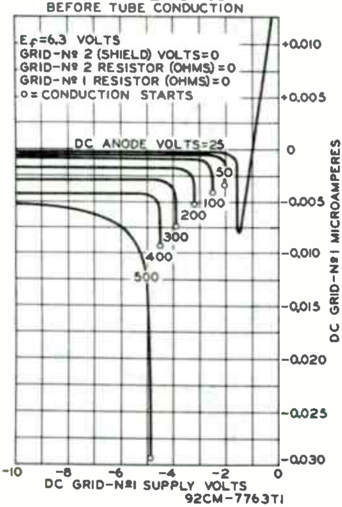
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7747

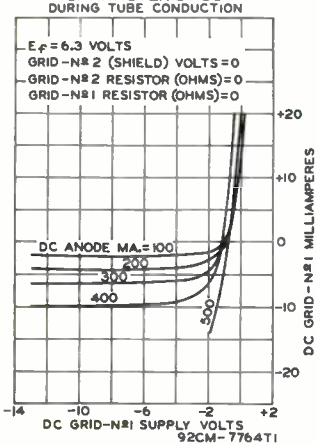
6012

CHARACTERISTIC CURVES

AVERAGE GRID-№1 CHARACTERISTICS
BEFORE TUBE CONDUCTION



AVERAGE GRID-№1 CHARACTERISTICS
DURING TUBE CONDUCTION



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

6073 PREMIUM TYPE

RCA

6073

VOLTAGE REGULATOR

MINIATURE GLOW-DISCHARGE TYPE

Intended for applications where very stable characteristics and dependable performance under shock and vibration are paramount. The 6073 is a "premium" version of the OA2.

DATA

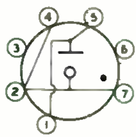
General:

Cathode . . . . Cold

Mechanical:

Mounting Position	Any
Maximum Overall Length	2-5/8"
Maximum Seated Length	2-3/8"
Length, Base Seat to Bulb Top (Excluding tip)	2" ± 3/32"
Maximum Diameter	3/4"
Bulb	T-5-1/2
Base	Small-Button Miniature 7-Pin (JETEC No. E7-1)
Basing Designation for BOTTOM VIEW	5BQ

Pin 1 - Anode
Pin 2 - Cathode
Pin 3 - Internal Connection-Do Not Use
Pin 4 - Cathode



Pin 5 - Anode
Pin 6 - Internal Connection-Do Not Use
Pin 7 - Cathode

Maximum Ratings, *Absolute Values*:

AVERAGE STARTING CURRENT (See note below)	75 max.	ma
DC CATHODE CURRENT	30 max.	ma
	5 min.	ma
AMBIENT TEMPERATURE RANGE	-55 to +90	°C
FREQUENCY	0 max.	cps

Characteristics Range Values for Equipment Design:

	Min.	*Av.*	*Max.*	
DC Anode-Supply Voltage	185▲	-	-	volts
Anode Breakdown Voltage	-	156	165●	volts
Anode Voltage Drop	140★	151	168●	volts
Regulation (5 to 30 ma)	-	2	6●	volts

Circuit Values:

Shunt Capacitor	-	-	0.1	μf
Series Resistor			See note below	

NOTE: The notes and circuit information shown under Type OA2 are also applicable to the 6073.

▲,●,★: See next page.

MAY 1, 1952

TENTATIVE DATA

World Radio History

RCA

6073
VOLTAGE REGULATOR

Shock and Vibration Tests:

These tests are made as indicated in the JAN Specifications JAN 1-A for Electron Tubes, May, 1946 under the sections as follows:

Section F-6b (9e) Shock Test:
Instantaneous Impact Acceleration . . . . 900 max. g

Section F-6b (9f) Vibration Test:
Vibrational Acceleration. . . . . 2.5 max. g

▲ Not less than indicated supply voltage should be provided to insure "starting" throughout tube life.

● Maximum individual tube value during life.

★ Minimum individual tube value during life.

MAY 1, 1952 TENTATIVE DATA

World Radio History

PREMIUM TYPE 6074

6074
VOLTAGE REGULATOR

MINIATURE GLOW-DISCHARGE TYPE

Intended for applications where very stable characteristics and dependable performance under shock and vibration are paramount. The 6074 is a "premium" version of the OB2.

DATA

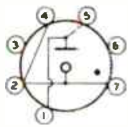
General:

Cathode . . . . Cold

Mechanical:

Mounting Position . . . . Any
Maximum Overall Length . . . . 2-5/8"
Maximum Seated Length . . . . 2-3/8"
Length, Base Seat to Bulb Top (Excluding tip) . . . 2" ± 3/32"
Maximum Diameter . . . . 3/4"
Bulb T-5-1/2
Base . . . . Small-Button Miniature 7-Pin (JETEC No. E7-1)
Basing Designation for BOTTOM VIEW 5BQ

Pin 1 – Anode
Pin 2 – Cathode
Pin 3 – Internal Connection–Do Not Use
Pin 4 – Cathode



Pin 5 – Anode
Pin 6 – Internal Connection–Do Not Use
Pin 7 – Cathode

Maximum Ratings, *Absolute Values*:

AVERAGE STARTING CURRENT (See note below)	75 max.	ma
DC CATHODE CURRENT	30 max.	ma
	5 min.	ma
AMBIENT TEMPERATURE RANGE	-55 to +90	°C
FREQUENCY	0 max.	cps

Characteristics Range Values for Equipment Design:

	Min.	*Av.*	*Max.*	
DC Anode-Supply Voltage	133▲	–	–	volts
Anode Breakdown Voltage	–	115	133●	volts
Anode Voltage Drop	101♠	108	114●	volts
Regulation (5 to 30 ma)	–	1	4●	volts

Circuit Values:

Shunt Capacitor	–	–	0.1	μf
Series Resistor			See note below	

NOTE: The notes and circuit information shown under Type 6A2 are also applicable to the 6074.

▲, ●, ♠: See next page.

MAY 1, 1952 TENTATIVE DATA

World Radio History

RCA

6074

VOLTAGE REGULATOR

Shock and Vibration Tests:

These tests are made as indicated in the JAN Specifications JAN 1-A for Electron Tubes, May, 1946 under the sections as follows:

Section F-6b (9e) Shock Test:
Instantaneous Impact Acceleration . . . . 900 max. g

Section F-6b (9f) Vibration Test:
Vibrational Acceleration. . . . . 2.5 max. g

▲ Not less than indicated supply voltage should be provided to insure "starting" throughout tube life.

● Maximum individual tube value during life.

★ Minimum individual tube value during life.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

6130/3C45
HYDROGEN THYRATRON

POSITIVE-CONTROL TRIODE TYPE

GENERAL DATA

Electrical:

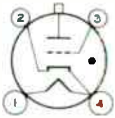
Heater, for Unipotential Cathode:

Voltage	6.3 $\left\{\begin{matrix}+5\% \\ -10\%\end{matrix}\right.$	ac or dc volts
Current at 6.3 volts:		
Minimum	2	amp
Average	2.3	amp
Maximum	2.5	amp
Minimum heating time	2	minutes
Direct Interelectrode Capacitances (Approx.):		
Grid to anode	3.9	$\mu\mu f$
Grid to cathode	8.6	$\mu\mu f$
Ionization Time (Approx.)□	0.6	μsec
Deionization Time (Approx.)	25	μsec
Anode-Cathode Voltage Drop (Approx.) at middle of pulse duration	150	volts
Maximum Variation in Firing Time (Jitter)	0.06	μsec

Mechanical:

Operating Position	Any
Maximum Overall Length	5-3/16"
Seated Length	4-3/8" ± 3/16"
Maximum Diameter	1-9/16"
Weight (Approx.)	3 oz
Cooling	Natural
Bulb	T12
Cap	Small (JEDEC No.C1-1)
Base	Medium-Shell Small 4-Pin, Micanol (JEDEC No.A4-9)
Basing Designation for BOTTOM VIEW	4BL

Pin 1 - Heater
Pin 2 - Cathode, Circuit Returns



Pin 3 - Grid
Pin 4 - Heater, Cathode
Cap - Anode

PULSE-MODULATOR SERVICE

Maximum and Minimum CCS● Ratings, *Absolute Values:*

	For pressures down to 70 mm of Hg#	
DC ANODE-SUPPLY VOLTAGE	800 min.	volts
PEAK ANODE VOLTAGE:		
Forward (E_{bmf})*	3000 max.	volts
Inverse:*	5% of E_{bmf} min.	volts
After anode-current pulse:▲		
During first 25 μsec	1500 max.	volts
After first 25 μsec	3000 max.	volts

□,●,#,*,▲: See next page.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON NEW JERSEY

World Radio History

6130

6130/3C45

HYDROGEN THYRATRON

	For pressures down to 70 mm of Hg#	
GRID VOLTAGE:		
Negative (DC or Peak), before conduction.	200 max.	volts
Peak positive-pulse.	175 min.	volts
ANODE CURRENT:		
Peak	35 max.	amp
Average°	0.045 max.	amp
Rate of rise	750 max.	amp/μsec
OPERATION FACTOR†.	3×10^8 max.	
PULSE DURATION■.	6 max.	μsec
AMBIENT-TEMPERATURE RANGE. . . .	-50 to +90	°C

Typical Operation:▲

	At 2000 pps in accompanying circuit with pulse duration of 0.5 μsec	
DC Anode-Supply Voltage.	1250	volts
Peak Anode Voltage:		
Forward.	3000	volts
Inverse:		
Immediately after anode-current pulse.	530	volts
GRID VOLTAGE:		
Negative, before conduction. . . .	0	volts
Peak positive-pulse (Unloaded) . .	175	volts
Effective Grid-Circuit Resistance. .	1000	ohms
ANODE CURRENT:		
Peak	35	amp
Average°	0.035	amp
Operation Factor†.	2.1×10^8	
Peak Power Output to Pulse Transformer (T).	43000	watts

Maximum Circuit Values:

Effective Grid-Circuit Resistance. .	1500 max.	ohms

□ Defined as the time interval between the point on the rising portion of the grid pulse which is 26 per cent of the peak unloaded-pulse amplitude and the point on the anode-current pulse which is 26 per cent of its peak amplitude. The anode-current pulse has a maximum time rise of 0.05 μsec. The grid pulse has a minimum peak amplitude of 130 volts, a maximum rise time of 0.5 μsec, and is supplied by a driver having a maximum internal impedance of 1500 ohms.

● Continuous Commercial Service.

Corresponds to altitude of about 50,000 feet.

* In applications where the anode voltage is applied instantaneously, the power-supply filter should be designed so that the peak forward anode voltage is applied at a rate not to exceed 75,000 volts per second.

▲ Exclusive of spike not having more than 0.05 μsec duration.

° Averaged over any cycle.

† Defined as *Peak Forward Anode Volts x Pulse-Repetition Rate (pps) x Peak Anode Amperes* (excluding spike).

■,▲: See next page.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

6130

6130/3C45
HYDROGEN THYRATRON

• Pulse duration is defined as the time interval between points on the pulse envelope at which instantaneous amplitudes are equal to 70.7 per cent of the maximum amplitude excluding spike.

♦ Operation with a bulb temperature within the approximate range of 60° to 90° C measured on the bulb directly opposite the anode is recommended for longest life. To attain this temperature under operating conditions involving low ambient temperature, the use of a heat-conserving enclosure for the tube may be necessary.

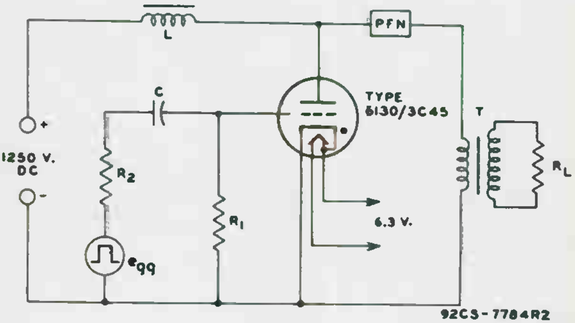
OPERATING CONSIDERATIONS

The *anode* is brought out of the tube to a Small cap. The connector for this cap should be of the heat-radiating type and the connector lead should have ample current-carrying capability for the operating requirements.

Shielding of the 6130/3C45 should be provided if it is operated in the presence of strong electric fields which will ionize the gas within the tube. Any such ionization will cause erratic performance.

Cooling of the 6130/3C45 is accomplished by natural circulation of air around it. Under no circumstances should a stream of cooling air be applied to the glass envelope.

TYPICAL PULSE-MODULATOR CIRCUIT



C: Blocking Capacitor, 0.001 μf

egg: Pulse Generator supplying peak positive-pulse grid voltage of 175 volts (unloaded)

L: Charging Choke, 5 henries

PFN: Pulse-Forming Network with iterative impedance of 50 ohms, and a two-way transmission time of 0.5 μsec

R_1: Grid Resistor, 30,000 ohms

R_2: Effective Resistance of grid circuit, 1000 ohms

R_L: Load Resistance. Value reflected into primary of transformer (T) is 35 ohms.

T: Matching Pulse Transformer

World Radio History

6130

6130/3C45

HYDROGEN THYRATRON

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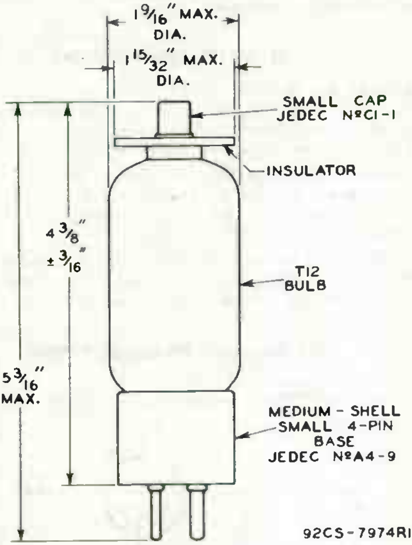


World Radio History

RCA

2X2-A

HALF-WAVE VACUUM RECTIFIER

For applications critical as to severe shock and vibration

GENERAL DATA

Electrical:

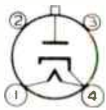
Heater, for Unipotential Cathode:

	Min.	*Av.*	*Max.*	
Voltage.	2.25	2.50	2.75	ac volts
Current at 2.50 volts. . .	1.55	1.75	1.95	amp

Mechanical:

Mounting Position.	Any
Maximum Overall Length	4-17/32"
Seated Length.	3-25/32" ± 1/8"
Maximum Diameter	1-9/16"
Dimensional Outline.	*See General Section*
Weight (Approx.)	1.3 oz
Bulb	ST-12
Cap.	Small (JETEC No.C1-1)
Base	Small-Shell Small 4-Pin (JETEC No.A4-5)
Basing Designation for BOTTOM VIEW	4AB

Pin 1 – Heater
Pin 2 – No Connection
Pin 3 – No Connection



Pin 4 – Heater, Cathode
Cap – Plate

HALF-WAVE RECTIFIER

Maximum Ratings, *Design-Center Values:*

PEAK INVERSE PLATE VOLTAGE	12500 max.	volts
PEAK PLATE CURRENT	60 max.	ma
DC OUTPUT CURRENT.	7.5 max.	ma
HOT-SWITCHING TRANSIENT CURRENT, for duration of 0.2 second max.	100 max.	ma
AMBIENT TEMPERATURE.	70 max.	oC

Typical Operation:

AC Plate-Supply Voltage (RMS).	5500	volts
Total Effective Plate-Supply Impedance . .	0.3	megohm
Filter Input Capacitor	0.1	μf
DC Output Current.	2	ma
DC Output Voltage (At input to filter) . .	4500	volts

SHOCK TEST DATA

Impact Acceleration.	250 max.	g

This test is performed on a sample lot of tubes from each production run to determine ability of tube to withstand the specified impact acceleration. The tubes are subjected to a total of 3 blows in each of the 3 primary mutually

← indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

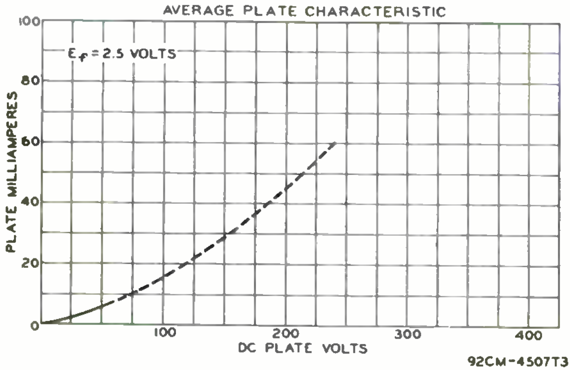
World Radio History

RCA

2X2-A

HALF-WAVE VACUUM RECTIFIER

perpendicular tube planes when tested in the Navy Type, High-Impact (flyweight) Shock Machine. At the end of this test, tubes will not show permanent or temporary shorts or open circuits, and will not be inoperative.



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

579-B

HALF-WAVE HIGH-VACUUM RECTIFIER

DATA

Electrical:

Filament, Thoriated Tungsten:

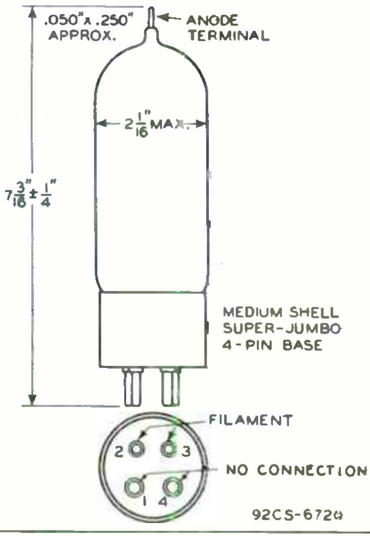
Voltage	2.5 ± 5%	volts
Current	6	amp

Mechanical:

Mounting Position	Vertical
Overall Length	7-3/16" ± 1/4"
Maximum Diameter	2-1/16"
Bulb	T-16
Bulb Terminal	See Outline Drawing
Base	Medium Shell Super-Jumbo 4-Pin

Maximum Ratings, Absolute Values:

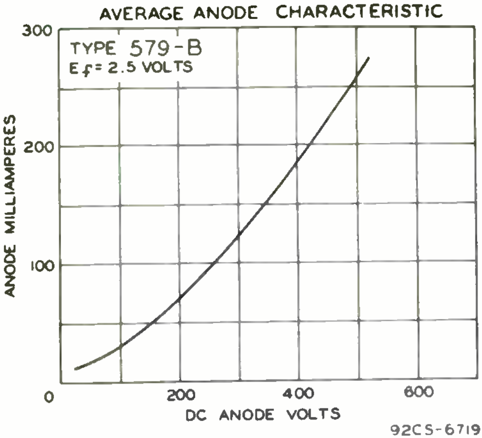
PEAK INVERSE ANODE VOLTAGE	20000 max.	volts
PEAK ANODE CURRENT	270 max.	ma.
AVERAGE ANODE CURRENT	25 max.	ma.
AMBIENT AIR TEMPERATURE	50 max.	°C
BULB TEMPERATURE	75 max.	°C



RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
World Radio History

579-B

HALF-WAVE HIGH-VACUUM RECTIFIER



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

1945

VACUUM-GAUGE TUBE

HYDROGEN-SENSITIVE, IONIZATION TYPE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:

Voltage	6.3 ± 10%	ac or dc volts
Current	0.75	amp

Mechanical:

Mounting Position	Any
Maximum Overall Length	6-3/8"
Maximum Diameter	1-5/16"
Tubulation	See Outline Drawing
Bulb	Metal Shell MT8G
Base	Small-Wafer Octal 8-Pin

BOTTOM VIEW

Pin 1 - Cathode
Pin 2 - Heater
Pin 3 - Ion Collector
Pin 4 - Cathode
Pin 5 - Plate, Shell DO NOT USE FOR GETTER CONNECTION

Pin 6 - Cathode
Pin 7 - Heater
Pin 8 - Getter

Shell - Plate, Getter Connection to Hexagonal Section of Tubulation

LEAK DETECTOR

Maximum Ratings, ***Absolute Values:***

PLATE VOLTAGE	300 max.	volts
ION-COLLECTOR VOLTAGE	{ -30 max.	volts
	{ -15 min.	volts
PLATE CURRENT	50 max.	ma.
PLATE DISSIPATION	7 max.	watts
PEAK HEATER-CATHODE VOLTAGE	0 max.	volts

Typical Operation:

Plate Voltage	185	volts
Minimum Plate-Supply Voltage	250	volts
Ion-Collector Voltage	-22.5	volts
Plate Current	32	ma.
Ion-Collector Current	Less than 0.5*	μamp
Plate Dissipation	6	watts

* With no hydrogen in the gauge. When hydrogen from minute leaks enters the gauge tube, the ion-collector current may increase by less than 1%. In order to obtain a definite reading of such small changes in ion-collector current, it is necessary to use an amplifier capable of amplifying dc currents of the order of 0.005 μamp.

The metal shell of the 1945 contains an indirectly-heated cathode, an ion-collector and a plate made of palladium. The palladium plate located across the inner end of the tubulation serves, when cold, as a vacuum-tight barrier to the vacuum system. This construction permits the metal enclosure to be exhausted to a much better vacuum than

World Radio History

1945
VACUUM-GAUGE TUBE

(continued from preceding page)

normally exists in a vacuum system. However, when heated, the palladium plate serves as a permeable membrane which permits any hydrogen in the vacuum system to which the 1945 is connected to flow into the tube.

Practical application of the 1945 to locating a leak consists simply of connecting it to the vacuum system and of probing the system with a jet of gas containing a high percentage of hydrogen. If a leak is present, hydrogen enters the vacuum system at the point of leakage, passes through the hot palladium plate, and produces an increase in current to the ion-collector.

Because of its high vacuum, the 1945 can detect far smaller leaks than are detectable using conventional ionization gauges operating at the same pressure as the vacuum system. Actually, an increase in hydrogen pressure of less than 10^{-7} mm of mercury (10^{-4} microns) can be detected by the 1945.

The 1945 can be connected to a hard-glass, soft-glass, or metal vacuum system.

Connection to a hard-glass system may readily be made by breaking off the tip of the glass tubulation (see Outline Drawing), and sealing the (Corning Code 772 Nonex) tubulation to the glass system.

Connection to a soft-glass system requires a graded seal between the hard-glass tubulation of the 1945 and the soft glass of the system.

Connection to a metal system requires that the glass tubulation first be removed by pinching the glass with pliers at a point close to the Kovar seal. Then, the 1945 can be connected to a metal system by a straight pipe coupling which is necessary for clearance of the metal exhaust tubulation. Always apply the wrench to the hexagonal section and never to the metal shell. After the coupling has been tightened, it should be coated with Glyptal to insure that the joint is vacuum tight.

Suitable support should be provided for the 1945. In a glass system, it should be supported by a suitable clamp encircling the metal shell. The clamp should be lined with an asbestos pad so that the clamp does not place a strain on the welds. In a metal system, the 1945 can usually be supported by the pipe coupling.

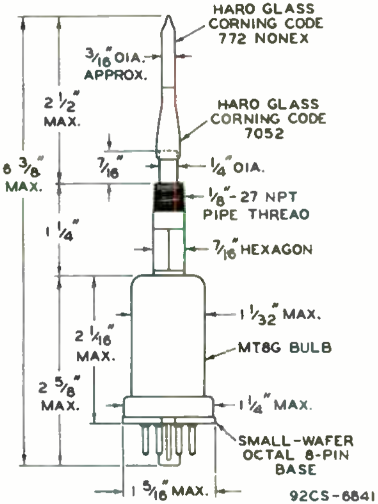
For safety reasons, it is advisable to have the metal shell of the 1945 at ground potential (positive polarity).

World Radio History

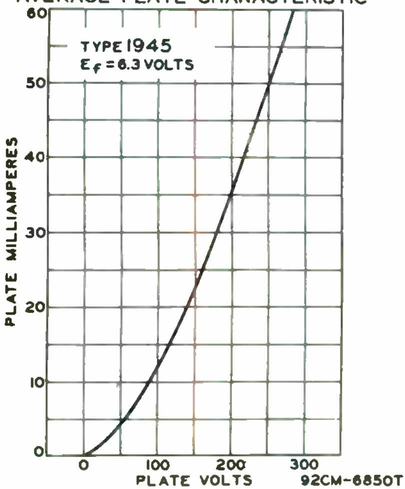
1945

1945

VACUUM-GAUGE TUBE



AVERAGE PLATE CHARACTERISTIC



World Radio History

World Radio History

RCA

1950
VACUUM-GAUGE TUBE

SOFT-GLASS BULB, IONIZATION TYPE

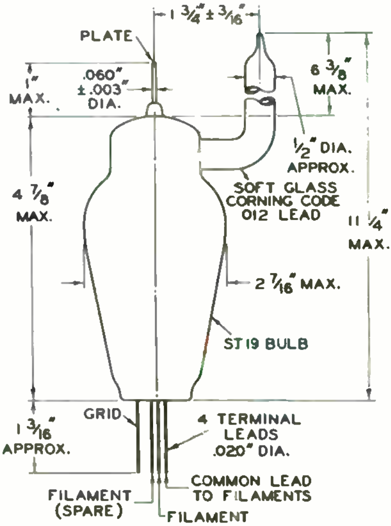
DATA

General:

Filament, Tungsten:*		
Voltage (Approx.)	5	ac or dc volts
Current (Approx.)	3.5	amp
Maximum Tube Length (Including tubulation)		11-1/4"
Maximum Tube Radius		2-3/16"
Maximum Bulb Length		4-7/8"
Maximum Bulb Diameter		2-7/16"
Bulb		ST-19
Tubulation		1/2" Diameter Soft Glass, Corning Code 012 Lead
Operating Position		Vertical, with tubulation up or down; Horizontal with stem press in vertical plane
Terminal Arrangement		See Outline Drawing

* The 1950 contains two filaments, one of which is a spare. Values shown are for either filament operated alone. The filament voltage should be kept as low as possible during degassing because use of a low filament voltage materially increases filament life.

Maximum Ratings, Typical Degassing Conditions, Typical Operation, Calibration and Terminal Lead Connections for the 1950 are the same as for the 1949.



WorldRadioHistory

World Radio History

5794

5794

FIXED-TUNED OSCILLATOR TRIODE

"PENCIL TYPE" WITH INTEGRAL RESONATORS

For radiosonde service at 1680 Mc

The 5794 is the same as the 6562 except for the following items:

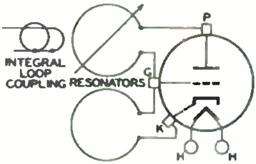
Mechanical:

Dimensions . . . . *See Dimensional Outline*

Terminal Connections *(See Dimensional Outline)*:

H – Heater

K – Cathode



G – Grid

P – Plate

OPERATING CONSIDERATIONS

The *flexible heater leads* of the 5794 are usually soldered to the circuit elements. Soldering of these connections should not be made closer than 3/4" from the end of the tube. If this precaution is not followed, the heat of the soldering operation may crack the glass seals of the leads and damage the tube. Under no circumstances should any of the electrodes be soldered to the circuit elements. Connections to the electrodes should be made by spring contact only.

The 5794 should be supported by a suitable clamp around the metal shell either above or below the frequency-adjustment screw. It is essential, however, that the pressure exerted on the shell by the clamp be held to a minimum because excessive pressure can distort the reasonators and result in a change of frequency.

The *plate and cathode connections* should have flexible leads which will accommodate variations in the relative positions of the plate and cathode terminals in individual tubes.

The 5794 may be mechanically tuned by adjustment of the frequency-adjustment screw located on the metal shell of the tube. A clockwise rotation of the frequency-adjustment screw will decrease the frequency, while a counterclockwise rotation will increase the frequency. The range of adjustment provided by the screw is ±12 megacycles.

← indicates a change.

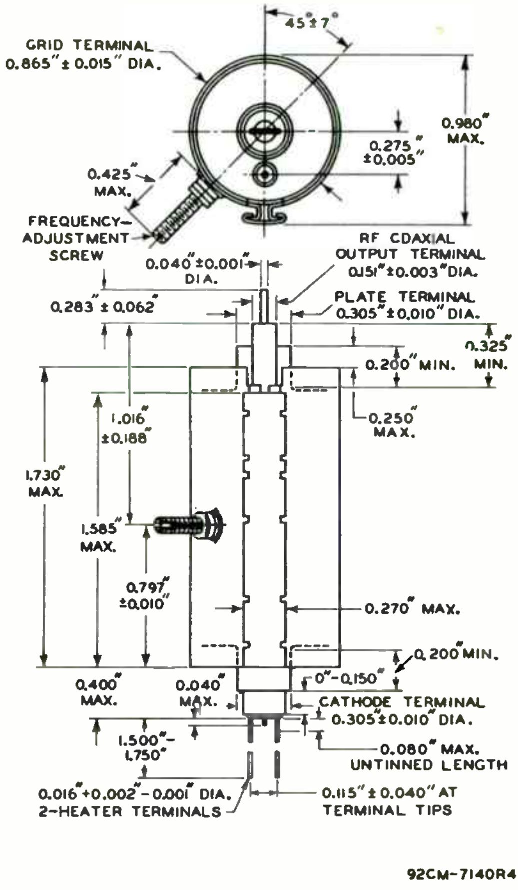
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

5794

5794

FIXED-TUNED OSCILLATOR TRIODE



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

5825

5825

HALF-WAVE VACUUM RECTIFIER

GENERAL DATA

Electrical:

Filament, Thoriated Tungsten:

Voltage	1.6	ac volts
Current	1.25	amp

Direct Interelectrode Capacitance:°

Plate to Filament	2.2	$\mu\mu f$

Tube Voltage Drop at maximum peak plate current	1750	volts

° with no external shield.

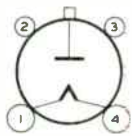
Mechanical:

Mounting Position	Any
Overall Length	5-11/16" ± 5/32"
Seated Length	5-1/6" ± 5/32"
Maximum Diameter	2-1/16"
Bulb	ST-16
Cap	Medium
Base	Medium-Shell Small 4-Pin
Basing Designation for BOTTOM VIEW	4P

Pin 1 – Filament

Pin 2 – No Connection

Pin 3 – No Connection



Pin 4 – Filament, Internal Shield

Cap – Plate

HALF-WAVE RECTIFIER

Maximum Ratings, ***Absolute Values:***

For supply frequencies up to 250 kc

PEAK INVERSE PLATE VOLTAGE	60000 max.	volts
PEAK PLATE CURRENT	40 max.	ma
AVERAGE PLATE CURRENT	2 max.	ma
HOT-SWITCHING TRANSIENT CURRENT for duration of 0.1 sec. max.	100 max.	ma
PLATE DISSIPATION	3.5 max.	watts
BULB TEMPERATURE	80 max.	°C

Typical Operation at 70 kc in Half-Wave Circuit with Capacitor-Input to Filter:

AC Plate-Supply Voltage (RMS)	21200	volts
Filter-Input Capacitor	350	$\mu\mu f$
Effective Plate-Supply Impedance	120000	ohms
DC Output Current	2	ma
DC Output Voltage at Input to Filter (Approx.):		
At half-load current (1 ma)	28000	volts
At full-load current (2 ma)	26700	volts
Voltage Regulation (Approx.):		
Half-load to full-load current	1300	volts

SEPT. 15, 1949 TENTATIVE DATA

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

5825

5825

HALF-WAVE VACUUM RECTIFIER

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Filament Current	1	1.15	1.35	amp
Plate-Filament Capacitance	-	2.14	2.26	$\mu\mu$f

Note: with 1.6 volts dc on filament.

OPERATING NOTES

When the filament is supplied from an rf power source which is at a high dc potential above ground, adjustment of the filament voltage by direct measurement is usually impractical. However, a simple method utilizing visual comparison of filament temperatures can be used for adjustment of filament power. The color temperature of the filament operating from an rf power source may be checked visually by observing in a darkened room the reflection of the incandescent filament upon the surface of the internal shield. A visual comparison of this color temperature with that obtained when the filament of another 5825 is operated from a dc or low-frequency ac supply of 1.6 volts, provides a convenient means for adjusting the amount of rf excitation to produce 1.6 volts (rms) at the filament terminals.

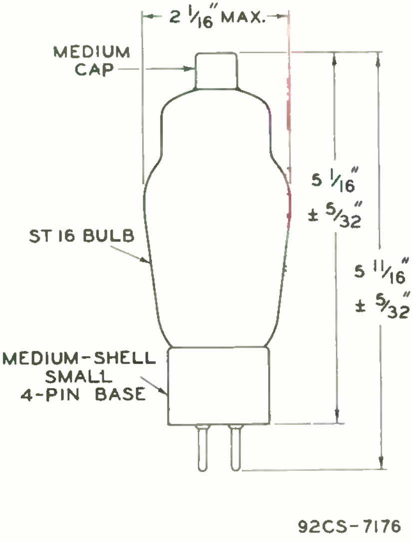
The filament must never under any condition of operation be allowed to reach a temperature higher than that caused by operating the filament on dc or low-frequency ac at a voltage of 1.68 volts. Operation at higher temperatures will cause impaired performance of the tube. During circuit adjustment, however, it is permissible to allow the filament voltage to rise to 2 volts for the brief interval required to make the adjustment.

Soft x-rays are produced when the 5825 is operated at a plate voltage above approximately 20000 volts. These rays can constitute a health hazard unless the tube is adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.

RCA

5825

HALF-WAVE VACUUM RECTIFIER

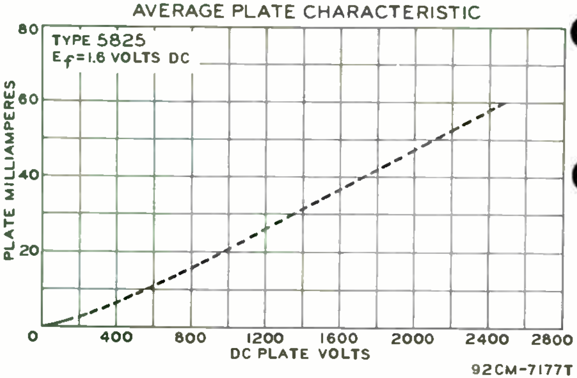


World Radio History

RCA

5825

HALF-WAVE VACUUM RECTIFIER



TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

RCA

8013-A

HALF-WAVE VACUUM RECTIFIER

GENERAL DATA

Electrical:

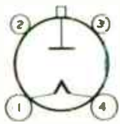
Filament, Thoriated Tungsten:

	Min.	*Av.*	*Max.*	
Voltage	2.37	2.50	2.63	ac volts
Current at 2.50 volts . . .	4.7	5.0	5.3	amp

Mechanical:

Mounting Position . . Any, preferably vertical with base down
Maximum Overall Length. . . . . 6-1/16"
Seated Length . . . . 5-9/32" ± 5/32"
Maximum Diameter. . . . . 2-1/16"
Weight (Approx.). . . . . 2.9 oz
Bulb. ST-16
Cap . . . . Skirted Medium with Rolled Edge (JETEC No. C1-19)
Base. . . . . Medium-Shell Small 4-Pin (JETEC No. A4-9)
Basing Designation for BOTTOM VIEW. 4P

Pin 1 - Filament
Pin 2 - No Connection
Pin 3 - No Connection



Pin 4 - Filament
Cap - Plate

HALF-WAVE RECTIFIER

Maximum Ratings, ***Absolute Values:***

PEAK PLATE VOLTAGE:			
Forward	40000▲	max.	volts
Inverse	40000▲	max.	volts
PLATE CURRENT:			
Peak.	150	max.	ma
Average	20	max.	ma
Fault	500	max.	ma
PLATE DISSIPATION	12	max.	watts

OPERATING CONSIDERATIONS

Filament and *plate voltage* may be applied simultaneously to the 8013-A.

The *bulb* of the 8013-A should be cleaned regularly. Accumulation of dust or other foreign matter on the bulb will cause leakage and, as a result, probably tube failure.

X-rays are produced during normal operation of the 8013-A. These rays can constitute a health hazard unless the tube is adequately shielded for X-ray radiation. Although relatively simple shielding should prove adequate, make sure it provides the required protection to the operator.

▲This value may be increased to 55000 volts when the 8013-A is immersed in oil.

← Indicates a change.

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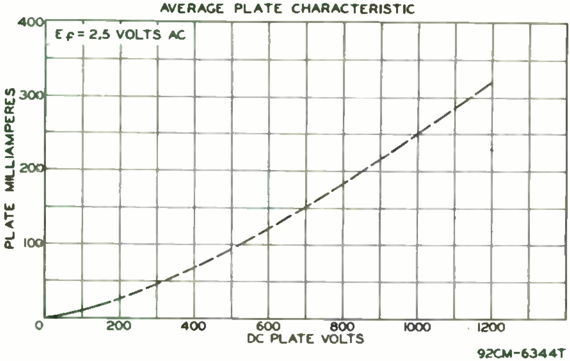
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

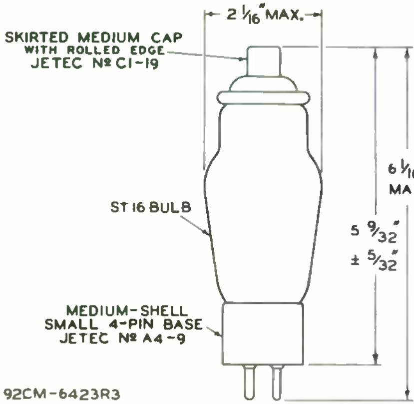
World Radio History

RCA

8013-A

HALF-WAVE VACUUM RECTIFIER





World Radio History

8020

8020

HALF-WAVE HIGH-VACUUM RECTIFIER

DATA

Electrical:

Filament, Thoriated Tungsten:		
Voltage	5	volts
Current	5.5 - 6.5	amp
Direct Interelectrode Capacitance:		
Anode to Filament	1.4	μμf
Tube Voltage Drop at 100 ma.	200	volts

Mechanical:

Mounting Position	Vertical, Base Down
Overall Length	7-1/2" ± 1/2"
Maximum Diameter	2-5/16"
Bulb	T-18
Cap	Medium
Base	Medium 4-Pin, Bayonet

RECTIFIER SERVICE

Maximum Ratings, Absolute Values:

PEAK INVERSE ANODE VOLTAGE	40000 max.	volts
PEAK ANODE CURRENT	750 max.	ma.
AVERAGE ANODE CURRENT	100 max.	ma.

SURGE - LIMITING DIODE SERVICE

Maximum Ratings, Absolute Values:

FILAMENT VOLTAGE	5.8 max.	volts
PEAK FORWARD ANODE VOLTAGE	12500 max.	volts
AVERAGE ANODE DISSIPATION	75 max.	watts

Typical Operation:

Filament Voltage	5.5	volts
Peak Forward Anode Voltage	10000	volts
Minimum Peak Anode Current	2	amp

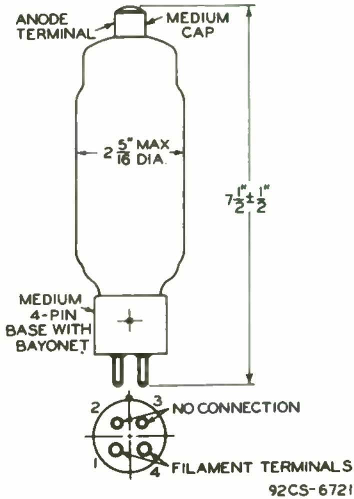
World Radio History

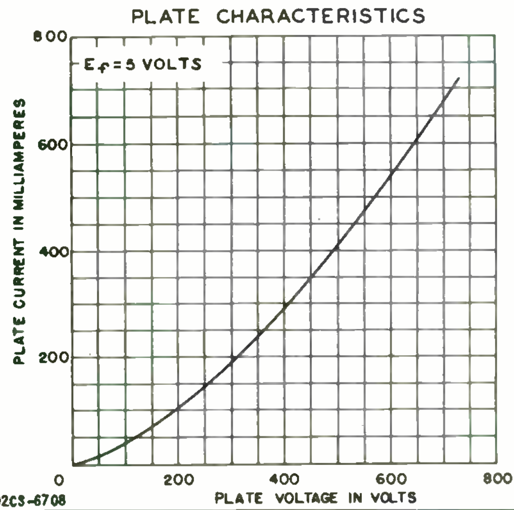
8020

RCA

8020

HALF-WAVE HIGH-VACUUM RECTIFIER





MAY 1, 1946

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-6721-6708

World Radio History

Receiving Tubes—Part 1

RCA TUBE
HANDBOOK
HB-3

RECEIVING
TUBE
SECTION — Part 1

This Section contains data for those tubes used primarily in broadcast and home-television receivers.

For further Technical Information, write to Commercial Engineering, Tube Division, Radio Corporation of America, Harrison, N. J.

