RCA TUBE
HANDBOOK
HB-3

MISCELLANEOUS TUBE SECTION

This Section contains data on certain tubes not falling within the scope of other Sections of this Handbook.

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

SEPARATOR

CLASSIFICATION CHART FOR TYPES IN MISCELLANEOUS TUBE SECTION

When choosing tube types, the equipment designer should refer to the RCA PREFERRED TYPES LIST and its companion list - TYPES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN - both of which appear in the General Section.

Description	TUBE TYPE
TUBES FOR UHF APPLICATIONS	
Acorn Types	
Oscillator Triode	6F4
Oscillator Triode	6L4
Sharp-Cutoff Pentode	954
Medium-Mu Triode	955
Remote-Cutoff Pentode	956
Medium-Mu Triode	957
Medium-Mu Triode	958-A
Sharp-Cutoff Pentode	959
UHF Diode	9004
UHF Diode	9005
"Pencil Types"	
Medium-Mu Triode	5675
Fixed-Tuned Oscillator Triode	5794
High-Mu Triode	5876
Medium-Mu Triode	5892
UHF Diode	6173
Medium-Mu Triode	6263
Medium-Mu Triode	6264
Fixed-Tuned Oscillator Triode	6562
Other Types for UHF Applications	
Lighthouse Triode	2C40
Lighthouse Triode	2C43
Klystron	2K26
High-Mu Triode	6J4□
Oscillator Triode	6026■
Traveling-Wave Tube	6861
Sharp-Cutoff Pentode	9001□
Medium-Mu Triode	9002□
Remote-Cutoff Pentode	9003□
UHF Diode	9006□
VACUUM-GAUGE TUBES	
Thermocouple Type	1945
Pirani Type	1947
Hard-Glass Bulb, Ionization Type	1949
Soft-Glass Bulb, Ionization Type	1950

□ Miniature type.
■ Subminiature type.

CLASSIFICATION CHART FOR TYPES IN MISCELLANEOUS TUBE SECTION

Description	TUBE TYPE
TUBES FOR SPECIAL APPLICATIONS	
Mechano-Electronic Transducer	5734
Remote-Cutoff Beam Pentode (For use in Shunt Voltage-Regulator Service)	5890

RECTIFIERS

Maximum Plate Ma.♦		Maximum Peak Inverse Plate Volts♦	Filament (F) or Heater (H)		TUBE TYPE
Average	Peak		Volts	Amperes	
Half-Wave Vacuum Types					
2	40	60000	1.6 F	1.25	5825
5	20	20000	2.5 F	5	878
7.5■	60■	12500■	2.5 H	1.75	2X2-A
20	150	40000▲	2.5 F	5	8013-A
25	270	20000	2.5 F	6	579-B
100	750	40000	5 F	6	8020

♦ Absolute values, except as noted.

▲ This value may be increased to 55,000 volts when the 8013-A is immersed in oil.

■ Design-center value.

MAX. D-C HEATER-CATHODE POTENTIALS
OF MISCELLANEOUS TYPES

Based on JAN Specifications as of January 3, 1944

The following Miscellaneous Tubes appear in the JAN Specifications as having an *absolute maximum* heater-cathode potential rating as shown below. The corresponding *design-center maximum* ratings may be taken as 90 volts and 80 volts, respectively, for the 100- and 90-volt absolute maximum values. Types for which heater-cathode potential ratings are given on their data pages are not included in this list.