World Radio History

World Radio History

RECEIVING-TUBE GUIDE - 1

Beam Power Tube

□ 5AQ5	▲ 6GC5	□ 12AQ5	□ 35B5
□ 5CZ5	○ 6FE5	□ 12CA5	□ 35C5
○ 5V6GT	○ 6L6	□ 12CU5/12C5	○ 35L6GT
□ 6AQ5A	○ 6L6GB †	○ 12L6GT	□ 50B5
□ 6AS5	○ 6L6GC †	○ 12V6GT	□ 50C5
□ 6CM6	○ 6V6	○ 12W6GT	○ 50FE5
□ 6CU5	○ 6V6GTA	□ 25C5	○ 50L6GT
□ 6CZ5	○ 6W6GT	□ 25F5A	□ 6973 †
○ 6DG6GT	○ 6Y6G	□ 34GD5	○ 7027A †
□ 6DS5	□ 12AB5	□ 34GD5A	○ 7408 †

Power Pentode

□ 6BQ5	○ 6K6GT	□ 25EH5	□ 50FK5
□ 6EH5	□ 8BQ5	□ 35EH5	□ 60FX5
○ 6F6	□ 12EH5	□ 50EH5	□ 7189 †
□ 6GK6			▲ 7868 †

2. AUTOMATIC GAIN CONTROL CIRCUITS (AGC & AVC)

Diode—Sharp-Cutoff Pentode

□ 6KL8	□ 12KL8

Diode—Remote-Cutoff Pentode

□ 6EQ7	□ 12EQ7	□ 20EQ7

Twin Diode—Medium-Mu Triode

□ 6BF6	○ 6SR7	□ 12BF6	○ 12SR7

Twin Diode—High-Mu Triode

□ 3AV6	□ 6AV6	□ 12AT6	○ 12SQ7GT
□ 4AV6	○ 6SQ7	□ 12AV6	□ 18FY6
□ 6AT6	○ 6SQ7GT	○ 12SQ7	□ 18FY6A

Medium-Mu Triode—Sharp-Cutoff Pentode

□ 5AN8	□ 6AZ8	□ 6BH8	□ 6CU8
□ 5GH8	□ 6BA8A	□ 6CH8	□ 6GH8
□ 6AN8A			□ 6GH8A

High-Mu Triode—Sharp-Cutoff Pentode

□ 6AW8A	□ 6JV8	□ 8AW8A	□ 8JV8

Sharp-Cutoff Twin Pentode

□ 3BU8	□ 4BU8	□ 4GS8	□ 6BU8
□ 3GS8			□ 6HS8

3. BURST AMPLIFIERS

Medium-Mu Triode—Sharp-Cutoff Pentode

□ 5EA8	□ 6EA8	□ 6GH8	□ 6GH8A
□ 5GH8			

High-Mu Triode with Twin Diodes

□ 6BN8

4. CATHODE-DRIVE RF AMPLIFIERS (GROUNDED-GRID)

Medium-Mu Triode

□ 6BC4

Medium-Mu Twin Triode

□ 4BC8	□ 4BZ7	□ 6BC8	□ 6BS8
□ 4BQ7A	□ 5BK7A	□ 6BK7A	□ 6BZ7
□ 4BS8	□ 5BQ7A	□ 6BQ7A	□ 6FW8

High-Mu Triode

◊ 2CW4	□ 6AB4	◊ 6CW4	◊ 6DS4
◊ 2DS4			

High-Mu Twin Triode

□ 6DT8	□ 12AZ7	□ 12AZ7A	□ 12DT8
□ 12AT7			

5. COLOR KILLERS

Quadruple Diode

□ 6JU8

□ Miniature ○ Octal ▲ Novar † For high-fidelity equipment. ◊ Nuvistor

World Radio History

In this Application Guide, RCA receiving tubes are classified by function (application) and by structure (diode, triode, etc.).

Triodes are designated as *low-*, *medium-*, or *high-mu* types on the following basis: *low*, less than 10; *medium*, 10 or more, but less than 50; *high*, 50 or more. Where applicable, tubes are designated as *sharp-*, *semiremote*, or *remote-cutoff* on the basis of the ratio, in per cent, of the negative control-grid voltage to the screen-grid voltage (or, for triodes, the plate voltage) as given in the characteristics or typical operation values. These terms are defined as follows: *sharp*, less than 10 per cent; *semiremote*, 10 or more, but less than 20 per cent; *remote*, 20 per cent or more.

APPLICATIONS

1. Audio-Frequency Amplifiers
2. Automatic Gain Control (AGC and AVC) Circuits
3. Burst Amplifiers
4. Cathode-Drive RF Amplifiers (Grounded-Grid)
5. Color Killers
6. Color Matrixing Circuits
7. Complex-Wave Generators
8. Converters
9. Dampers
10. Demodulators (Color TV)
11. Detectors
12. DC Restorers
13. Discriminators
14. Frequency Dividers
15. FM Detectors
16. Gated Noise, AGC, and Sync Amplifiers
17. Harmonic Generators
18. Horizontal-Deflection Circuits
19. Intermediate-Frequency Amplifiers
20. Limiters
21. Mixers—RF
22. Mixer-Oscillators—RF
23. Multivibrators
24. Noise Inverters
25. Oscillators
26. Phase Inverters
27. Phase Splitters
28. Radio-Frequency Amplifiers
29. Reactance Circuits
30. Rectifiers
31. Regulators
32. Relay Control Circuits
33. Sync Amplifiers
34. Sync Clippers
35. Sync Separators
36. Tuning Indicators
37. Vertical-Deflection Circuits
38. Video Amplifiers

1. AUDIO-FREQUENCY AMPLIFIERS

Voltage Amplifiers

Medium-Mu Triode with Twin Diode

□ 6BF6 ○ 6SR7 □ 12BF6 ○ 12SR7

Medium-Mu Triode—Sharp-Cutoff Pentode

□ 7199 †

Medium-Mu Twin Triode

□ 5J6 ○ 6SN7GTB □ 9AU7 ○ 12SN7GTA
□ 6J6A □ 7AU7 □ 12AU7A □ 19J6

High-Mu Triode

○ 12SF5

High-Mu Triode with Twin Diode

□ 3AV6 □ 6BN8 □ 12AT6 □ 14GT8
□ 4AV6 □ 6CN7 □ 12AV6 □ 18FY6
□ 6AT6 ○ 6SQ7 ○ 12SQ7 □ 18FY6A
□ 6AV6 ○ 6SQ7GT ○ 12SQ7GT

High-Mu Triode with Triple Diode

□ 5T8 □ 6T8A □ 19T8

High-Mu Twin Triode

□ 6EU7 † □ 12AX7A † □ 12AZ7A ○ 12SL7GT
○ 6SL7GT □ 12AZ7 □ 12BZ7 □ 20EZ7
□ 12AX7 † □ 7025 †

Sharp-Cutoff Pentode

□ 3DT6A* □ 5GX6* □ 6GX6* □ 5879 †
□ 4DT6A* □ 6DT6A* □ 6HZ6* □ 7543 †

Remote-Cutoff Pentode with Diode

□ 12CR6

Power Amplifiers

Power Triode

2A3

□ Miniature
○ Octal
* Dual-control grids
† For high-fidelity equipment

World Radio History

Twin Diode—High-Mu Triode

☐ 3AV6 ☐ 6BN8 ☐ 12AT6 ☐ 14GT8
☐ 4AV6 ☐ 6CN7 ☐ 12AV6 ☐ 18FY6
☐ 6AT6 ○ 6SQ7 ○ 12SQ7 ☐ 18FY6A
☐ 6AV6 ○ 6SQ7GT ○ 12SQ7GT

Triple Diode

☐ 6BJ7

Triple Diode—High-Mu Triode

☐ 5T8 ☐ 6T8A ☐ 19T8

Quadruple Diode

☐ 6JU8

Sharp-Cutoff Pentode

☐ 3DT6A* ☐ 5GX6* ☐ 6DT6A* ☐ 6GX6*
☐ 4DT6A* ☐ 6HZ6*

12. DC RESTORERS

Diode—Sharp-Cutoff Pentode

☐ 5AM8 ☐ 5AS8 ☐ 6AM8A ☐ 6AS8

Triple Diode

☐ 6BJ7

13. DISCRIMINATORS

FM

Twin Diode

☐ 3AL5 ☐ 6AL5 ☐ 12AL5

Twin Diode—High-Mu Triode

☐ 6BN8 ☐ 14GT8

Triple Diode—High-Mu Triode

☐ 5T8 ☐ 6T8A ☐ 19T8

Beam Tube

☐ 3BN6 ☐ 4BN6 ☐ 6BN6

RECEIVING-TUBE GUIDE - 2

FM Quadrature-Grid

Sharp-Cutoff Pentode

☐ 3DT6A* ☐ 5GX6* ☐ 6DT6A* ☐ 6GY6*
☐ 4DT6A* ☐ 5GY6* ☐ 6GX6* ☐ 6HZ6*

Beam Tube

☐ 3BN6 ☐ 4BN6 ☐ 6BN6

Horizontal AFC

Twin Diode—High-Mu Triode

☐ 6BN8 ☐ 6CN7

14. FREQUENCY DIVIDERS

High-Mu Twin Double-Plate Triode

☐ 12FQ8

15. FM DETECTORS (See *13. DISCRIMINATORS*)

16. GATED NOISE, AGC, AND SYNC AMPLIFIERS

High-Mu Triode—Sharp-Cutoff Pentode

☐ 6KA8 ☐ 8KA8

Sharp-Cutoff Pentode

☐ 6GY6*

Pentagrid Amplifier

☐ 3BY6 ☐ 3CS6 ☐ 6BY6 ☐ 6CS6

17. HARMONIC GENERATORS
(See *7. COMPLEX-WAVE GENERATORS*)

18. HORIZONTAL-DEFLECTION CIRCUITS

Oscillators

Medium-Mu Triode—Sharp-Cutoff Pentode

☐ 5GH8 ☐ 6GH8 ☐ 6GH8A

☐ Miniature ○ Octal * Dual-control grids

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6. COLOR MATRIXING CIRCUITS

Medium-Mu Twin Triode

□ 6CG7	□ 6GU7	□ 8CG7	□ 8FQ7
□ 6FQ7			□ 12BH7A

7. COMPLEX-WAVE GENERATORS

High-Mu Twin Double-Plate Triode

□ 12FQ8

Sharp-Cutoff Twin-Plate Tetrode—Diode

□ 6FA7

Sharp-Cutoff Three-Plate Tetrode—Diode

□ 6KM8

Sharp-Cutoff Three-Plate Tetrode—Medium-Mu Triode

□ 6FH8

8. CONVERTERS

Medium-Mu Triode—Sharp-Cutoff Pentode

□ 5EA8	□ 5U8	□ 6GH8	□ 6U8A
□ 5GH8	□ 5X8	□ 6GH8A	□ 6X8
□ 5KE8	□ 6EA8	□ 6KE8	□ 19X8

High-Mu Twin Triode

□ 6DT8	□ 12AZ7	□ 12AZ7A	□ 12DT8
□ 12AT7			

Sharp-Cutoff Pentode

□ 6AU6	□ 12AU6	□ 18GD6A

Pentagrid

□ 6BA7	○ 6SA7GT	□ 12BE6	○ 12SA7GT
□ 6BE6	□ 12BA7	○ 12SA7	□ 18FX6
○ 6SA7			□ 18FX6A

9. DAMPERS

Half-Wave (Diode)

○ 6AU4GTA	○ 6DA4	▲ 12BS3	○ 17D4
○ 6AX4GT	○ 6DE4	○ 12D4	○ 17DE4
○ 6AX4GTB	○ 6DM4	○ 12DM4	○ 17DM4
▲ 6AY3	▲ 6DW4	○ 17AX4GT	○ 19AU4
▲ 6BA3	○ 6W4GT	○ 17AX4GTA	○ 19AU4GTA
▲ 6BH3	○ 12AX4GTA	▲ 17AY3	▲ 22BH3
▲ 6BS3	○ 12AX4GTB	▲ 17BH3	○ 22DE4
○ 6CQ4	▲ 12AY3	▲ 17BS3	○ 25AX4GT

10. DEMODULATORS (COLOR TV)

Medium-Mu Twin Triode

□ 12BH7A

High-Mu Twin Triode

□ 12AZ7 □ 12AZ7A

Sharp-Cutoff Pentode

□ 6GY6

Pentagrid Amplifier

□ 6BY6

11. DETECTORS

Diode—Sharp-Cutoff Pentode

□ 5AM8	□ 6AM8A	□ 6AS8	□ 6KL8
□ 5AS8			□ 12KL8

Diode—Remote-Cutoff Pentode

□ 6EQ7	□ 12CR6	□ 12EQ7	□ 20EQ7

Twin Diode

□ 3AL5	○ 6H6	□ 12AL5	○ 12H6
□ 6AL5			

Twin Diode—Medium-Mu Triode

□ 12BF6

□ Miniature ○ Octal ▲ Novar

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21. MIXERS — RF

Medium-Mu Twin Triode

□ 5J6 □ 6J6A □ 12AV7 □ 19J6

High-Mu Triode

◇ 2CW4 □ 6AB4 ◇ 6CW4

22. MIXER-OSCILLATORS—RF

Medium-Mu Triode—Sharp-Cutoff Tetrode

□ 5CL8A □ 5CQ8 □ 6CL8A □ 6CQ8

Medium-Mu Triode—Sharp-Cutoff Pentode

□ 5AT8 □ 5KE8 □ 6BR8A □ 6KE8
□ 5B8 □ 5U8 □ 6CG8A □ 6U8A
□ 5BR8 □ 5X8 □ 6EA8 □ 6X8
□ 5CG8 □ 6AT8A □ 6FG7 □ 19EA8
□ 5EA8 □ 19X8

High-Mu Twin Triode

□ 6DT8 □ 12AT7 □ 12DT8

23. MULTIVIBRATORS

Medium-Mu Triode—Sharp-Cutoff Pentode

□ 5GH8 □ 6GH8 □ 6GH8A

Medium-Mu Twin Triode

□ 6CG7 ○ 6SN7GTB □ 9AU7 ○ 12SN7GTA
□ 6GU7 □ 7AU7 □ 12AU7A

High-Mu Twin Triode

□ 12AX7 □ 12AX7A

24. NOISE INVERTERS

High-Mu Triode—Sharp-Cutoff Pentode

□ 6KA8 □ 8KA8

Sharp-Cutoff Pentode

□ 6GY6 *

25. OSCILLATORS

Radio Frequency—UHF

Medium-Mu Triode

□ 2AF4B □ 3AF4A □ 6AF4 ◇ 6DV4
◇ 2DV4 □ 3DZ4 □ 6AF4A □ 6DZ4
□ 2DZ4

Radio Frequency—VHF

Medium-Mu Twin Triode

□ 5J6 □ 6J6A □ 12AV7 □ 19J6

High-Mu Triode

□ 6AB4

Power Triode

□ 6C4 (Class C)

Low Frequency, Sweep Type

Medium-Mu Triode—Sharp-Cutoff Pentode

□ 5AN8 □ 6AZ8 □ 6BH8 □ 6CU8
□ 6AN8A □ 6BA8A □ 6CH8 □ 6CX8
□ 6AU8A □ 8CX8

High-Mu Triode with Twin Diode

□ 6BN8 □ 6CN7

High-Mu Triode—Sharp-Cutoff Pentode

□ 6AW8A □ 8AW8A

High-Mu Twin Triode

□ 12AX7 □ 12AX7A

26. PHASE INVERTERS

Medium-Mu Triode—High-Mu Triode

□ 12DW7

□ **Miniature** ○ **Octal** ◇ **Nuvistor** * **Dual-control grids**

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Medium-Mu Twin Triode

□ 6CG7	□ 7AU7	□ 8FQ7	□ 12AU7
□ 6FQ7	□ 8CG7	□ 9AU7	□ 12BH7A
○ 6SN7GTB			○ 12SN7GTA

Amplifiers

Beam Power Tube

○ 6AU5GT	○ 6EX6	○ 12DQ6A	▲ 17GT5
○ 6AV5GA	▲ 6GJ5	○ 12DQ6B	○ 17GW6
○ 6BG6A	▲ 6GT5	▲ 12GJ5	▲ 17JB6
○ 6BQ6GTB/ 6CU6	○ 6GW6	▲ 12GT5	▲ 22JG6
	▲ 6JB6	○ 12GW6	○ 25AV5GA
○ 6CB5A	▲ 6JE6	▲ 12JB6	○ 25BQ6GTB/ 25CU6
○ 6CD6GA	○ 12AV5GA	○ 17BQ6GTB	
○ 6DN6	○ 12BQ6GTB/ 12CU6	○ 17DQ6B	○ 25CD6GB
○ 6DQ5		▲ 17GJ5	○ 25DN6
○ 6DQ6B			

19. INTERMEDIATE-FREQUENCY AMPLIFIERS

Medium-Mu Triode—Sharp Cutoff Tetrode

□ 5CQ8	□ 6CQ8

Medium-Mu Triode—Sharp-Cutoff Pentode

□ 5AN8	□ 6AZ8	□ 6CH8	□ 6CX8
□ 6AN8A	□ 6BH8	□ 6CU8	□ 8CX8
□ 6AU8A			

High-Mu Triode—Sharp-Cutoff Pentode

□ 6AW8A	□ 6JV8	□ 8AW8A	□ 8JV8
□ 6GN8	□ 6KV8	□ 8GN8	□ 10HF8
□ 6HF8			□ 11KV8

Sharp-Cutoff Pentode

□ 3AU6	□ 4EW6	□ 6AU6	□ 6EJ7
□ 3CB5	□ 4JC6	□ 6AU6A	□ 6EW6
□ 3CB6	□ 4JD6 ■	□ 6BC5	□ 6HS6
□ 3CF6	□ 5EW6	□ 6CB6	□ 6JC6
□ 3DK6	○ 6AB7	□ 6CB6A	□ 6JD6 ■
□ 3JC6	○ 6AC7	□ 6CF6	□ 12AU6
□ 3JD6 ■	□ 6AG5	□ 6DC6	□ 12AW6
□ 4AU6	□ 6AH6	□ 6DE6	□ 18GD6A
□ 4CB6	□ 6AK5	□ 6DK6	□ 19HS6

Sharp-Cutoff Pentode with Diode

□ 5AM8	□ 6AM8A	□ 6AS8	□ 6KL8
□ 5AS8			□ 12KL8

Semiremote-Cutoff Pentode

□ 3BZ6	□ 6BZ6	□ 6GM6	□ 6JH6
□ 4BZ6	□ 6EH7	□ 6HR6	□ 12BZ6
□ 5GM6			□ 19HR6

Remote-Cutoff Pentode

□ 6BA6	○ 6SK7GT	○ 12SK7	□ 18FW6
○ 6SK7	□ 12BA6	○ 12SK7GT	□ 18FW6A

Remote-Cutoff Pentode with Diode

□ 6EQ7	□ 12EQ7	□ 20EQ7

20. LIMITERS

Beam Tube

□ 3BN6	□ 4BN6	□ 6BN6

Sharp-Cutoff Pentode

□ 3AU6	□ 6AU6A	□ 6HS6	□ 12AU6
□ 4AU6	□ 6GX6	□ 6HZ6	□ 19HS6
□ 5GX6			

Sharp-Cutoff Pentode with Diode

□ 6KL8	□ 12KL8

□ Miniature ○ Octal ▲ Novar ■ Approaches semiremote-cutoff characteristic; used in first-if amplifier applications

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29. REACTANCE CIRCUITS

Medium-Mu Triode—Sharp-Cutoff Pentode

□ 5AN8 □ 6AZ8 □ 6BA8A □ 6CH8
□ 6AN8A □ 6CU8

High-Mu Triode with Twin Diodes

□ 6CN7

High-Mu Triode—Sharp-Cutoff Pentode

□ 6AW8A □ 8AW8A

30. RECTIFIERS

Power-Supply Types

Half-Wave (Diode)

□ 35W4 □ 36AM3A □ 36AM3B □ 50DC4
○ 35Z5GT

Full-Wave (Twin Diode)

○ 3DG4 ○ 5U4GB ○ 5Y3GT □ 6CA4
○ 5AS4A ○ 5V3A ○ 5Y4GT □ 6X4
▲ 5BC3 ○ 5V4G ○ 5Z4 ○ 6X5GT
○ 5DJ4 ○ 5V4GA ○ 6AX5GT □ 12X4

High-Voltage Types
(For rf-rectifier or pulsed low-current applications)

Half-Wave (Diode)

○ 1B3GT ○ 1J3 □ 1V2 ○ 3A3
○ 1G3GT/1B3GT ○ 1K3 □ 1X2B

31. REGULATORS

High-Voltage, Low Current

Sharp-Cutoff Beam Triode

○ 6BK4

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32. RELAY CONTROL CIRCUITS

Medium-Mu Twin Triode

□ 12FV7

High-Mu Twin Triode

□ 6EV7

33. SYNC AMPLIFIERS

Medium-Mu Triode—Sharp-Cutoff Pentode

□ 6AU8A □ 6AZ8 □ 6CX8 □ 8CX8

Medium-Mu Twin Triode

□ 6CG7 □ 7AU7 □ 12AU7A

High-Mu Triode with Twin Diode

□ 6CN7

High-Mu Triode—Sharp-Cutoff Pentode

□ 6AW8A □ 6JV8 □ 8AW8A □ 8JV8

High-Mu Twin Triode

□ 12BZ7

34. SYNC CLIPPERS

Medium-Mu Triode—Sharp-Cutoff Tetrode

□ 5CQ8 □ 6CQ8

Medium-Mu Triode—Sharp-Cutoff Pentode

□ 5AN8 □ 6AU8A □ 6CH8 □ 6CX8
□ 6AN8A □ 6AZ8 □ 6CU8 □ 8CX8

High-Mu Triode—Sharp-Cutoff Pentode

□ 6AW8A □ 6HF8 □ 8AW8A □ 8GN8
□ 6EB8 □ 6JV8 □ 8EB8 □ 8JV8
□ 6GW8 □ 10HF8

High-Mu Twin Triode

□ 12BZ7

□ Miniature ○ Octal ▲ Novar

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Medium-Mu Twin Triode

□ 6CG7 ○ 6SN7GTB □ 9AU7 ○ 12SN7GTA
□ 6GU7 □ 7AU7 □ 12AU7A

High-Mu Triode—Sharp-Cutoff Pentode

□ 6AW8A □ 6GN8 □ 8AW8A □ 8GN8
□ 6EB8 □ 6HF8 □ 8EB8 □ 10HF8

High-Mu Twin Triode

○ 6SL7GT □ 12AX7A ○ 12SL7GT □ 7025
□ 12AX7

27. PHASE SPLITTERS

Medium-Mu Triode—Sharp-Cutoff Tetrode

□ 5CQ8 □ 6CQ8

Medium-Mu Triode—Sharp-Cutoff Pentode

□ 5AN8 □ 6AZ8 □ 6CH8 □ 7199
□ 6AN8A □ 6BA8A □ 6CU8

High-Mu Triode—Sharp-Cutoff Pentode

□ 6AW8A □ 8AW8A

28. RADIO-FREQUENCY AMPLIFIERS

Medium-Mu Triode

□ 2BN4A □ 3BN4A □ 6BC4 □ 6BN4A

Medium-Mu Triode—Sharp-Cutoff Tetrode

□ 5CQ8 □ 6CQ8

Medium-Mu Twin Triode

□ 4BC8 □ 5BK7A □ 6BK7B □ 6FW8
□ 4BQ7A □ 5BQ7A □ 6BQ7A □ 6J6A
□ 4BS8 □ 5J6 □ 6BS8 □ 19J6
□ 4BZ7 □ 6BC8 □ 6BZ7

High-Mu Triode

◇ 2CW4 □ 3GK5 ◇ 6DS4 □ 6FQ5A
◇ 2DS4 □ 6AB4 □ 6ER5 □ 6GK5
□ 2FH5 ◇ 6CW4 □ 6FH5 ◇ 13CW4

High-Mu Twin Triode

□ 6DT8 □ 12AZ7 □ 12AZ7A □ 12DT8

Power Triode

□ 6C4 (Class C)

Sharp-Cutoff Tetrode

□ 2CY5 □ 3CY5 □ 6CY5 □ 6FV6

Sharp-Cutoff Pentode

□ 3AU6 ○ 6AB7 □ 6BH6 ○ 6SJ7
□ 3BC5 ○ 6AC7 □ 6CB6 □ 12AU6
□ 3CB6 □ 6AG5 □ 6CB6A □ 12AW6
□ 3CF6 □ 6AK5 □ 6CF6 ○ 12SJ7
□ 4AU6 □ 6AU6A □ 6DC6 □ 18GD6A
□ 4CB6 □ 6BC5 □ 6DE6

Sharp-Cutoff Pentode with Diode

□ 6KL8 □ 12KL8

Remote-Cutoff Pentode

□ 3BA6 ○ 6SK7 □ 12BA6 ○ 12SK7GT
□ 6BA6 ○ 6SK7GT ○ 12SK7 □ 18FW6
□ 6BJ6 □ 18FW6A

Remote-Cutoff Pentode with Diode

□ 6EQ7 □ 12EQ7 □ 20EQ7

□ Miniature ○ Octal ◇ Nuvistor

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Power Pentode

○ 6K6GT

38. VIDEO AMPLIFIERS

Medium-Mu Triode—Sharp-Cutoff Pentode

☐ 5AN8	☐ 6AZ8	☐ 6BH8	☐ 6CU8
☐ 6AN8A	☐ 6BA8A	☐ 6CH8	☐ 6CX8
☐ 6AU8A			☐ 8CX8

High-Mu Triode—Sharp-Cutoff Pentode

☐ 6AW8A	☐ 6HF8	☐ 8AW8A	☐ 8JV8
☐ 6EB8	☐ 6JV8	☐ 8EB8	☐ 10HF8
☐ 6GN8	☐ 6KV8	☐ 8GN8	☐ 11KV8

Sharp-Cutoff Pentode

☐ 12BY7A

Sharp-Cutoff Pentode with Diode

☐ 5AM8	☐ 5AS8	☐ 6AM8A	☐ 6AS8

Beam Power Tube

☐ 25BK5

Power Pentode

○ 6AG7	☐ 6CL6	☐ 6GK6

☐ Miniature ○ Octal

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Sharp-Cutoff Twin Pentode

□ 3BU8 □ 4BU8 □ 4GS8 □ 6BU8
□ 3GS8 □ 6HS8

Pentagrid Amplifier

□ 3BY6 □ 3CS6 □ 6BY6 □ 6CS6

35. SYNC SEPARATORS

Medium-Mu Triode—Sharp-Cutoff Tetrode

□ 5CQ8 □ 6CQ8

Medium-Mu Triode—Sharp-Cutoff Pentode

□ 5AN8 □ 6AU8A □ 6CU8 □ 6GH8A
□ 5GH8 □ 6AZ8 □ 6CX8 □ 8CX8
□ 6AN8A □ 6CH8 □ 6GH8

Medium-Mu Twin Triode

□ 6CG7 □ 7AU7 □ 12AU7A

High-Mu Triode with Twin Diode

□ 6CN7

High-Mu Triode—Sharp-Cutoff Pentode

□ 6AW8A □ 6JV8 □ 8AW8A □ 8JV8
□ 6EB8 □ 6KA8 □ 8EB8 □ 8KA8
□ 6GN8 □ 6KV8 □ 8GN8 □ 10HF8
□ 6HF8 □ 11KV8

High-Mu Twin Triode

□ 12BZ7

Sharp-Cutoff Twin Pentode

□ 3BU8 □ 4BU8 □ 4GS8 □ 6BU8
□ 3GS8 □ 6HS8

Pentagrid Amplifier

□ 3BY6 □ 3CS6 □ 6BY6 □ 6CS6

Pentagrid Amplifier

□ 3BY6 □ 3CS6 □ 6BY6 □ 6CS6

36. TUNING INDICATORS

Indicator with Triode Unit

6E5 6U5

Twin Indicator Units

○ 6AF6G

37. VERTICAL-DEFLECTION CIRCUITS

Oscillators and Amplifiers (Combined)

Medium-Mu Triode—Low-Mu Triode

□ 6DE7 □ 6EW7 □ 10DE7 □ 13DE7

Medium-Mu Dual Triode

□ 6CM7 □ 6CS7 □ 8CM7

High-Mu Triode—Low-Mu Triode

□ 6CY7 ▲ 6FD7 □ 10DR7 ○ 13EM7
□ 6DR7 ▲ 6GF7 ○ 10EM7 ▲ 13FD7
□ 6EA7 ○ 6GL7 ▲ 10GF7 ▲ 13GF7
○ 6EM7

High-Mu Triode—Beam Power Tube

▲ 15KY8

Amplifiers

Low-Mu Triode

□ 12B4A

Medium-Mu Triode

□ 6S4A

Beam Power Tube

□ 5AQ5 ○ 5V6GT □ 6CM6 □ 6EM5
□ 5CZ5 □ 6AQ5A □ 6CZ5 □ 8EM5

□ Miniature ○ Octal ▲ Novar

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RCA RECEIVING-TUBE DATA

Types Not Recommended for New Equipment Design

Type	Name	Tube Dimensions and Basing Diagram△ Dim.	B. D.	Heater or Filament (F) Volts	Amps.	Use	Plate Supply Volts	Grid Bias Volts (v) or Cathode Resistor Ohms (Ω)	Screen Supply Volts	Screen Current Ma.	Plate Current Ma.	AC Plate Resistance Ohms	Transconductance Micromhos	Amplification Factor	Load for Stated Power Output Ohms	Power Output Watts
				Unless specified all types have heaters. ⊕ Heater with controlled warmup time.		Values to right give operating conditions and characteristics for indicated typical use										
1X2-A	Half-Wave Rectifier	B13	9Y	1.25F	0.2	Pulsed Rectifier in TV Receivers	Max. Peak Inverse Plate Volts, 20000 Max. Peak Plate Ma., 45					Max. Average Plate Ma., 0.5				
2A3	Power Triode	K11	4D	2.5F	2.5	Class A Amplifier	250	−45v	—	—	60.0	800	5250	4.2	2500	3.5
						Push-Pull Class AB_1 Amplifier	300 300	780Ω♠ −62v	—	—	80.0♠ 80.0♠	—	—	—	5000 3000	10.0† 15.0†
2AF4-B	Medium-Mu Triode	A1	7DK	2.35⊕	0.6	Class A Amplifier	80	150Ω	—	—	17.5	2100	6500	13.5	—	—
						Oscillator at 1000 Mc.	100	Grid Res., 10000 ohms			17	Grid Current (Approx.), 750 μa.				
2DZ4	Medium-Mu Triode	A1	7DK	2.35⊕	0.6	UHF Oscillator in TV Receivers	13[illegible]	10000 Ω	—	—	15.5	Plate-Circuit Resistance; 2700 ohms				
2EN5	Twin Diode	A2	7FL	2.1⊕	0.45	Horizontal Phase Detector	Max. Peak Heater-Cathode Volts, ±200 DC Volts Not to Exceed +100					Max. DC Plate Ma., 5				
3A2	Half-Wave Rectifier	B5	9DT	3.15	0.22	Pulsed Rectifier in TV Receivers	Max. Peak Inverse Plate Volts, 18000 Max. Peak Plate Ma., 80					Max. Average Plate Ma., 1.5				
3B2	Half-Wave Rectifier	F38	8GH	3.15	0.22	Pulsed Rectifier in TV Service	Max. Peak Plate Ma. 80 Max. Total DC & Peak Inverse Plate Volts, 35000 (Abs.)					Max. DC Inverse Plate Volts, 25000 Max. Average Plate Ma., 1.1				
3GS8/ 3BU8	Sharp-Cutoff Twin Pentode	B4	9LW	3.15⊕	0.6	Class A Amplifier (With both sections operating)	For other characteristics, refer to Type 4GS8/4BU8.									
3LF4	Beam Power Tube	J2	6BA	1.4F 2.8F	0.1 0.05	Class A Amplifier	For other characteristics, refer to Type 3Q5-GT.									
3Q4	Power Pentode	A2	7BA	1.4F 2.8F	0.1 0.05	Class A Amplifier	For other characteristics, refer to Type 3V4									
3Q5-GT	Beam Power Tube	F6	7AP	1.4F 2.8F	0.1 0.05	Class A Amplifier	110 110	− 6.6v − 6.6v	110 110	1.4 1.1	10.0 8.5	100000 110000	2200 2000	—	8000 8000	0.40 0.33
3S4	Power Pentode	A2	7BA	1.4F 2.8F	0.1 0.05	Class A Amplifier	90 90	− 7v − 7v	67.5 67.5	1.4 1.1	7.4 6.1	100000 100000	1575 1425	— —	8000 8000	0.27 0.235
3V4	Power Pentode	A2	6BX	1.4F 2.8F	0.1 0.05	Class A Amplifier	90 90	− 4.5v − 4.5v	90 90	2.1 1.7	9.5 7.7	100000 120000	2150 2000	— —	10000 10000	0.27 0.24
4GS8/ 4BU8	Sharp-Cutoff Twin Pentode	B4	9LW	4.2⊕	0.45	Class A Amplifier (With both sections operating)	100	:	67.5	6.0	—	Grid-No. 3 volts, each section, −10				
							100	:	67.5	3.6	2.0	Grid-No. 3 volts, each section, 0				
									: Grid current adjusted for 100 microamperes DC							
5AZ4	Full-Wave Rectifier	J3	5T	5.0F	2.0	With Capacitive-Input Filter	Max. AC Volts per Plate (RMS), 350 Max. Peak Inverse Volts, 1400					Max. DC Output Ma., 125 Max. Peak Plate Ma., 440			Min. Total Effect. Supply Imped. per Plate, 50 ohms	
5BE8	Medium-Mu Triode—Sharp-Cutoff Pentode	B2	9EG	4.7⊕	0.6	Triode Unit as Class A Amplifier	150	56Ω	—	—	18	5000	8500	40	—	—
						Pentode Unit as Class A Amplifier	250	68Ω	110	3.5	10	400000	5200	—	—	—
5BT8	Twin-Diode—Sharp-Cutoff Pentode	B2	9FE	4.7⊕	0.6	Class A Amplifier	200	180Ω	150	2.8	9.5	300000	6200	—	—	—
5DH8	High-Mu Triode—Sharp-Cutoff Pentode	B2	9EG	5.2⊕	0.6	Triode Unit as Class A Amplifier	250	390Ω	—	—	7.3	12000	4400	53	—	—
						Pentode Unit as Class A Amplifier	125	56Ω	125	3.8	13.5	150000	8600	—	—	—
5DJ4	Full-Wave Rectifier	F25	8KS	5.0F	3.0	With Capacitive-Input Filter	Max. DC Output Ma., 300 for AC Volts per Plate, 500 and Min. Total Effect. Supply Imped. per Plate, 83 ohms					Max. Peak Inverse Volts, 1700 Max. Peak Plate Ma. per Plate, 1000				
						With Inductive-Input Filter	Max. DC Output Ma., 300 for AC Volts per Plate, 600 Max. Peak Inverse Volts, 1700					Max. Peak Plate Ma. per Plate, 1000				

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RCA RECEIVING-TUBE DATA

Types Not Recommended for New Equipment Design

Type	Name	Tube Dimensions and Basing Diagram△ Dim.	B. D.	Heater or Filament (F) Unless specified all types have heaters. ⊕ Heater with controlled warmup time. Volts	Amps.	Use Values to right give operating conditions and characteristics for indicated typical use	Plate Supply Volts	Grid Bias Volts (v) or Cathode Resistor Ohms (Ω)	Screen Supply Volts	Screen Current Ma.	Plate Current Ma.	AC Plate Resistance Ohms	Transconductance Micromhos	Amplification Factor	Load for Stated Power Output Ohms	Power Output Watts
0Z4	Full-Wave Gas Rectifier	E2 F2	4R	—	—	Rectifier	Starting-Supply Voltage per Plate, 300 min. peak volts. DC Output Current, 75 max., 30 min. ma. Peak Plate Current, 200 max. ma. DC Output Voltage, 300 max. volts.									
0Z4-G	Full-Wave Gas Rectifier	E2 F2	4R	—	—	Rectifier	Starting-Supply Voltage per Plate, 300 min. peak volts. DC Output Current, 75 max., 30 min. ma. Peak Plate Current, 200 max. ma. DC Output Voltage, 300 max. volts.									
1A3	Diode	A2	5AP	1.4	0.15	Rectifier	Max. Peak Plate Inverse Volts, 330 Max. Peak Plate Ma., 5 Max. DC Output Ma., 0.5 Max. Peak Heater-Cathode Volts, 140									
1A5-GT	Power Pentode	F6	6X	1.4F	0.05	Class A Amplifier	85 90	− 4.5v − 4.5v	85 90	0.7 1.1	3.5 4.0	300000 300000	800 850	—	25000 25000	0.100 0.115
1A7-GT	Pentagrid Converter ⊕	F7	7Z✱	1.4F	0.05	Converter	90	0v	45	0.7	0.6	600000	Anode-Grid (#2): 90 volts, 1.2 ma. Oscillator-Grid (#1) Resistor, 0.2 meg. Conversion Transcond., 250 micromhos.			
1AX2	Half-Wave Rectifier	B8	9Y	1.4F	0.65	Pulsed Rectifier in TV Receivers	Max. Peak Inverse Plate Volts, 25000 Max. Peak Plate Ma., 45 Max. Average Plate Ma., 0.5									
1B3-GT	Half-Wave Rectifier	F20	3C	1.25F	0.2	Pulsed Rectifier in TV Receivers	Max. Peak Inverse Plate Volts, 26000 Max. Peak Plate Ma., 50 Max. Average Plate Ma., 0.5									
1DN5	Diode—Semiremote-Cutoff Pentode	A2	6BW	1.4F	0.5	Pentode Unit as Class A Amplifier	67.5	0v	67.5	0.55	2.1	600000	630	—	—	—
1H5-GT	Diode—High-Mu Triode	F7	5Z✱	1.4F	0.05	Triode Unit as Class A Amplifier	90	0v	—	—	0.15	240000	275	65	—	—
1J3	Half-Wave Rectifier	F20	3C	1.25F	0.2	Pulsed Rectifier in TV Receivers	Max. Peak Inverse Plate Volts, 26000 (Abs.) Max. Peak Plate Ma., 50 Max. Average Plate Ma., 0.5									
1L6	Pentagrid Converter ⊕	A2	7DC	1.4F	0.05	Converter	90	0v	45	0.6	0.5	650000	Anode-Grid (#2): 90 max. volts, 1.2 ma. Oscillator Grid (#1) Resistor, 0.2 meg. Conversion Transcond., 300 micromhos.			
1LA6	Pentagrid Converter ⊕	J2	7AK	1.4F	0.05	Converter	90	0v	65	0.6	0.55	750000	Total Cathode ma., 4. Conversion Transcond. (for grid-No. 4 bias of −3 volts), 10 micromhos.			
1LB4	Power Pentode	J2	5AD	1.4F	0.05	Class A Amplifier	90	− 9v	90	1.0	5.0	—	925	—	12000	0.200
1LH4	Diode—High-Mu Triode	J2	5AG	1.4F	0.05	Triode Unit as Class A Amplifier	For other characteristics, refer to Type 1H5-GT.									
1LN5	Sharp-Cutoff Pentode	J2	7AO	1.4F	0.05	Class A Amplifier	90	0v	90	0.35	1.6	1.1§	800	—	—	—
1N5-GT	Sharp-Cutoff Pentode	F7	5Y✱	1.4F	0.05	Class A Amplifier	90	0v	90	0.3	1.2	1.5§	750	—	—	—
1R5	Pentagrid Converter▲	A2	7AT	1.4F	0.05	Converter	45 90	0v 0v	45 67.5	2.1 3.5	0.7 1.5	500000 400000	Conversion Transcond., 210 μmhos. Conversion Transcond., 280 μmhos.			
1S4	Power Pentode	A2	7AV	1.4F	0.1	Class A Amplifier	45 90	− 4.5v − 7v	45 67.5	0.8 1.4	3.8 7.4	100000 100000	1250 1575	—	8000 8000	0.065 0.27
1S5	Diode—Sharp-Cutoff Pentode	A2	6AU	1.4F	0.05	Pentode Unit as AF Amplifier	Plate Supply, 90 v applied through 1 meg. resistor. Screen Supply, 90 v applied through 3.1 meg. resistor. Grid Bias, 0 volts. Grid Resistor, 10 megohms. Voltage Gain, 66 approx.									
1T4	Remote-Cutoff Pentode	A2	6AR	1.4F	0.05	Class A Amplifier	45 90	0v 0v	45 67.5	0.7 1.4	1.7 3.5	350000 500000	700 900	—	—	—
1U4	Sharp-Cutoff Pentode	A2	6AR	1.4F	0.05	Class A Amplifier	90	0v	90	0.50	1.1	1.0§	900	—	—	—
1U5	Diode—Sharp-Cutoff Pentode	A2	6BW	1.4F	0.05	Pentode Unit as Class A Amplifier	67.5	0v	67.5	0.4	1.6	600000	625	—	—	—
1-v	Half-Wave Rectifier	K4	4G	6.3	0.3	With Capacitive-Input Filter	Max. AC Plate Volts (RMS), 325 Max. DC Output Ma., 45 Min. Total Effective Plate-Supply Impedance: Up to 117 volts, 0 ohms; at 150 volts, 30 ohms; at 325 volts, 75 ohms.									

Note: For footnotes, see end of this section. △ For key to tube dimensions, description, and basing diagram, see end of this section.

World Radio History

Type	Name	Tube Dimensions and Basing Diagram△ Dim.	B. D.	Heater or Filament (F) Unless specified all types have heaters. ⊕ Heater with controlled warmup time. Volts	Amps.	Use Values to right give operating conditions and characteristics for indicated typical use	Plate Supply Volts	Grid Bias Volts (v) or Cathode Resistor Ohms (Ω)	Screen Supply Volts	Screen Current Ma.	Plate Current Ma.	AC Plate Resistance Ohms	Transconductance Micromhos	Amplification Factor	Load for Stated Power Output Ohms	Power Output Watts
6U5	Electron-Ray Tube	K3	6R	6.3	0.3	Visual Indicator	Plate & Target Supply = 250 volts. Triode Plate Resistor = 1.0 meg. Target Current = 4.0 ma. Grid Bias, −22 volts; Shadow Angle, 0°. Bias, 0 volts; Angle, 90°; Plate Current, 0.24 ma.									
6V6	Beam Power Tube	E4	7AC	6.3	0.45	Single-Tube Class A Amplifier	250 315	−12.5v −13v	250 225	4.5 2.2	45.0 34.0	50000 80000	4100 3750	— —	5000 8500	4.5 5.5
						Push-Pull Class AB₁ Amplifier	250 285	−15v −19v	250 285	5.0♠ 4.0♠	70.0♠ 70.0♠	— —	— —	— —	10000 8000	10.0† 14.0†
6Y6-G	Beam Power Tube	F28	7AC‡	6.3	1.25	Single-Tube Class A Amplifier	135 200	−13.5v −14v	135 135	3.5 2.2	58.0 61.0	9300 18300	7000 7100	— —	2000 2600	3.6 6.0
7A4	Medium-Mu Triode	J2	5AC	6.3	0.3	Amplifier	For other characteristics, refer to Type 6J5.									
7A5	Beam Power Tube	J3	6AA	6.3	0.75	Class A Amplifier	110 125	− 7.5v − 9v	110 125	3.0 3.3	40.0 44.0	16000 17000	5800 6000	—	2500 2700	1.5 2.2
7A6	Twin Diode	J2	7AJ	6.3	0.15	Detector Rectifier	Max. AC Voltage per Plate, 150 Volts, RMS Max. DC Output Current per plate, 8 Ma.									
7A7	Remote-Cutoff Pentode	J2	8V	6.3	0.3	Class A Amplifier	For other characteristics, refer to Type 6SK7.									
7A8	Octode Converter	J2	8U	6.3	0.15	Converter	250	− 3v	100	3.2	3.0	700000	Anode-Grid (#2): 250▲ max. volts, 4.2 ma. Oscillator-Grid (#1) Resistor ●. Conversion Transcond., 550 micromhos.			
7AF7	Medium-Mu Twin Triode	J2	8AC	6.3	0.3	Each Unit as Class A Amplifier	250	−10v	—	—	9.0	7600	2100	16	—	—
7AG7	Sharp-Cutoff Pentode	J2	8V	6.3	0.15	Class A Amplifier	250	250Ω	250	2.0	6.0	1 meg.	4200	—	—	—
7B4	High-Mu Triode	J2	5AC	6.3	0.3	Amplifier	For other characteristics, refer to Type 6SF5.									
7B7	Remote-Cutoff Pentode	J2	8V	6.3	0.15	Class A Amplifier	250	− 3v	100	1.7	8.5	750000	1750	—	—	—
7B8	Pentagrid Converter⊕	J2	8X	6.3	0.3	Converter	For other characteristics, refer to Type 6A8.									
7C5	Beam Power Tube	J3	6AA	6.3	0.45	Class A Amplifier	For other characteristics, refer to Type 6V6.									
7C6	Twin Diode—High-Mu Triode	J2	8W	6.3	0.15	Triode Unit as Class A Amplifier	250	− 1v	—	—	1.3	100000	1000	100	—	—
7C7	Sharp-Cutoff Pentode	J2	8V	6.3	0.15	Class A Amplifier	250	− 3v	100	0.5	2.0	2.0§	1300	—	—	—
7F7	High-Mu Twin Triode	J2	8AC	6.3	0.3	Each Unit as Class A Amplifier	250	− 2v	—	—	2.3	44000	1600	70	—	—
7F8	Medium-Mu Twin Triode	J2	8BW	6.3	0.3	Each Unit as Class A Amplifier	250	500Ω	—	—	6.0	—	3300	48	—	—
7H7	Semiremote-Cutoff Pentode	J2	8V	6.3	0.3	Class A Amplifier	100 250	− 1.5v 180Ω	100 150	2.6 3.2	7.5 10.0	350000 800000	4000 4000	— —	— —	— —
7J7	Triode-Heptode Converter	J2	8BL	6.3	0.3	Triode Unit as Oscillator	250▲	Triode-Grid Resistor, 50000 ohms			5.0	Triode-Grid & Heptode-Grid Current, 0.4 ma.				
						Heptode Unit as Mixer	250	− 3v	100	2.8	1.4	1.5§	Conversion Transcond., 290 μmhos.			
7K7	Twin Diode—High-Mu Triode	J2	8BF	6.3	0.3	Triode Unit as Class A Amplifier	250	− 2v	—	—	2.3	44000	1600	70	—	—
7N7	Medium-Mu Twin-Triode	J3	8AC	6.3	0.6	Each Unit as Class A Amplifier	90 250	0v − 8v	— —	— —	10.0 9.0	6700 7700	3000 2600	20 20	— —	— —
7V7	Sharp-Cutoff Pentode	J2	8V	6.3	0.45	Class A Amplifier	300	160Ω	150	3.9	10.0	300000	5800	—	—	—

World Radio History

RCA RECEIVING-TUBE DATA

Types Not Recommended for New Equipment Design

Type	Name	Tube Dimensions and Basing Diagram△ Dim.	B. D.	Heater or Filament (F) Unless specified all types have heaters. ⊕ Heater with controlled warmup time. Volts	Amps.	Use Values to right give operating conditions and characteristics for indicated typical use	Plate Supply Volts	Grid Bias Volts (v) or Cathode Resistor Ohms (Ω)	Screen Supply Volts	Screen Current Ma.	Plate Current Ma.	AC Plate Resistance Ohms	Transconductance Micromhos	Amplification Factor	Load for Stated Power Output Ohms	Power Output Watts
6K8	Triode-Hexode Converter	E3	8K	6.3	0.3	Triode Unit as Oscillator	100	Grid Res., 50000 ohms			3.8	Triode-Grid & Hexode-Grid Current, 0.15 ma.				
						Hexode Unit as Mixer	100 250	− 3v − 3v	100 100	6.2 6.0	2.3 2.5	400000 600000	Conversion Transcond., 325 micromhos. Conversion Transcond., 350 micromhos.			
6KL8	Diode—Sharp-Cutoff Pentode	B4	9LQ	6.3	0.3	Pentode Unit as Class A Amplifier	100	2.2 MΩ Grid. Res	100	2.2	5.5	550000	4300	—	—	—
6L6-GB	Beam Power Tube	F22	7AC	6.3	0.9	Single-Tube Class A Amplifier	250 250	−14v 168Ω	250 250	5.0 5.4	72.0 75.0	— —	— —	— —	2500 2500	6.5 6.5
						Push-Pull Class A Amplifier	270 270	−17.5v 124Ω♠	270 270	11.0♠ 11.0♠	134.0♠ 134.0♠	— —	— —	— —	5000 5000	17.5† 18.5†
						Push-Pull Class AB_1 Amplifier	360 360	−22.5v 248Ω♠	270 270	5.0♠ 5.0♠	88.0♠ 88.0♠	— —	— —	— —	6600 9000	26.5† 24.5†
6L7	Pentagrid Mixer▲	E3	7T	6.3	0.3	Mixer Service	250	− 6v	150	9.2	2.3	Oscillator-Grid (No. 3) Bias, −15 volts. Grid-No. 3 Peak Swing, 16 volts minimum. Conversion Transcond., 350 micromhos.				
6N7 6N7-GT	Medium-Mu Twin Power Triode	E4 F6	8B 8B‡	6.3	0.8	Class A Amplifier (as Driver)°	250 300	− 5v − 6v	—	—	6.0 7.0	11300 11000	3100 3200	35 35	20000 or more	exceeds 0.4
						Class B Amplifier	300	0v	Power Output for 1 tube at stated plate-to-plate load.						8000	10.0
6Q7	Twin Diode High-Mu Triode	E3	7V	6.3	0.3	Triode Unit as Class A Amplifier	100 250	− 1v − 3v	—	—	0.8 1.1	58000 58000	1200 1200	70 70	—	—
6R7	Twin Diode—Medium-Mu Triode	E3	7V	6.3	0.3	Triode Unit as Class A Amplifier	250	− 9v	—	—	9.5	8500	1900	16	—	—
6S8-GT	Triple Diode—High-Mu Triode	F6	8CB	6.3	0.3	Triode Unit as Class A Amplifier	250	− 2v	—	—	0.9	91000	1100	100	—	—
6SB7-Y	Pentagrid Converter▲	E2	8R	6.3	0.3	Mixer	100	− 1v	100	10.2	3.6	500000	Grid-No. 1 Resistor, 20000 ohms Conversion Transcond., 950 micromhos			
6SC7	High-Mu Twin Triode	E2	8S	6.3	0.3	Each Unit as Amplifier	250	− 2v	—	—	2.0	53000	1325	70	—	—
6SF5 6SF5-GT	High-Mu Triode	E2 F6	6AB 6AB‡	6.3	0.3	Class A Amplifier	250	− 2v	—	—	0.9	66000	1500	100	—	—
6SF7	Diode—Remote-Cutoff Pentode	E2	7AZ	6.3	0.3	Pentode Unit as Class A Amplifier	100 250	− 1v − 1v	100 100	3.4 3.3	12.0 12.4	200000 700000	1975 2050	—	—	—
6SG7	Semiremote-Cutoff Pentode	E2	8BK	6.3	0.3	Class A Amplifier	100 250	− 1v − 2.5v	100 150	3.2 3.4	8.2 9.2	250000 1.0§	4100 4000	— —	— —	— —
6SH7	Sharp-Cutoff Pentode	E2	8BK	6.3	0.3	Class A Amplifier	100 253	− 1v − 1v	100 150	2.1 4.1	5.3 10.8	350000 900000	4000 4900	—	—	—
6SK7 6SK7-GT	Remote-Cutoff Pentode	E2 F7	8N 8N‡	6.3	0.3	Class A Amplifier	100 250	− 1v − 3v	100 100	4.0 2.6	13.0 9.2	120000 800000	2350 2000	—	—	—
6SR7	Twin Diode—Medium-Mu Triode	E2	8Q	6.3	0.3	Triode Unit as Class A Amplifier	250	− 9v	—	—	9.5	8500	1900	16	—	—
6SS7	Remote-Cutoff Pentode	E2	8N	6.3	0.15	Class A Amplifier	250	− 3v	100	2.0	9.0	1.0§	1850	—	—	—
6T4	Medium-Mu Triode	A1	7DK	6.3	0.225	Oscillator in UHF TV Receivers	Max. DC Plate Volts, 200 Max. DC Cathode Ma., 30						Max. Grid Ma., 8 Max. Plate Dissipation, 3.5 watts			
						Class A Amplifier	80	150Ω	—	—	18	—	7000	13	—	—

World Radio History

Type	Name	Tube Dimensions and Basing Diagram△ Dim.	B. D.	Heater or Filament (F) Unless specified all types have heaters. ⊕ Heater with controlled warmup time. Volts	Amps.	Use Values to right give operating conditions and characteristics for indicated typical use	Plate Supply Volts	Grid Bias Volts (v) or Cathode Resistor Ohms (Ω)	Screen Supply Volts	Screen Current Ma.	Plate Current Ma.	AC Plate Resistance Ohms	Transconductance Micromhos	Amplification Factor	Load for Stated Power Output Ohms	Power Output Watts
6EH8	Medium-Mu Triode—Sharp-Cutoff Pentode	B2	9JG	6.3⊕	0.45	Triode Unit as Class A Amplifier	125	−1v	—	—	13.5	—	7500	40	—	—
						Pentode Unit as Class A Amplifier	125	−1v	125	4	12	170000	6000	—	—	—
6EV7	High-Mu Twin Triode	B4	9LP	6.3	0.6	Relay Control	250 150	0v 0v	— —	— —	18.5 10.0	Grid Volts for Plate μa, 100 = −9 2500-ohm Grid Volts for Plate μa, 100 = −5 relay				
6EX6	Beam Power Tube	F33	5BT	6.3⊕	2.25	Horizontal Deflection Amplifier	175	−30v	175	3.3	67	8500	7700	—	—	—
6EY6	Beam Power Tube	F9	7AC	6.3⊕	0.68	Vertical Deflection Amplifier	250	−17.5v	250	3	44	60000	4400	—	—	—
6EZ5	Beam Power Tube	F9	7AC	6.3	0.8	Vertical Deflection Amplifier	250	−20v	250	3.5	43	50000	4100	—	—	—
6F5	High-Mu Triode	E3	5M	6.3	0.3	Class A Amplifier	100 250	−1v −2v	—	—	0.4 0.9	85000 66000	1150 1500	100 100	—	—
6F6	Power Pentode	E4	7S	6.3	0.7	Pentode Class A Amplifier	250 285	−16.5v −20v	250 285	6.5 7.0	34.0 38.0	80000 78000	2500 2550	—	7000 7000	3.2 4.8
6F6-G		F28	7S‡			Triode□ Class A Amplifier	250	−20v	—	—	31.0	2600	2600	6.8	4000	0.85
6F6-GT		F9	7S‡			Pentode Push-Pull Class A Amplifier	315	−24v	285	12.0♠	62.0♠	—	—	—	10000	11.0†
6F7	Low-Mu Triode—Remote-Cutoff Pentode	K5	7E	6.3	0.3	Triode Unit as Class A Amplifier	100	−3v	—	—	3.5	16000	500	8	—	—
						Pentode Unit as Class A Amplifier	250	−3v	100	1.5	6.5	850000	1100	—	—	—
6F8-G	Medium-Mu Twin Triode	F24	8G	6.3	0.6	Each Unit as Class A Amplifier	For other characteristics, refer to Type 6J5.									
6FE5	Beam Power Tube	F15	8KB	6.3	1.2	Class A Amplifier	145	−16v	145	18	100	8000	9500	—	1000	5.6
6FW8	Medium-Mu Twin Triode	B2	9AJ	6.3	0.4	Each Unit as Class A Amplifier	100	1.2v	—	—	15	2500	13000	33	—	—
6G6-G	Power Pentode	F21	7S‡	6.3	0.15	Pentode Class A Amplifier	180	−9v	180	2.5	15.0	175000	2300	—	10000	1.1
6GV8	High-Mu Triode—Power Pentode	B3	9LY	6.3	0.9	Triode Unit as Class A Amplifier	100	−8V	—	—	5	7600	6500	50	—	—
						Pentode Unit as Class A Amplifier	170	−15V	170	2.7	41	25000	7500	7 Grid. No. 1 to Grid. No. 2		
6GY8	Triple High-Mu Triode	B2	9MB	6.3	0.45	Each Unit as Class A Amplifier	125	−1v	—	—	4.5	14000	4500	63	—	—
6J5 6J5-GT	Medium-Mu Triode	E2 F7	6Q 6Q✕	6.3	0.3	Class A Amplifier	90 250	0v −8v	— —	— —	10 9	6700 7700	3000 2600	20 20	— —	— —
6J7	Sharp-Cutoff Pentode	E3	7R	6.3	0.3	Pentode Class A RF Amplifier	100 250	−3v −3v	100 100	0.5 0.5	2.0 2.0	1.0§ 1.0§	1185 1225	— —	— —	— —
6K7 6K7-GT	Remote-Cutoff Pentode	E3 F7	7R 7R✕	6.3	0.3	Class A Amplifier	250	−3v	125	2.6	10.5	600000	1650	—	—	—

Note: For footnotes, see end of this section.

△ For key to tube dimensions, description, and basing diagram, see end of this section.

World Radio History

RCA RECEIVING-TUBE DATA

Types Not Recommended for New Equipment Design

Type	Name	Tube Dimensions and Basing Diagram△ Dim.	B. D.	Heater or Filament (F) Unless specified all types have heaters. ⊕ Heater with controlled warmup time. Volts	Amps.	Use Values to right give operating conditions and characteristics for indicated typical use	Plate Supply Volts	Grid Bias Volts (v) or Cathode Resistor Ohms (Ω)	Screen Supply Volts	Screen Current Ma.	Plate Current Ma.	AC Plate Resistance Ohms	Transconductance Micromhos	Amplification Factor	Load for Stated Power Output Ohms	Power Output Watts
6BY5-GA	Full-Wave Rectifier	F17	6CN	6.3	1.6	Television Damper Service	Max. Peak Inverse Plate Volts, 3000 (Abs.) Max. Peak Plate Ma., 525 Max. DC Plate Ma., 175 Max. Peak Heater-Cathode Volts: −450, +100									
6BZ8	Medium-Mu Twin Triode	B2	9AJ	6.3	0.4	Each Unit as Class A Amplifier	125	100Ω	—	—	10	5600	8000	45	—	—
6C5	Medium-Mu Triode	E2	6Q	6.3	0.3	Class A Amplifier	250	−8v	—	—	8.0	10000	2000	20	—	—
6C6	Sharp-Cutoff Pentode	K9	6F	6.3	0.3	Amplifier Detector	For other characteristics, refer to Type 6J7.									
6C8-G	Medium-Mu Twin-Triode	F24	8G	6.3	0.3	Each Unit as Class A Amplifier	250	−4.5v	—	—	3.2	22500	1600	36	—	—
6C9	Sharp-Cutoff Dual Tetrode	G1	10F	6.3	0.4	Each Unit as Class A Amplifier	125	−1V	80	1.5	10	100000	8000	—	—	—
6CH8	Medium-Mu Triode—Sharp-Cutoff Pentode	B2	9FT	6.3	0.45	Triode Unit as Class A Amplifier	200	−6v	—	—	13	5750	3300	19	—	—
						Pentode Unit as Class A Amplifier	200	180Ω	150	2.8	9.5	300000	6200	—	—	—
6CK4	Low-Mu Triode	F9	8JB	6.3	1.25	Vertical Deflection Amplifier	Max. DC Plate Volts, 550 Max. Peak Cathode Ma., 350 Max. Peak Positive-Pulse Plate Volts, 2000 (Abs.) Max. Plate Dissipation, 12 watts									
6CM8	High-Mu Triode—Sharp-Cutoff Pentode	B2	9FZ	6.3⊕	0.45	Triode Unit as Class A Amplifier	250	−2v	—	—	1.8	50000	2000	100	—	—
						Pentode Unit as Class A Amplifier	250	180Ω	150	2.8	9.5	600000	6200	—	—	—
6CR6	Diode—Remote-Cutoff Pentode	A2	7EA	6.3	0.3	Pentode Unit as Class A Amplifier	250	−2v	100	2.6	6	800000	2200	Grid-No. 1 Volts for transcond. of 10 micromhos, −32		
6D6	Remote-Cutoff Pentode	K9	6F	6.3	0.3	Class A Amplifier	250	−3v	100	2.0	8.2	800000	1600	—	—	—
6DC8	Twin Diode—Remote-Cutoff Pentode	B4	9HE	6.3	0.3	Class A Amplifier	250	−2v	100	2.7	9	1§	3800	—	—	—
6DM4	Half-Wave Rectifier	F15	4CG	6.3	1.2	Damper Service	Max. Peak Inverse Plate Volts, 5000 Max. Peak Plate Ma., 1100 Max. DC Plate Ma., 175 Max. Peak Heater—Cathode Volts, −5000 (DC Component Not to Exceed 900 Volts) Max. Peak Heater—Cathode Volts, +300 (DC Component Not to Exceed 100 Volts)									
6DN6	Beam Power Tube	F33	5BT	6.3	2.5	Horizontal Deflection Amplifier	Max. DC Plate Volts, 700 Max. DC Cathode Ma., 200 Max. Peak Positive-Pulse Plate Volts, 6600 (Abs.) Max. Plate Dissipation, 15 watts									
6DQ6-A	Beam Power Tube	F22	6AM	6.3	1.2	Horizontal Deflection Amplifier	Max. DC Plate Volts, 770 Max. DC Cathode Ma., 155 Max. Peak Positive-Pulse Plate Volts, 6000 (Abs.) Max. Plate Dissipation, 18 watts									
6DW5	Beam Power Tube	B10	9CK	6.3	1.2	Vertical Deflection Amplifier	Max. DC Plate Volts, 330 Max. DC Cathode Ma., 65 Max. Peak Positive-Pulse Plate Volts, 2200 Max. Plate Dissipation, 11 watts									
6DZ7	Twin Power Pentode	F17	8JP	6.3	1.52	Each Unit as Class A Amplifier	250	−7.3v	250	5.5	48	38000	11300	—	—	—
						Both Units as Push-Pull Class AB_1 Amplifier	400 300	−11v 120Ω	250 250	13 15	100 80	— —	— —	— —	9000 9000	18 12
6EH5	Power Pentode	A3	7CV	6.3	1.2	Class A Amplifier	110	62Ω	115	11.5	42	11000	14600	—	8000	1.4

Note: For footnotes, see end of this section.

△ For key to tube dimensions, description, and basing diagram, see end of this section.

World Radio History

RCA RECEIVING-TUBE DATA

Types Not Recommended for New Equipment Design

Type	Name	Tube Dimensions and Basing Diagram △ Dim.	B. D.	Heater or Filament (F) Unless specified all types have heaters. ⊕ Heater with controlled warmup time. Volts	Amps.	Use Values to right give operating conditions and characteristics for indicated typical use	Plate Supply Volts	Grid Bias Volts (v) or Cathode Resistor Ohms (Ω)	Screen Supply Volts	Screen Current Ma.	Plate Current Ma.	AC Plate Resistance Ohms	Transconductance Micromhos	Amplification Factor	Load for Stated Power Output Ohms	Power Output Watts
6AQ8	Medium-Mu Twin Triode	B2	9AJ	6.3	0.435	Each Unit as Class A Amplifier	250	−2v	—	—	10	9700	6000	57	—	—
6AR5	Power Pentode	A3	6CC	6.3	0.4	Class A Amplifier	250	−18v	250	5.5	32.0	90000	2300	—	7600	3.4
6AS5	Beam Power Tube	A3	7CV	6.3	0.8	Class A Amplifier	150	−8.5v	110	2.0	35	—	5600	—	4500	2.2
6AV5-GA	Beam Power Tube	F19	6CK	6.3	1.2	Horizontal Deflection Amplifier	Max. DC Plate Volts, 550; Max. DC Cathode Ma., 110; Max. Peak Positive-Pulse Plate Volts, 5500 (Abs.); Max. Plate Dissipation, 11 watts									
6AX8	Medium-Mu Triode—Semiremote Cutoff Pentode	B2	9AE	6.3	0.45	Triode Unit as Class A Amplifier	150	560Ω	—	—	18	5000	8500	40	—	—
						Pentode Unit as Class A Amplifier	250	120Ω	110	3.5	10	400000	4800	—	—	—
6B8	Twin-Diode—Semiremote-Cutoff Pentode	E3	8E	6.3	0.3	Pentode Unit as Amplifier	250	−3v	125	2.3	10	600000	1325	—	—	—
6BD6	Remote-Cutoff Pentode	A2	7BK	6.3	0.3	Class A Amplifier	250	−3v	100	3.0	9.0	800000	2000	—	—	—
6BF5	Beam Power Tube	A3	7BZ	6.3	1.2	Class A Amplifier	110	−7.5v	110	4.0	36.0	12000	7500	—	2500	1.9
6BF6	Twin-Diode—Medium-Mu Triode	A2	7BT	6.3	0.3	Triode Unit as Class A Amplifier	250	−9v	—	—	9.5	8500	1900	16	Power Output, 300 milliwatts	
6BG6-G 6BG6-GA	Beam Power Tube	F40 F33	5BT	6.3	0.9	Horizontal Deflection Amplifier	Max. DC Plate Volts, 700; Max. DC Cathode Ma., 110; Max. Peak Positive-Pulse Plate Volts, 6600 (Abs.); Max. Plate Dissipation, 20 watts									
6BH3	Novar Half-Wave Rectifier	C4	9HP	6.3	1.6	Television Damper Service	Max. Peak Inverse Plate Volts, 5500; Max. Peak Plate Ma., 1100; Max. DC Plate Ma., 180; Max. Peak Heater–Cathode Volts, −5500 (DC Component Not to Exceed 900 Volts); Max. Peak Heater–Cathode Volts, +300 (DC Component Not to Exceed 100 Volts)									
6BH8	Medium-Mu Triode—Sharp-Cutoff Pentode	B4	9DX	6.3⊕	0.6	Triode Unit as Class A Amplifier	150	−5v	—	—	9.5	5150	3300	17	—	—
						Pentode Unit as Class A Amplifier	200	82Ω	125	3.4	15	150000	7000	—	—	—
6BK4	Sharp-Cutoff Beam Triode	F34	8GC	6.3	0.2	Voltage-Control	Max. DC Plate Volts, 27000; Max. Unregulated DC Supply Volts, 60000; Max. DC Plate Ma., 1.6; Max. Plate Dissipation, 25 Watts									
6BK5	Beam Power Tube	B4	9BQ	6.3	1.2	Class A Amplifier	250	−5v	250	3.5	35	100000	8500	—	6500	3.5
6BS8	Medium-Mu Twin Triode	B2	9AJ	6.3	0.4	Each Unit as Class A Amplifier	150	220Ω	—	—	10	5000	7200	36	—	—
6BV8	Twin Diode—Medium-Mu Triode	B2	9FJ	6.3⊕	0.6	Triode Unit as Class A Amplifier	200	330Ω	—	—	11	5900	5600	33	—	—
6BW4	Full-Wave Rectifier	B4	9DJ	6.3	0.9	With Capacitive Input Filter	Max. AC Volts per Plate (RMS), 325; Max. Peak Inverse Volts, 1275; Max. DC Output Ma., 62.5; Max. Peak Plate Ma. per Plate, 350; Total Effect. Supply Imped. per Plate, 82 ohms									
						With Inductive Input Filter	Max. AC Volts per Plate (RMS), 450; Max. Peak Inverse Volts, 1275; Max. DC Output Ma., 62.5; Max. Peak Plate Ma. per Plate, 350; Min. Value of Input Choke, 10 henries									
6BX7-GT	Medium-Mu Twin Triode	F6	8BD	6.3	1.5	Vertical Deflection Oscillator	Max. DC Plate Volts, 500; Max. DC Cathode Ma., 180; Max. Plate Dissipation: 10 watts either plate; 12 watts both plates									
						Vertical Deflection Amplifier	Max. DC Plate Volts, 500; Max. DC Cath. Ma., 180; Max. Peak Positive-Pulse Plate Volts, 2000 (Abs.); Max. Plate Dissipation: 10 watts either plate; 12 watts both plates									

Note: For footnotes, see end of this section.

△ For key to tube dimensions, description, and basing diagram, see end of this section.

World Radio History

RCA RECEIVING-TUBE DATA

Types Not Recommended for New Equipment Design

Type	Name	Tube Dimensions and Basing Diagram△ Dim.	B. D.	Heater or Filament (F) Unless specified all types have heaters. ⊕ Heater with controlled warmup time. Volts	Amps.	Use Values to right give operating conditions and characteristics for indicated typical use	Plate Supply Volts	Grid Bias Volts (v) or Cathode Resistor Ohms (Ω)	Screen Supply Volts	Screen Current Ma.	Plate Current Ma.	AC Plate Resistance Ohms	Transconductance Micromhos	Amplification Factor	Load for Stated Power Output Ohms	Power Output Watts
5T4	Full-Wave Rectifier	F23	5T	5.0F	2.0	With Capacitive-Input Filter	Max. AC Volts per Plate (RMS), 450 Max. Peak Inverse Volts, 1550				Max. DC Output Ma., 225 Max. Peak Plate Ma., 675			Min. Total Effect. Supply Imped. per Plate, 150 ohms		
						With Inductive-Input Filter	Max. AC Volts per Plate (RMS), 550 Max. Peak Inverse Volts, 1550				Max. DC Output Ma., 225 Max. Peak Plate Ma., 675			Min. Value of Input Choke, 10 henries		
5U4-G	Full-Wave Rectifier	F39	5T‡	5.0F	3.0	With Capacitive-Input Filter	Max. AC Volts per Plate (RMS), 450 Max. Peak Inverse Volts, 1550				Max. DC Output Ma., 225 Max. Peak Plate Ma., 675			Min. Total Effect. Supply Imped. per Plate, 170 ohms		
5X4-G	Full-Wave Rectifier	F39	5Q	5.0F	3.0		For other ratings, refer to Type 5U4-G.									
5Y4-GA 5Y4-GT	Full-Wave Rectifier	F25 F8	5Q	5.0F	2.0		Max. Peak Plate Ma., 400					For other ratings, refer to Type 5AZ4.				
5Z3	Full-Wave Rectifier	K11	4C	5.0F	3.0		For other ratings, refer to Type 5U4-G.									
5Z4	Full-Wave Rectifier	E4	5L	5.0	2.0	With Capacitive-Input Filter	Max. AC Volts per Plate (RMS), 350 Max. Peak Inverse Volts, 1400				Max. DC Output Ma., 125 Max. Peak Plate Ma., 375			Min. Total Effect. Supply Imped. per Plate, 50 ohms		
						With Inductive-Input Filter	Max. AC Volts per Plate (RMS), 500 Max. Peak Inverse Volts, 1400				Max. DC Output Ma., 125 Max. Peak Plate Ma., 375			Min. Value of Input Choke, 5 henries		
6A7	Pentagrid Converter ○	K5	7C	6.3	0.3	Converter	For other characteristics, refer to Type 6A8.									
6A8	Pentagrid Converter ○	E3	8A 8A‡ 8A	6.3	0.3	Converter	250	− 3v	100	2.7	3.5	360000	Anode-Grid (#2): 250 max. v, 4.0 ma. Oscillator-Grid (#1) Res. . Conversion Transcond., 550 μmhos.			
6AB5/ 6N5	Electron-Ray Tube	K3	6R	6.3	0.15	Visual Indicator	Plate & Target Supply = 135 volts. Triode Plate Resistor = 0.25 meg. Target Current = 2.0 ma. Grid Bias, − 10.0 volts; Shadow Angle, 0°. Bias, 0 volts; Angle, 90°; Plate Current, 0.5 ma.									
							Plate & Target Supply = 135 volts. Triode Plate Resistor = 1.0 meg. Target Current = 1.9 ma. Grid Bias, −15.5 volts; Shadow Angle, 0°. Bias, 0 volts; Angle, 90°; Plate Current, 0.13 ma.									
6AB7	Sharp-Cutoff Pentode	E2	8N	6.3	0.45	Class A Amplifier	300	− 3v	200	3.2	12.5	700000	5000	——	——	——
6AC5-GT	High-Mu Power Triode	F6	6Q‡	6.3	0.4	Class B Amplifier	250	0v	——	——	5.0♠	——	——	——	10000	8.0†
						Dynamic-Coupled Amplifier With 76 Driver	250	Bias for both 6AC5-GT and 76 is developed in coupling circuit. Average Plate Current of Driver = 5.5 milliamperes. Average Plate Current of 6AC5-GT = 32 milliamperes.							7000	3.7
6AC7	Sharp-Cutoff Pentode	E2	8N	6.3	0.45	Class A Amplifier	300	160Ω	150	2.5	10.0	1.0§	9000	——	——	——
6AH4-GT	Low-Mu Triode	F6	8EL	6.3	0.75	Vertical Deflection Amplifier	Max. DC Plate Volts, 500 Max. DC Cathode Ma., 60				Max. Peak Positive-Pulse Plate Volts, 2000 Max. Plate Dissipation, 7.5 watts					
6AH6	Sharp-Cutoff Pentode	A2	7BK	6.3	0.45	Class A Amplifier	300	160Ω	150	2.5	10.0	500000	9000	——	——	——
6AL7-GT	Electron-Ray Tube	F6	8CH	6.3	0.15	Visual Indicator	Target Voltage, 315 volts Grid Voltage = 0 volts Cathode Bias Res., 3300 ohms approx.				Grid Voltage for Pattern Cutoff, −7 volts approx. Deflecting-Electrodes—No. 1, No. 2 and No. 3 Voltage = 0					
6AM4	High-Mu Triode	B1	9BX	6.3	0.225	Class A Amplifier	200	100Ω	——	——	10	8700	9800	85	——	——
6AQ6	Twin-Diode—High-Mu Triode	A2	7BT	6.3	0.15	Triode Unit as Class A Amplifier	100 250	− 1v − 3v	——	——	0.8 1.0	61000 58000	1150 1200	70 70	——	——
6AQ7-GT	Twin-Diode—High-Mu Triode	F6	8CK	6.3	0.3	Triode Unit as Class A Amplifier	250	− 2v	——	——	2.3	44000	1600	70	——	——

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Type	Name	Tube Dimensions and Basing Diagram△ Dim.	B. D.	Heater or Filament (F) Unless specified all types have heaters. ⊕ Heater with controlled warmup time. Volts	Amps.	Use Values to right give operating conditions and characteristics for indicated typical use	Plate Supply Volts	Grid Bias Volts (v) or Cathode Resistor Ohms (Ω)	Screen Supply Volts	Screen Current Ma	Plate Current Ma	AC Plate Resistance Ohms	Transconductance Micromhos	Amplification Factor	Load for Stated Power Output Ohms	Power Output Watts
12AW6	Sharp-Cutoff Pentode	A2	7CM	12.6	0.15	Class A Amplifier	100 250	180Ω 180Ω	100 150	1.4 2.0	4.5 6.5	600000 800000	4500 5000	—	—	—
12AX7	High-Mu Twin-Triode	B2	9A	6.3 12.6	0.3 0.15	Each Unit as Class A Amplifier	100 250	− 1v − 2v	—	—	0.5 1.2	80000 62500	1250 1600	100 100	—	—
12BK5	Beam Power Tube	B4	9BQ	12.6⊕	0.6	Class A Amplifier	250	− 5v	250	3.5	35	100000	8500	—	6500	3.5
12BL6	Remote-Cutoff Pentode⊙	A2	7BK	10.0 to 15.9	0.15 approx. at 12.6 v	Class A Amplifier	12.6	Grid-No. 1 Supply Volts, 0	12.6	0.5	1.35	500000	1350	Grid-No. 1 and Grid-No. 3 Volts for transcond. of 10 micromhos, −5		
12BR7	Twin Diode—High-Mu Triode	B2	9CF	6.3 12.6	0.45 0.225	Triode Unit as Class A Amplifier	100 250	270Ω 2000	—	—	3.7 10	15000 10900	4000 5500	60 60	—	—
12BV7	Sharp-Cutoff Pentode	B4	9BF	6.3 12.6	0.6 0.3	Class A Amplifier	250 250	68Ω − 8v	150 180	6 —	27 0.5✱	85000	13000	—	—	—
12BW4	Full-Wave Rectifier	B4	9DJ	12.6	0.45	With Capacitive Input Filter	Max. AC Volts per Plate (RMS) 450 Max. Peak Inverse Volts, 1275				Max. DC Output Ma., 62.5 Max. Peak Plate Ma., 350			Total Effect. Supply Imped. per Plate, 82 ohms		
12BZ7	High-Mu Twin Triode	B4	9A	6.3 12.6	0.6 0.3	Each Unit as Class A Amplifier	250	− 2v	—	—	2.5	31800	3200	100	—	—
12CN5	Remote-Cutoff Pentode⊙	A3	7CV	10.0 to 15.9	0.45 approx. at 12.6 v	Class A Amplifier	12.6	—	12.6	3.5	4.5	40000	3800	Grid-No. 1 Supply Volts, 0 Grid-No. 1 Res., 2.2 megohms		
12CT8	Medium-Mu Triode—Sharp-Cutoff Pentode	B4	9DA	12.6⊕	0.3	Triode Unit as Class A Amplifier	150	150Ω	—	—	9	8200	4900	40	—	—
						Pentode Unit as Class A Amplifier	200	82Ω	125	3.4	15	150000	7000	—	—	—
12CX6	Remote-Cutoff Pentode⊙	A2	7BK	10.0 to 15.9	0.15 approx. at 12.6 v	Class A Amplifier	12.6	Grid-No. 1 Supply Volts, 0	12.6	1.4	3	40000	3100	Grid-No. 1 Volts for Plate Current of 10 μa., −4.5		
12DE8	Diode—Remote-Cutoff Pentode⊙	B2	9HG	10.0 to 15.9	0.2 approx. at 12.6V	Pentode Unit as Class A Amplifier	12.6	—	12.6	0.5	1.3	300000	1500	Grid-No. 1 Supply Volts, 0 Grid-No. 1 Res., 2.2 megohms		
12DK6	Sharp-Cutoff Pentode	A2	7CM	12.6	0.15	Class A Amplifier	125	56Ω	125	3.8	12	350000	9800	—	—	—
12DK7	Twin Diode—Power Tetrode⊙	B2	9HZ	10.0 to 15.9	0.5 approx. at 12.6V	Tetrode Unit as Class A Amplifier	12.6	—	12.6	1	6	4000	5000	—	3500	0.010
12DL8	Twin Diode—Power Tetrode⊙	B4	9HR	10.0 to 15.9	0.55 approx. at 12.6 v	Tetrode Unit as Class A Amplifier	12.6	Grid-No. 2 (Control Grid) Volts, −0.5 (across 2.2 megohm resistor) Grid-No. 1 (Space-Charge Grid) Volts, 12.6 Transcond. (Grid-No. 2 to Plate), 15000 μmhos					Ampl. Factor (Grid-No. 2 to Plate) 7.2 Grid-No. 1 Ma., 75 Plate Ma., 40 Plate Resistance, 480 ohms			
12DQ7	Power Pentode	B4	9BF	6.3⊕ 12.6	0.6 0.3	Class A Amplifier	200	68Ω	125	5.6	26	53000	10500	—	—	—
12DS7	Twin Diode—Power Tetrode⊙	B4	9JU	10.0 to 15.9	0.4 approx. at 12.6 v	Tetrode Unit as Class A Amplifier	12.6	12.6v	−0.5 (across 2.2 megohm resistor)	75 (Grid-No. 1)	35	500	19000 (Grid-No. 2 to Plate)	9.1 (Grid-No. 2 to Plate)	—	—
						Diode Units	Diode Plate Ma., with 10 Volts Applied, 3 Ma.									
12DU7	Twin Diode—Power Tetrode⊙	B2	9JX	10.0 to 15.9	0.25 approx. at 12.6V	Tetrode Unit as Class A Amplifier	12.6	—	12.6	1.5	12	6000	6200	—	2700	0.025