Type	*Absolute Max. Volts*
2C21/1642	100
2C22	100
6C4	100
12A6	100
954	90
955	90
956	90
1629	100
1635	100
9001	90
9002	90
9003	90

(Tentative)

RCA

2J41

MAGNETRON

FREQUENCY-STABILIZED TYPE
Tunable: 9300-9320 Mc

GENERAL DATA

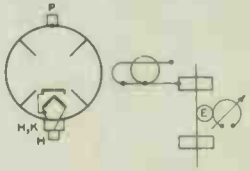
Electrical:

Heater, for Unipotential Cathode:		
Voltage	5 ± 10%	ac or dc volts
Current	0.86	amp
Minimum Cathode Heating Time	1	minute
Frequency	9310	Mc
Frequency Range	9320 max.	Mc
	9300 min.	Mc
Maximum Pulling Frequency:		
At 9300 Mc	2.5	Mc
At 9310 Mc	1.5	Mc
At 9320 Mc	2.5	Mc
Maximum Frequency Change with Anode Stud Temperature Change	0.025	Mc/°C

Mechanical:

Mounting Position	Any
Dimensions	*See Dimensional Outline*
Weight (Approx.)	7-1/2 lbs
Mating Output RF Connector	MIL Type UG-40/U
Base	Short Skirted Miniature Double Bayonet
Terminal Connections *(See Dimensional Outline)*:	

H – Heater
K – Cathode
P – Anode



PULSED OSCILLATOR SERVICE

Maximum and Minimum Ratings, *Absolute Values:*

For Duty Cycle of 0.003 max.

PEAK ANODE VOLTAGE	3000 max.	volts
PEAK ANODE CURRENT	1.2 max.	amp
	0.8 min.	amp
PEAK POWER INPUT	3.6 max.	kw
AVERAGE POWER INPUT	10.8 max.	watts
PULSE DURATION	0.6 max.	μsec
OPERATION TIME IN ANY 100-MILLISECOND INTERVAL	3 max.	μsec
AMBIENT TEMPERATURE	85 max.	°C
ABSOLUTE PRESSURE ON WAVEGUIDE WINDOW	30 max.	psi
LOAD VOLTAGE STANDING-WAVE RATIO	1.5 max.	
TIME OF RISE OF VOLTAGE PULSE	0.2 max.	μsec

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

2J41

MAGNETRON

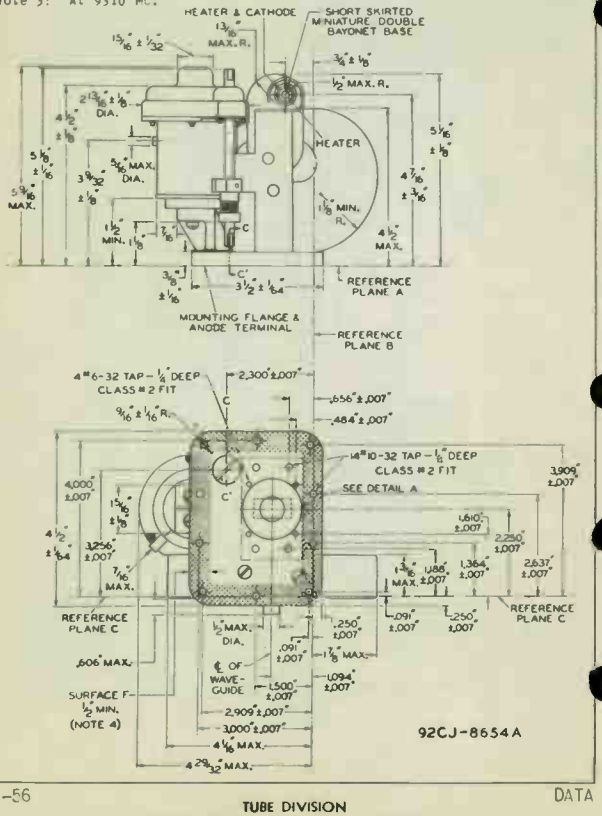
CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current	1	0.32	0.40	amp
Peak Anode Voltage	1,2,3	2350	2650	volts
Peak Power Output:				
At 9300 Mc	1,2	240	–	watts
At 9310 Mc	1,2	300	–	watts
At 9320 Mc	1,2	240	–	watts

Note 1: With 5 volts ac or dc on heater.