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RCA RECEIVING-TUBE DATA

Types Not Recommended for New Equipment Design

Type	Name	Tube Dimensions and Basing Diagram△		Heater or Filament (F) Unless specified all types have heaters. ⊕ Heater with controlled warmup time.		Use Values to right give operating conditions and characteristics for indicated typical use	Plate Supply	Grid Bias Volts (v) or Cathode Resistor	Screen Supply	Screen Current	Plate Current	AC Plate Resistance	Transconductance	Amplification Factor	Load for Stated Power Output	Power Output
		Dim.	B. D.	Volts	Amps.		Volts	Ohms (Ω)	Volts	Ma.	Ma.	Ohms	Micromhos		Ohms	Watts
7W7	Sharp-Cutoff Pentode	J2	8BJ	6.3	0.45	Class A Amplifier	For other characteristics, refer to Type 7V7.									
7X7	Twin Diode—High-Mu Triode	J3	8BZ	6.3	0.3	Triode Unit as Class A Amplifier	250	− 1v	—	—	1.9	67000	1500	100	—	—
7Y4	Full-Wave Rectifier	J2	5AB	6.3	0.5	With Capacitive-Input Filter	Max. Peak Inverse Volts, 1250				Max. DC Output Ma., 70			Max. Peak Plate Ma., 180		
7Z4	Full-Wave Rectifier	J3	5AB	6.3	0.9	With Capacitive-Input Filter	Max. Peak Inverse Volts, 1250				Max. DC Output Ma., 100 Max. Peak Plate Ma., 300			Min. Total Effec. Supply Imped. per Plate, 75 ohms		
9BR7	Twin Diode—High-Mu Triode	B2	9CF	4.7⊕ 9.4	0.6 0.3	Triode Unit as Class A Amplifier	250	200Ω	—	—	10	10900	4000	60	—	—
9CL8	Medium-Mu Triode—Sharp-Cutoff Tetrode	B2	9FX	9.5⊕	0.3	Triode Unit as Class A Amplifier	125	56Ω	—	—	15	5000	8000	40	—	—
						Tetrode Unit as Class A Amplifier	125	− 1v	125	4	12	100000	5800	—	—	—
9U8-A	Medium-Mu Triode—Sharp-Cutoff Pentode	B2	9AE	9.45⊕	0.3	Triode Unit as Class A Amplifier	125	− 1v	—	—	13.5	5000	7500	40	—	—
						Pentode Unit	125	− 1v	110	3.5	9.5	200000	5000	—	—	—
10C8	High-Mu Triode—Sharp-Cutoff Pentode	B2	9DA	10.5⊕	0.3	Triode Unit as Class A Amplifier	250	390Ω	—	—	7.3	12000	4400	53	—	—
						Pentode Unit as Class A Amplifier	135	100Ω	135	3.2	11.5	190000	8000	—	—	—
12AC6	Remote-Cutoff Pentode⊙	A2	7BK	10.0 to 15.9	0.15 approx. at 12.6 v	Class A Amplifier	12.6	—	12.6	.2	.55	500000	730	Grid-No. 1 Supply Volts, 0 Grid-No. 1 Res., 2.2 megohms		
12AD6	Pentagrid Converter⊙	A2	7CH	10.0 to 15.9	0.15 approx. at 12.6 v	Converter	12.6	Self-excited	12.6	1.5	0.45	1§	Grid-No. 1 Resistor, 33000 ohms Conversion Transcond., 260 micromhos			
12AE6-A	Twin Diode—Medium-Mu Triode⊙	A2	7BT	10.0 to 15.9	0.15 approx. at 12.6 v	Triode Unit as Class A Amplifier	12.6	0v	—	—	1	13000	1300	16.7	—	—
12AE7	Dual Triode	B2	9A	10.0 to 15.9	0.45 approx. at 12.6V	Unit No. 1 as Class A Amplifier	12.6	Grid Res. 1.5 megohms			1.9	3150	4000	13.0	—	—
						Unit No. 2 as Class A Amplifier	12.6	Grid Res. 1 megohm			7.5	985	6500	6.4	—	—
12AF6	Remote-Cutoff Pentode⊙	A2	7BK	10.0 to 15.9	0.15 approx. at 12.6 v	Class A Amplifier	12.6	—	12.6	0.45	1.1	350000	1500	Grid-No. 1 Supply Volts, 0 Grid-No. 1 Res., 2.2 megohms		
12AH7-GT	Medium-Mu Twin Triode	F6	8BE	12.6	0.15	Each Unit as Class A Amplifier	180	− 6.5v	—	—	7.6	8400	1900	16	—	—
12AJ6	Twin Diode—Medium-Mu Triode⊙	A2	7BT	10.0 to 15.9	0.15 approx. at 12.6 v	Triode Unit as Class A Amplifier	12.6	Grid-No. 1 Supply Volts, 0 Grid-No. 1 Res., 2.2 megohms			0.75	45000	1200	55	—	—
12AL8	Medium-Mu Triode—Power Tetrode⊙	B4	9GS	10.0 to 15.9	0.55 approx. at 12.6 v	Triode Unit as Class A Amplifier	12.6	− 0.9v (across 2.2 megohm res.)			.5	13000	1000	13	—	—
						Tetrode Unit as Class A Amplifier		Grid-No. 2 (Control Grid) Volts, −.5 (across 2.2 megohm res.) Grid-No. 1 (Space-Charge Grid) Volts, 12.6 Transcond. (Grid-No. 2 to Plate), 15000 μmhos					Ampl. Factor (Grid-No. 2 to Plate) 7.2 Grid-No. 1 Ma., 75 Plate Ma., 40 Plate Resistance, 480 ohms			
12AV7	Medium-Mu Twin-Triode	B2	9A	6.3 12.6	0.45 0.225	Each Unit as Class A Amplifier	150	56Ω	—	—	18	48000	8500	41	Cutoff Volts, −12	

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RCA RECEIVING-TUBE DATA

Types Not Recommended for New Equipment Design

Type	Name	Tube Dimensions and Basing Diagram△ Dim.	B. D.	Heater or Filament (F) Unless specified all types have heaters. ⊕ Heater with controlled warmup time. Volts	Amps.	Use Values to right give operating conditions and characteristics for indicated typical use	Plate Supply Volts	Grid Bias Volts (v) or Cathode Resistor Ohms (Ω)	Screen Supply Volts	Screen Current Ma.	Plate Current Ma.	AC Plate Resistance Ohms	Transconductance Micromhos	Amplification Factor	Load for Stated Power Output Ohms	Power Output Watts
12GA6	Pentagrid Converter⊙	A2	7CH	10.0 to 15.9	0.15 approx. at 12.6V	Converter	12.6	1.6v	12.6	0.8	0.3	1§	Grid No. 1 Res., 33000 ohms. Conversion. Transcond., 140 μmhos			
12J5-GT	Medium-Mu Triode	F7	8Q‡	12.6	0.15	Amplifier	For other characteristics, refer to Type 6J5-GT.									
12J7-GT	Sharp-Cutoff Pentode	F7	7R✕	12.6	0.15	Amplifier	For other characteristics, refer to Type 6J7.									
12J8	Twin Diode—Power Tetrode⊙	B2	9GC	10.0 to 15.9	0.325 approx. at 12.6 v	Tetrode Unit as Class A Amplifier	12.6	− 0v	12.6	1.5	12	6000	5500	—	2700	0.02
12K5	Power Tetrode⊙	A3	7EK	10.0 to 15.9	0.4 approx. at 12.6 v	Class A Amplifier	DC Plate Volts, 12.6 Grid-No. 2 (Control Grid) Volts, −.5 Plate Resistance, 480 ohms Grid-No. 1 (Space-Charge Grid) Volts, 12.6 Amplification Factor, Grid-No. 2 to Plate, 7.2 DC Plate Ma., 40 Grid-No. 1 Ma., 75 Transcond., Grid-No. 2 to Plate, 15000 μmhos									
12K7-GT	Remote-Cutoff Pentode	F7	7R✕	12.6	0.15	Amplifier	For other characteristics, refer to Type 6K7-GT.									
12KL8	Diode—Sharp-Cutoff Pentode	B4	9LQ	12.6	0.15	Pentode Unit as Class A Amplifier	For other characteristics, refer to Type 6KL8.									
12L6-GT	Beam Power Tube	F6	7AC‡	12.6⊕	0.6	Class A Amplifier	110 200	− 7.5v 180Ω	110 125	4.0 2.2	49 46	13000 28000	8000 8000	— —	2000 4000	2.1 3.8
12R5	Beam Power Tube	A3	7CV	12.6⊕	0.6	Vertical Deflection Amplifier	Max. DC Plate Volts, 150 Max. Peak Neg.-Pulse Grid-No. 1 Volts, 150 Max. Peak Cathode Ma., 155 Max. Grid-No. 2 Volts, 150 Max. Plate Dissipation, 4.5 watts Max. Peak Positive-Pulse Plate Volts, 1500 (Abs.)									
12SA7-GT	Pentagrid Converter▲	F6	8AD	12.6	0.15	Converter	250	Self-Excited	100	8.5	3.5	1.0§	Grid-No. 1 Resistor, 20000 ohms. Conversion Transcond., 450 micromhos.			
12SC7	High-Mu Twin Triode	E2	8S	12.6	0.15	Each Unit as Class A Amplifier	For other characteristics, refer to Type 6SC7.									
12SF5	High-Mu Triode	E2	6AB	12.6	0.15	Class A Amplifier	For other characteristics, refer to Type 6SF5.									
12SF7	Diode—Remote-Cutoff Pentode	E2	7AZ	12.6	0.15	Pentode Unit as Amplifier	For other characteristics, refer to Type 6SF7.									
12SG7	Semiremote-Cutoff Pentode	E2	8BK	12.6	0.15	Class A Amplifier	For other characteristics, refer to Type 6SG7.									
12SH7	Remote-Cutoff Pentode	E2	8BK	12.6	0.15	Class A Amplifier	For other characteristics, refer to Type 6SH7.									
12SK7 12SK7-GT	Remote-Cutoff Pentode	E2 F7	8N 8N✕	12.6	0.15	Class A Amplifier	For other characteristics, refer to Type 6SK7.									
12SQ7-GT	Twin Diode—High-Mu Triode	E2 F7	8Q 8Q✕	12.6	0.15	Triode Unit as Class A Amplifier	100 250	− 1v − 2v	—	—	0.5 1.1	110000 85000	925 1175	100 100	— —	— —
12SR7	Twin Diode—Medium-Mu Triode	E2	8Q	12.6	0.15	Triode Unit as Class A Amplifier	For other characteristics, refer to Type 6SR7.									
12U7	Medium-Mu Twin Triode	B2	7CK	10.0 to 15.9	0.15 approx. at 12.6 v	Each Unit as Class A Amplifier	12.6	0v	—	—	1	12500	1600	20	—	—
14A7	Remote-Cutoff Pentode	J2	8V	12.6	0.15	Class A Amplifier	100 250	− 1v − 3v	100 100	4.0 2.6	13.0 9.2	120000 800000	2350 2000	—	—	—
14AF7	Medium-Mu Twin-Triode	J2	8AC	12.6	0.15	Each Unit as Class A Amplifier			For other characteristics, refer to Type 7AF7.							

World Radio History

RCA RECEIVING-TUBE DATA

Types Not Recommended for New Equipment Design

Type	Name	Tube Dimensions and Basing Diagram△ Dim.	B. D.	Heater or Filament (F) Unless specified all types have heaters. ⊕ Heater with controlled warmup time. Volts	Amps.	Use Values to right give operating conditions and characteristics for indicated typical use	Plate Supply Volts	Grid Bias Volts (v) or Cathode Resistor Ohms (Ω)	Screen Supply Volts	Screen Current Ma.	Plate Current Ma.	AC Plate Resistance Ohms	Transconductance Micromhos	Amplification Factor	Load for Stated Power Output Ohms	Power Output Watts
12DV8	Twin Diode—Power Tetrode⊙	B4	9HR	10.0 to 15.9	0.375 approx. at 12.6 v	Class A Amplifier	Grid-No. 2 (Control Grid) Resistor, 4.7 megohms Grid-No. 1 (Space-Charge Grid) Volts, 12.6 Transcond. (Grid-No. 2 to Plate), 8500 μmhos						Ampl. Factor (Grid-No. 2 to Plate) 7.6 Grid-No. 1 Ma., 53 Plate Ma., 9 Plate Resistance, 900 ohms			
12DW7	Dual Triode	B2	9A	12.6 6.3	0.15 0.3	Unit No. 1 as Class A Amplifier	250	− 2v	—	—	1.2	62500	—	100	—	—
						Unit No. 2 as Class A Amplifier	250	−8.5v	—	—	10.5	7700	2200	17	—	—
12DY8	Medium-Mu Triode—Remote-Cutoff Tetrode⊙	B2	9JD	10.0 to 15.9	0.35 approx. at 12.6V	Triode Unit as Class A Amplifier	12.6	—	—	—	1.2	10000	2000	20	—	—
						Tetrode Unit as Signal Seeker Relay	10	—	10	—	5 min.	Grid No. 1 resistor 10 megohms. Plate Load 700 ohms				
							15	− 6v	15	—	3 max.	—	—	—	Plate Load 700 ohms	
12EA6	Remote-Cutoff Pentode⊙	A2	7BK	10.0 to 15.9	0.19 approx. at 12.6 v	Class A Amplifier	12.6	—	12.6	1.4	3.2	32000	3800	{Grid-No. 1 Supply Volts, 0 Grid-No. 1 Res., 10 megohms}		
12EC8	Medium-Mu Triode—Semiremote-Cutoff Pentode⊙	B2	9FA	10.0 to 15.9	0.225 approx. at 12.6V	Triode Unit as Class A Amplifier	12.6	4700Ω Grid Res.	—	—	2.4	6000	4700	25	—	—
						Pentode Unit as Class A Amplifier	12.6	—	12.6	0.28	0.66	750000	2000	Grid No. 1 Res., 33000 ohms.		
12ED5	Beam Power Tube	A3	7CV	12.6⊕	0.45	Class A Amplifier	1.25	− 4.5v	125	7	37	14000	8500	—	4500	1.5
12EG6	Pentagrid Amplifier⊙	A2	7CH	10.0 to 15.9	0.15 approx. at 12.6 v	Class A Amplifier	12.6	−0.6v†	12.6	2.8	.55	150000	800‡	‡Between Grid-No. 3 & Plate †Bias voltage across res. 2.2 megohms		
12EH5	Power Pentode	A3	7CV	12.6⊕	0.6	Class A Amplifier	110	62Ω	115	11.5	42	11000	14600	—	3000	1.4
12EK6	Remote-Cutoff Pentode⊙	A2	7BK	10.0 to 15.9	0.19 approx. at 12.6 v	Class A Amplifier	12.6	—	12.6	1.7	4	50000	4200	Grid-No. 1 Supply Volts, 0 Grid-No. 1 Res. (Bypassed), 2.2 megohms		
12EL6	Twin Diode—High-Mu Triode⊙	A2	7FB	10.0 to 15.9	0.15 approx. at 12.6 v	Class A Amplifier	12.6	0v	—	—	0.75	45000	1200	55	—	—
12EN6	Beam Power Tube	F6	7AC	12.6⊕	0.6	Vertical Deflection Amplifier	Max. Peak Pos.-Pulse Volts, 1200 Max. Peak Neg.-Pulse Grid Volts, 250 Max. Peak Cathode Ma., 175						Max. Plate Dissipation, 7 watts Max. DC Plate Volts, 300			
12EQ7	Diode—Remote-Cutoff Pentode	B4	9LQ	12.6	0.15	Pentode Unit as Class A Amplifier	100	0v	100	3.5	9	250000	3800	Grid-No. 1 Res., 2.2 megohms		
12F8	Twin Diode—Remote-Cutoff Pentode⊙	B2	9FH	10.0 to 15.9	0.15 approx. at 12.6 v	Pentode Unit as Class A Amplifier	12.6	0v	12.6	0.38	1	330000	1000	Grid-No. 1 Volts for transcond. of 10 micromhos, −5		
12FK6	Twin Diode—Low-Mu Triode⊙	A2	7BT	10.0 to 15.9	0.15 approx. at 12.6 v	Triode Unit as Class A Amplifier	12.6	Grid Supply Volts, 0 Grid Res. (Bypassed), 2.2 megohms			1.3	6200	1200	7.4	—	—
12FM6	Twin Diode—Medium-Mu Triode⊙	A2	7BT	10.0 to 15.9	0.15 approx. at 12.6 v	Triode Unit as Class A Amplifier	12.6	0v	—	—	1	7700	1300	10	—	—
12FV7	Medium-Mu Twin Triode	B4	9A	6.3 12.6	0.9 0.45	Each Unit as Class A Amplifier	100	− 2v	—	—	16	2250	9600	21.5	—	—

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Type	Name	Tube Dimensions and Basing Diagram△ Dim.	B. D.	Heater or Filament (F) Unless specified all types have heaters. ⊕ Heater with controlled warmup time. Volts	Amps.	Use Values to right give operating conditions and characteristics for indicated typical use	Plate Supply Volts	Grid Bias Volts (v) or Cathode Resistor Ohms (Ω)	Screen Supply Volts	Screen Current Ma.	Plate Current Ma.	AC Plate Resistance Ohms	Transconductance Micromhos	Amplification Factor	Load for Stated Power Output Ohms	Power Output Watts
25L6-GT	Beam Power Tube	F6	7AC‡	25.0	0.3	Amplifier	100 200	− 7.5v 180Ω	110 125	4 2.2	49 46	13000 28000	8000 8000	—	2000 4000	2.1 3.8
25W4-GT	Half-Wave Rectifier	F6	4CG	25.0	0.3	Television Damper Service	Max. Peak Inverse Plate Volts, 3850 (Abs.) Max. Peak Plate Ma., 750 Max. DC Plate Ma., 125					Max. Peak Heater-Cathode Volts: {−500 (Abs.) / +200 •• DC Component must not exceed 100 volts.				
25Z5	Rectifier-Doubler	K4	6E	25.0	0.3	Rectifier-Doubler	For other ratings, refer to Type 25Z6-GT.									
25Z6-GT	Rectifier-Doubler	F6	7Q	25.0	0.3	Voltage Doubler	Max. AC Volts per Plate (RMS), 117 Max. DC Output Ma., 75					Min. Total Effective Plate-Supply Impedance: Half-Wave, 30 ohms; Full-Wave, 15 ohms.				
			7Q‡	25.0	0.3	Half-Wave Rectifier	Max. AC Volts per Plate (RMS), 235 Max. DC Output Ma. per Plate, 75					Min. Total Effect. Supply Imped. per Plate: at 117 volts, 15 ohms; at 150 volts, 40 ohms; at 235 volts, 100 ohms.				
34GD5	Beam Power Tube	A3	7CV	34.0	0.1	Class A Amplifier	110	− 7.5v	110	3	35	13000	5700	—	2500	1.4
35A5	Beam Power Tube	J3	6AA	35.0	0.15	Single-Tube Class A Amplifier	110 200	− 7.5v 180Ω	110 125	3 2.0	40 43	14000 34000	5800 6100	— —	2500 5000	1.5 3.0
35B5	Beam Power Tube	A3	7BZ	35.0	0.15	Class A Amplifier	110	− 7.5v	110	3.0	40.0	13000	5800	—	2500	1.5
35DZ8	High-Mu Triode—Power Pentode	B10	9JE	35.0	0.15	Triode Unit as Class A Amplifier	120	1500Ω	—	—	0.8	—	1400	100	—	—
						Pentode Unit as Class A Amplifier	140	180Ω	120	6	45	—	7500	—	2500	2.0
35GL6	Beam Power Tube	A3	7FZ	35.0	0.15	Class A Amplifier	110	− 7.5v	110	3	45	12000	7500	—	2500	1.8
35Y4	Half-Wave Rectifier Heater Tap for Pilot	J3	5AL	35.0	0.15	With Capacitive-Input Filter	Max. AC Plate Volts (RMS), 117. Min. Total Effect. Plate-Supply Impedance, 15 ohms. Max. DC Output Ma.: With Pilot and No Shunt Res., 60; With Pilot and Shunt Res., 90; Without Pilot, 100.									
		Pilot Between Pins 1 and 4														
35Z3	Half-Wave Rectifier	J3	4Z	35.0	0.15	With Capacitive-Input Filter	For other ratings, refer to Type 35Z5-GT.									
35Z4-GT	Half-Wave Rectifier	F6	5AA	35.0	0.15	With Capacitive-Input Filter	Max. DC Output Ma., 100					Min. Total Effective Plate-Supply Impedance: Up to 117 volts, 15 ohms; at 235 volts, 100 ohms.				
35Z5-GT	Half-Wave Rectifier Heater Tap for Pilot	F6	6AD	35.0	0.15	With Capacitive-Input Filter	Min. Total Effect. Plate-Supply Imped.: Up to 117 volts, 15 ohms; at 235 volts, 100 ohms. Max. DC Output Ma.: With Pilot and No Shunt Res., 60; With Pilot and Shunt Res., 90; Without Pilot, 100.									
		Pilot Between Pins 2 and 3														
36AM3-A	Half-Wave Rectifier	A3	5BQ	36.0	0.1	With Capacitive-Input Filter	Max. AC Plate Volts (RMS), 120 Max. DC Output Ma., 82					Max. Peak Inverse Volts, 365 Tube Voltage Drop for Plate Ma. = 150, 16 volts				
42	Power Pentode	K8	6B	6.3	0.7	Amplifier	For other characteristics, refer to Type 6F6-G.									
43	Power Pentode	K8	6B	25.0	0.3	Class A Amplifier	95	−15v	95	4	20	45000	2000	—	4500	0.9
50A5	Beam Power Tube	J3	6AA	50.0	0.15	Single-Tube Class A Amplifier	100 200	− 7.5v 180Ω	110 125	4 2.2	49 46	13000 28000	8000 8000	—	2000 4000	2.1 3.8
50FK5	Power Pentode	A3	7CV	50.0	0.1	Class A Amplifier	110	62Ω	115	8.5	32	14000	12800	—	3000	1.2
50X6	Rectifier-Doubler	J3	7DX	50.0	0.15	Rectifier-Doubler	For other ratings, refer to Type 25Z6-GT.									
50Y6-GT	Rectifier-Doubler	F6	7Q‡	50.0	0.15	Rectifier-Doubler	For other ratings, refer to Type 25Z6-GT.									
50Y7-GT	Rectifier-Doubler Heater Tap for Pilot	F6	8AN	50.0	0.15	Voltage Doubler	Max. AC Volts per Plate (RMS), 117 Max. DC Output ma., 65					Min. Total Effective Plate-Supply Impedance per Plate, 15 ohms				
		Pilot Lamp Between Pins 6 and 7				Half-Wave Rectifier	Max. AC Volts per Plate (RMS), 235 Max. DC Output Ma. per Plate, 65					Min. Total Effec. Plate-Supply Imped. per Plate: At 117 volts, 15 ohms; at 150 volts, 40 ohms; at 235 volts, 100 ohms				
75	Twin Diode—High-Mu Triode	K5	6G	6.3	0.3	Amplifier	100 250	− 1v − 2v	—	—	0.5 1.1	110000 85000	925 1175	100 100	—	—

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RCA RECEIVING-TUBE DATA

Types Not Recommended for New Equipment Design

Type	Name	Tube Dimensions and Basing Diagram△ Dim.	B. D.	Heater or Filament (F) Unless specified all types have heaters. ⊕ Heater with controlled warmup time. Volts	Amps.	Use Values to right give operating conditions and characteristics for indicated typical use	Plate Supply Volts	Grid Bias Volts (v) or Cathode Resistor Ohms (Ω)	Screen Supply Volts	Screen Current Ma.	Plate Current Ma.	AC Plate Resistance Ohms	Transconductance Micromhos	Amplification Factor	Load for Stated Power Output Ohms	Power Output Watts
14B6	Twin Diode—High-Mu Triode	J2	8W	12.6	0.15	Triode Unit as Class A Amplifier	100 250	− 1v − 2v	—	—	0.5 1.1	110000 85000	925 1175	100 100	— —	— —
14C7	Sharp-Cutoff Pentode	J2	8V	12.6	0.15	Class A Amplifier	100 250	− 3v − 3v	100 100	0.9 0.8	2.9 3.0	700000 1.0+§	1575 1650	—	—	—
14F7	High-Mu Twin Triode	J2	8AC	12.6	0.15	Each Unit as Class A Amplifier	250	− 2v	—	—	2.3	44000	1600	70	—	—
14F8	Medium-Mu Twin Triode	J2	8BW	12.6	0.15	Each Unit as Class A Amplifier	250	500Ω	—	—	6.0	—	3300	48	—	—
14Q7	Pentagrid Converter▲	J2	8AL	12.6	0.15	Converter	250	Self-Excited	100	8.5	3.5	1.0§	Grid-No. 1 Resistor, 20000 ohms. Conversion Transcond., 450 micromhos.			
14R7	Twin Diode—Remote-Cutoff Pentode	J2	8AE	12.6	0.15	Pentode Unit as Class A Amplifier	250	− 1v	100	2.1	5.7	1.0§	3200	—	—	—
17BH3	Novar Half-Wave Rectifier	C1	9HP	17.0⊕	0.6	Television Damper Service	For other ratings, refer to Type 6BH3.									
17BQ6-GTB	Beam Power Tube	F16	6AM	16.8⊕	0.45	Horizontal Deflection Amplifier	Max. DC Plate Volts, 600 Max. DC Cathode Ma., 112.5 Max. Peak Positive-Pulse Plate Volts, 6000 (Abs.) Max. Plate Dissipation, 11 watts									
17C9	Sharp-Cutoff Twin Tetrode	G1	10F	16.8	0.15	Each Unit as Class A Amplifier	125	− 1v	80	1.5	10	100000	8000	—	—	—
17DM4	Half-Wave Rectifier	F15	4CG	16.8⊕	0.45	Television Damper Service	For other ratings, refer to Type 6DM4.									
17GE5	Beam Power Tube	L2	12BJ	16.8	0.45	Horizontal Deflection Amplifier	Max. DC Plate Volts, 770 Max. DC Cathode Ma., 175 Max. Peak Positive-Pulse Plate Volts, 6500 (Abs.) Max. Plate Dissipation, 17.5 watts									
17GT5	Beam Power Tube	C2	9NZ	16.8⊕	0.45	Horizontal Deflection Amplifier	Max. DC Plate Volts, 770 Max. DC Cathode Ma., 175 Max. Peak Cathode Ma., 550 Max. Peak Pos.-Pulse Plate Volts, 6500 Max. Plate Dissipation, 17.5 watts									
17GV5	Beam Power Tube	L3	12DR	16.8	0.45	Horizontal Deflection Amplifier	For other characteristics, refer to Type 17GE5									
17H3	Half-Wave Rectifier	B4	9FK	17.5⊕	0.3	Television Damper Service	Max. Peak Inverse Plate Volts, 2000 Max. Peak Plate Ma., 450 Max. Average Plate Ma., 75 Max. Plate Dissipation, 3 watts									
18A5	Beam Power Tube	F9	6CK	18.5⊕	0.3	Horizontal Deflection Amplifier	Max. DC Plate Volts, 350 Max. DC Cathode Ma., 90 Max. Peak Pos.-Pulse Plate Volts, 3000 Max. Plate Dissipation, 9 watts									
19AU4-GTA	Half-Wave Rectifier	F15	4CG	18.9⊕	0.6	Television Damper Service	Max. Peak Inverse Plate Volts, 4500 Max. Peak Plate Ma., 1300 Max. Average Plate Ma., 210 Max. Plate Dissipation, 6.5 Watts									
19BG6-GA	Beam Power Tube	F33	5BT	18.9	0.3	Horizontal Deflection Amplifier	Max. DC Plate Volts, 700 Max. DC Plate Current, 110 ma. Max. Peak Positive-Pulse Plate Volts, 6600 (Abs.) Max. Plate Dissipation, 20 watts									
19J6	Medium-Mu Twin Triode	A2	7BF	18.9	0.15	Each Unit as Class A Amplifier	100	50Ω (For both units at the specified conditions)			8.5	7100	5300	38	—	—
19T8	Triple Diode—High-Mu Triode	B2	9E	18.9	0.15	Triode Unit as Class A Amplifier	100 250	− 1v − 3v	—	—	0.8 1.0	54000 58000	1300 1200	70 70	— —	— —
19X8	Medium-Mu Triode—Sharp-Cutoff Pentode	B2	9AK	18.9	0.15	Triode Unit as Class A Amplifier	125	− 1v	—	—	12	6000	6500	40	—	—
						Pentode Unit as Class A Amplifier	125	− 1v	125	2.2	9	300000	5500	—	—	—
25CA5	Beam Power Tube	A3	7CV	25.0	0.3	Class A Amplifier	110 125	− 4v − 4.5v	110 125	3.5 4	32 37	16000 15000	8100 9200	— —	3500 4500	1.1 1.5
25EC6	Beam Power Tube	F29	5BT	25.0⊕	0.6	Horizontal Deflection Amplifier	Max. DC Plate Volts, 700 Max. DC Cathode Ma., 200 Max. Peak Positive-Pulse Plate Volts, 7000 (Abs.) Max. Plate Dissipation 10 watts.									
25L6	Beam Power Tube	E4	7AC	25.0	0.3	Amplifier	110 200	− 7.5v − 8v	110 110	4 2	49 50	13000 30000	9000 9500	— —	2000 3000	2.1 4.3

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FOOTNOTES

Note 1: Subscript 1 on class of amplifier service (as AB_1) indicates that grid current does not flow during any part of input cycle.

■ With tube mounted horizontally and pins No. 4 and No. 8 in a vertical plane (pin No. 4 on top), deflecting electrode No. 1 controls left-hand section of pattern, deflecting electrode No. 2 controls top right-hand section of pattern, deflecting electrode No. 3 controls bottom section of

Supply voltage applied through 20000-ohm voltage-dropping resistor

§ Megohms.

● 50000 ohms.

♠ For two tubes.

□ Grid # 2 tied to plate.

Applied through plate resistor of 250000 ohms.

° Both grids connected together; likewise, both plates.

▲ Grids # 2 and # 4 are screen. Grid # 1 is signal-input control grid.

‡ This diagram is like the one having the same designation except that Pin No. 1 has no connection.

This diagram is like the one having the same designation except that base sleeve is connected to Pin No. 1.

⊙ For use in automobile receivers which operate directly from 12-volt storage batteries.

▲ Grids # 2 and # 4 are screen. Grid # 3 is signal-input control grid.

Grids # 3 and # 5 are screen. Grid # 4 is signal-input control grid.

† Power output is for two tubes at stated plate-to-plate load.

KEY TO TUBE DIMENSIONS

Symbol	Maximum Overall Length	x	Diameter	Description
A1	1-3/4"	x	3/4"	7-Pin Miniature Types
A2	2-1/8"	x	3/4"	
A3	2-5/8"	x	3/4"	
B1	1-3/4"	x	7/8"	9-Pin Miniature Types
B2	2 3/16"	x	7/8"	
B4	2-5/8"	x	7/8"	
B5	2-11/16"	x	7/8"	
B8	2-27/32"	x	7/8"	
B10	3-1/16"	x	7/8"	
B13	2-13/16"	x	7/8"	
C1	3.410"	x	1.188"	Novar Types
C2	3.54"	x	1.562"	
E2	2-5/8"	x	1-5/16"	Octal-Metal Types
E3	3-1/8"	x	1-5/16"	
E4	3-1/4"	x	1-5/16"	
E5	4-5/16"	x	1-5/8"	
F1	2-5/16"	x	1-5/16"	Octal-Glass Types
F2	2-5/8"	x	1-1/16"	
F6	3-5/16"	x	1-9/32"	Octal-Glass Types
F7	3-5/16"	x	1-5/16"	
F8	3-3/8"	x	1-9/32"	
F9	3-7/16"	x	1-9/32"	
F10	3-15/32"	x	1-7/16"	
F15	3-13/16"	x	1-9/32"	
F16	3-7/8"	x	1-9/32"	
F17	3-7/8"	x	1-9/16"	
F19	4"	x	1-9/16"	
F20	4-1/16"	x	1-9/32"	
F21	4-1/8"	x	1-9/16"	
F22	4-1/4"	x	1-9/16"	
F23	4-5/16"	x	1-5/8"	
F24	4-15/32"	x	1-9/16"	
F25	4-5/8"	x	1-9/16"	
F28	4-5/8"	x	1-13/16"	
F29	4-3/4"	x	1-9/16"	
F33	5"	x	1-9/16"	
F34	5"	x	1-23/32"	
F38	5-7/32"	x	1-23/32"	
F39	5-5/16"	x	2-1/16"	
F40	5-11/16"	x	2-1/16"	Octal-Glass Types
G1	2.190"	x	0.875"	10-Pin Miniature Type
H2	3.23"	x	1.188"	9-Pin T9-Bulb Types
J2	2-25/32"	x	1-3/16"	Lock-In Types
J3	3-5/32"	x	1-3/16"	
K3	4-3/16"	x	1-3/16"	Other Types
K4	4-3/16"	x	1-9/16"	
K5	4-17/32"	x	1-9/16"	
K8	4-11/16"	x	1-13/16"	
K9	4-15/16"	x	1-9/16"	
K11	5-3/8"	x	2-1/16"	
L2	2.875"	x	1.563"	12-Pin T9-Bulb Type
L3	3.625"	x	1.563"	

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RCA RECEIVING-TUBE DATA

Types Not Recommended for New Equipment Design

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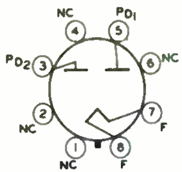
80	Full-Wave Rectifier	K8	4C	5.0F	2.0	With Capacitive-Input Filter	AC Volts per Plate (RMS), 350 Max. Peak Inverse Volts, 1400				DC Output Ma., 125 Max. Peak Plate Ma., 440			Min. Total Effect. Supply Imped. per Plate, 50 ohms		
						With Inductive-Input Filter	AC Volts per Plate (RMS), 500 Max. Peak Inverse Volts, 1400				Max. DC Output Ma., 125 Max. Peak Plate Ma., 440			Min. Value of Input Choke, 10 henries		
84/6Z4	Full-Wave Rectifier	K4	5D	6.3	0.5	With Capacitive-Input Filter	AC Volts per Plate (RMS), 325 Max. Peak Inverse Volts, 1250				DC Output Ma., 60 Max. Peak Plate Ma., 180			Total Effect. Supply Imped. per Plate, 150 ohms.		
						With Inductive-Input Filter	AC Volts per Plate (RMS), 450 Max. Peak Inverse Volts, 1250				Max. DC Output Ma., 60 Max. Peak Plate Ma., 180			Value of Input Choke, 10 henries		
117L7-GT/117M7-GT	Rectifier-Beam Power Tube	F9	8AO	117	0.09	Amplifier Unit as Class A Amplifier	105	− 5.2v	105	4	43	17000	5300	——	4000	0.85
						Half-Wave Rectifier	Max. AC Plate Volts (RMS), 117 Max. Peak Inverse Volts, 350				Max. DC Output Ma., 75 Max. Peak Plate Ma., 450			Min. Total Effect. Plate-Supply Imped., 15 ohms.		
117N7-GT	Rectifier-Beam Power Tube	F9	8AV	117	0.09	Amplifier Unit as Class A Amplifier	100	− 6v	100	5	51	16000	7000	——	3000	1.2
						Half-Wave Rectifier	Max. AC Plate Volts (RMS), 117 Max. Peak Inverse Volts, 350				Max. DC Output Ma., 75 Max. Peak Plate Ma., 450			Min. Total Effect. Plate-Supply Impedance, 15 ohms.		
117P7-GT	Rectifier-Beam Power Tube	F9	8AV	117	0.09		For other characteristics, refer to Type 117L7/M7-GT.									
117Z3	Half-Wave Rectifier	A3	4CB	117	0.04	With Capacitive-Input Filter	Max. Peak Inverse Volts, 330				Max. DC Output Ma., 90 Max. Peak Plate Ma., 540			Min. Total Effect. Plate-Supply Imped., 20 ohms		
117Z6-GT	Rectifier-Doubler	F6	7Q⊕	117	0.075	Voltage Doubler	AC Volts per Plate (RMS), 117 DC Output Ma., 60				Min. Total Effective Plate-Supply Impedance per Plate: Half-Wave, 30 ohms; Full-Wave, 15 ohms.					
						Half-Wave Rectifier	AC Volts per Plate (RMS), 235 DC Output Ma. per Plate, 60				Min. Total Effect. Supply Imped. per Plate: At 117 volts, 15 ohms; at 150 volts, 40 ohms; at 235 volts, 100 ohms.					
5881	Beam Power Tube	F10	7AC	6.3	0.9	Single Tube Class A Amplifier	250 350	−14v −18v	250 250	4.3 2.5	75 53	30000 48000	6100 5200	—— ——	2500 4200	6.7 11.3
						Push-Pull Class A Amplifier	250 270	−16v −17.5v	250 270	10♠ 11♠	120♠ 134♠	—— ——	—— ——	—— ——	5000 5000	14.5† 17.5†
						Push-Pull Class AB_1 Amplifier	360 360	−22.5v −22.5v	270 270	5♠ 5♠	88♠ 88♠	—— ——	—— ——	—— ——	6600 3800	26.5† 18 †
7247	Dual Triode	B2	9A	12.6 6.3	0.15 0.3	Unit No. 1 as Class A Amplifier	250	− 2v	——	——	1.2	62500	1600	100	——	——
						Unit No. 2 as Class A Amplifier	250	− 8.5v	——	——	10.5	7700	2200	17	——	——
7695	Beam Power Tube	H2	9MQ	50	0.15	Class A Amplifier	130	−11v	130	5	100	7000	11000	——	1100	4.5
						Push-Pull Class AB_1 Amplifier	140	50Ω	140	9♠	210♠	——	——	——	1500	10†
EM84/6FG6	Electron-Ray Tube	B8	9GA	6.3	0.27	Visual Indicator	Triode Plate Supply Volts, 250 Triode-Plate Resistance, 1 meg. Triode Grid-Supply Volts, −22 Max. Length of Dark Part of Target, when triode grid resistor = 0, 1.14 inch				Triode Plate Ma., 0.06			Fluorescent-Target Volts, 250 Triode-Grid Resistance, 0.47 meg. Fluorescent Target Ma., 1.6		

World Radio History



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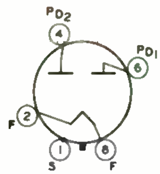

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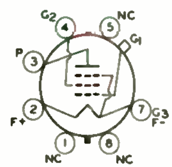

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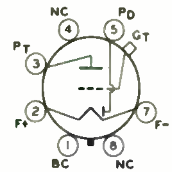

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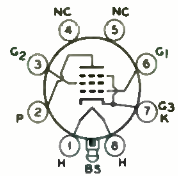

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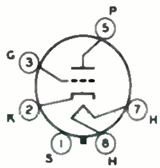

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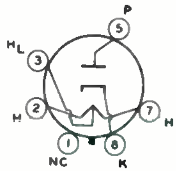

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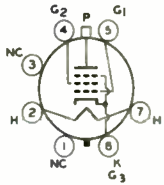

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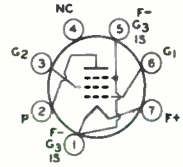

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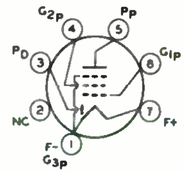

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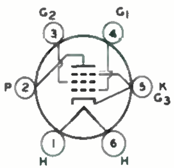

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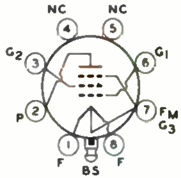

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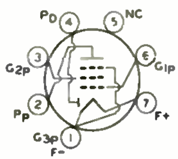

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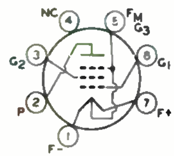

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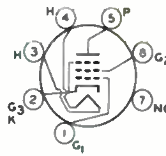

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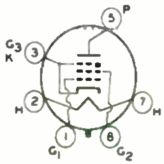

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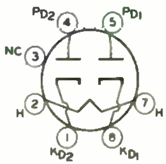

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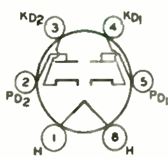

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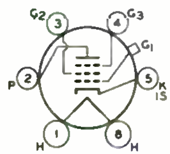

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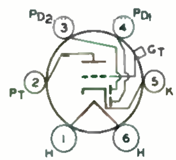

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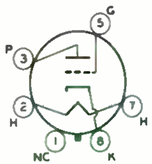

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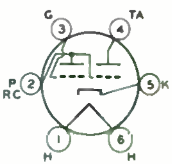

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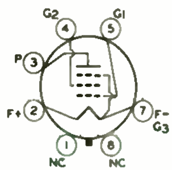

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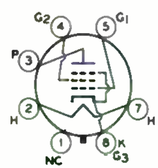

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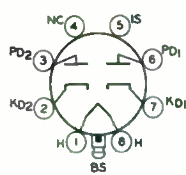


7AJ

World Radio History

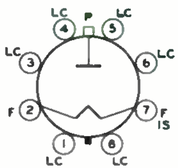
KEY: BASING DIAGRAMS *(Bottom Views)*

● = Gas-Type Tube
BC = Base Sleeve
BS = Base Shell
C = External Conductive Coating
CL = Collector
DJ = Deflecting Electrode
ES = External Shield
F = Filament

F+ = Filament (positive only)
F− = Filament (negative only)
FM = Filament Tap
G = Grid
H = Heater
HL = Heater Tap for Panel Lamp
HM = Heater Tap
IC = Internal Connection—Do Not Use

IS = Internal Shield
K = Cathode
LC = Limited Connection—Do Not Use, Except As Specified in Data
NC = No Internal Connection
P = Plate (Anode)
RC = Ray-Control Electrode
S = Shell
TA = Target

Subscripts for multi-unit types: B, beam unit; D, diode unit; HP, heptode unit; HX, hexode unit; P. pentode unit; T, triode unit; TR, tetrode unit.



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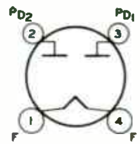

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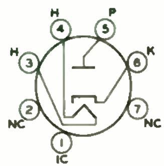

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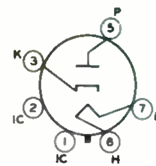

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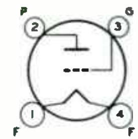

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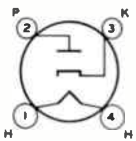

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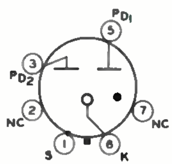

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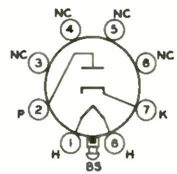

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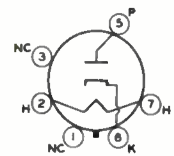

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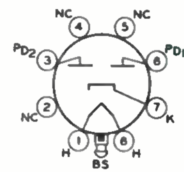

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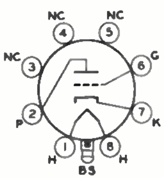

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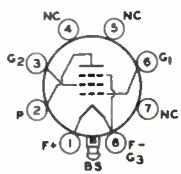

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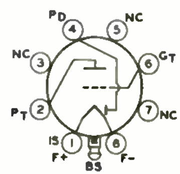

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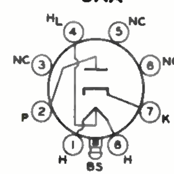

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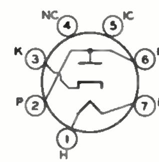

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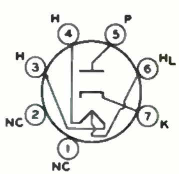

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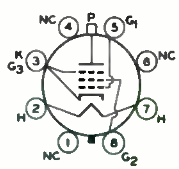

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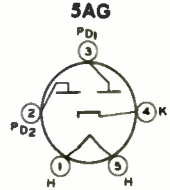

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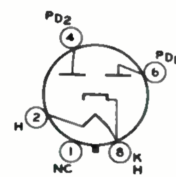

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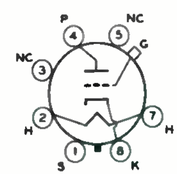

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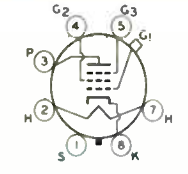
World Radio History



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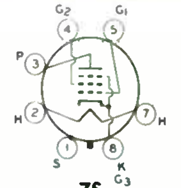

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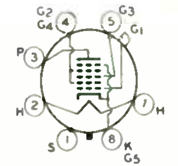

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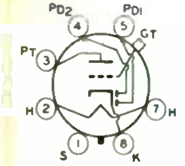

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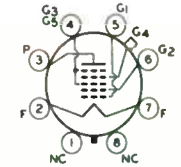

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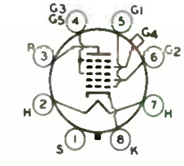

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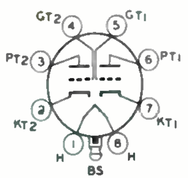

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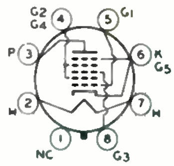

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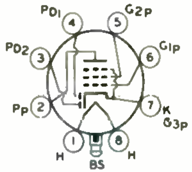

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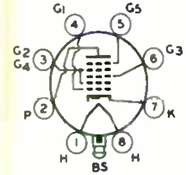

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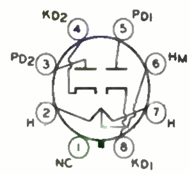

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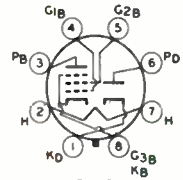

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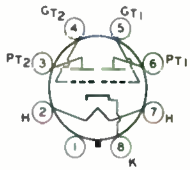

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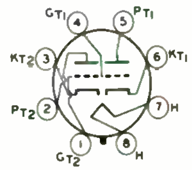

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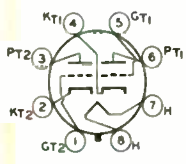

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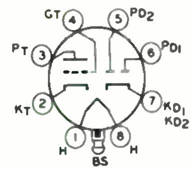

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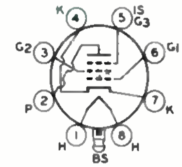

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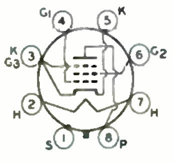

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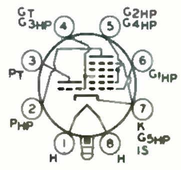

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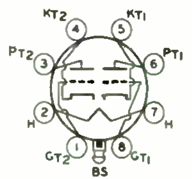

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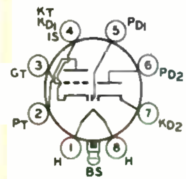

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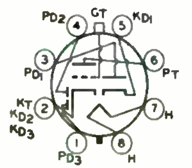

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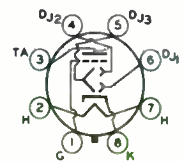

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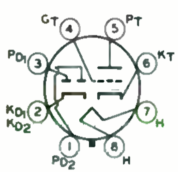

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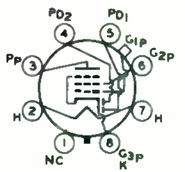

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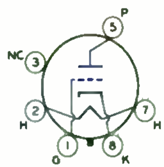

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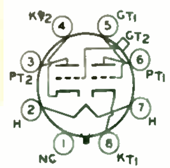

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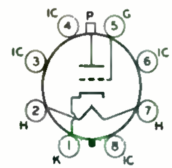

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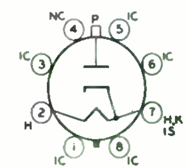

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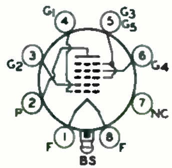
World Radio History

RCA RECEIVING-TUBE DATA

Types Not Recommended for New Equipment Design



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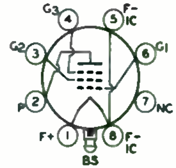

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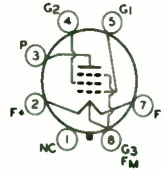

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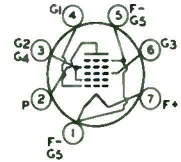

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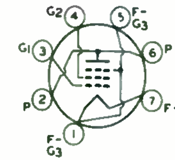

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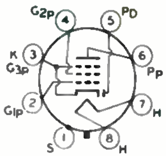

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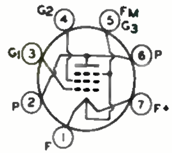

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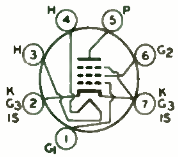

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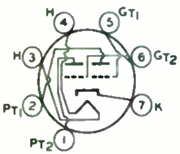

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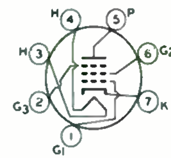

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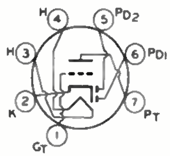

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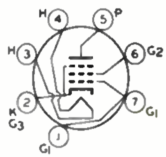

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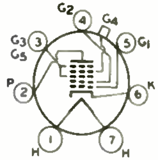

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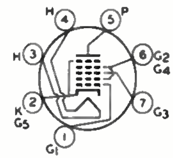

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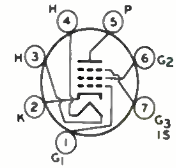

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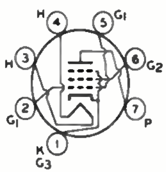

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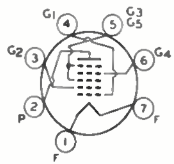

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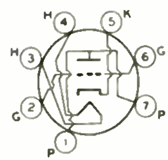

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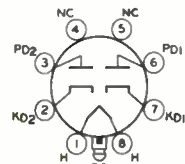

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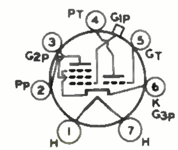

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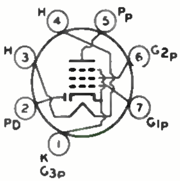

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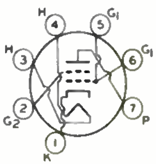

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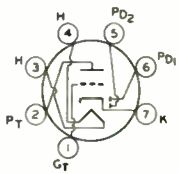

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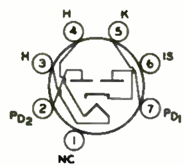

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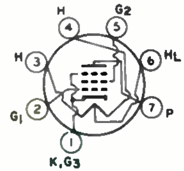

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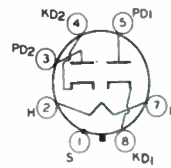

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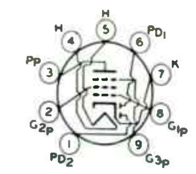

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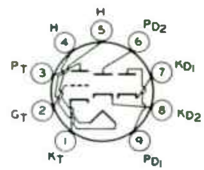

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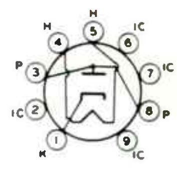

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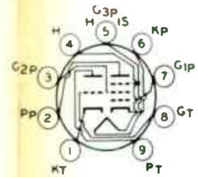

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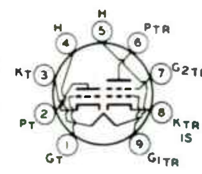

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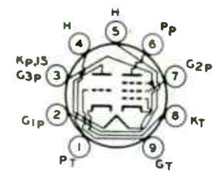

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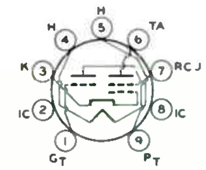

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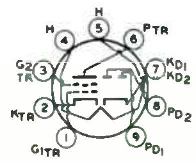

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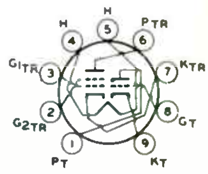

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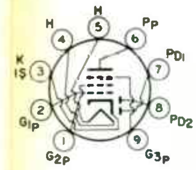

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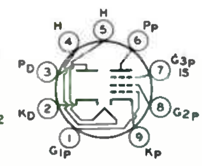

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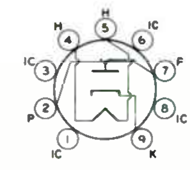

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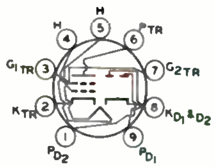

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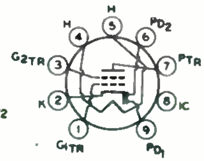

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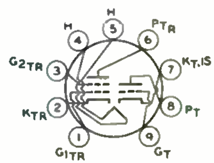

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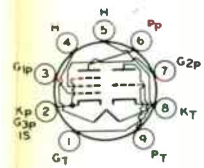

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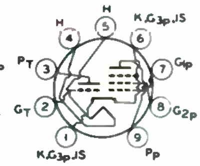

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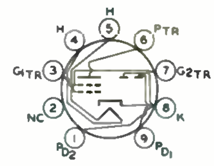

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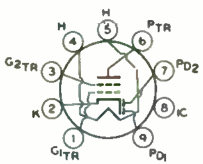

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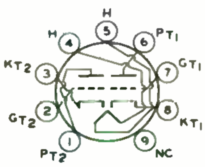

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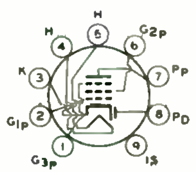

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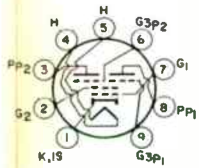

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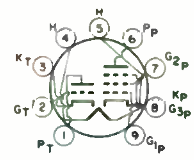

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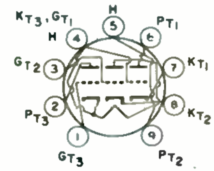

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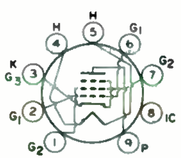

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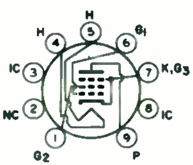

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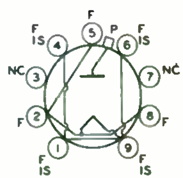

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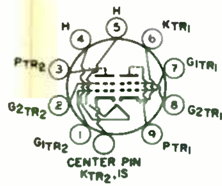

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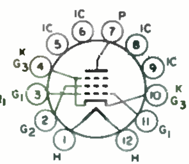

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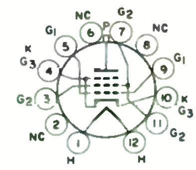
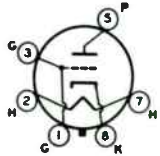


12DR

World Radio History

RCA RECEIVING-TUBE DATA

Types Not Recommended for New Equipment Design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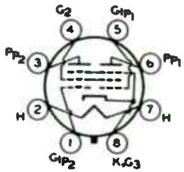
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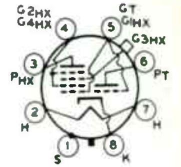
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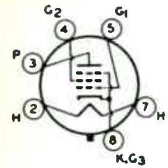
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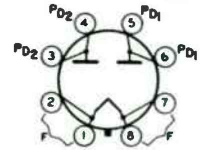
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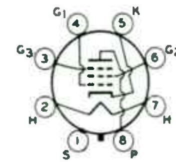
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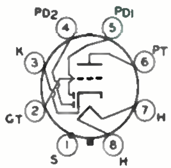
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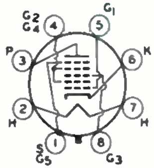
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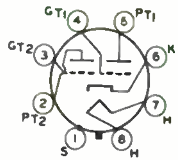
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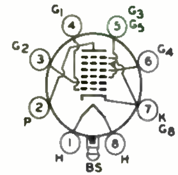
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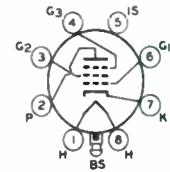
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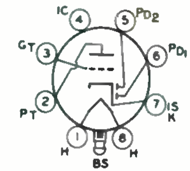
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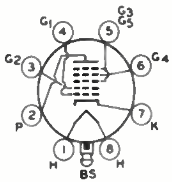
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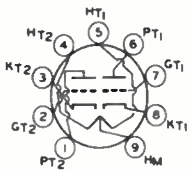
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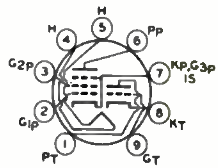
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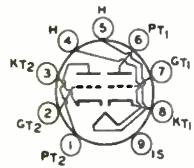
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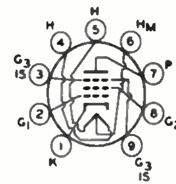
9AK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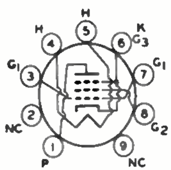
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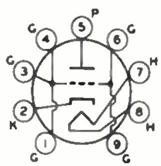
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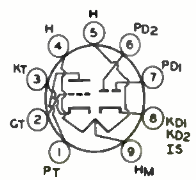
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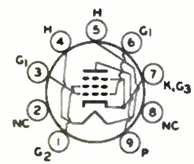
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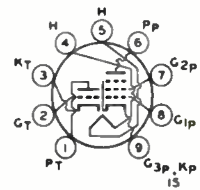
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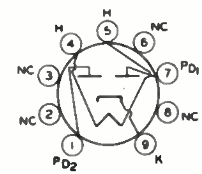
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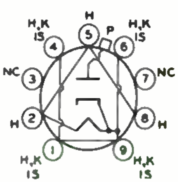
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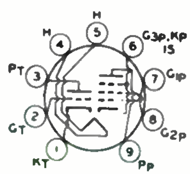
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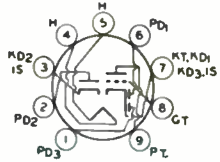
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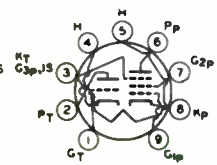
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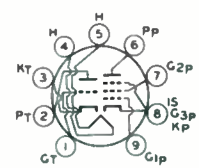
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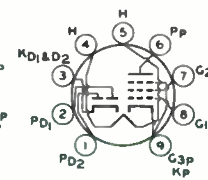

9FE

World Radio History

This listing groups RCA receiving-tube types which differ only in their heater ratings. The first column, in bold face, is arranged only by the alphabetical portion of the type designation.

6A8	6A8G	6A8GT
	12A8GT	
6AF3	12AF3	
6AF4	2AF4B	3AF4A
	6AF4A	
6AL5	3AL5	12AL5
6AM8A	5AM8	
6AN8A	5AN8	
6AQ5A	5AQ5	12AQ5
6AR11	11AR11	
6AS8	5AS8	
6AT6	12AT6	
6AT8A	5AT8	
6AU4	19AU4	19AU4GTA
6AU6A	3AU6	4AU6
	12AU6	
12AU7A	7AU7	9AU7
6AU8A	8AU8	
6AV5GA	12AV5GA	25AV5GA
6AV6	3AV6	4AV6
	12AV6	
6AW8A	8AW8A	
6AX3	12AX3	17AX3
6AX4GT	6AX4GTA	12AX4GTA
	12AX4GTB	17AX4GT
	17AX4GTA	25AX4GT
6AY3	12AY3	17AY3
6B10	8B10	
6BA6	3BA6	12BA6
6BA7	12BA7	
6BA8A	8BA8A	
6BC5	3BC5	4BC5
6BC8	4BC8	
6BD6	12BD6	
6BE6	3BE6	12BE6
6BF6	12BF6	
6BG6GA	19BG6GA	
6BH3	17BH3	22BH3
6BH8	8BH8	
6BK5	12BK5	25BK5
6BK7B	5BK7A	
6BL8	4BL8	
6BN4A	2BN4A	3BN4A
6BN6	3BN6	4BN6
6BN8	8BN8	
6BQ5	8BQ5	

6BQ6GTB/ 6CU6	12BQ6GTB/ 12CU6	17BQ6GTB
	25BQ6GTB/ 25CU6	
6BQ7A	4BQ7A	5BQ7A
6BR8A	5BR8	
6BS3	12BS3	17BS3
6BS8	4BS8	
6BU8	3BU8	4BU8
6BW4	12BW4	
6BW8	5BW8	
6BY6	3BY6	
6BZ6	3BZ6	4BZ6
	12BZ6	
6BZ7	4BZ7	
50C5	25C5	
6C9	17C9	
6CA5	12CA5	25CA5
6CB6	3CB6	4CB6
	6CB6A	
6CD6GA	25CD6GB	
6CE5	3CE5	
6CF6	3CF6	
6CG7	8CG7	
6CG8	5CG8	6CG8A
6CL8A	5CL8A	19CL8A
6CM7	8CM7	
6CM8	5CM8	
6CN7	8CN7	
6CQ8	5CQ8	
6CS6	3CS6	4CS6
6CS7	8CS7	
6CU5	12CU5/ 12C5	17CU5
6CW4	2CW4	13CW4
6CX8	8CX8	
6CY5	2CY5	3CY5
	4CY5	
6CY7	11CY7	
6CZ5	5CZ5	
6DA4	17D4	
6DE4	17DE4	22DE4
6DE6	4DE6	
6DE7	10DE7	13DE7
6DK6	3DK6	4DK6
	12DK6	

World Radio History

Related RCA Receiving-Tube Types

6DM4	12DM4	17DM4
6DN6	25DN6	
6DQ6B	12DQ6A	12DQ6B 17DQ6B
6DR7	10DR7	13DR7
6DS4	2DS4	
6DT5	12DT5	
6DT6A	3DT6A	4DT6A
6DT8	12DT8	
6DV4	2DV4	
6DX8	10DX8	
6DZ4	2DZ4	3DZ4
6EA5	3EA5	
6EA8	5EA8	19EA8
6EB8	8EB8	
6EH5	12EH5	25EH5 50EH5
6EH7	3EH7	4EH7
6EJ7	3EJ7	4EJ7
6EM5	8EM5	
6EM7	10EM7	13EM7
6EQ7	12EQ7	20EQ7
6ER5	2ER5	3ER5
6ES8	4ES8	
6EU8	5EU8	
6EW6	4EW6	5EW6
6EY6	7EY6	
6F5	6F5GT	12F5GT
6FD7	13FD7	
6FE5	50FE5	
6FG7	5FG7	
6FH5	2FH5	3FH5
6FQ7	8FQ7	
6FS5	2FS5	
6FV8	5FV8	6FV8A
60FX5	12FX5	
6GE5	12GE5	17GE5
6GF7	10GF7	13GF7
6GH8	5GH8	6GH8A
6GJ5	12GJ5	17GJ5
6GK5	2GK5	3GK5
6GM6	4GM6	5GM6
6GN8	8GN8	10GN8
3GS8	4GS8	
6GT5	12GT5	17GT5
6GW6	12GW6	17GW6
6GX6	5GX6	
6H6	6H6GT/G	12H6
6HA5	See 6HM5/6HA5	
6HB6	15HB6	

6HF8	10HF8	
6HM5/6HA5	3HM5/3HA5	
6HR6	19HR6	
6HS6	19HS6	
6HS8	3HS8	4HS8
6J5	6J5GT	12J5GT
6J6A	5J6	19J6
6J7	6J7GT	12J7GT
6JB6	12JB6	17JB6
6JC6	3JC6	4JC6
6JD6	3JD6	4JD6
6JV8	8JV8	
6K7	6K7GT	12K7GT
6K8	12K8	
6KA8	8KA8	
6KE8	5KE8	
6KL8	12KL8	
6KV8	11KV8	
50L6GT	12L6GT	25L6 25L6GT
6LC8	8LC8	
6Q7	6Q7GT	12Q7GT
6S8GT	12S8GT	
6SA7	6SA7GT	12SA7 12SA7GT
6SC7	12SC7	
6SF5	6SF5GT	12SF5 12SF5GT
6SF7	12SF7	
6SG7	12SG7	
6SH7	12SH7	
6SJ7	6SJ7GT	12SJ7 12SJ7GT
6SK7	6SK7GT	12SK7 12SK7GT
6SL7GT	12SL7GT	
6SN7GTB	12SN7GTA	
6SQ7	6SQ7GT	12SQ7 12SQ7GT
6SR7	12SR7	
6T8A	5T8	19T8
6U8A	5U8A	9U8A
6V6	6V6GTA	5V6GT 12V6GT
6W4GT	25W4GT	
6W6GT	12W6GT	
6X4	12X4	
6X8	5X8	19X8

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.
World Radio History

DIODE CONSIDERATIONS
DIODE-TRIODE AND DIODE-PENTODE TUBES

Certain multi-unit tubes contain one or more diode plates, each having its own base pin, in addition to a triode or pentode unit. Such types may employ either a unipotential cathode or a filamentary cathode.

In unipotential-cathode tubes the cathode is common to the triode or pentode unit and the diode(s). In filamentary-cathode tubes the filament is likewise common to the triode or pentode unit and the diode(s). However, in filament types, diode operation is affected by the position of the diode plate(s) with respect to the filament, and, therefore, the position of the diode plate(s) is specified on the individual tube data sheets.

The rectifying action of the diode is commonly used for the following purposes:

Detection: Detection may be accomplished by using either a half-wave or full-wave circuit arrangement to supply signal voltage to the triode or pentode unit of the tube or to another amplifier tube. The half-wave circuit will provide approximately twice the rectified voltage obtainable from a full-wave circuit for the same applied signal voltage. Since the amplitude variation of the envelope of the rectified voltage is usually of greater importance than rectifier power, the half-wave circuit is more commonly used in practice.

AVC: Regulation of amplifier gain, generally called Automatic Volume Control, may be accomplished by using the output of a diode rectifier in a number of ways. The diode output may be applied to the control grids of the preceding amplifier tubes, or it may be applied, in the case of rf pentodes, to their suppressors, plates and/or screens.

The above functions can be performed simultaneously by using a single diode, two diodes in parallel, or by two diodes operating independently. A number of typical circuit arrangements are shown on the following pages.

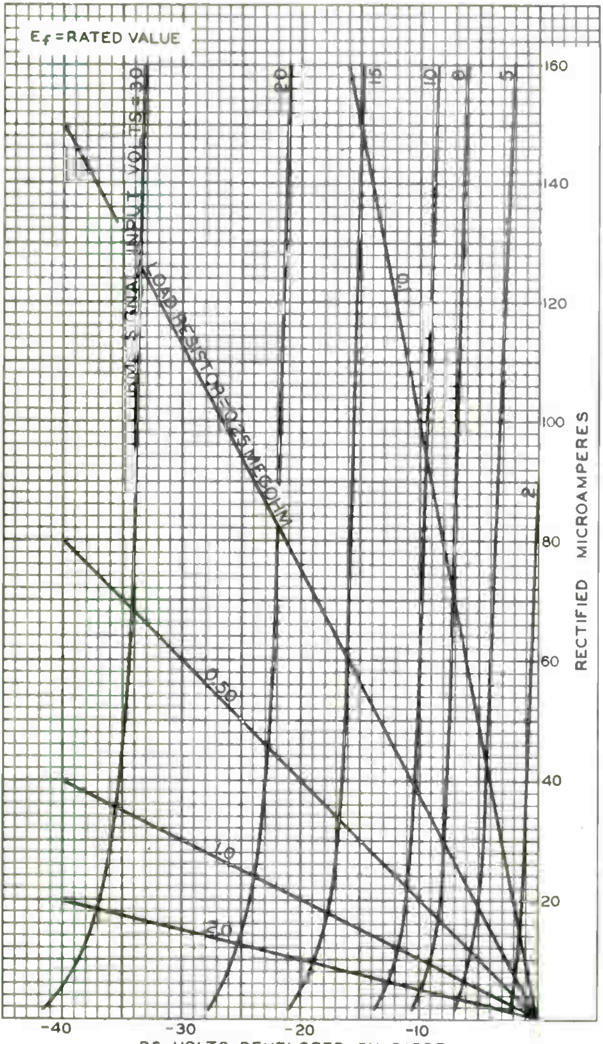
Average Characteristic Curves for diodes in diode-triode and diode-pentode tubes are shown on the next page.

World Radio History

AVERAGE DIODE CHARACTERISTICS

HALF-WAVE RECTIFICATION-SINGLE DIODE UNIT

SEE PRECEDING PAGE



JULY 15, 1947

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

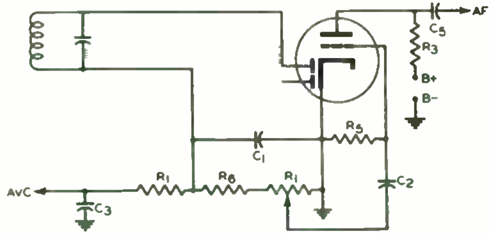
92CM-6875

World Radio History

DIODE CONSIDERATIONS

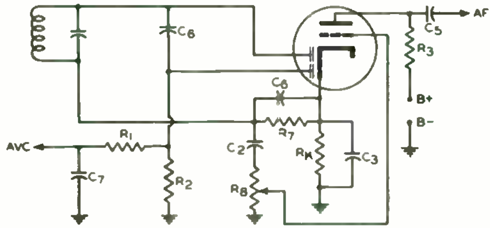
TYPICAL DIODE-TRIODE CIRCUITS

HALF-WAVE DETECTOR, AVC, ZERO-BIAS AMPLIFIER



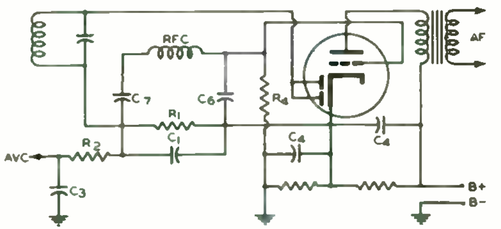
92CS-6677

HALF-WAVE DETECTOR AND DELAYED AVC, CATHODE-BIAS AMPLIFIER



92CS-6679

HALF-WAVE DETECTOR, AVC, FIXED-BIAS AMPLIFIER



92CS-6678R1

TYPICAL VALUES

C1: 150 µµf for 450-1600 kc
C2: 0.01 µf
C3: 0.1 µf
C4: 0.5 µf or larger
C5: 0.01 to 0.1 µf or larger
C6: 100 µµf
C7: 0.01 to 0.05 µf
R1: 0.5 Megohm
R2: 1.0 Megohm
R3: 0.1 Megohm
R4: 0.05 to 1.0 Megohm
R5: 10 Megohms
R6: 22000 Ohms
R7: 0.25 Megohm
R8: 1 to 2 Megohm

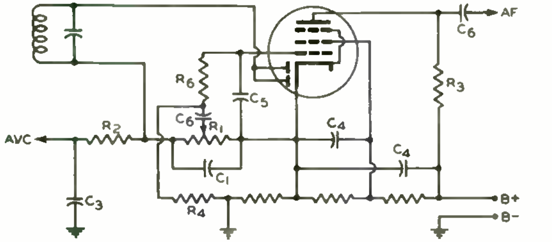
World Radio History

RCA

DIODE CONSIDERATIONS

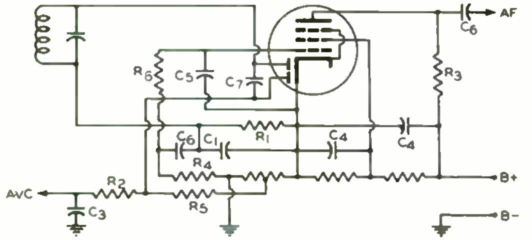
TYPICAL DIODE-PENTODE CIRCUITS

HALF-WAVE DETECTOR AND AVC, FIXED-BIAS AMPLIFIER



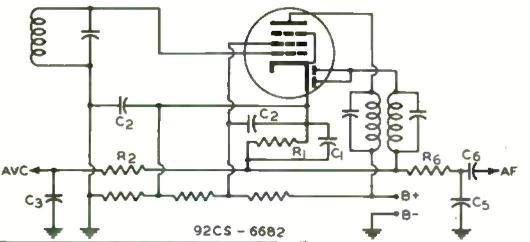
92CS-6681

HALF-WAVE DETECTOR, SEPARATE AVC, FIXED-BIAS AMPLIFIER



92CS-6680

HALF-WAVE DETECTOR, AVC, FIXED-BIAS H-F AMPLIFIER



92CS-6682

TYPICAL VALUES

C1: 150 $\mu\mu$f for 450-1600 kc
C2, C3: 0.1 μf
C4: 0.5 μf or larger
C5: 100 $\mu\mu$f or smaller
C6: 0.01 to 0.1 μf
C7: 500 to 1000 $\mu\mu$f

R1: 0.5 to 1.0 Megohm
R2: 1.0 to 1.5 Megohms
R3: 0.1 to 0.2 Megohm
R4: 0.5 to 1.0 Megohm
R5: 1.0 Megohm
R6: 0.1 to 0.2 Megohm

Devices and arrangements shown or described herein may use patents of RCA or others. Information contained herein is furnished without responsibility by RCA for its use and without prejudice to RCA's patent rights.

World Radio History

KEY TO RESISTANCE-COUPLED AMPLIFIER CHARTS

Note: Chart number references, listed below, supersede those which may appear on individual tube data sheets for these types.

Tube Type	Chart No.	Tube Type	Chart No.	Tube Type	Chart No.	Tube Type	Chart No.	Tube Type	Chart No.
3AU6....	2	5BK7A...	10	6BZ7......	10	6T8A.....	5	12AX7A.....	9
3AV6....	9	5BQ7A...	10	6C4.......	3	7AU7.....	3	12AY7......	1
3BC5....	11	5T8.....	5	6CB6......	11	8CG7.....	8	12SL7GT....	5
3CB6....	11	6AB4....	4	6CB6A.....	11	8CN7.....	5	12SN7GTA...	8
3CF6....	1	6AG5....	11	6CF6......	11	8FQ7.....	8	19T8.......	5
4AU6....	2	6AT6....	5	6CG7......	8	9AU7.....	3	20EZ7......	9
4AV6....	9	6AU6A...	2	6CN7......	5	12AT6....	5	5879▲......	6
4BC5....	11	6AV6....	9	6EU7......	9	12AT7....	4	5879*......	7
4BQ7A...	10	6BC5....	11	6FQ7......	8	12AU6....	2	7025.......	9
4BZ7....	10	6BK7B...	10	6SL7GT....	5	12AU7A...	3	7199▲......	12
4CB6....	11	6BQ7A...	10	6SN7GTB...	8	12AV6....	9	7199*......	13

▲ Pentode Unit

* Triode Unit or Triode Connection

SYMBOLS USED IN RESISTANCE-COUPLED AMPLIFIER CHARTS

- **C** = Blocking Capacitor (μf).
- **C_k** = Cathode Bypass Capacitor (μf).
- **C_{g2}** = Screen-Grid Bypass Capacitor (μf).
- **E_{bb}** = Plate-Supply Voltage. Voltage at plate equals plate-supply voltage minus drop in R_p and R_k.
- **R_k** = Cathode Resistor (ohms).
- **R_{g2}** = Screen-Grid Resistor (megohms).
- **R_g** = Grid Resistor (megohms) for following stage.
- **R_p** = Plate Resistor (megohms).
- **V.G.** = Voltage Gain.
- **E_o** = Output Voltage (peak volts). This voltage is obtained across R_g (for following stage) at any frequency within the flat region of the output vs. frequency curve, and is for the condition where the signal level is adequate to swing the grid of the resistance-coupled amplifier tube to the point where its grid starts to draw current.

Note: The listed values for E_o are the peak output voltages available when the grid is driven from a low-impedance source. The listed values for the cathode resistors are optimum for any signal source. With a high-impedance source, protection against severe distortion and loss of gain due to input loading may be obtained by the use of a coupling capacitor connected directly to the input grid and a high-value resistor connected between the grid and ground.

World Radio History

CIRCUIT ADVANTAGES

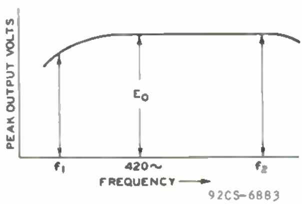
For most of the types shown, the data pertain to operation with cathode bias; for all of the pentodes, the data pertain to operation with series screen-grid resistor. The use of a cathode-bias resistor where feasible and a series screen-grid resistor where applicable offers several advantages over fixed-voltage operation.

The advantages are: (1) effects of possible tube differences are minimized; (2) operation over a wide range of plate-supply voltages without appreciable change in gain is feasible; (3) the low frequency at which the amplifier cuts off is easily changed; and (4) tendency toward motorboating is minimized.

NUMBER OF STAGES

These advantages can be enhanced by the addition of suitable decoupling filters in the plate supply of each stage of a multi-stage amplifier. With proper filters, three or more amplifier stages can be operated from a single power-supply unit of conventional design without encountering any difficulties due to coupling through the power unit. When decoupling filters are not used, not more than two stages should be operated from a single power-supply unit.

GENERAL CIRCUIT CONSIDERATIONS



In the discussions which follow, the frequency (f_2) is that value at which the high-frequency response begins to fall off. The frequency (f_1) is that value at which the low-frequency response drops below a satisfactory value, as discussed below. A variation of 10 per cent in values of resistors and capacitors has only slight effect on performance. One-half-watt resistors are usually suitable for R_{g2}, R_g, and R_k resistors. Capacitors C and C_{g2} should have a working voltage equal to or greater than E_{bb}. Capacitor C_k may have a low working voltage in the order of 10 to 25 volts.

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Triode Amplifier *(Heater-Cathode Type)*

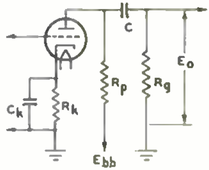

Diagram No.1

Capacitors C and C_k have been chosen to give an output voltage equal to 0.8 E_o for a frequency (f_1) of 100 cycles. For any other values of (f_1), multiply values of C and C_k by $100/f_1$. In the case of capacitor C_k, the values shown in the charts are for an amplifier with dc heater excitation; when ac is used, depending on the character of the associated circuit, the gain, and the value of f_1, it may be necessary to increase the value of C_k to minimize hum disturbances. It may be desirable to operate the heater at a positive voltage of from 15 to 40 volts with respect to the cathode. The voltage output at f_1, or "n" like stage equals $(0.8)^n E_o$ where E_o is peak output voltage of final stage. For an amplifier of typical construction, the value of f_2 is well above the audio-frequency range for any value of R_p.

Pentode Amplifier *(Heater-Cathode Type)*

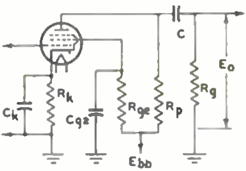

Diagram No.2

Capacitors C, C_k, and C_{g2} have been chosen to give an output voltage equal to 0.7 E_o for a frequency (f_1) of 100 cycles. For any other value of f_1, multiply values of C, C_k, and C_{g2} by $100/f_1$. In the case of capacitor C_k, the values shown in the charts are for an amplifier with dc heater excitation; when ac is used, depending on the character of the associated circuits, the voltage gain, and the value of f_1, it may be necessary to increase the value of C_k to minimize hum disturbances. It may be desirable to operate the heater at a positive voltage of from 15 to 40 volts with respect to the cathode. The voltage output at f_1 for "n" like stages equals $(0.7)^n E_o$ where E_o is the peak output voltage of final stage. For an amplifier of typical construction, and for R_p values of 0.1, 0.25, and 0.5 megohm, approximate values of f_2 are 20000, 10000, and 5000 cps, respectively.

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World Radio History

RESISTANCE-COUPLED AMPLIFIER CHARTS

1 12AY7•

See *Circuit Diagram 1*

E_{bb}	R_p	R_g	R_{g2}	R_k	C_{g2}	C_k	C	E_o*	V.G.
90	0.1	0.24	—	1800	—	—	—	13	24
	0.24	0.51	—	3700	—	—	—	14	26
	0.51	1.0	—	7800	—	—	—	16	27
180	0.1	0.24	—	1300	—	—	—	31	27
	0.24	0.51	—	2800	—	—	—	33	29
	0.51	1.0	—	5700	—	—	—	33	30
300	0.1	0.24	—	1200	—	—	—	58	28
	0.24	0.51	—	2300	—	—	—	30	30
	0.51	1.0	—	4800	—	—	—	56	31

2 3AU6, 4AU6, 6AU6A, 12AU6

See *Circuit Diagram 2*

E_{bb}	R_p	R_g	R_{g2}	R_k	C_{g2}	C_k	C	E_o*	V.G.
90	0.22	0.22	0.340	2700	0.057	5.8	0.0081	16	79
	0.22	0.47	0.370	2900	0.050	5.4	0.0055	22	104
	0.22	1.0	0.380	3100	0.050	5.3	0.0034	25	125
	0.47	0.47	1.00	6000	0.027	2.8	0.0042	13	105
	0.47	1.0	1.00	6200	0.023	2.7	0.0027	17	137
	0.47	2.2	1.00	6300	0.027	2.8	0.0019	25	161
	1.0	1.0	1.90	10800	0.017	1.7	0.0025	10	139
	1.0	2.2	2.40	13100	0.017	1.7	0.0017	19	184
180	0.22	0.22	0.520	1340	0.059	8.8	0.0081	31	143
	0.22	0.47	0.520	1390	0.059	8.7	0.0053	43	192
	0.22	1.0	0.520	1420	0.059	8.6	0.0032	48	223
	0.47	0.47	1.05	2700	0.039	5.5	0.0041	34	189
	0.47	1.0	1.15	2880	0.037	5.4	0.0027	43	249
	0.47	2.2	1.20	2960	0.036	5.4	0.0019	50	294
	1.0	1.0	2.40	5500	0.028	3.2	0.0023	33	230
	1.0	2.2	2.70	6000	0.022	2.8	0.0015	40	323
300	0.22	0.22	0.530	780	0.077	13.[illegible]	0.0082	53	200
	0.22	0.47	0.540	783	0.077	13.2	0.0053	65	270
	0.22	1.0	0.540	800	0.077	13.1	0.0033	74	316
	0.47	0.47	1.15	1590	0.057	8.4	0.0045	56	275
	0.47	1.0	1.22	1650	0.049	7.4	0.0027	72	357
	0.47	2.2	1.31	1720	0.045	7.2	0.0017	82	418
	1.0	1.0	2.50	3300	0.036	5.3	0.0022	57	352
	1.0	2.2	2.80	3500	0.031	4.2	0.0015	72	466

• One triode unit. * Peak volts.
▲ Coupling capacitors should be selected to give desired frequency response. Cathode resistors should be adequately bypassed.

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Electronic Components and Devices Harrison, N. J.

World Radio History

RESISTANCE-COUPLED AMPLIFIER CHARTS

3

6C4, 7AU7,• 9AU7,• 12AU7A•

See *Circuit Diagram 1*

E_{bb}	R_p	R_g	R_{g2}	R_k	C_{g2}	C_k	C	E_o*	V.G.
90	0.047	0.047	—	1600	—	3.2	0.061	9	10
	0.047	0.1	—	1800	—	2.5	0.033	11	11
	0.047	0.22	—	2000	—	2.0	0.015	14	11
	0.1	0.1	—	3000	—	1.6	0.032	10	11
	0.1	0.22	—	3800	—	1.1	0.015	15	11
	0.1	0.47	—	4500	—	1.0	0.007	18	11
	0.22	0.22	—	6800	—	0.7	0.015	14	11
	0.22	0.47	—	9500	—	0.5	0.0065	20	11
	0.22	1.0	—	11500	—	0.43	0.0035	24	11
180	0.047	0.047	—	920	—	3.9	0.062	20	11
	0.047	0.1	—	1200	—	2.9	0.037	26	12
	0.047	0.22	—	1400	—	2.5	0.016	29	12
	0.1	0.1	—	2000	—	1.9	0.032	24	12
	0.1	0.22	—	2800	—	1.4	0.016	33	12
	0.1	0.47	—	3600	—	1.1	0.007	40	12
	0.22	0.22	—	5300	—	0.8	0.015	31	12
	0.22	0.47	—	8300	—	0.56	0.007	44	12
	0.22	1.0	—	10000	—	0.48	0.0035	54	12
300	0.047	0.047	—	870	—	4.1	0.065	38	12
	0.047	0.1	—	1200	—	3.0	0.034	52	12
	0.047	0.22	—	1500	—	2.4	0.016	68	12
	0.1	0.1	—	1900	—	1.9	0.032	44	12
	0.1	0.22	—	3000	—	1.3	0.016	68	12
	0.1	0.47	—	4000	—	1.1	0.007	80	12
	0.22	0.22	—	5300	—	0.9	0.015	57	12
	0.22	0.47	—	8800	—	0.52	0.007	82	12
	0.22	1.0	—	11000	—	0.46	0.0035	92	12

• One triode unit. * Peak volts.