Note 2: With peak anode current of 1 ampere, duty cycle of 0.003, pulse duration of 0.5 μsec ± 10%, load voltage standing-wave ratio, 1.1 max.

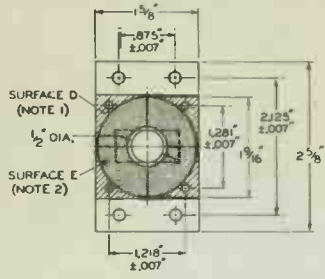
Note 3: At 9310 Mc.



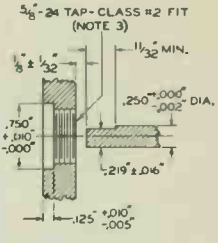
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

2J41

MAGNETRON



ENLARGED VIEW
DETAIL A



ENLARGED VIEW
SECTION C-C'

Reference plane A is defined as the plane through a plane surface on which the mounting flange rests.

Reference plane B is defined as the plane which is perpendicular to the reference plane A and passes through the exact centers of the indicated mounting flange holes.

Reference plane C is defined as the plane which is mutually perpendicular to the reference planes A and B and passes through the exact center of the indicated mounting flange hole.

NOTE 1: When resting on a plane surface, surface D has a flatness such that a 0.010" thickness gauge, 1/8" wide will not enter between surface D and the plane surface by more than 0.020".

NOTE 2: Surface E recessed not more than 0.035" and not less than 0.010" and parallel to surface D within 0.0 0".

NOTE 3: Hole and shaft are concentric within 0.02D".

NOTE 4: With the mounting flange resting on a plane surface, the flatness of surface F is such that a 0.010" thickness gauge, 1/8" wide will not enter more than 1/4".

92CJ-8654B

RCA

IC21

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 7 - Grid
Pin 2 - Cathode	Pin 8 - No Connection
Pin 3 - No Connection	• - Gas Tube Type
Pin 5 - Anode	
Mounting Position	Any

BOTTOM VIEW (G-4V)

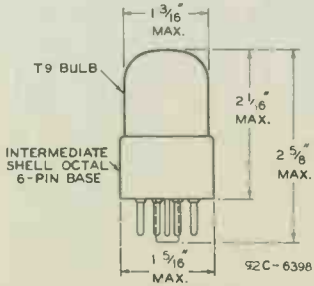
CHARACTERISTICS

Peak Anode Breakdown Voltage (Grid tied to cathode)	180 min.	volts
Peak Positive Grid Breakdown Voltage	66 min. 80 max.	volts volts
D-C Anode Extinction Voltage	73 approx.	volts
Grid Current (For transition of discharge to anode at 100 volts peak)	25 av. 50 max.	μamp. 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

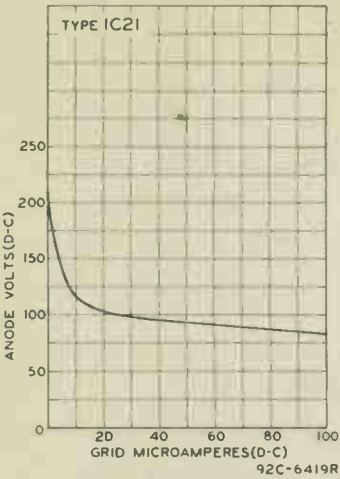
RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY INC

TENTATIVE DATA

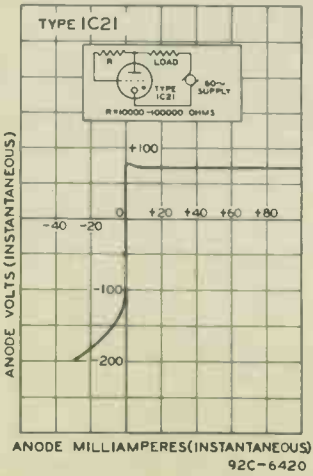
IC21

GAS-TRIODE

AVERAGE TRANSITION CHARACTERISTIC



AVERAGE ANODE CHARACTERISTIC



2A4-G

GAS-TRIODE

HOT-CATHODE CONTROL-GRID TYPE

Filament	Coated	
Voltage*	2.5	a-c or d-c volts
Current	2.5	amp.
Maximum Overall Length		4-1/8"
Maximum Seated Height		3-9/16"
Maximum Diameter		1-9/16"
Bulb		ST-12
Base		Small Shell Octal 7-Pin
Pin 1 - No Connection		Pin 5 - Grid
Pin 2 - Filament +		Pin 7 - Filament -
Pin 3 - Plate		Pin 8 - No Connection
Pin 4 - No Connection		
Mounting Position		Any

BOTTOM VIEW (G-5S7)

RELAY SERVICE

Peak Inverse Anode Voltage	200 max. volts
Peak Forward Anode Voltage	200 max. volts
Peak Voltage Between Any Two Electrodes	250 max. volts
Peak Anode Current	1.25 max. amp.
Average Anode Current (Averaged over Any Period of 45 Seconds)	0.10 max. amp.
Anode Drop	15 volts

* Filament voltage should be applied for 2 seconds before current is drawn from the anode.

2C40

LIGHTHOUSE TRIODE

Supersedes Types 446-A and 446-B in Military Equipment

GENERAL DATA

Electrical:

Heater for Unipotential Cathode:		
Voltage	6.3 ± 5%	ac or dc volts
Current	0.75	amp.
Direct Interelectrode Capacitances:		
Grid to Plate*	1.3	μμf
Grid to Cathode*	2.1	μμf
Plate to Cathode*Δ	0.02	μμf
Cathode to Shell	100 approx.	μμf
Characteristics, Class A_1 Amplifier:		
DC Plate Voltage	250	volts
Cathode-Bias Resistor**	200	ohms
Amplification Factor	36	
Plate Resistance	7500	ohms
Transconductance	4800	μmhos
Plate Current	16.5	ma.

Mechanical:

Operating Position	Any
Mounting	Tube should be supported by its metal shell and not by its base or other terminals
Dimensions and Terminals	See Outline Drawing
Base	Small H-Wafer Octal 6-Pin

BOTTOM VIEW

Pin 1 – Internal Con. Do Not Use	Shell (S)	Cathode RF Terminal
Pin 2 – Heater	Center Disc (G)	Grid Terminal
Pin 3 – Cathode		
Pin 5 – Cathode		
Pin 7 – Heater	Post & End Disc (P)	Plate Terminal
Pin 8 – Cathode		

RF AMPLIFIER & OSCILLATOR – Class C Telegraphy

Maximum Ratings, *Design-Center Values*:

DC PLATE VOLTAGE	450 max.	volts
DC PLATE CURRENT	22 max.	volts
PLATE DISSIPATION	5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts
PLATE-SEAL TEMPERATURE#	150 max.	°C

* With cathode connected directly to shell.
** Fixed bias is not recommended.
Δ With shield having diameter of 2-3/8" in plane of grid disc terminal.
\# Under extremely high ambient temperatures, the plate-seal temperature must never exceed 200°C.