World Radio History

RESISTANCE-COUPLED AMPLIFIER CHARTS

4

6AB4, 12AT7•

See *Circuit Diagram 1*

E_{bb}	R_p	R_g	R_{g2}	R_k	C_{g2}	C_k	C	E_o*	V.G.
90	0.1	0.1	—	2680	—	2.4	0.026	8	24
	0.1	0.22	—	3060	—	2.00	0.014	11	25
	0.1	0.47	—	3390	—	1.84	0.0074	13	28
	0.22	0.22	—	5500	—	1.33	0.0136	10	25
	0.22	0.47	—	6300	—	1.01	0.0067	14	28
	0.22	1.0	—	6930	—	0.92	0.0038	15	28
	0.47	0.47	—	10900	—	0.63	0.007	13	26
	0.47	1.0	—	12500	—	0.52	0.0043	14	28
	0.47	2.2	—	13500	—	0.47	0.0031	18	28
180	0.1	0.1	—	1407	—	3.6	0.029	20	31
	0.1	0.22	—	1674	—	3.0	0.016	28	33
	0.1	0.47	—	1786	—	2.6	0.0083	31	34
	0.22	0.22	—	2890	—	1.75	0.0140	24	33
	0.22	0.47	—	3860	—	1.34	0.0077	35	33
	0.22	1.0	—	4660	—	1.14	0.0047	42	33
	0.47	0.47	—	6960	—	0.83	0.0075	31	31
	0.47	1.0	—	8450	—	0.67	0.0046	39	32
	0.47	2.2	—	9600	—	0.55	0.0032	45	32
300	0.1	0.1	—	974	—	4.0	0.028	37	34
	0.1	0.22	—	1404	—	3.1	0.015	57	34
	0.1	0.47	—	2169	—	2.5	0.0083	78	33
	0.22	0.22	—	2510	—	1.9	0.015	50	33
	0.22	0.47	—	4200	—	1.3	0.0074	78	33
	0.22	1.0	—	4950	—	1.1	0.0046	85	32
	0.47	0.47	—	5700	—	0.90	0.0076	57	33
	0.47	1.0	—	8720	—	0.62	0.0041	81	32
	0.47	2.2	—	9700	—	0.57	0.0030	88	32

• One triode unit. * Peak volts.

World Radio History

RESISTANCE-COUPLED AMPLIFIER CHARTS

5

5T8, 6AT6, 6CN7, 6SL7GT,• 6T8A, 8CN7, 12AT6, 12SL7GT,• 19T8

See *Circuit Diagram 1*

E_{bb}	R_p	R_g	R_{g2}	R_k	C_{g2}	C_k	C	E_o*	V.G.
	0.1	0.1	—	4200	—	2.5	0.025	5.4	22
	0.1	0.22	—	4600	—	2.2	0.014	7.5	27
	0.1	0.47	—	4800	—	2.0	0.0065	9.1	30
	0.22	0.22	—	7000	—	1.5	0.013	7.3	30
90	0.22	0.47	—	7800	—	1.3	0.007	10	34
	0.22	1.0	—	8100	—	1.1	0.0035	12	37
	0.47	0.47	—	12000	—	0.83	0.006	10	36
	0.47	1.0	—	14000	—	0.7	0.0035	14	39
	0.47	2.2	—	15000	—	0.6	0.002	16	41
	0.1	0.1	—	1900	—	3.6	0.027	19	30
	0.1	0.22	—	2200	—	3.1	0.014	25	35
	0.1	0.47	—	2500	—	2.8	0.0065	32	37
	0.22	0.22	—	3400	—	2.2	0.014	24	38
180	0.22	0.47	—	4100	—	1.7	0.0065	34	42
	0.22	1.0	—	4600	—	1.5	0.0035	38	44
	0.47	0.47	—	6600	—	1.1	0.0065	29	44
	0.47	1.0	—	8100	—	0.9	0.0035	38	46
	0.47	2.2	—	9100	—	0.8	0.002	43	47
	0.1	0.1	—	1500	—	4.4	0.027	40	34
	0.1	0.22	—	1800	—	3.6	0.014	54	38
	0.1	0.47	—	2100	—	3.0	0.0065	63	41
	0.22	0.22	—	2600	—	2.5	0.013	51	42
300	0.22	0.47	—	3200	—	1.9	0.0065	65	46
	0.22	0.1	—	3700	—	1.6	0.0035	77	48
	0.47	0.47	—	5200	—	1.2	0.006	61	48
	0.47	1.0	—	6300	—	1.0	0.0035	74	50
	0.47	2.2	—	7200	—	0.9	0.002	85	51

• One triode unit. * Peak volts.

World Radio History

RESISTANCE-COUPLED AMPLIFIER CHARTS

6

As Pentode: 5879

See *Circuit Diagram 2*

E_{bb}	R_p	R_g	R_{g2}	R_k	C_{g2}	C_k	C	E_o*	V.G.
90	0.1	0.1	0.35	1700	0.044	4.6	0.020	13	29
	0.1	0.22	0.35	1700	0.046	4.5	0.012	17	39
	0.1	0.47	0.35	1700	0.047	4.4	0.006	20	47
	0.22	0.22	0.80	3000	0.034	3.2	0.010	15	43
	0.22	0.47	0.80	3000	0.035	3.1	0.005	21	59
	0.22	1.0	0.80	3000	0.036	3.0	0.003	24	67
	0.47	0.47	1.9	7000	0.021	1.8	0.005	21	59
	0.47	1.0	1.9	7000	0.022	1.7	0.003	25	75
	0.47	2.2	1.9	7000	0.023	1.7	0.002	28	87
180	0.1	0.1	0.35	700	0.060	7.4	0.020	24	39
	0.1	0.22	0.35	700	0.062	7.3	0.012	28	56
	0.1	0.47	0.35	700	0.064	7.2	0.006	33	65
	0.22	0.22	0.80	1200	0.045	5.5	0.010	24	65
	0.22	0.47	0.80	1200	0.046	5.3	0.005	31	87
	0.22	1.0	0.80	1200	0.048	5.2	0.003	34	101
	0.47	0.47	1.9	2500	0.033	3.5	0.005	27	98
	0.47	1.0	1.9	2500	0.034	3.4	0.003	32	122
	0.47	2.2	1.9	2500	0.035	3.3	0.002	37	140
300	0.1	0.1	0.35	300	0.075	10.8	0.020	25	51
	0.1	0.22	0.35	300	0.077	10.6	0.012	32	68
	0.1	0.47	0.35	300	0.080	10.5	0.006	35	83
	0.22	0.22	0.80	600	0.056	7.9	0.010	28	81
	0.22	0.47	0.80	600	0.057	7.5	0.005	37	109
	0.22	1.0	0.80	600	0.058	7.4	0.003	41	123
	0.47	0.47	1.3	1200	0.044	5.3	0.005	34	125
	0.47	1.0	1.3	1200	0.046	5.2	0.003	42	152
	0.47	2.2	1.3	1200	0.047	5.1	0.002	48	174

* Peak volts.

World Radio History

RESISTANCE-COUPLED AMPLIFIER CHARTS

7

As Triode: 5879

See *Circuit Diagram 1*

E_{bb}	R_p	R_g	R_{g2}	R_k	C_{g2}	C_k	C	E_o*	V.G.
90	0.047	0.047	—	1800	—	2.9	0.060	9	10
	0.047	0.1	—	2100	—	2.4	0.033	12	11
	0.047	0.22	—	2200	—	2.3	0.016	14	21
	0.1	0.1	—	3200	—	1.8	0.027	10	12
	0.1	0.22	—	3900	—	1.3	0.015	13	13
	0.1	0.47	—	4300	—	1.0	0.007	16	13
	0.22	0.22	—	6200	—	0.87	0.015	12	13
	0.22	0.47	—	8100	—	0.53	0.006	16	13
	0.22	1.00	—	9000	—	0.49	0.003	19	14
180	0.047	0.047	—	1200	—	3.5	0.063	21	12
	0.047	0.1	—	1600	—	2.6	0.033	29	13
	0.047	0.22	—	1800	—	2.4	0.016	35	13
	0.1	0.1	—	2200	—	1.9	0.031	26	13
	0.1	0.22	—	2900	—	1.35	0.015	33	14
	0.1	0.47	—	3400	—	1.1	0.007	40	14
	0.22	0.22	—	4500	—	0.92	0.015	28	14
	0.22	0.47	—	6400	—	0.61	0.006	39	14
	0.22	1.00	—	8200	—	0.52	0.003	47	14
300	0.047	0.047	—	1100	—	3.9	0.063	42	13
	0.047	0.1	—	1500	—	2.8	0.033	65	13
	0.047	0.22	—	1700	—	2.5	0.016	71	14
	0.1	0.1	—	2000	—	2.1	0.032	45	15
	0.1	0.22	—	3400	—	1.4	0.015	74	15
	0.1	0.47	—	3700	—	1.1	0.007	83	15
	0.1	0.22	—	4300	—	0.97	0.015	50	15
	0.22	0.47	—	7200	—	0.63	0.007	88	15
	0.22	1.00	—	7400	—	0.63	0.003	94	15

* Peak volts.

RESISTANCE-COUPLED AMPLIFIER CHARTS

8

6CG7,• 6FQ7,• 6SN7GTB,• 8CG7,• 8FQ7,• 12SN7GTA•

See *Circuit Diagram 1*

E_{bb}	R_p	R_g	R_{g2}	R_k	C_{g2}	C_k	C	E_o*	V.G.
90	0.047	0.047	—	1870	—	3.1	0.063	14	13
	0.047	0.1	—	2230	—	2.5	0.031	18	14
	0.047	0.22	—	2500	—	2.1	0.016	20	14
	0.1	0.1	—	3370	—	1.8	0.034	15	14
	0.1	0.22	—	4100	—	1.3	0.015	20	14
	0.1	0.47	—	4800	—	1.1	0.006	23	15
	0.22	0.22	—	7000	—	0.80	0.013	16	14
	0.22	0.47	—	9100	—	0.65	0.007	22	14
	0.22	1.00	—	10500	—	0.60	0.004	25	15
180	0.047	0.047	—	1500	—	3.6	0.066	33	14
	0.047	0.1	—	1860	—	2.9	0.055	41	14
	0.047	0.22	—	2160	—	2.2	0.015	47	15
	0.1	0.1	—	2750	—	1.8	0.028	35	15
	0.1	0.22	—	3550	—	1.4	0.015	45	15
	0.1	0.47	—	4140	—	1.3	0.007	51	16
	0.22	0.22	—	5150	—	1.0	0.016	36	16
	0.22	0.47	—	7000	—	0.71	0.007	45	16
	0.22	1.00	—	7800	—	0.61	0.004	51	16
300	0.047	0.047	—	1300	—	3.6	0.061	59	14
	0.047	0.1	—	1580	—	3.0	0.032	73	15
	0.047	0.22	—	1800	—	2.5	0.015	83	16
	0.1	0.1	—	2500	—	1.9	0.031	68	16
	0.1	0.22	—	3130	—	1.4	0.014	82	16
	0.1	0.47	—	3900	—	1.2	0.0065	96	16
	0.22	0.22	—	4800	—	0.95	0.015	68	16
	0.22	0.47	—	6500	—	0.69	0.0065	85	16
	0.22	1.00	—	7800	—	0.58	0.0035	96	16

• One triode unit. * Peak volts.

RESISTANCE-COUPLED AMPLIFIER CHARTS

9

3AV6, 4AV6, 6AV6, 6EU7,• 12AV6, 12AX7A,• 20EZ7,• 7025•

See *Circuit Diagram 1*

E_{bb}	R_p	R_g	R_{g2}	R_k	C_{g2}	C_k	C	E_o*	V.G.
90	0.1	0.1	—	4400	—	2.7	0.023	5	29
	0.1	0.22	—	4700	—	2.4	0.013	6	35
	0.1	0.47	—	4800	—	2.3	0.007	8	41
	0.22	0.22	—	7000	—	1.6	0.012	6	39
	0.22	0.47	—	7400	—	1.4	0.006	9	45
	0.22	1.0	—	7600	—	1.3	0.003	11	48
	0.47	0.47	—	12000	—	0.9	0.006	9	48
	0.47	1.0	—	13000	—	0.8	0.003	11	52
	0.47	2.2	—	14000	—	0.7	0.002	13	55
180	0.1	0.1	—	1800	—	4.0	0.025	18	40
	0.1	0.22	—	2000	—	3.5	0.013	25	47
	0.1	0.47	—	2200	—	3.1	0.006	32	52
	0.22	0.22	—	3000	—	2.4	0.012	24	53
	0.22	0.47	—	3500	—	2.1	0.006	34	59
	0.22	1.0	—	3900	—	1.8	0.003	39	63
	0.47	0.47	—	5800	—	1.3	0.006	30	62
	0.47	1.0	—	6700	—	1.1	0.003	39	66
	0.47	2.2	—	7400	—	1.0	0.002	45	68
300	0.1	0.1	—	1300	—	4.6	0.027	43	45
	0.1	0.22	—	1500	—	4.0	0.013	57	52
	0.1	0.47	—	1700	—	3.6	0.006	66	57
	0.22	0.22	—	2200	—	3.0	0.013	54	59
	0.22	0.47	—	2800	—	2.3	0.006	69	65
	0.22	1.0	—	3100	—	2.1	0.003	79	68
	0.47	0.47	—	4300	—	1.6	0.006	62	69
	0.47	1.0	—	5200	—	1.3	0.003	77	73
	0.47	2.2	—	5900	—	1.1	0.002	92	75

• One triode unit. * Peak volts.

World Radio History

RESISTANCE-COUPLED AMPLIFIER CHARTS

10

4BQ7A,• 4BZ7,• 5BK7A,• 5BQ7A,• 6BK7B,• 6BQ7A,• 6BZ7•

See *Circuit Diagram 1*

E_{bb}	R_p	R_g	R_{g2}	R_k	C_{g2}	C_k	C	E_o*	V.G.
90	0.047	0.047	—	1580	—	4.0	0.058	9	18
	0.047	0.10	—	1760	—	3.5	0.032	13	19
	0.047	0.22	—	1820	—	3.0	0.015	16	20
	0.1	0.1	—	2920	—	2.1	0.029	12	19
	0.1	0.22	—	3570	—	1.7	0.015	17	20
	0.1	0.47	—	4020	—	1.4	0.0075	20	20
	0.22	0.22	—	6040	—	0.98	0.0135	16	19
	0.22	0.47	—	7500	—	0.78	0.0075	21	20
	0.22	1.0	—	8800	—	0.63	0.0036	25	20
180	0.047	0.047	—	694	—	6.0	0.062	25	23
	0.047	0.1	—	817	—	4.4	0.032	32	24
	0.047	0.22	—	905	—	4.0	0.0155	35	25
	0.10	0.1	—	1596	—	2.80	0.030	30	23
	0.10	0.22	—	1630	—	2.30	0.0152	32	24
	0.10	0.47	—	1860	—	2.00	0.0073	38	24
	0.22	0.22	—	3950	—	1.24	0.0150	35	22
	0.22	0.47	—	4500	—	0.96	0.0072	41	23
	0.22	1.0	—	5530	—	0.79	0.0038	49	23
300	0.047	0.047	—	438	—	6.70	0.062	38	26
	0.047	0.1	—	542	—	5.50	0.032	48	27
	0.047	0.22	—	644	—	4.30	0.016	57	27
	0.10	0.10	—	1009	—	3.5	0.031	42	25
	0.10	0.22	—	1332	—	2.5	0.015	56	26
	0.10	0.47	—	1609	—	2.1	0.0074	64	25
	0.22	0.22	—	2623	—	1.5	0.015	50	24
	0.22	0.47	—	3900	—	1.1	0.0073	70	24
	0.22	1.0	—	4920	—	0.88	0.0039	84	24

• One triode unit. * Peak volts.

World Radio History

RESISTANCE-COUPLED AMPLIFIER CHARTS

11

3BC5, 3CB6, 3CF6, 4BC5, 4CB6, 6AG5, 6BC5, 6CB6, 6CB6A, 6CF6

See *Circuit Diagram 2*

E_{bb}	R_p	R_g	R_{g2}	R_k	C_{g2}	C_k	C	E_o*	V.G.
	0.22	0.22	0.480	3800	0.046	5.5	0.0084	10	89
	0.22	0.47	0.480	3800	0.049	5.5	0.0054	16	114
	0.22	1.0	0.500	4400	0.045	5.3	0.0034	23	128
	0.47	0.47	1.04	7200	0.033	2.9	0.0044	10	111
90	0.47	1.0	1.04	7700	0.033	2.8	0.0029	15	133
	0.47	2.2	1.10	8400	0.031	2.6	0.0020	18	152
	1.0	1.0	2.50	16000	0.018	1.4	0.0023	10	118
	1.0	2.2	2.50	18600	0.016	1.2	0.0017	11	139
	0.22	0.22	0.550	1600	0.072	9.5	0.0090	30	161
	0.22	0.47	0.620	1800	0.062	8.5	0.0053	36	208
	0.22	1.0	0.650	1900	0.062	8.5	0.0034	43	239
	0.47	0.47	1.00	3400	0.059	6.0	0.0048	34	183
180	0.47	1.0	1.00	3500	0.059	6.0	0.0031	41	229
	0.47	2.2	1.00	3800	0.059	5.8	0.0020	46	262
	1.0	1.0	2.60	7300	0.029	2.7	0.0022	33	227
	1.0	2.2	2.60	7400	0.029	2.7	0.0016	38	281
	0.22	0.22	0.600	980	0.085	13.0	0.0085	51	223
	0.22	0.47	0.680	1090	0.084	12.0	0.0055	64	288
	0.22	1.0	0.700	1150	0.081	11.0	0.0033	74	334
	0.47	0.47	1.25	2000	0.064	7.9	0.0045	52	285
300	0.47	1.0	1.34	2150	0.061	7.6	0.0029	67	363
	0.47	2.2	1.53	2350	0.057	7.1	0.0019	79	416
	1.0	1.0	2.60	4000	0.044	5.2	0.0023	51	334
	1.0	2.2	3.00	4700	0.038	4.3	0.0015	69	427

• One triode unit. * Peak volts.

RESISTANCE-COUPLED AMPLIFIER CHARTS

12

7199 (Pentode Unit)

See Circuit Diagram 2

E_{bb}	R_p	R_g	R_{g2}	R_k	C_{g2}	C_k	C	E_o*	V.G.
90	0.22	0.22	0.560	3700	0.046	4.50	0.0090	12	73
	0.22	0.47	0.600	3900	0.043	4.30	0.0055	17	95
	0.22	1.0	0.640	4200	0.039	4.00	0.0033	19	109
	0.47	0.47	0.870	6000	0.036	2.70	0.0046	16	95
	0.47	1.0	0.980	6700	0.044	3.00	0.0030	22	113
	0.47	2.2	1.00	6700	0.043	2.80	0.0020	25	131
	1.0	1.0	2.00	12200	0.021	1.44	0.0028	15	119
	1.0	2.2	2.20	12800	0.024	1.74	0.0016	21	167
180	0.22	0.22	0.530	1570	0.069	7.50	0.0088	32	82
	0.22	0.47	0.600	1730	0.064	7.40	0.0064	38	164
	0.22	1.0	0.650	1820	0.061	7.30	0.0034	45	190
	0.47	0.47	1.12	3200	0.053	5.30	0.0046	35	147
	0.47	1.0	1.40	3500	0.042	5.10	0.0028	40	209
	0.47	2.2	1.57	3740	0.040	5.40	0.0019	45	250
	1.0	1.0	2.50	6500	0.039	2.80	0.0024	34	179
	1.0	2.2	3.40	7500	0.026	2.30	0.0015	39	277
300	0.22	0.22	0.600	9200	0.086	11.2	0.0085	52	182
	0.22	0.47	0.670	1010	0.076	10.5	0.0052	66	236
	0.22	1.0	0.720	1100	0.076	10.0	0.0033	77	257
	0.47	0.47	1.25	1950	0.060	7.0	0.0044	41	221
	0.47	1.0	1.43	3210	0.053	6.4	0.0027	72	296
	0.47	2.2	1.45	2200	0.055	6.3	0.0019	82	345
	1.0	1.0	3.00	4100	0.040	4.2	0.0022	57	295
	1.0	2.2	3.30	4340	0.037	3.6	0.0016	74	378

* Peak volts.

World Radio History

RESISTANCE-COUPLED AMPLIFIER CHARTS

13

7199 (Triode Unit)

See *Circuit Diagram 1*

E_{bb}	R_p	† R_g	† R_{g2}	R_k	C_{g2}	C_k	C	E_o*	V.G.
90	0.047	0.047	—	1292	—	3.3	0.060	8	12
	0.047	0.1	—	1401	—	2.8	0.032	10	13
	0.047	0.22	—	1470	—	2.4	0.016	11	13
	0.10	0.1	—	2630	—	1.60	0.029	9	13
	0.10	0.22	—	3090	—	1.24	0.015	12	13
	0.10	0.47	—	3440	—	1.10	0.008	14	14
	0.22	0.22	—	6550	—	0.70	0.015	12	12
	0.22	0.47	—	8270	—	0.51	0.0077	16	12
	0.22	1.0	—	9130	—	0.44	0.0045	18	12
180	0.047	0.047	—	723	—	4.0	0.061	16	14
	0.047	0.1	—	836	—	3.5	0.032	20	14
	0.047	0.22	—	948	—	2.9	0.016	24	15
	0.10	0.1	—	1543	—	2.0	0.031	17	14
	0.10	0.22	—	2002	—	1.6	0.016	24	14
	0.10	0.47	—	2522	—	1.2	0.0082	30	13
	0.22	0.22	—	4390	—	0.79	0.015	24	13
	0.22	0.47	—	6122	—	0.57	0.0078	33	12
	0.22	1.0	—	8060	—	0.47	0.0046	41	12
300	0.047	0.047	—	534	—	4.0	0.061	27	15
	0.047	0.1	—	726	—	3.6	0.031	38	15
	0.047	0.22	—	840	—	3.0	0.015	44	15
	0.10	0.1	—	1117	—	2.3	0.031	26	15
	0.10	0.22	—	1613	—	1.7	0.0155	41	14
	0.10	0.47	—	2043	—	1.31	0.0078	51	14
	0.22	0.22	—	3133	—	0.93	0.015	36	13
	0.22	0.47	—	4480	—	0.69	0.0079	51	13
	0.22	1.0	—	4930	—	0.56	0.0045	55	13

* Peak volts.

World Radio History

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GRID-No. 2 INPUT RATING CHART

The Grid-No.2 Input Rating Chart shown on the back of this page presents graphically the relationship between the grid-No.2 voltage and the maximum grid-No.2 input for certain multi-electrode tube types.

The chart shows that full rated grid-No.2 input is permissible at grid-No.2 voltages up to 50 per cent of the maximum rated grid-No.2 supply voltage. From the 50 per cent point to the full rated value of supply voltage, the grid-No.2 input must be decreased. The decrease in allowable grid-No.2 input follows a curve of the parabolic form.

This chart is useful for applications utilizing either a fixed grid-No.2 voltage, or a series grid-No.2 voltage-dropping resistor.

Where a fixed grid-No.2 voltage is used, it is necessary only to determine that the grid-No.2 input is within the boundary of the operating area on the chart at the selected value of grid-No.2 voltage to be used.

Where a grid-No.2 voltage-dropping resistor is used, the minimum value of resistor that will assure tube operation within the boundary of the curve can be determined from the following relation:

$$R_{g2} \geqq \frac{E_{c2}\,(E_{cc2} - E_{c2})}{P_{c2}}$$

where:

R_{g2} = minimum value for grid-No.2 voltage-dropping resistor in ohms.

E_{c2} = selected value of grid-No.2 voltage in volts.

E_{cc2} = grid-No.2 supply voltage in volts.

P_{c2} = grid-No.2 input in watts corresponding to E_{c2}.

EXAMPLES

Example 1 - *Use of a Fixed Grid-No.2 Supply Voltage:*

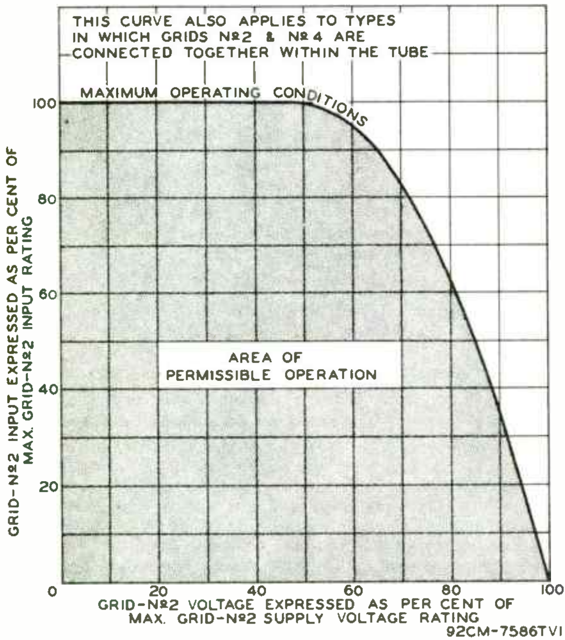
The tube data for a certain tube stipulates a maximum grid-No.2 supply voltage rating of 300 volts, and a maximum grid-No.2 input rating of 1 watt. It is desired to operate the tube with a fixed voltage of 200 volts between grid No.2 and cathode. This value is 66-2/3% of the maximum grid-No.2 supply voltage rating. From the chart, the maximum grid-No.2 input, therefore, must be limited to 88% of the maximum grid-No.2 input rating or 0.88 watt.

GRID-No 2 INPUT RATING CHART

Example 2 - *Use of a Grid-No.2 Voltage-Dropping Resistor:*

The tube data for a certain tube stipulates a maximum grid-No.2 supply voltage rating of 300 volts, and a maximum grid-No.2 input rating of 1 watt. It is desired to operate the tube with a grid-No.2-to-cathode voltage of 250 volts, obtained through a dropping resistor from a 300-volt power supply. Because 250 volts is 83% of 300 volts, the maximum grid-No.2 input must be limited, as shown on the chart, to 56% of the maximum grid-No.2 input rating, or 0.56 watt. Then, the minimum value required for the grid-No.2 voltage-dropping resistor will be:

$$R_{g2} = \frac{250\ (300 - 250)}{0.56} = 22{,}320 \text{ ohms}$$

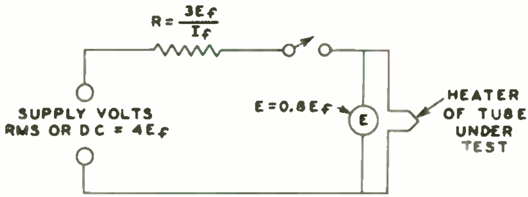


TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

HEATER WARM-UP TIME MEASUREMENT
FOR TUBE TYPES INTENDED FOR USE IN SERIES HEATER-STRING ARRANGEMENT

Heater warm-up time is measured in the circuit shown below as follows: The heater is placed in series with a resistance having a value 3 times the heater operating resistance. A voltage having a value 4 times the rated heater voltage is then applied. Heater warm-up time is then defined as the time required for the voltage across the heater to reach 80 per cent of its rated value.

TEST CIRCUIT FOR DETERMINING HEATER WARM-UP TIME



E_f = RATED HEATER VOLTAGE OF TUBE UNDER TEST.
I_f = RATED HEATER CURRENT OF TUBE UNDER TEST.
92CS-8503

World Radio History

World Radio History

RCA

1AC5
POWER PENTODE
SUBMINIATURE TYPE

GENERAL DATA

Electrical:

Filament, Coated:

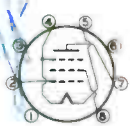
Voltage	1.25	dc volts
Current	0.04	amp

Mechanical:

Mounting Position	Any
Maximum Overall Length	1-3/4"
Maximum Seated Length	1-1/2"
Length, Base Seat to Bulb Top (excluding tip)	1.200" ± 0.060"
Maximum Diameter	0.4"
Bulb	T-3
Base	Small-Button Sub-minar 8-Pin

BOTTOM VIEW

Pin 1 – No Connection
Pin 2 – Grid No.1
Pin 3 – No Connection
Pin 4 – Filament (–) Grid No.3



Pin 5 – Filament (+)
Pin 6 – No Connection
Pin 7 – Plate
Pin 8 – Grid No.2

AMPLIFIER – Class A_1

Maximum Ratings, ***Design-Center Values*:**

PLATE VOLTAGE	67.5 max.	volts
GRID-No. 2 (SCREEN) VOLTAGE	67.5 max.	volts
TOTAL CATHODE CURRENT	4.0 max.	ma

Typical Operation and Characteristics:

Plate Voltage	30	45	67.5	volts
Grid-No.2 Voltage	30	45	67.5	volts
Grid-No.1 (Control-Grid) Voltage	-2	-3	-4.5	volts
Peak AF Grid-No.1 Voltage	2	3	4.5	volts
Zero-Signal Plate Current	0.5	1.0	2.0	ma
Zero-Signal Grid-No.2 Current	0.1	0.2	0.4	ma
Plate Resistance	0.2	0.17	0.15	megohm
Transconductance	450	600	750	µmhos
Load Resistance	50000	40000	25000	ohms
Total Harmonic Distortion	10	10	10	%
Max.-Signal Power Output	5	15	50	mw

SEPT. 15, 1949

TENTATIVE DATA

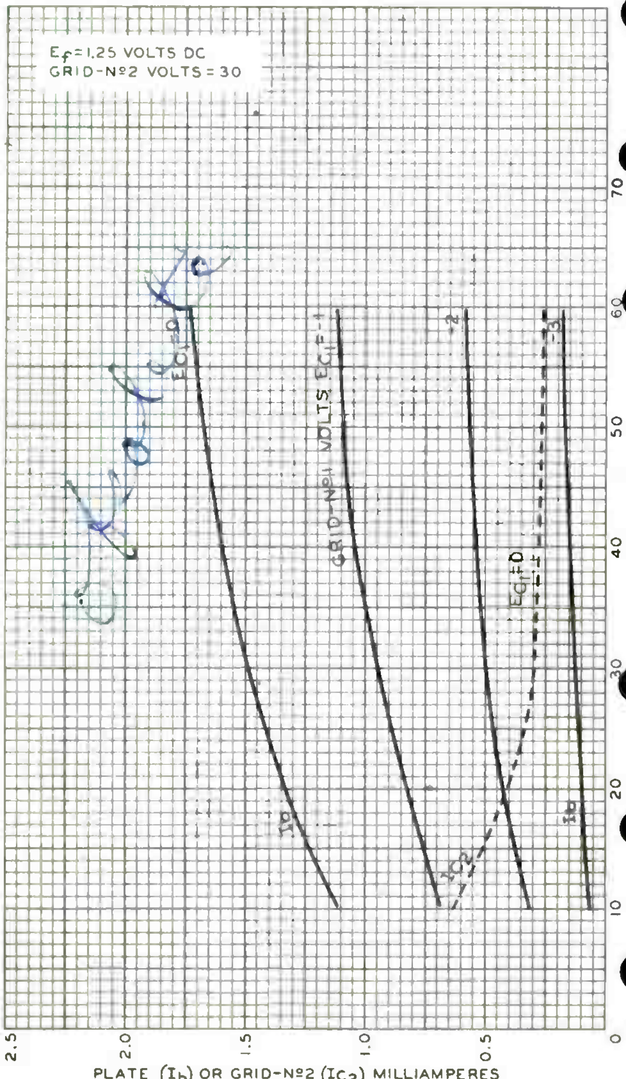
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

IAC5

IAC5

AVERAGE PLATE CHARACTERISTICS



APRIL 12,1949

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA HARRISON NEW JERSEY

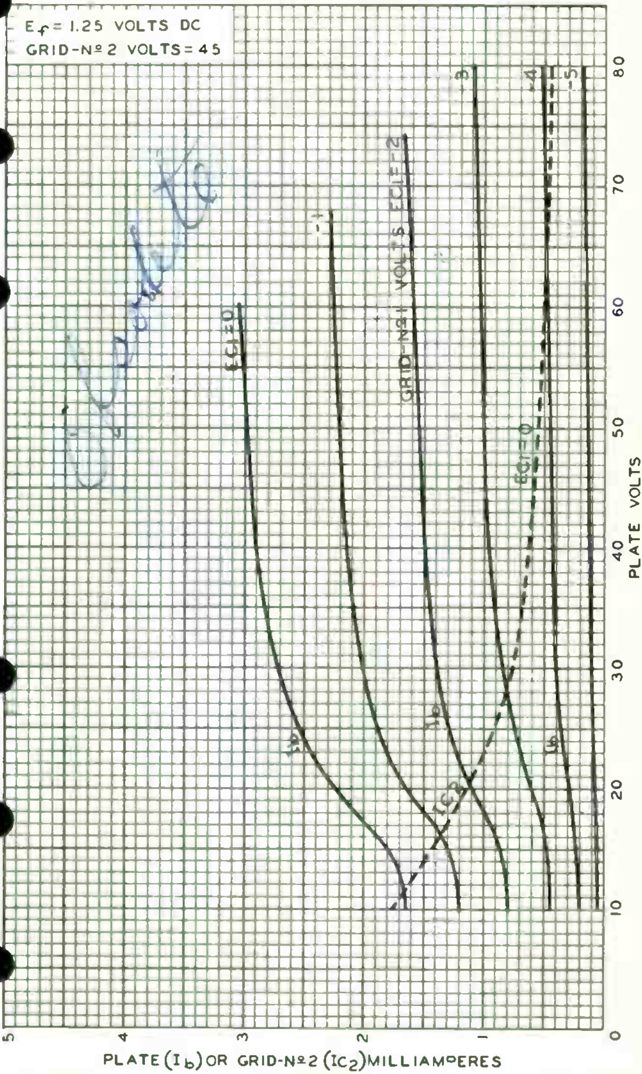
92CM-7245

1AC5

RCA

1AC5

AVERAGE PLATE CHARACTERISTICS



APRIL 26, 1949 — TUBE DEPARTMENT — 92CM-7261

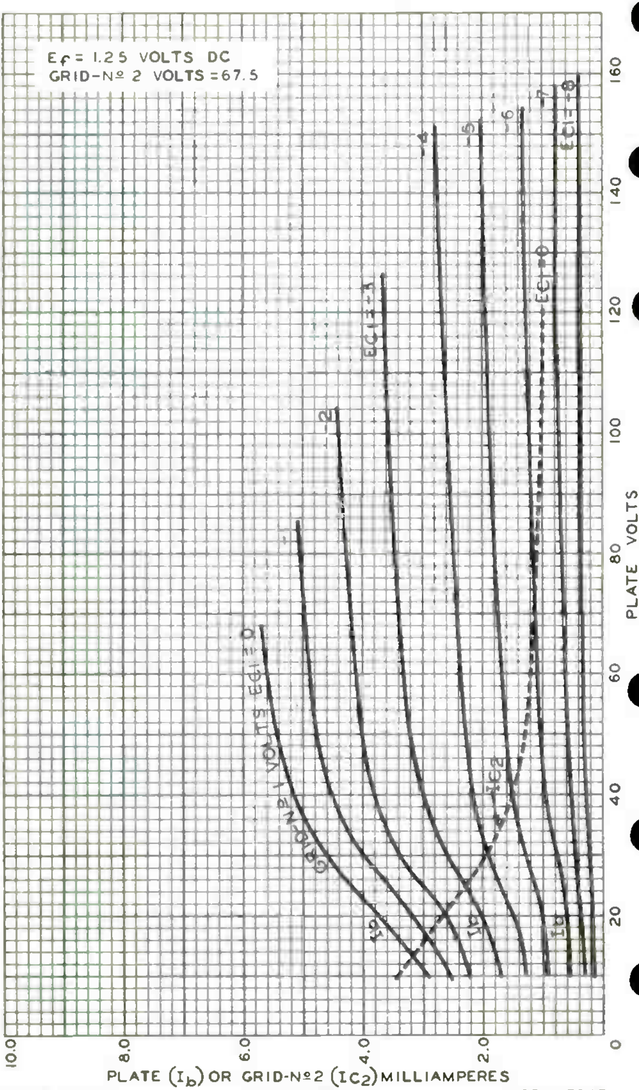
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

1AC5

1AC5

AVERAGE PLATE CHARACTERISTICS



APRIL 13, 1949

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA HARRISON NEW JERSEY

92CM-7247

World Radio History

Half-Wave Vacuum Rectifier

ELECTRICAL

Bogey Values

Filament (Coated) Voltage, AC or DC	1.25	V
Filament Current	0.2	A
Direct Interelectrode Capacitance (Approx.)		
Without external shield		
Plate to filament	1.6	pF

MECHANICAL

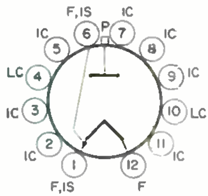
Operating Position	Any
Type of Cathode	Coated Filament
Maximum Overall Length	3.125 in
Seated Length	2.500 to 2.750 in
Diameter	1.062 to 1.188 in
Dimensional Outline (JEDEC No.9-98)	See *General Section*
Envelope	JEDEC T9

Caps (Alternates)
- Small (JEDEC No.C1-1)
- Small with Tubular Support (JEDEC No.C1-34)

Base . . . . . Small-Button Duodecar 12-Pin (JEDEC No.E12-70)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Filament, Internal Shield
Pin 2 – Do Not Use[a]
Pin 3 – Do Not Use[a]
Pin 4 – See **Note**
Pin 5 – Do Not Use[a]
Pin 6 – Same as Pin 1
Pin 7 – Do Not Use[a]
Pin 8 – Do Not Use[a]
Pin 9 – Do Not Use[a]
Pin 10 – See **Note**
Pin 11 – Do Not Use[a]
Pin 12 – Filament
Cap – Plate



12GV

Note: *May be used only under conditions specified in Operating Considerations.*

PULSED-RECTIFIER SERVICE

Design-Maximum Ratings

For operation in a 525-line, 30-frame system

Inverse Plate Voltage		
Total dc and peak[b]	26000	V
DC	22000	V
Peak Plate Current	50	mA
Average Plate Current	0.5	mA
Filament Voltage, AC or DC	1.05 to 1.45	V

Characteristics, Instantaneous Value

Tube Voltage Drop for plate mA = 7	225	V

[a] Socket terminals 2, 3, 5, 7, 8, 9, and 11 should not be used as tie points.
[b] This rating is applicable when the duration of the voltage pulse does not exceed 15 per cent of one horizontal scanning cycle. In a 525-line 30-frame system, 15 per cent of one horizontal scanning cycle is 10 microseconds.

← Indicates a change.

World Radio History

OPERATING CONSIDERATIONS

Socket Connections. Socket terminals 4 and 10 may be used as tie points for components at or near the cathode potential; otherwise, do not use.

The high voltages at which the 1AD2 is operated are very dangerous. Great care should be taken in the design of equipment to prevent the operator from coming in contact with these high voltages. Particular care against fatal shock should be taken in the measurement of filament voltage. Under all circumstances, circuit parts which may be at high potentials should be enclosed or adequately insulated.

X-Radiation. The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce *X-radiation* which can constitute a health hazard unless such tubes are adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.

World Radio History

Half-Wave Vacuum Rectifier

For High-Voltage Rectifier Circuits in Color and Black-and-White TV Receivers

ELECTRICAL CHARACTERISTICS

Bogey Values

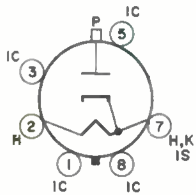
Heater Characteristics and Ratings			
Voltage (AC)	E_h	3.15	V
Current at 3.15 V	I_h	0.220	A
Direct Interelectrode Capacitance (Approx.)			
Without external shield			
P to (K + IS + H)	$C_{p\text{-all}}$	1.5	pF
Instantaneous Tube Voltage Drop			
For i_b = 7 mA	e_b	100	V

MECHANICAL CHARACTERISTICS

Operating Position. . . . . Any
Type of Cathode . . . . Coated Unipotential
Maximum Overall Length. . . . . 3.812 in
Maximum Seated Length . . . . 3.250 in
Maximum Diameter. . . . . 1.281 in
Envelope. . . . . JEDEC T9
Caps (Alternates)
Small (JEDEC No.C1-1)
Small with Tubular Support (JEDEC No.C1-34)
Base (Alternates)
Intermediate-Shell Octal:
6-Pin, Arrangement 1 (JEDEC Group 1, No.B6-8)
Short Intermediate-Shell Octal with External Barriers:
6-Pin, Arrangement 1 (JEDEC Group 1, No.B6-60)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Do Not Use
Pin 2 – Heater
Pin 3 – Do Not Use
Pin 5 – Do Not Use
Pin 7 – Heater, Cathode, Internal Shield
Pin 8 – Do Not Use
Cap – Plate



Note: May be used only under conditions specified in Operating Considerations.

PULSED-RECTIFIER SERVICE

Design-Maximum Ratings
For operation in a 525-line, 30-frame system

Peak Inverse Plate Voltage[a] . .	-	30000	V
Peak Plate Current	i_b	100	mA
Average Plate Current	$I_{b(av)}$	2	mA
Heater Voltage, AC	E_h	2.65 min — 3.65 max	V

World Radio History

a This rating is applicable when the duration of the voltage pulse does not exceed 15% of one horizontal scanning cycle. In a 525-line, 30-frame system, 15% of one horizontal scanning cycle is 10 μs.