2C40
LIGHTHOUSE TRIODE

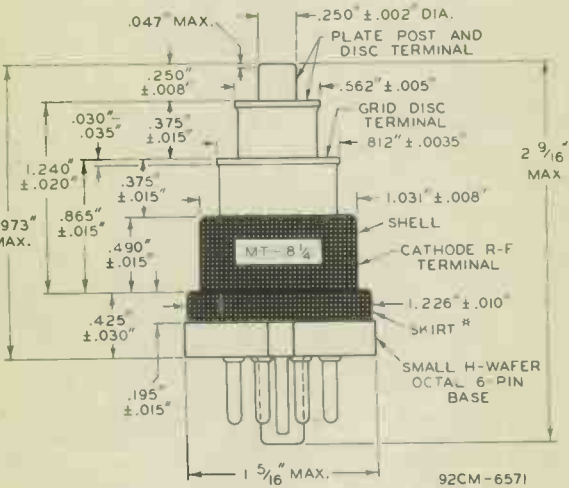


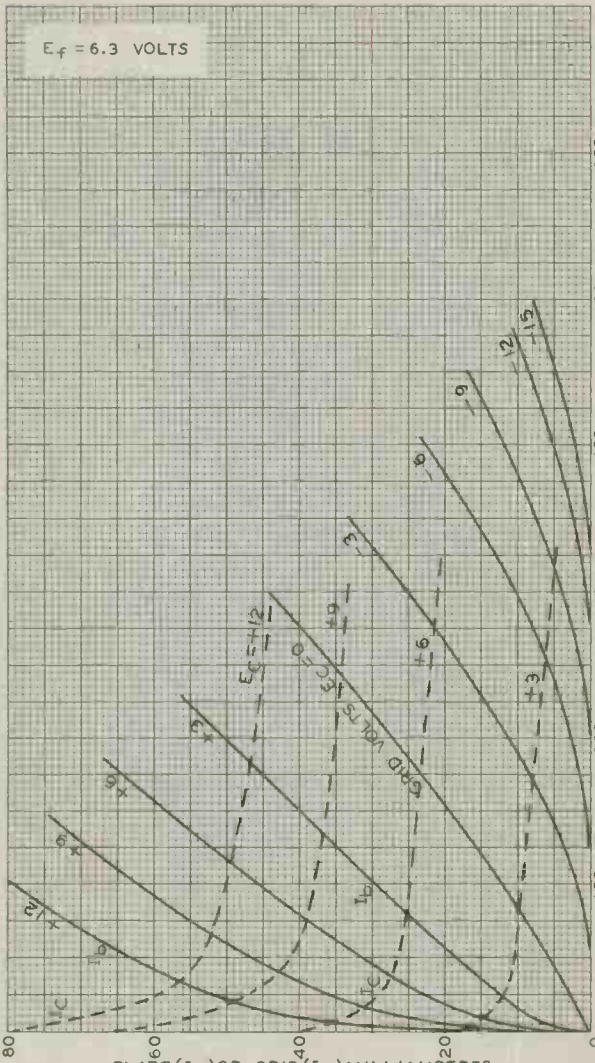
PLATE POST, GRID DISC TERMINAL, AND CATHODE RF TERMINAL ARE CONCENTRIC WITH RESPECT TO EACH OTHER WITHIN 1/64".

* NOT TO BE USED FOR RF CONTACT IN NEW EQUIPMENT DESIGNS.

RCA

2C40

AVERAGE PLATE CHARACTERISTICS



2C43

LIGHTHOUSE TRIODE

GENERAL DATA

Electrical:

Heater for Unipotential Cathode:		
Voltage	6.3 ± 5%	ac or dc volts
Current	0.9	amp.
Direct Interelectrode Capacitances:		
Grid to Plate*	1.7	μμf
Grid to Cathode*	2.8	μμf
Plate to Cathode*Δ	0.02	μμf
Cathode to Shell	100 approx.	μμf
Characteristics, Class A_1 Amplifier:		
DC Plate Voltage	250	volts
Cathode-Bias Resistor**	100	ohms
Amplification Factor	48	
Plate Resistance	6000	ohms
Transconductance	8000	μmhos
Plate Current	20	ma.