OPERATING CONSIDERATIONS

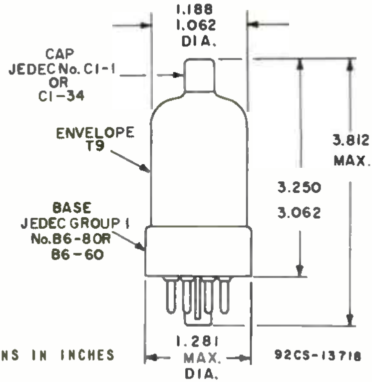
Socket terminals 1, 3, 4, 5, 6 and 8 may be connected to terminal 7 or to a corona shield which connects to terminal 7. Socket terminals 4 and 6 may be used as tie points at or near cathode potential. Otherwise, do not use.

The high voltages at which the 3A3A is operated may be extremely dangerous to the user. Great care should be taken during the adjustment of circuits. The tube and its associated apparatus, especially all parts which may be at high potential above ground, should be housed in a protective enclosure. The protective housing should be designed with interlocks so that personnel cannot possibly come in contact with any high potential points in the electrical system. The interlock devices should function to break the primary circuits of the high-voltage supply when any gate or door on the protective housing is opened, and should prevent the closing of this primary circuit until the door is locked again.

It should be noted that *high voltages* may appear at normally low-potential points in the circuit as a result of capacitor breakdown or incorrect circuit connections. Therefore, before any part of the circuit is touched, the power-supply switch should be turned off and both terminals of any capacitor should be grounded.

Operation of the 3A3A with a plate voltage above approximately 16000 volts (absolute value) results in the production of X radiations which can constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Relatively simply shielding should prove adequate, but the need for this precaution should be considered in equipment design.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES 92CS-13718

World Radio History

Half-Wave Vacuum Rectifier

ELECTRICAL

Filament, Coated

	Min	Av	Max	
Voltage (AC)	1.05	1.25	1.45	V
Current at 1.25 volts	-	0.2	-	A

Direct Interelectrode Capacitance (Approx.)[a]

Plate to filament & internal shield	1.3	pF

MECHANICAL

Operating Position	Any
Maximum Overall Length	3-9/16 in
Seated Length	2-13/16 ± 3/16 in
Maximum Diameter	1-9/32 in
Bulb	T9
Cap	Small with Tubular Support (JEDEC No.C1-34)

Bases (Alternates)

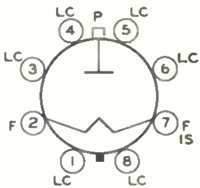
Intermediate-Shell Octal:
- 8-Pin (JEDEC Group 1, No.B8-6)
- 7-Pin, Arrangement 2 (JEDEC Group 1, No.B7-166)
- 6-Pin, Arrangement 1 (JEDEC Group 1, No.B6-8)
- 5-Pin, Arrangement 2 (JEDEC Group 1, No.B5-82)

Short Intermediate-Shell Octal:
- 7-Pin (JEDEC Group 1, No.B7-47)

Short Intermediate-Shell Octal with External Barriers:
- 6-Pin, Arrangement 1 (JEDEC Group 1, No.B6-60)
- 5-Pin, Arrangement 2 (JEDEC Group 1, No.B5-85)

Basing Designation for BOTTOM VIEW . . . 3C

Pin 1[b] - Limited Connection[c]
Pin 2 - Filament
Pin 3 - Same as Pin 1
Pin 4[d] - Same as Pin 1
Pin 5 - Same as Pin 1
Pin 6[e] - Same as Pin 1
Pin 7 - Filament, Internal Shield
Pin 8 - Same as Pin 1
Cap - Plate



PULSED-RECTIFIER SERVICE

Maximum Ratings, Design-Maximum Values

For operation in a 525-line, 30-frame system

Inverse Plate Voltage

Total dc and peak[f]	26000	V
DC	22000	V
Peak Plate Current	50	mA
Average Plate Current	0.5	mA

Characteristics, Instantaneous Value

Tube Voltage Drop for plate mA = 7	100	V

World Radio History

RADIO-FREQUENCY RECTIFIER SERVICE

Maximum Ratings, Design-Maximum Values

For operation in a 525-line, 30-frame system

Peak Inverse Plate Voltage	33000	V
Peak Plate Current	35	mA
Average Plate Current	1.1	mA
Frequency Range of Supply Voltage	1.5 to 100	kc/s

Characteristics, Instantaneous Value

Tube Voltage Drop for plate mA = 7	100	V

[a] Without external shield.

[b] On the 5-pin bases, pin 1 is omitted.

[c] See *Operating Considerations*.

[d] On the 5-pin bases, the 6-pin bases, and the 7-pin base JEDEC No.B7-166, pin 4 is omitted.

[e] On the 5-pin bases, the 6-pin bases, and the 7-pin base JEDEC No.B7-47, pin 6 is omitted.

[f] This rating is applicable where the duration of the voltage pulse does not exceed 15 per cent of one horizontal scanning cycle. In a 525-line, 30-frame system, 15 per cent of one horizontal scanning cycle is 10 microseconds.

OPERATING CONSIDERATIONS

Socket Connections. Socket terminals 1, 3, 4, 5, 6, and 8 may be connected to socket terminal 7 or to a corona shield which is connected to socket terminal 7. Socket terminals 4 and 6 may be used as tie points for components at or near filament potential. Otherwise, do not use.

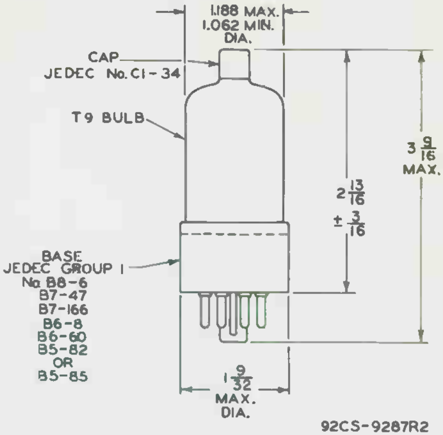
Measurement of Filament Voltage. To measure the filament voltage when the filament is at a high dc potential with respect to ground, it is recommended that a simple method utilizing visual comparison of the filament temperature be used. The color temperature of the filament, operating from a pulse- or rf-power source, may be checked by observing in a darkened room the reflection of the incandescent filament upon the surface of the internal shield. A visual comparison of this color temperature with that obtained when the filament of another 1G3GT/1B3GT is operated from a dc or low-frequency ac supply of 1.25 volts, provides a convenient means for adjusting the amount of excitation to produce 1.25 volts (rms) at the filament terminals.

The high voltages at which the 1G3GT/1B3GT is operated are very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with these high voltages. Particular care against fatal shock should be taken in the measurement of filament voltage. Under all circumstances, circuit parts which may be at high potentials should be enclosed or adequately insulated.

X-Radiation. The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce *X-radiation* which can constitute a health hazard unless such tubes are adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.

World Radio History

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

World Radio History

World Radio History

1K3

RCA

1K3

HALF-WAVE VACUUM RECTIFIER

GENERAL DATA

Electrical:

Filament, Coated:

Voltage*	1.25	ac volts
Current	0.2	amp

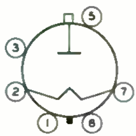
Direct Interelectrode Capacitance (Approx.):○

Plate to filament and internal shield	1.6	μμf

Mechanical:

Operating Position	Any
Maximum Overall Length	3-9/16"
Seated Length	2-13/16" ± 3/16"
Maximum Diameter	1-9/32"
Bulb	T9
Cap	Small with Tubular Support (JEDEC No.C1-34)
Base	Intermediate-Shell Octal 6-Pin, Arrangement 1 (JEDEC No.B6-8), or Short Intermediate-Shell Octal 6-Pin with External Barriers, Arrangement 1 (JEDEC No.B6-60)
Basing Designation for BOTTOM VIEW	3C

Pin 1 - Internal Connection—Do Not Use■
Pin 2 - Filament
Pin 3 - Same as Pin 1
Pin 5 - Same as Pin 1



Pin 7 - Filament, Internal Shield
Pin 8 - Same as Pin 1
Cap - Plate

PULSED-RECTIFIER SERVICE

Maximum Ratings, ***Design-Maximum Values:***

For operation in a 525-line, 30-frame system□

INVERSE PLATE VOLTAGE:

Total dc and peak●	26000 max.	volts
DC	22000 max.	volts
PEAK PLATE CURRENT	50 max.	ma
DC PLATE CURRENT	0.5 max.	ma

Characteristics:

DC Plate Voltage	225	volts
DC Plate Current	7	ma

* Under no circumstances should the filament voltage be less than 1.05 volts or more than 1.45 volts.

○ Without external shield.

■ *See Operating Considerations.*

□ As described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission.

● The duration of the voltage pulse must not exceed 15 per cent of one horizontal scanning cycle. In a 525-line, 30-frame system, 15 per cent of one horizontal scanning cycle is 10 microseconds.

World Radio History

1K3

HALF-WAVE VACUUM RECTIFIER

OPERATING CONSIDERATIONS

Socket Connections. Socket terminals Nos.1,3,4,5,6, and 8 may be connected to socket terminal No.7 or to a corona shield which is connected to socket terminal No.7. Socket terminals Nos.4 and 6 may be used as tie points for components at or near filament potential.

Measurement of Filament Voltage. To measure the filament voltage when the filament is at a high dc potential with respect to ground, it is recommended that a simple method utilizing visual comparison of the filament temperature be used. The color temperature of the filament, operating from a pulse- or rf-power source, may be checked by observing in a darkened room the reflection of the incandescent filament upon the surface of the internal shield. A visual comparison of this color temperature with that obtained when the filament of another 1K3 is operated from a dc or low-frequency ac supply of 1.25 volts, provides a convenient means for adjusting the amount of excitation to produce 1.25 volts (rms) at the filament terminals.

The high voltages at which the 1K3 is operated are very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with these high voltages. Particular care against fatal shock should be taken in the measurement of filament voltage. Under all circumstances, circuit parts which may be at high potentials should be enclosed or adequately insulated.

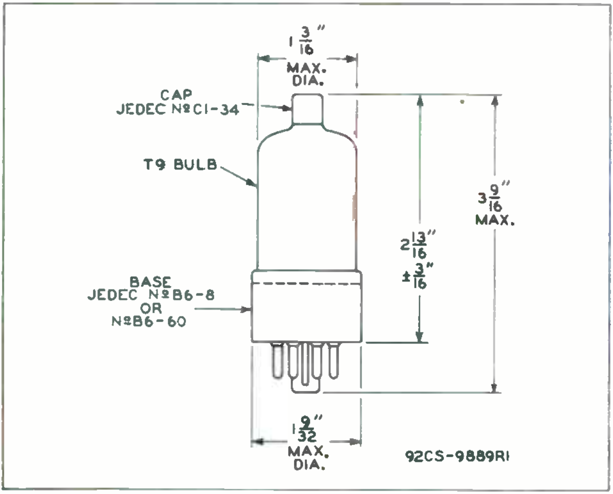
X rays. The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce *X rays* which can constitute a health hazard unless such tubes are adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.

World Radio History

1K3

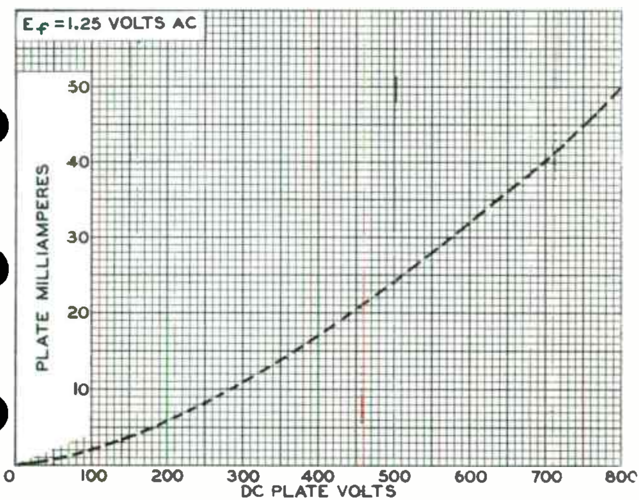
RCA 1K3

HALF-WAVE VACUUM RECTIFIER



10-59 CE-9889R1

AVERAGE PLATE CHARACTERISTIC



ELECTRON TUBE DIVISION 92CS-10251

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

World Radio History

Half-Wave Vacuum Rectifier

Electrical:

Filament Characteristics and Ratings:

	Min.	*Av.*	*Max.*	
Voltage (AC)	1.05	1.25	1.45	volts
Current at 1.25 volts	–	0.2	–	amp

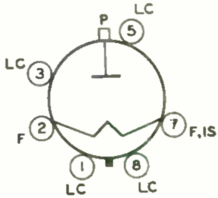
Direct Interelectrode Capacitance (Approx.):[a]

Plate to filament and internal shield	1.6	pf

Mechanical:

Operating Position . . . . . Any
Type of Cathode . . . . . Coated Filament
Maximum Overall Length . . . . . 3-9/16"
Seated Length . . . . . 2-13/16" ± 3/16"
Maximum Diameter . . . . . 1-9/32"
Bulb T9
Cap . . . . . Small with Tubular Support (JEDEC No. C1-34)
Bases (Alternates):
Intermediate-Shell Octal:
6-Pin, Arrangement 1 (JEDEC Group 1, No.B6-8)
Short Intermediate-Shell Octal with External Barriers:
6-Pin, Arrangement 1 (JEDEC Group 1, No.B6-60)
Basing Designation for BOTTOM VIEW 3C

Pin 1 – See *Note*
Pin 2 – Filament
Pin 3 – See *Note*
Pin 5 – See *Note*
Pin 7 – Filament, Internal Shield
Pin 8 – See *Note*
Cap – Plate



NOTE: May be used only under conditions specified in Operating Considerations.

PULSED-RECTIFIER SERVICE

Maximum Ratings, ***Design-Maximum Values:***

For operation in a 525-line, 30-frame system[b]

Inverse Plate Voltage:		
Total dc and peak[c]	26000 max.	volts
DC	22000 max.	volts
Peak Plate Current	50 max.	ma
DC Plate Current	0.5 max.	ma

Characteristics:

DC Plate Voltage	225	volts
DC Plate Current	7	ma

World Radio History

a Without external shield.

b As described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission.

c The duration of the voltage pulse must not exceed 15 per cent of one horizontal scanning cycle. In a 525-line, 30-frame system, 15 per cent of one horizontal scanning cycle is 10 microseconds.

OPERATING CONSIDERATIONS

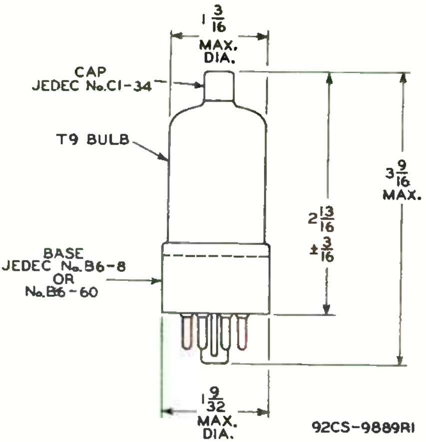
Socket Connections. Socket terminals 1, 3, 4, 5, 6, and 8 may be connected to socket terminal No. 7 or to a corona shield which is connected to socket terminal 7. Socket terminals 4 and 6 may be used as tie points for components at or near filament potential.

Measurement of Filament Voltage. To measure the filament voltage when the filament is at a high dc potential with respect to ground, it is recommended that a simple method utilizing visual comparison of the filament temperature be used. The color temperature of the filament, operating from a pulse-or-rf-power source, may be checked by observing in a darkened room the reflection of the incandescent filament upon the surface of the internal shield. A visual comparison of this color temperature with that obtained when the filament of another 1K3/1J3 is operated from a dc or low-frequency ac supply of 1.25 volts, provides a convenient means for adjusting the amount of excitation to produce 1.25 volts (rms) at the filament terminals.

The high voltages at which the 1K3/1J3 is operated are very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with these high voltages. Particular care against fatal shock should be taken in the measurement of filament voltage. Under all circumstances, circuit parts which may be at high potentials should be enclosed or adequately insulated.

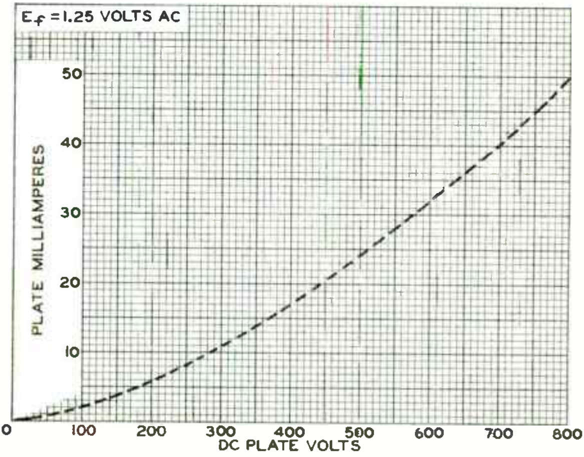
X-radiation. The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce X-radiation which can constitute a health hazard unless such tubes are adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.

World Radio History



DIMENSIONS IN INCHES

AVERAGE PLATE CHARACTERISTIC



92CS-10251

World Radio History

World Radio History

1V2

HALF-WAVE VACUUM RECTIFIER

MINIATURE TYPE

GENERAL DATA

Electrical:

Filament, Coated:		
Voltage	0.625	ac volt
Current	0.3	amp
Direct Interelectrode Capacitance (Approx.):°		
Plate to Filament	0.8	μμf

° With no external shield.

Mechanical:

Mounting Position	Any
Maximum Overall Length	2-3/16"
Maximum Seated Length	1-15/16"
Length, Base Seat to Bulb Top (Excluding tip) .	1-9/16" ± 3/32"
Maximum Diameter	7/8"
Bulb	T-6-1/2
Base	Small-Button Noval 9-Pin
Basing Designation for BOTTOM VIEW	9U

Pin 1 - Internal Connection-Do Not Use
Pin 2 - Same as pin 1
Pin 3 - Same as pin 1
Pin 4 - Filament

Pin 5 - Filament
Pin 6 - Same as pin 1
Pin 7 - Same as pin 1
Pin 8 - Same as pin 1
Pin 9 - Plate

HALF-WAVE RECTIFIER

*Pulsed-Rectifier Service**

Maximum Ratings, *Design-Center Values*:

PEAK INVERSE PLATE VOLTAGE	7500 max.	volts
PEAK PLATE CURRENT	10 max.	ma
AVERAGE PLATE CURRENT	0.5 max.	ma

* The duration of the voltage pulse must not exceed 15% of one horizontal scanning cycle in a 525-line, 30-frame system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. In such a system, 15% of one scanning cycle is 10 microseconds.

OPERATING NOTES

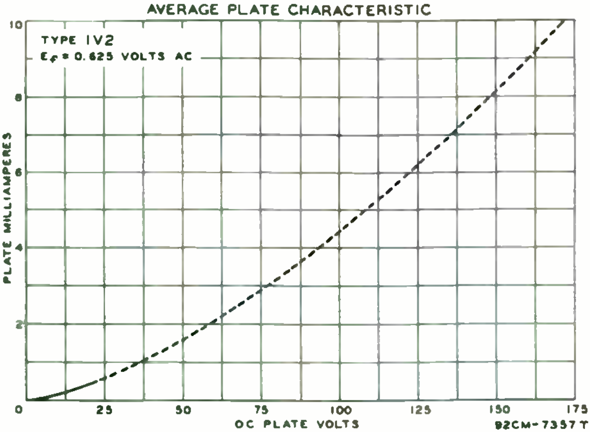
When the filament voltage is measured, it is recommended that a thermal rms voltmeter be used. The meter and its leads must be insulated to withstand 15000 volts and the stray capacitances to ground should be minimized.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
World Radio History

1V2

1V2

HALF-WAVE VACUUM RECTIFIER



NOV. 15, 1949

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-7357T

World Radio History

Half-Wave Vacuum Rectifier

9-PIN MINIATURE TYPE

GENERAL DATA

Electrical:

Filament, Coated:

	Min.	*Av.*	*Max.*	
Voltage (AC)	1.05	1.25	1.45	volts
Current at 1.25 volts	–	0.2	–	amp

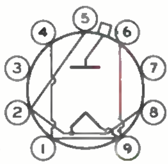
Direct Interelectrode Capacitance (Approx.):[a]

Plate to filament & internal shield	1	$\mu\mu f$

Mechanical:

Operating Position	Any
Maximum Overall Length	2-27/32"
Seated Length	2-7/16" ± 1/8"
Diameter	0.750" to 0.875"
Dimensional Outline	See *General Section*
Bulb	T6-1/2
Cap	Skirted Miniature (JEDEC No.C1-2 or C1-33)
Base	Small-Button Noval 9-Pin (JEDEC No.E9-1)
Basing Designation for BOTTOM VIEW	9Y

Pin 1 – Filament, Internal Shield
Pin 2 – Filament
Pin 3 – Limited Connection[b]
Pin 4 – Same as Pin 1



Pin 5 – Same as Pin 2
Pin 6 – Same as Pin 1
Pin 7 – Same as Pin 3
Pin 8 – Same as Pin 2
Pin 9 – Same as Pin 1
Cap – Plate

PULSED-RECTIFIER SERVICE

Maximum Ratings, ***Design-Maximum Values:***

For operation in a 525-line, 30-frame system[c]

INVERSE PLATE VOLTAGE:		
Total dc and peak[d]	22000 max.	volts
DC	18000 max.	volts
PEAK PLATE CURRENT	45 max.	ma
AVERAGE PLATE CURRENT	0.5 max.	ma

Characteristics, Instantaneous Value:

Tube Voltage Drop for plate ma. = 7	100	volts

[a] Without external shield.

[b] See *Operating Considerations*.

[c] As described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission.

[d] The duration of the voltage pulse must not exceed 15 per cent of one horizontal scanning cycle. In a 525-line, 30-frame system, 15 per cent of one horizontal scanning cycle is 10 microseconds.

← Indicates a change.

World Radio History

OPERATING CONSIDERATIONS

Socket Connections. Socket terminals 3 and 7 may be used as tie points for components at or near filament potential; otherwise, do not use.

Measurement of Filament Voltage. To measure the filament voltage when the filament is at a high dc potential with respect to ground, it is recommended that a simple method utilizing visual comparison of the filament temperature be used. The color temperature of the filament, operating from a pulse-or-rf-power source, may be checked by observing in a darkened room the reflection of the incandescent filament upon the surface of the internal shield. A visual comparison of this color temperature with that obtained when the filament of another 1X2B is operated from a dc or low-frequency ac supply of 1.25 volts, provides a convenient means for adjusting the amount of excitation to produce 1.25 volts (rms) at the filament terminals.

The high voltages at which the 1X2B is operated are very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with these high voltages. Particular care against fatal shock should be taken in the measurement of filament voltage. Under all circumstances, circuit parts which may be at high potentials should be enclosed or adequately insulated.

X rays. The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce *X rays* which can constitute a health hazard unless such tubes are adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.

World Radio History

Half-Wave Vacuum Rectifier

Electrical:

Heater Characteristics and Ratings:

Voltage (AC or DC)	2.5 ± 0.4	volts
Current at heater volts = 2.5	0.330	amp

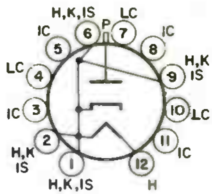
Direct Interelectrode Capacitance (Approx.):[a]

P to (K + IS + H)	1.4	pf

Mechanical:

Operating Position . . . . Any
Type of Cathode . . . . Coated Unipotential
Maximum Overall Length . . . . 3.625"
Seated Length . . . . 3.000" to 3.250"
Diameter . . . . 1.062" to 1.188"
Bulb T9
Cap . . . . Small (JEDEC No.C1-1) or Small With Tubular Support (JEDEC No.C1-34)
Base . . . . . Small-Button Duodecar 12-Pin (JEDEC No.E12-70)
Basing Designation for BOTTOM VIEW 12EW

Pin 1 - Heater, Cathode, Internal Shield
Pin 2 - Same as Pin 1
Pin 3 - Do Not Use[b]
Pin 4 - See *Note*
Pin 5 - Do Not Use[b]
Pin 6 - Same as Pin 1
Pin 7 - See *Note*
Pin 8 - Do Not Use[b]
Pin 9 - Same as Pin 1
Pin 10 - See *Note*
Pin 11 - Do Not Use[b]
Pin 12 - Heater
Cap - Plate



NOTE: May be used only under conditions specified in Operating Considerations.

PULSED-RECTIFIER SERVICE

Maximum Ratings, *Design-Maximum Values:*

For operation in a 525-line, 30-frame system[c]

Inverse Plate Voltage:			
Total dc and peak[d]	30000	max.	volts
DC	24000	max.	volts
Peak Plate Current	80	max.	volts
Average Plate Current	1.5	max.	volts

Characteristics, Instantaneous Value:

Tube Voltage Drop for plate ma. = 7	100	volts

[a] Without external shield.
[b] Socket terminals 3, 5, 8, and 11 should not be used as tie points.

World Radio History

c As described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission.

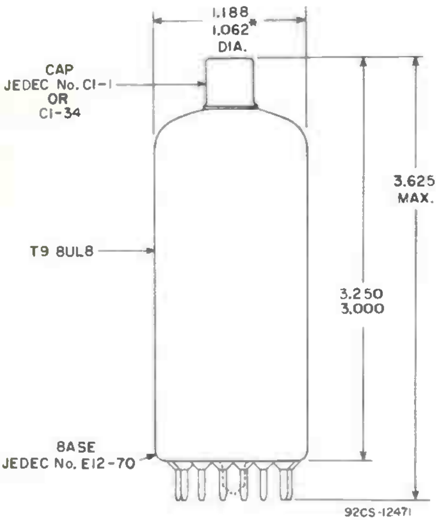
d This rating is applicable when the duration of the voltage pulse does not exceed 15 per cent of one horizontal scanning cycle. In a 525-line, 30-frame system, 15 per cent of one horizontal scanning cycle is 10 microseconds.

OPERATING CONSIDERATIONS

Socket Connections. Socket terminals 4, 7, and 10 may be used as tie points for components at or near the cathode potential; otherwise, do not use.

The high voltages at which the 2AS2 is operated are very dangerous. Great care should be taken in the design of equipment to prevent the operator from coming in contact with these high voltages. Particular care against fatal shock should be taken in the measurement of heater voltage. Under all circumstances, circuit parts which may be high potentials should be enclosed or adequately insulated.

X-radiation. The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce *X-radiation* which can constitute a health hazard unless such tubes are adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.



DIMENSIONS IN INCHES

* Applies to minimum diameter except in area of seal.

World Radio History

Half-Wave Vacuum Rectifier

Useful in High-Voltage, Low-Current Applications such as Pulse-Operated, Focus-Rectifier Circuits in Color TV Receivers

ELECTRICAL

Filament Characteristics and Ratings

Voltage (AC)	1.80 ± 0.27	V
Current at 1.80 V	0.225	A ←

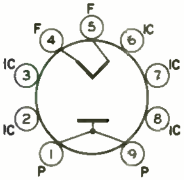
Direct Interelectrode Capacitance (Approx.)[a]

Plate to filament	0.8	pF ←

MECHANICAL

Operating Position.	Any
Type of Cathode	Coated Filament
Maximum Overall Length.	2-3/16 in
Maximum Seated Length	1-15/16 in
Length, Base Seat to Bulb Top (Excluding tip). .	1-9/16 ± 3/32 in
Diameter.	0.750 to 0.875 in
Dimensional Outline	See *General Section*
Bulb.	T6-1/2
Socket.	See *Operating Considerations*
Base.	Small-Button Noval 9-Pin (JEDEC No.E9-1)
Basing Designation for BOTTOM VIEW.	9U

Pin 1 – Plate
Pin 2 – Do Not Use[b]
Pin 3 – Do Not Use[b]
Pin 4 – Filament
Pin 5 – Filament



Pin 6 – Do Not Use[b]
Pin 7 – Do Not Use[b]
Pin 8 – Do Not Use[b]
Pin 9 – Plate

HALF-WAVE PULSED RECTIFIER

Design-Maximum Ratings

Except as Noted

For Operation in a 525-line, 30-frame system[c]

Inverse Plate Voltage

Peak (Absolute-maximum value)[d].	8250[e]	V
DC.	7000	V

Plate Current

Peak.	50	mA ←
Average	0.6	mA

Characteristics, Instantaneous Value

Tube Voltage Drop for plate mA = 1.	20	V ←

← Indicates a change.

World Radio History

[a] Without external shield.

[b] See *Operating Considerations*.

[c] As described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations". Federal Communications Commission.

[d] The duration of the voltage pulse must not exceed 15 per cent of one horizontal scanning cycle. In a 525-line, 30-frame system, 15 per cent of one horizontal scanning cycle is 10 microseconds.

[e] Under no circumstances should this absolute-maximum value be exceeded.

OPERATING CONSIDERATIONS

Socket Connections. The base pins of the 2AV2 fit the Noval 9-contact socket. Socket terminals 2, 3, 6, 7, and 8 should not be used as tie points for external-circuit components. The socket should be made of material having low leakage and should have adequate insulation between its filament and plate terminals to withstand the maximum peak-inverse plate voltage. To provide the required insulation in Noval 9-contact sockets having a cylindrical center shield, it is necessary to remove the center shield. In addition, it is recommended that socket clips for pins 2, 3, 6, 7, and 8 be removed to minimize leakage and the possibility of arc-over.

Measurement of Filament Voltage. It is recommended that a thermal rms voltmeter be used to measure filament voltage. The meter and its leads must be insulated to withstand 15,000 volts. To minimize loading of the rectifier circuit during this measurement, stray capacitances to ground should be kept as low as possible.

High Voltages. The high voltage at which the 2AV2 is operated are very dangerous. Great care should be taken in the design of equipment to prevent the operator from coming in contact with these high voltages. Particular care against fatal shock should be taken in measuring the filament voltage particularly in those circuits where the filament is not grounded. In all cases, all circuit parts which may be at high potentials should be enclosed and interlock switches should be used to open the primary circuit of the high-voltage power supply when access to the equipment is required.

World Radio History

Half-Wave Vacuum Rectifier

9-PIN MINIATURE TYPE

For High-Voltage Rectifier Service in Transistorized TV Receivers

ELECTRICAL

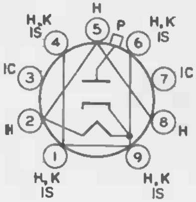
Heater Characteristics and Ratings

Voltage (AC)	2.30 ± 0.30	V
Current at 2.30 V.	0.300	A
Direct Interelectrode Capacitance (Approx.)		
Without external shield		
P to (K + IS + H)	1.0	pF

MECHANICAL

Operating Position	Any
Type of Cathode	Coated Unipotential
Maximum Overall Length	2-27/32 in
Seated Length.	2-7/16 ± 1/8 in
Diameter	0.750 to 0.875 in
Dimensional Outline (JEDEC No.6-7) . . .	See *General Section*
Bulb	T6-1/2
Cap.	Skirted Miniature (JEDEC No.C1-2 or C1-33)
Base	Small-Button Noval 9-Pin (JEDEC No.E9-1)
Basing Designation for BOTTOM VIEW	9RT

Pin 1 – Heater, Cathode, Internal Shield
Pin 2 – Heater
Pin 3 – Do Not Use
Pin 4 – Same as Pin 1
Pin 5 – Heater
Pin 6 – Same as Pin 1
Pin 7 – Do Not Use
Pin 8 – Heater
Pin 9 – Same as Pin 1
Cap – Plate



PULSED-RECTIFIER SERVICE

For operation in a 525-line, 30-frame system

Maximum Ratings, Design-Maximum Values

Peak Inverse Plate Voltage[a]	20000	V
Peak Plate Current	80	mA
Average Plate Current.	1.0	mA

Characteristic, Instantaneous Value

Tube Voltage Drop for plate mA = 7	80	V

[a] This rating is applicable where the duration of the voltage pulse does not exceed 15 per cent of one horizontal scanning cycle. In a 525-line, 30-frame system, 15 per cent of one horizontal scanning cycle is 10 microseconds.

World Radio History

OPERATING CONSIDERATIONS

Socket Connections. The base pins of the 2BJ2 fit the Noval 9-contact socket. Socket terminals 3 and 7 should not be used as tie points for external-circuit components.

The high voltages at which the 2BJ2 is operated are very dangerous. Great care should be taken in the design of equipment to prevent the operator from coming in contact with these high voltages. Particular care against fatal shock should be taken in the measurement of heater voltage. Under all circumstances, circuit parts which may be at high potentials should be enclosed or adequately insulated.

X-radiation. The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce X-radiation which can constitute a health hazard unless such tubes are adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.

World Radio History

Sharp-Cutoff Tetrode

7-PIN MINIATURE TYPE

With Heater Having Controlled Warm-Up Time

The 2CY5 is the same as the 6CY5 except for the following items:

Heater, for Unipotential Cathode:

Voltage (AC or DC)	2.4	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec

World Radio History

World Radio History

2ER5

High-Mu Triode

The 2ER5 is the same as the 6ER5 except for the following items:

Heater Characteristics and Ratings

Current.	0.600 ± 0.040	A
Voltage (AC or DC) at 0.600 A.	2.3	V

2FH5

High-Mu Triode

The 2FH5 is the same as the 6FH5 except for the following items:

Heater Characteristics and Ratings

Current.	0.600 ± 0.040	A
Voltage (AC or DC) at 0.600 A.	2.35	V
Warm-up time (Average)	11	s

2FS5

Beam Hexode

The 2FS5 is the same as the 6FS5 except for the following items:

Heater Characteristics and Ratings

Current.	0.600 ± 0.040	A
Voltage (AC or DC) at 0.600 A.	2.4	V
Warm-up time (Average)	11	s

2GK5

High-Mu Triode

The 2GK5 is the same as the 6GK5 except for the following items:

Heater Characteristics and Ratings

Current.	0.600 ± 0.040	A
Voltage (AC or DC) at 0.600 A.	2.3	V
Warm-up time (Average)	11	s

World Radio History

2GU5

Beam Hexode

The 2GU5 is the same as the 6GU5 except for the following items:

Heater Characteristics and Ratings

Current	0.600 ± 0.040	A
Voltage (AC or DC) at 0.600 A.	2.4	V
Warm-up time (Average)	11	s

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

World Radio History

Half-Wave Vacuum Rectifier

For High-Voltage Rectifier Circuits in Color and Black-and-White TV Receivers

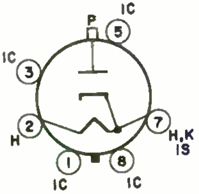
Electrical:

	Min.	*Av.*	*Max.*	
Heater Characteristics and Ratings:				
Voltage (AC or DC).	2.65	3.15	3.65	volts
Current at heater volts = 3.15. .	-	0.220	-	amp
Direct Interelectrode Capacitance (Approx.):				
Without external shield				
P to (K + IS + H)	-	1.5	-	pf

Mechanical:

Operating Position. Any
Type of Cathode . . . . Coated Unipotential
Maximum Overall Length. . . . . 4-1/16"
Seated Length . . . . 3-5/16" ± 3/16"
Maximum Diameter. 1-9/32"
Dimensional Outline (JEDEC No.9-51) . . . . See *General Section*
Bulb. T9
Cap . . . . .Small (JEDEC No.C1-1) or
Small with Tubular Support (JEDEC No.C1-34)
Bases (Alternates):
Intermediate-Shell Octal:
6-Pin, Arrangement 1 (JEDEC Group 1, No.B6-8)
Short Intermediate Shell Octal with External Barriers:
6-Pin, Arrangement 1 (JEDEC Group 1, No.B6-60)
Basing Designation for BOTTOM VIEW. 8EZ

Pin 1 - Do Not Use
Pin 2 - Heater
Pin 3 - Do Not Use
Pin 5 - Do Not Use
Pin 7 - Heater, Cathode, Internal Shield
Pin 8 - Do Not Use
Cap - Plate



PULSED-RECTIFIER SERVICE

Maximum Ratings, ***Design-Maximum Values:***

For operation in a 525-line, 30-frame system

Peak Inverse Plate Voltage[a]	30000	volts
Peak Plate Current.	88	ma
Average Plate Current	1.7	ma

[a] This rating is applicable when the duration of the voltage pulse does not exceed 15 per cent of one horizontal scanning cycle. In a 525-line, 30-frame system, 15 per cent of one horizontal scanning cycle is 10 microseconds.

← Indicates a change.

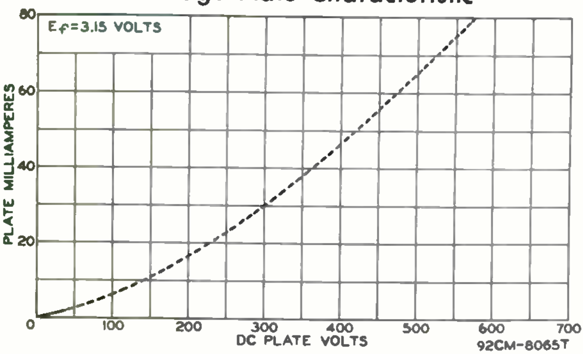
World Radio History

OPERATING CONSIDERATIONS

The high voltages at which the 3A3 is operated are very dangerous. Great care should be taken in the design of equipment to prevent the operator from coming in contact with these high voltages. Particular care against fatal shock should be taken in the measurement of heater voltage. Under all circumstances, circuit parts which may be at high potentials should be enclosed or adequately insulated.

X-radiation. The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce *X-radiation* which can constitute a health hazard unless such tubes are adequately shielded. Relatively simple shielding should prove adequate, but the need for this protection should be considered in equipment design.

Average Plate Characteristic



World Radio History

3AF4A

Medium-Mu Triode

7-PIN MINIATURE TYPE

The 3AF4A is the same as the 6AF4A except for the following items:

Heater Characteristics and Ratings:

Current.	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450.	3.15	volts
Warm-up time (Average)	11	sec

3AL5

Twin Diode

7-PIN MINIATURE TYPE

The 3AL5 is the same as the 6AL5 except for the following items:

Heater Characteristics and Ratings:

Current.	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600.	3.15	volts
Warm-up time (Average)	11	sec

World Radio History

World Radio History

Half-Wave Vacuum Rectifier

DUODECAR TYPE

Electrical:

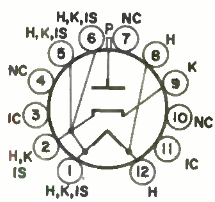
Heater Characteristics and Ratings:

Voltage (AC or DC)	3.15 ± 0.32	volts
Current at heater volts = 3.15	0.220	amp
Direct Interelectrode Capacitance (Approx.):[a]		
P to (K+IS+H)	1.5	pf

Mechanical:

Operating Position	Any
Type of Cathode	Coated Unipotential
Maximum Overall Length	3.625"
Seated Length	3.000" to 3.250"
Diameter	1.062" to 1.188"
Dimensional Outline	See *General Section*
Bulb	T9
Cap	Small (JEDEC No.C1-1) or Small With Tubular Support (JEDEC No.C1-34)
Base	Small-Button Duodecar 12-Pin (JEDEC No.E12-70)
Basing Designation for BOTTOM VIEW	12FV

Pin 1 - Heater, Cathode, Internal Shield
Pin 2 - Same as Pin 1
Pin 3 - *Do Not Use*
Pin 4 - No Internal Connection
Pin 5 - Same as Pin 1
Pin 6 - Same as Pin 1
Pin 7 - Same as Pin 4
Pin 8 - Heater
Pin 9 - Same as Pin 1
Pin 10 - Same as Pin 4
Pin 11 - *Do Not Use*
Pin 12 - Heater
Cap - Plate



PULSED-RECTIFIER SERVICE

Maximum Ratings, ***Design-Maximum Values:***

For operation in a 525-line, 30-frame system[b]

Peak Inverse Plate Voltage[c]	30000 max.	volts
Peak Plate Current	88 max.	ma
Average Plate Current	1.7 max.	ma

[a] Without external shield.

[b] As described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission.

[c] This rating is applicable when the duration of the voltage pulse does not exceed 15 per cent of one horizontal scanning cycle. In a 525-line, 30-frame system, 15 per cent of one horizontal scanning cycle is 10 microseconds.

World Radio History

OPERATING CONSIDERATIONS

The high voltages at which the 3AT2 is operated are very dangerous. Great care should be taken in the design of equipment to prevent the operator from coming in contact with these high voltages. Particular care against fatal shock should be taken in the measurement of heater voltage. Under all circumstances, circuit parts which may be at high potentials should be enclosed or adequately insulated.

X-radiation. The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce *X-radiation* which can constitute a health hazard unless such tubes are adeouately shielded. Relatively simple shielding should prove adeouate, but the need for this precaution should be considered in equipment design.

World Radio History

Sharp-Cutoff Pentode

7-PIN MINIATURE TYPE

The 3AU6 is the same as the 6AU6A except for the following items:

Heater Characteristics and Ratings:

Current	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600	3.15	volts
Warm-up time (Average)	11	sec

3AV6

Twin Diode—High-Mu Triode

7-PIN MINIATURE TYPE

The 3AV6 is the same as the 6AV6 except for the following items:

Heater Characteristics and Ratings:

Current	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600	3.15	volts
Warm-up time (Average)	11	sec

World Radio History

World Radio History

Half-Wave Vacuum Rectifier

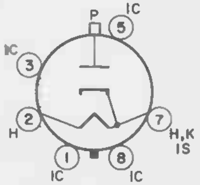
Electrical:

	Min.	*Av.*	*Max.*	
Heater Characteristics and Ratings:				
Voltage (AC or DC)	2.65	3.15	3.65	volts
Current at heater volts = 3.15. . .	–	0.220	–	amp
Direct Interelectrode Capacitance (Approx.):[a]				
P to (K+IS+H)	–	1.5	–	pf

Mechanical:

Operating Position. Any
Type of Cathode . . . . Coated Unipotential
Maximum Overall Length. . . . . 3.625"
Seated Length . . . . 3.000" to 3.250"
Diameter. . . . . 1.062" to 1.188"
Dimensional Outline . . . . See *General Section*
Bulb. T9
Cap . . . . Small (JEDEC No. C1-1) or
Small with Tubular Support (JEDEC No.C1-34)
Bases (Alternates):
Intermediate-Shell Octal:
6-Pin, Arrangement 1 (JEDEC Group 1, No.B6-8)
Short Intermediate Shell Octal with External Barriers:
6-Pin, Arrangement 1 (JEDEC Group 1, No.B-6-60)
Basing Designation for BOTTOM VIEW. 8L/

Pin 1 - Do Not Use
Pin 2 - Heater
Pin 3 - Do Not Use
Pin 5 - Do Not Use
Pin 7 - Heater, Cathode, Internal Shield
Pin 8 - Do Not Use
Cap - Plate



PULSED-RECTIFIER SERVICE

Maximum Ratings, ***Design-Maximum Values:***

For operation in a 525-line, 30-frame system[b]

Peak Inverse Plate Voltage[c]	30000 max.	volts
Peak Plate Current.	88 max.	ma
Average Plate Current	1.7 max.	ma

[a] Without external shield.

[b] As described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission.

[c] This rating is applicable when the duration of the voltage pulse does not exceed 15 per cent of one horizontal scanning cycle. In a 525-line, 30-frame system, 15 per cent of one horizontal scanning cycle is 10 microseconds.

World Radio History

OPERATING CONSIDERATIONS

The high voltages at which the 3AW3 is operated are very dangerous. Great care should be taken in the design of equipment to prevent the operator from coming in contact with these high voltages. Particular care against fatal shock should be taken in the measurement of heater voltage. Under all circumstances, circuit parts which may be at high potentials should be enclosed or adequately insulated.

X-radiation. The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce *X-radiation* which can constitute a health hazard unless such tubes are adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.

World Radio History

RCA

3AL5

TWIN DIODE

7-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 3AL5 is the same as the 6AL5 except for the following items:

Heater, for Unipotential Cathode:		
Voltage	3.15	. . . . . . ac or dc volts
Current	0.6	. . . . amp
Warm-up time (Average)* .	11	. . . . sec

3AU6

SHARP-CUTOFF PENTODE

7-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 3AU6 is the same as the 6AU6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage	3.15	. . . . . . ac or dc volts
Current	0.6	. . . . amp
Warm-up time (Average)* .	11	. . . . sec
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode .	200 max.	volts
Heater positive with respect to cathode .	200▲ max.	volts

3AV6

TWIN DIODE—HIGH-MU TRIODE

7-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 3AV6 is the same as the 6AV6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage	3.15	. . . . . . ac or dc volts
Current	0.6	. . . . amp
Warm-up time (Average)* .	11	. . . . sec
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode .	200 max.	volts
Heater positive with respect to cathode .	200▲ max.	volts

* *For definition of heater warm-up time and method of determining it, see sheet HEATER WARM-UP TIME MEASUREMENT at front of this Section..*

▲ The dc component must not exceed 100 volts.

World Radio History

World Radio History

3BA6

Remote-Cutoff Pentode

7-PIN MINIATURE TYPE

With Heater Having Controlled Warm-Up Time

The 3BA6 is the same as the 6BA6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	3.15	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec

3BC5

Sharp-Cutoff Pentode

7-PIN MINIATURE TYPE

With Heater Having Controlled Warm-Up Time

The 3BC5 is the same as the 6BC5 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	3.15	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	200 max.	volts
Heater positive with respect to cathode	200[a] max.	volts

3BE6

Pentagrid Converter

7-PIN MINIATURE TYPE

With Heater Having Controlled Warm-Up Time

The 3BE6 is the same as the 6BE6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	3.15	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec

[a] The dc component must not exceed 100 volts.

World Radio History

3BN4

Medium-Mu Triode

7-PIN MINIATURE TYPE

With Heater Having Controlled Warm-Up Time

The 3BN4 is the same as the 6BN4 except for the following items:

Heater, for Unipotential Cathode:

Voltage (AC or DC)	3	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

3BN4A

Medium-Mu Triode

7-PIN MINIATURE TYPE

With Heater Having Controlled Warm-Up Time

The 3BN4A is the same as the 6BN4A except for the following items:

Heater, for Unipotential Cathode:

Voltage (AC or DC)	3	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec.

World Radio History

3BN6

Beam Tube

7-PIN MINIATURE TYPE

The 3BN6 is the same as the 6BN6 except for the following items:

Heater Characteristics and Ratings:

Current	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600	3.15	volts
Warm-up time (Average)	11	sec

3BU8

Sharp-Cutoff Twin Pentode
With Common Cathode, Grid No.1, and Grid No.2

9-PIN MINIATURE TYPE

The 3BU8 is the same as the 6BU8 except for the following items:

Heater Characteristics and Ratings:

Current	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600	3.15	volts
Warm-up time (Average)	11	sec

3BY6

Pentagrid Amplifier

7-PIN MINIATURE TYPE

The 3BY6 is the same as the 6BY6 except for the following items:

Heater Characteristics and Ratings:

Current	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600	3.15	volts
Warm-up time (Average)	11	sec

World Radio History

Semiremote-Cutoff Pentode

7-PIN MINIATURE TYPE

The 3BZ6 is the same as the 6BZ6 except for the following items:

Heater Characteristics and Ratings:		
Current.	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600	3.15	volts
Warm-up time (Average)	11	sec
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	300[a] max.	volts
Heater positive with respect to cathode	200[b] max.	volts

[a] The dc component must not exceed 200 volts.
[b] The dc component must not exceed 100 volts.

World Radio History

Half-Wave Vacuum Rectifier

For High-Voltage Rectifier Circuits in TV Receivers

ELECTRICAL

Heater Characteristics and Ratings

Voltage (AC)	3.60 ± 0.54	V
Current at 3.60 V.	0.225	A

Direct Interelectrode Capacitance (Approx.)

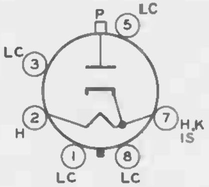
Without external shield

P to (H + K + IS).	1.6	pF

MECHANICAL

Mounting Position. . . . . Any
Type of Cathode. . . . . Coated Unipotential
Maximum Overall Length . . . . 4-1/16 in
Seated Length. . . . . 3-1/8 to 3-1/2 in
Maximum Diameter . . . . 1-9/32 in
Bulb T9
Cap. . . . . Small with Tubular Support (JEDEC No.C1-34)
Base (Alternates)
Intermediate Shell Octal:
6-Pin, Arrangement 1 (JEDEC Group 1, No.B6-8)
Short Intermediate-Shell Octal with External Barriers:
6-Pin, Arrangement 1 (JEDEC Group 1, No.B6-60)
Basing Designation for BOTTOM VIEW . . . . 8MH ←

Pin 1 - See *Note*
Pin 2 - Heater
Pin 3 - See *Note*
Pin 5 - See *Note*



Pin 7 - Heater, Cathode, Internal Shield
Pin 8 - See *Note*

Note: May be used only under conditions specified in Operating Considerations

PULSED-RECTIFIER SERVICE

For operation in a 525-line; 30-frame system[a]

Design-Maximum Ratings

Peak Inverse Plate Voltage	30000	V
Peak Plate Current	100	mA
Average Plate Current.	2	mA

Characteristic, Instantaneous Value

Tube Voltage Drop for plate mA = 11.	100	V

[a] As described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 per cent of one scanning cycle.

← Indicates a change.

OPERATING CONSIDERATIONS

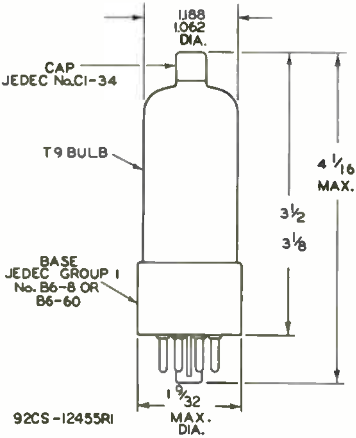
Socket terminals 1, 3, 4, 5, 6 and 8 may be connected to terminal 7 or to a corona shield which connects to terminal 7. Socket terminals 4 and 6 may be used as tie points at or near cathode potential. Otherwise, do not use.

The high voltages at which the 3CA3 is operated may be extremely dangerous to the user. Great care should be taken during the adjustment of circuits. The tube and its associated apparatus, especially all parts which may be at high potential above ground, should be housed in a protective enclosure. The protective housing should be designed with interlocks so that personnel cannot possibly come in contact with any high potential point in the electrical system. The interlock devices should function to break the primary circuit of the high-voltage supply when any gate or door on the protective housing is opened, and should prevent the closing of this primary circuit until the door is locked again.

It should be noted that *high voltages* may appear at normally low-potential points in the circuit as a result of capacitor breakdown or incorrect circuit connections. Therefore, before any part of the circuit is touched, the power-supply switch should be turned off and both terminals of any capacitor should be grounded.

Operation of the 3CA3 with a plate voltage above approximately 16000 volts (absolute value) results in the production of X-radiations which can constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Relatively simply shielding should prove adequate, but the need for this precaution should be considered in equipment design.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

World Radio History

3CB6

Sharp-Cutoff Pentode

7-PIN MINIATURE TYPE

The 3CB6 is the same as the 6CB6-A except for the following items:

Heater Characteristics and Ratings:		
Current	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600	3.15	volts
Warm-up time (Average)	11	sec
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	300 max.	volts
Heater positive with respect to cathode	200[a] max.	volts

3CE5

Sharp-Cutoff Pentode

7-PIN MINIATURE TYPE

The 3CE5 is the same as the 6CE5 except for the following items:

Heater Characteristics and Ratings:		
Current	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600	3.15	volts
Warm-up time (Average)	11	sec

3CF6

Sharp-Cutoff Pentode

7-PIN MINIATURE TYPE

The 3CF6 is the same as the 6CF6 except for the following items:

Heater Characteristics and Ratings:		
Current	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600	3.15	volts
Warm-up time (Average)	11	sec
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	300 max.	volts
Heater positive with respect to cathode	200[a] max.	volts

[a] The dc component must not exceed 100 volts.

World Radio History

3CS6

Pentagrid Amplifier

7-PIN MINIATURE TYPE

The 3CS6 is the same as the 6CS6 except for the following items:

Heater Characteristics and Ratings:

Current	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600	3.15	volts
Warm-up time (Average)	11	sec

3CY5

Sharp-Cutoff Tetrode

7-PIN MINIATURE TYPE

The 3CY5 is the same as the 6CY5 except for the following items:

Heater Characteristics and Ratings:

Current	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450	2.9	volts
Warm-up time (Average)	11	sec

World Radio History

Full-Wave Vacuum Rectifier

GENERAL DATA

Electrical:

Filament, Coated:

Voltage (AC or DC)	3.3 ± 10%	volts
Current at 3.3 volts	3.8	amp

Mechanical:

Operating Position	Any
Maximum Overall Length	4-5/8"
Maximum Seated Length	4-1/16"
Diameter	1.438" to 1.562"
Bulb	T12
Base	Short Medium-Shell Octal 5-Pin with External Barriers, Style A (JEDEC Group 1, No. B5-234) or Short Medium-Shell Octal 5-Pin with External Barriers, Style B (JEDEC Group 1, No. B5-239)
Basing Designation for BOTTOM VIEW	5DE

Pin 1 - Filament
Pin 2 - Internal Connection—Do Not Use

Pin 3 - Filament
Pin 5 - Plate No.2
Pin 7 - Plate No.1

FULL-WAVE RECTIFIER

Maximum Ratings, *Design-Maximum Values:*

PEAK INVERSE PLATE VOLTAGE	1050 max.	volts
AC PLATE SUPPLY VOLTAGE PER PLATE (RMS)	See *Rating Chart I*	
PEAK PLATE CURRENT PER PLATE	1.2 max.	amp
HOT-SWITCHING TRANSIENT PLATE CURRENT PER PLATE[a]	6.5 max.	amp
DC OUTPUT CURRENT	See *Rating Chart I*	
BULB TEMPERATURE (At hottest point on bulb surface)	200 max.	°C

Typical Operation:

With capacitor input to filter

AC Plate-to-Plate Supply Voltage (RMS)	550	volts
Filter-Input Capacitor[b]	40	μf
Total Effective Plate Supply Impedance Per Plate	32	ohms
DC Output Voltage (Approx.) at input to filter at full-load current of 350 ma.	300	volts

World Radio History

Characteristics:

Tube-Voltage Drop for plate ma. = 350 (Per plate). . . . . 25 volts

[a] Even occasional hot-switching with capacitor-input circuits permits the flow of plate current having magnitudes which can adversely affect the life and reliability of rectifier tubes. If capacitor-input circuits are to be used, protect the circuits against the adverse effects of possible hot-switching, and do not exceed a hot-switching transient plate current per plate of 6.5 amperes during the initial cycles of the hot-switching transient. If hot-switching is required in operation, the use of choke-input circuits is recommended. Such circuits limit the hot-switching current to a value no higher than that of the peak plate current.

[b] Values of capacitance higher than those indicated may be used, provided the effective plate supply impedance is increased to prevent exceeding the maximum peak-plate-current rating.

RATING CHARTS and OPERATION CHARACTERISTICS

Rating Chart I represents graphically the relationships between maximum ac voltage input and maximum dc output current derived from the fundamental ratings for conditions of capacitor input and choke input to filters. This graphical presentation gives the equipment designer considerable latitude in choice of operating conditions.

Rating Chart II represents graphically the relationship between maximum rectification efficiency and maximum dc output current per plate for conditions of capacitor input to filter.

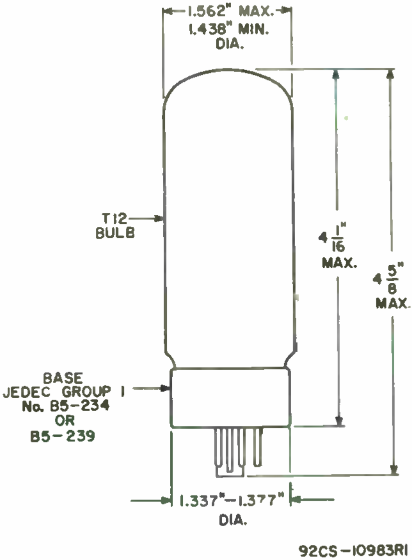
A choice of operating values of dc output current per plate and rectification efficiency should be made such that they fall within the area of permissible operation to insure that the maximum peak-plate-current rating will not be exceeded. If the operating values chosen fall outside the permissible operating area, a different choice of parameters should be made. For a given value of ac voltage input and dc output current, it is possible to reduce the rectification efficiency either by increasing the plate supply resistance per plate or by using a smaller value of input filter capacitor.

Rating Chart III represents graphically the relationships between minimum effective plate supply resistance per plate and maximum ac plate supply voltage per plate under no-load conditions of capacitor input to filter when occasional hot-switching is employed.

If occasional hot-switching is required with capacitor-input circuits, it is important to protect the tube and the circuits against the flow of plate currents having magnitudes in excess of the maximum hot-switching-current rating of 6.5 amperes. To limit the hot-switching current, adequate series plate supply resistance per plate is necessary. This resistance value may be determined with the formula shown in legend of *Rating Chart III*. To insure that the maximum hot-switching current is not exceeded, a value of series plate supply resistance per plate should be chosen such that it is equal to or greater than the minimum value indicated by the curve.

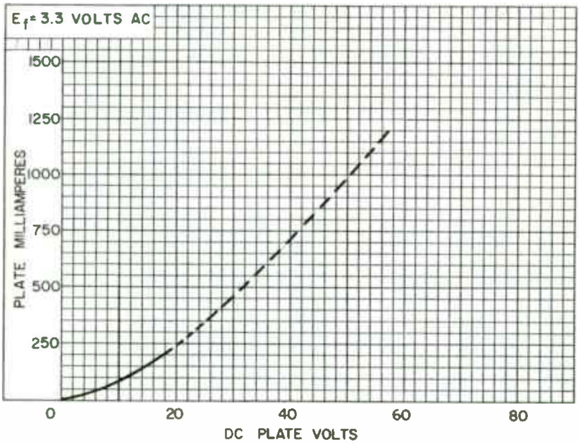
World Radio History

If appreciable series inductance is present in the plate supply, a value of series plate supply resistance smaller than that indicated by the curve may be employed provided it is experimentally determined that the combined effect of inductance and plate supply resistance used are adequate to limit the hot-switching current to the indicated maximum-rated value.



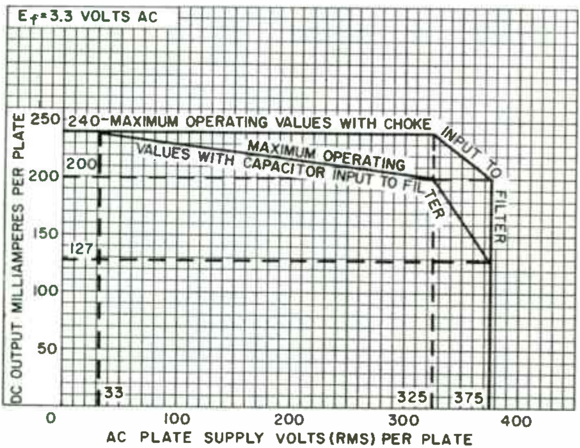
World Radio History

AVERAGE PLATE CHARACTERISTIC
Each Plate



92CS-10980

RATING CHART I



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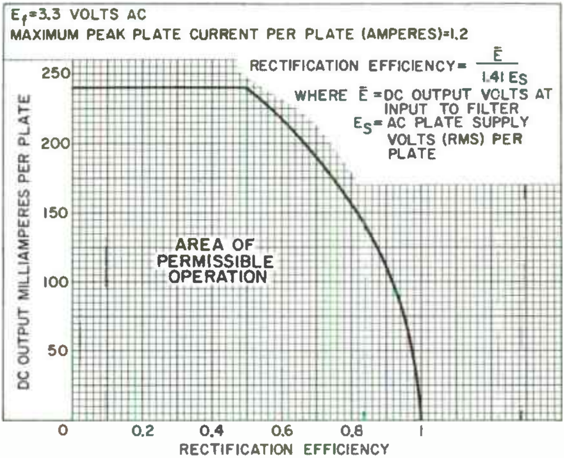
World Radio History

RATING CHART II
Capacitor Input to Filter



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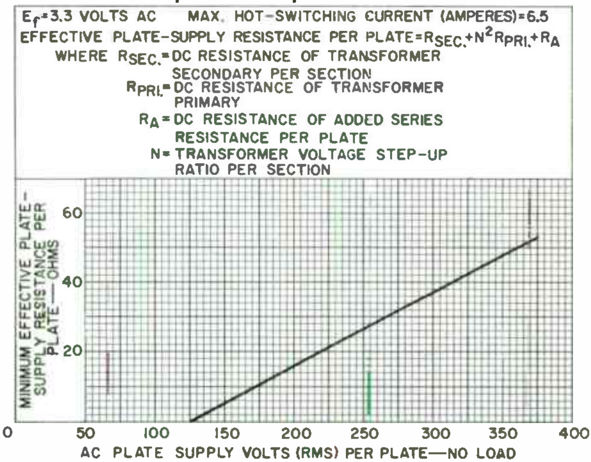
RATING CHART III
Capacitor Input to Filter



92CS-10977

World Radio History

World Radio History

Sharp-Cutoff Pentode

7-PIN MINIATURE TYPE

The 3DK6 is the same as the 6DK6 except for the following items:

Heater Characteristics and Ratings:		
Current.	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600.	3.15	volts
Warm-up time (Average)	11	sec
Peak heater-cathode voltage:		
Heater negative with respect to cathode	300[a] max.	volts
Heater positive with respect to cathode	200[b] max.	volts

3DT6A

Sharp-Cutoff Pentode

With Two Independent Control Grids

7-PIN MINIATURE TYPE

The 3DT6A is the same as the 6DT6A except for the following items:

Heater Characteristics and Ratings:		
Current.	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600.	3.15	volts
Warm-up time (Average)	11	sec

[a] The dc component must not exceed 200 volts.
[b] The dc component must not exceed 100 volts.

World Radio History

3DZ4

Medium-Mu Triode

7-PIN MINIATURE TYPE

The 3DZ4 is the same as the 6DZ4 except for the following items:

Heater Characteristics and Ratings:			
Current.	0.450 ± 0.030		amp
Voltage (AC or DC) at heater amperes = 0.450.	3.2		volts
Warm-up time (Average)	11		sec
Peak heater-cathode voltage:			
Heater negative with respect to cathode	180	max.	volts
Heater positive with respect to cathode	180[b]	max.	sec

3EA5

Sharp-Cutoff Tetrode

7-PIN MINIATURE TYPE

The 3EA5 is the same as the 6EA5 except for the following items:

Heater Characteristics and Ratings:		
Current.	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450.	2.9	volts
Warm-up time (Average)	11	sec

3EH7

Semiremote-Cutoff Pentode

9-PIN MINIATURE TYPE

The 3EH7 is the same as the 6EH7 expect for the following items:

Heater Characteristics and Ratings:		
Current.	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600.	3.4	volts

[b] The dc component must not exceed 100 volts.

World Radio History

3EJ7

Sharp-Cutoff Pentode

9-PIN MINIATURE TYPE

The 3EJ7 is the same as the 6EJ7 except for the following items:

Heater Characteristics and Ratings:

Current	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600	3.4	volts

3ER5

High-Mu Triode

7-PIN MINIATURE TYPE

The 3ER5 is the same as the 6ER5 except for the following items:

Heater Characteristics and Ratings:

Current	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450	2.8	volts

3FH5

High-Mu Triode

7-PIN MINIATURE TYPE

The 3FH5 is the same as the 6FH5 except for the following items:

Heater Characteristics and Ratings:

Current	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450	3.0	volts
Warm-up time (Average)	11	sec

World Radio History

3FS5

Beam Hexode

7-PIN MINIATURE TYPE

The 3FS5 is the same as the 6FS5 except for the following items:

Heater Characteristics and Ratings:

Current.	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450.	2.9	volts
Warm-up time (Average)	11	sec

3GK5

High-Mu Triode

7-PIN MINIATURE TYPE

The 3GK5 is the same as the 6GK5 except for the following items:

Heater Characteristics and Ratings:

Current.	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450.	2.8	volts
Warm-up time (Average)	11	sec

World Radio History

3GS8

Sharp-Cutoff Twin Pentode

With Common Cathode, Grid No.1, and Grid No.2

9-PIN MINIATURE TYPE

The 3GS8 is the same as the 4GS8/4BU8 except for the following items:

Heater Characteristics and Ratings:

Current.	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600.	3.15	volts

3HM5/3HA5

High-Mu Triode

7-PIN MINIATURE TYPE

The 3HM5/3HA5 is the same as the 6HM5/6HA5 except for the following items:

Heater Characteristics and Ratings:

Current.	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450.	2.7	volts
Warm-up time (Average)	11	sec

3HS8

Sharp-Cutoff Twin Pentode

9-PIN MINIATURE TYPE

The 3HS8 is the same as the 6HS8 except for the following items:

Heater Characteristics and Ratings:

Current.	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600.	3.15	volts
Warm-up time (Average)	11	sec

World Radio History

3JC6

Sharp-Cutoff Pentode

9-PIN MINIATURE TYPE

The 3JC6 is the same as the 6JC6 except for the following items:

Heater Characteristics and Ratings:		
Current.	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600.	3.5	volts
Warm-up time (Average)	11	sec

3JD6

Sharp-Cutoff Pentode

9-PIN MINIATURE TYPE

The 3JD6 is the same as the 6JD6 except for the following items:

Heater Characteristics and Ratings:		
Current.	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600.	3.5	volts
Warm-up time (Average)	11	sec

World Radio History

4AU6

Sharp-Cutoff Pentode

7-PIN MINIATURE TYPE

With Heater Having Controlled Warm-Up Time

The 4AU6 is the same as the 6AU6 except for the following items:

Heater Characteristics and Ratings *(Design-Maximum Values)*:

Current	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450	4.2	volts
Warm-up time (Average)	11	sec

4AV6

Twin Diode—High-Mu Triode

7-PIN MINIATURE TYPE

With Heater Having Controlled Warm-Up Time

The 4AV6 is the same as the 6AV6 except for the following items:

Heater Characteristics and Ratings *(Design-Maximum Values)*:

Current	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450	4.2	volts
Warm-up time (Average)	11	sec

4BC5

Sharp-Cutoff Pentode

7-PIN MINIATURE TYPE

With Heater Having Controlled Warm-Up Time

The 4BC5 is the same as the 6BC5 except for the following items:

Heater Characteristics and Ratings *(Design-Center Values)*:

Current	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450	4.2	volts
Warm-up time (Average)	11	sec
Peak heater-cathode voltage:		
Heater negative with respect to cathode	200 max.	volts
Heater positive with respect to cathode	200[a] max.	volts

[a] The dc component must not exceed 100 volts.

World Radio History

4BC8

Medium-Mu Twin Triode

With Semiremote-Cutoff Characteristic

9-PIN MINIATURE TYPE

With Heater Having Controlled Warm-Up Time

The 4BC8 is the same as the 6BC8 except for the following items:

Heater Characteristics and Ratings *(Design-Center Values)*:

Current.	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600.	4.2	volts
Warm-up time (Average)	11	sec

4BL8

Medium-Mu Triode—Sharp-Cutoff Pentode

9-PIN MINIATURE TYPE

With Heater Having Controlled Warm-Up Time

The 4BL8 is the same as the 6BL8 except for the following items:

Heater Characteristics and Ratings *(Design-Center Values)*:

Current.	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600.	4.6	volts

4BN6

Beam Tube

7-PIN MINIATURE TYPE

With Heater Having Controlled Warm-Up Time

The 4BN6 is the same as the 6BN6 except for the following items:

Heater Characteristics and Ratings *(Design-Maximum Values)*:

Current.	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450.	4.2	volts
Warm-up time (Average)	11	sec

World Radio History

4BQ7A

Medium-Mu Twin Triode

9-PIN MINIATURE TYPE

With Heater Having Controlled Warm-Up Time

The 4BQ7A is the same as the 6BQ7A except for the following items:

Heater Characteristics and Ratings *(Design-Center Values)*:

Current	0.600 ± 0.040	amp
Voltage (AC or DC) at heater current = 0.600	4.2	volts
Warm-up time (Average).	11	sec

4BS8

Medium-Mu Twin Triode

9-PIN MINIATURE TYPE

With Heater Having Controlled Warm-Up Time

The 4BS8 is the same as the 6BS8 except for the following items:

Heater Characteristics and Ratings *(Design-Center Values)*:

Current	0.600 ± 0.040	amp
Voltage (AC or DC) at heater current = 0.600	4.5	volts
Warm-up time (Average).	11	sec

4BU8

Sharp-Cutoff Twin Pentode

With Common Cathode, Grid No.1, & Grid No.2

9-PIN MINIATURE TYPE

With Heater Having Controlled Warm-Up Time

The 4BU8 is the same as the 6BU8 except for the following items:

Heater Characteristics and Ratings *(Design-Maximum Values)*:

Current	0.450 ± 0.030	amp
Voltage (AC or DC) at heater current = 0.450	4.2	volts
Warm-up time (Average).	11	sec

World Radio History

4BZ6

Semiremote-Cutoff Pentode

7-PIN MINIATURE TYPE

With Heater Having Controlled Warm-Up Time

The 4BZ6 is the same as the 6BZ6 except for the following items:

Heater Characteristics and Ratings *(Design-Maximum Values)*:

Current	0.450 ± 0.030	amp
Voltage (AC or DC) at heater current = 0.450	4.2	volts
Warm-up time (Average).	11	sec

4BZ7

Medium-Mu Twin Triode

9-PIN MINIATURE TYPE

With Heater Having Controlled Warm-Up Time

The 4BZ7 is the same as the 6BZ7 except for the following items:

Heater Characteristics and Ratings *(Design-Center Values)*:

Current	0.600 ± 0.040	amp
Voltage (AC or DC) at heater current = 0.600	4.2	volts
Warm-up time (Average).	11	sec

4CB6

Sharp-Cutoff Pentode

7-PIN MINIATURE TYPE

With Heater Having Controlled Warm-Up Time

The 4CB6 is the same as the 6CB6 except for the following items:

Heater Characteristics and Ratings *(Design-Center Values)*:

Current	0.450 ± 0.030	amp
Voltage (AC or DC) at heater current = 0.450	4.2	volts
Warm-up time (Average).	11	sec
Peak heater-cathode voltage:		
Heater negative with respect to cathode.	300[a] max.	volts
Heater positive with respect to cathode.	200[b] max.	volts

[a] The dc component must not exceed 200 volts.
[b] The dc component must not exceed 100 volts.

World Radio History

4CS6

Pentagrid Amplifier

7-PIN MINIATURE TYPE

The 4CS6 is the same as the 6CS6 except for the following items:

Heater Characteristics and Ratings:		
Current.	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450	4.2	volts
Warm-up time (Average)	11	sec

4CY5

Sharp-Cutoff Tetrode

7-PIN MINIATURE TYPE

The 4CY5 is the same as the 6CY5 except for the following items:

Heater Characteristics and Ratings:		
Current.	0.300 ± 0.020	amp
Voltage (AC or DC) at heater amperes = 0.300	4.5	volts
Warm-up time (Average)	11	sec

4DE6

Sharp-Cutoff Pentode

7-PIN MINIATURE TYPE

The 4DE6 is the same as the 6DE6 except for the following items:

Heater Characteristics and Ratings:		
Current.	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450	4.2	volts
Warm-up time (Average)	11	sec

World Radio History

4DK6

Sharp-Cutoff Pentode

7-PIN MINIATURE TYPE

The 4DK6 is the same as the 6DK6 except for the following items:

Heater Characteristics and Ratings:

Current.	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450	4.2	volts
Warm-up time (Average)	11	sec

4DT6A

Sharp-Cutoff Pentode

With Two Independent Control Grids

7-PIN MINIATURE TYPE

The 4DT6A is the same as the 6DT6A except for the following items:

Heater Characteristics and Ratings:

Current.	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450	4.2	volts
Warm-up time (Average)	11	sec

World Radio History

4EH7

Semiremote-Cutoff Pentode

9-PIN MINIATURE TYPE

The 4EH7 is the same as the 6EH7 except for the following items:

Heater Characteristics and Ratings:

Current.	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450.	4.4	volts

4EJ7

Sharp-Cutoff Pentode

9-PIN MINIATURE TYPE

The 4EJ7 is the same as the 6EJ7 except for the following items:

Heater Characteristics and Ratings:

Current.	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450.	4.4	volts

4ES8

Variable-Mu Twin Triode

9-PIN MINIATURE TYPE

The 4ES8 is the same as the 6ES8 except for the following items:

Heater Characteristics and Ratings:

Current.	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600.	4	volts
Warm-up time (Average)	11	sec

World Radio History

4EW6

Sharp-Cutoff Pentode

7-PIN MINIATURE TYPE

The 4EW6 is the same as the 6EW6 except for the following items:

Heater Characteristics and Ratings:		
Current.	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600.	4.2	volts
Warm-up time (Average)	11	sec

4GM6

Semiremote-Cutoff Pentode

7-PIN MINIATURE TYPE

The 4GM6 is the same as the 6GM6 except for the following items:

Heater Characteristics and Ratings:		
Current.	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600.	4.2	volts
Warm-up time (Average)	11	sec

World Radio History

Power Pentode

7-PIN MINIATURE TYPE

The 4GZ5 is the same as the 6GZ5 except for the following items:

Heater Characteristics and Ratings:		
Current.	0.600 ± 0.040	amp
Voltage (AC or DC) at heater amperes = 0.600.	4.0	volts
Warm-up time (Average)	11	sec

World Radio History

World Radio History

Sharp-Cutoff Pentode

9-PIN MINIATURE TYPE

GENERAL DATA

Electrical:

Heater Characteristics and Ratings:

Current	0.450 ± 0.030		amp
Voltage (AC or DC) at heater amperes = 0.450	4.2		volts
Warm-up time (Average)	11		sec
Peak heater-cathode voltage:			
Heater negative with respect to cathode	200 max.		volts
Heater positive with respect to cathode	200 max.		volts

Direct Interelectrode Capacitances:

	Without External Shield	*With External Shield*[a]	
Grid No.1 to plate	0.031	0.024	pf
Grid No.1 to cathode, grid No.3 & internal shield, grid No.2, and heater	8.7	8.7	pf
Plate to cathode, grid No.3 & internal shield, grid No.2, and heater	2.15	3.0	pf

Characteristics, Class A_1 Amplifier:

Plate Supply Voltage	125	volts
Grid No.3 (Suppressor Grid)	*Connected to cathode at socket*	
Grid No.2 Supply Voltage	125	volts
Cathode Resistor	56	ohms
Plate Resistance (Approx.)	0.156	megohm
Transconductance	15000	μmhos
Plate Current	13	ma
Grid No.2 Current	3.2	ma
Grid No.1 Voltage (Approx.) for transconductance (μmhos) = 100	-3	volts

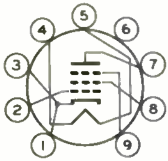
Mechanical:

Operating Position	Any
Type of Cathode	Coated Unipotential
Maximum Overall Length	2-3/16"
Maximum Seated Length	1-15/16"
Length, Base Seat to Bulb Top (Excluding tip)	1-9/16" ± 3/32"
Diameter	0.750" to 0.875"
Dimensional Outline	See *General Section*
Bulb	T6-1/2
Base	Small-Button Noval 9-Pin (JEDEC No.E9-1)

World Radio History

Basing Designation for BOTTOM VIEW. 9PM

Pin 1 - Cathode
Pin 2 - Grid No.1
Pin 3 - Cathode
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - No Internal Connection



Pin 7 - Plate
Pin 8 - Grid No.2
Pin 9 - Grid No.3, Internal Shield

AMPLIFIER — CLASS A_1

Maximum Ratings, ***Design-Maximum Values:***

PLATE VOLTAGE.	250 max.	volts
GRID No.2 (SCREEN-GRID) SUPPLY VOLTAGE . . .	250 max.	volts
GRID No.2 VOLTAGE. . . . . .See *Grid-No.2 Input Rating Chart* at front of Receiving Tube Section		
GRID-No.1 (CONTROL-GRID) VOLTAGE:		
Negative-bias value.	50 max.	volts
CATHODE CURRENT.	25 max.	ma
GRID No.2 INPUT:		
For grid-No.2 voltages up to 125 volts . .	0.6 max.	watt
For grid-No.2 voltages between 125 and 250 volts. . . . . .See *Grid-No.2 Input Rating Chart* at front of Receiving Tube Section		
PLATE DISSIPATION.	2.5 max.	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance:		
For fixed-bias operation	0.25 max.	megohm
For cathode-bias operation	1 max.	megohm

[a] With JEDEC shield No.315 connected to ground.

World Radio History

Sharp-Cutoff Twin Pentode

9-PIN MINIATURE TYPE

The 4HS8 is the same as the 6HS8 except for the following items:

Heater Characteristics and Ratings:

Current	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450	4.2	volts
Warm-up time (Average)	11	sec

World Radio History

World Radio History

Sharp-Cutoff Pentode

9-PIN MINIATURE TYPE

GENERAL DATA

Electrical:

Heater Characteristics and Ratings:

Current	0.450 ± 0.030	amp
Voltage (AC or DC) at heater amperes = 0.450	4.2	volts
Warm-up time (Average)	11	sec
Peak heater-cathode voltage:		
Heater negative with respect to cathode	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Direct Interelectrode Capacitances:

	Without External Shield	*With External Shield*[a]	
Grid No.1 to plate	0.031	0.024	pf
Grid No.1 to cathode, grid No.3 & internal shield, grid No.2, and heater	8.7	8.7	pf
Plate to cathode, grid No.3 & internal shield, grid No.2, and heater	2.15	3.0	pf

Characteristics, Class A_1 Amplifier:

Plate Supply Voltage	125	volts
Grid No.3 (Suppressor Grid)	*Connected to cathode at socket*	
Grid-No.2 Supply Voltage	125	volts
Cathode Resistor	56	ohms
Plate Resistance (Approx.)	0.143	megohm
Transconductance	14000	μmhos
Plate Current	15	ma
Grid-No.2 Current	4	ma
Grid-No.1 Voltage (Approx.) for transconductance (μmhos) = 100	-4.5	volts
Grid-No.1 Voltage (Approx.) for transconductance (μmhos) = 300	-3.5	volts

Mechanical:

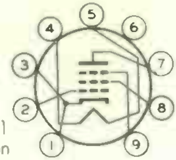
Operating Position	Any
Type of Cathode	Coated Unipotential
Maximum Overall Length	2-3/16"
Maximum Seated Length	1-15/16"
Length, Base Seat to Bulb Top (Excluding tip)	1-9/16" ± 3/32"
Diameter	0.750" to 0.875"
Dimensional Outline	See *General Section*
Bulb	T6-1/2
Base	Small-Button Noval 9-Pin (JEDEC No.E9-1)

World Radio History

4HT6

Basing Designation for BOTTOM VIEW 9PM

Pin 1 – Cathode
Pin 2 – Grid No.1
Pin 3 – Cathode
Pin 4 – Heater
Pin 5 – Heater
Pin 6 – No Internal Connection



Pin 7 – Plate
Pin 8 – Grid No.2
Pin 9 – Grid No.3, Internal Shield

AMPLIFIER — Class A_1

Maximum Ratings, ***Design-Maximum Values:***

PLATE VOLTAGE	250 max.	volts
GRID-No.2 (SCREEN-GRID) SUPPLY VOLTAGE	250 max.	volts
GRID-No.2 VOLTAGE	See *Grid-No.2 Input Rating Chart* at front of Receiving Tube Section	
GRID-No.1 (CONTROL-GRID) VOLTAGE:		
Negative-bias value	50 max.	volts
CATHODE CURRENT	25 max.	ma
GRID-No.2 INPUT:		
For grid-No.2 voltages up to 125 volts	0.6 max.	watt
For grid-No.2 voltages between 125 and 250 volts	See *Grid-No.2 Input Rating Chart* at front of Receiving Tube Section	
PLATE DISSIPATION	2.5 max.	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance:		
For fixed-bias operation	0.25 max.	megohm
For cathode-bias operation	1 max.	megohm

[a] With JEDEC shield No. 315 connected to ground.

World Radio History

4JC6

Sharp-Cutoff Pentode

The 4JC6 is the same as the 6JC6 except for the following items:

Heater Characteristics and Ratings

Current	I_h	0.450 ± 0.030	A
Voltage (AC or DC) at 0.450 A	E_h	4.5	V
Warm-up time (Average)		11	s

4JD6

Sharp-Cutoff Pentode

The 4JD6 is the same as the 6JD6 except for the following items:

Heater Characteristics and Ratings

Current	I_h	0.450 ± 0.030	A
Voltage (AC or DC) at 0.450 A	E_h	4.5	V
Warm-up time (Average)		11	s

4KE8

Medium-Mu Triode— Sharp-Cutoff Pentode

The 4KE8 is the same as the 6KE8 except for the following items:

Heater Characteristics and Ratings

Current	I_h	0.600 ± 0.040	A
Voltage (AC or DC) at 0.600 A	E_h	4.5	V
Warm-up time (Average)		11	s

World Radio History

5AM8

Diode—Sharp-Cutoff Pentode

CONTROLLED HEATER WARM-UP TIME

The 5AM8 is the same as the 6AM8A except for the following items:

Heater Characteristics and Ratings

Current.	I_h	0.600 ± 0.040	A
Voltage (AC or DC) at 0.600 A .	E_h	4.7	V

5AN8

Medium-Mu Triode—Sharp-Cutoff Pentode

CONTROLLED HEATER WARM-UP TIME

The 5AN8 is the same as the 6AN8A except for the following items:

Heater Characteristics and Ratings

Current.	I_h	0.600 ± 0.040	A
Voltage (AC or DC) at 0.600 A .	E_h	4.7	V

5AQ5

Beam Power Tube

CONTROLLED HEATER WARM-UP TIME

The 5AQ5 is the same as the 6AQ5A except for the following items:

Heater Characteristics and Ratings

Current.	I_h	0.600 ± 0.040	A
Voltage (AC or DC) at 0.600 A .	E_h	4.7	V

World Radio History