Mechanical:

Operating Position	Any
Mounting	Tube should be supported by its metal shell and not by its base or other terminals
Dimensions and Terminals	See Outline Drawing
Base	Small H-Wafer Octal 6-Pin

BOTTOM VIEW

Pin 1 – Internal Con. Do Not Use
Pin 2 – Heater
Pin 3 – Cathode
Pin 5 – Cathode
Pin 7 – Heater
Pin 8 – Cathode

Shell (S) – Cathode, RF Terminal
Center Disc (G) – Grid Terminal
Post & End Disc (P) – Plate Terminal

RF AMPLIFIER & OSCILLATOR – Class C Telegraphy

Maximum Ratings, *Design-Center Values*:

DC PLATE VOLTAGE	450 max.	volts
DC PLATE CURRENT	36 max.	ma.
PLATE DISSIPATION	10 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts
PLATE-SEAL TEMPERATURE#	150 max.	°C

* With cathode connected directly to shell.
** Fixed bias is not recommended.
Δ With shield having diameter of 2-3/8" in plane of grid disc terminal.
Under extremely high ambient temperatures, the plate-seal temperature must never exceed 200°C.

2C43

LIGHTHOUSE TRIODE

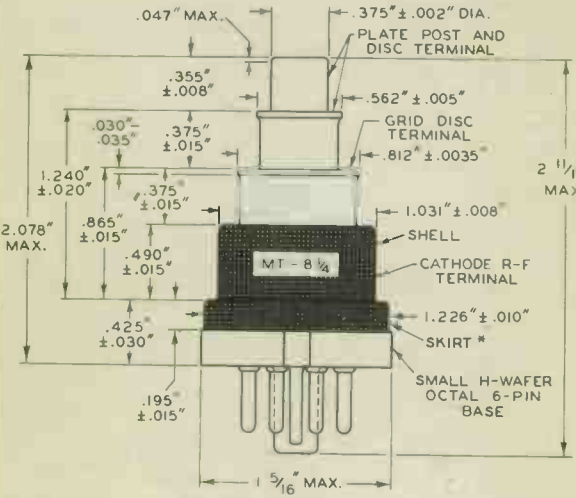


PLATE POST, GRID DISC TERMINAL, AND CATHODE RF TERMINAL ARE CONCENTRIC WITH RESPECT TO EACH OTHER WITHIN 1/64".

*NOT TO BE USED FOR RF CONTACT IN NEW EQUIPMENT DESIGNS.

2C43

AVERAGE PLATE CHARACTERISTICS

RCA

2C43

$E_f = 6.3$ VOLTS

PLATE (I_b) OR GRID (I_c) MILLIAMPERES

PLATE VOLTS

MAR. 5, 1945

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-6508

2K26
KLYSTRON

SINGLE-RESONATOR, REFLEX TYPE
Frequency: 6250 to 7060 Mc.

GENERAL DATA

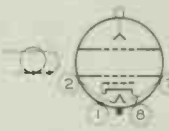
Electrical:

Heater, for Unipotential Cathode:		
Voltage	6.3 ± 0.5	ac or dc volts
Current	0.44	amp
Frequency Range	6250 to 7060	Mc

Mechanical:

Mounting Position	Any
Dimensions, Terminal Connections, and Mechanical Tuning Mechanism	See Outline Drawing
Resonant Cavity	Integral Part of Tube
Envelope	Metal
Cap	Miniature with Wafer
Base	Small-Wafer Octal 4-Pin with Pin No.4 replaced by Coaxial Output Line

BOTTOM VIEW



Pin 1 – Shell, Resonator
Pin 2 – Heater
Pin 7 – Heater
Pin 8 – Cathode
Cap – Reflector Terminal

NOTE: COAXIAL OUTPUT LINE PASSES THROUGH VACANT PIN POSITION NO. 4

CW OSCILLATOR – Class C

Maximum Ratings, *Absolute Values*:

DC RESONATOR VOLTAGE	330 max.	volts
DC REFLECTOR VOLTAGE:		
Positive Value	0 max.	volts
Negative Value	350 max.	volts
DC RESONATOR CURRENT	35 max.	ma
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	50 max.	volts
Heater positive with respect to cathode	50 max.	volts
AMBIENT TEMPERATURE OF SHELL	110 max.	°C
TEMPERATURE OF COAXIAL OUTPUT LINE	90 max.	°C

Typical Operation □ at 6660 Mc in Mode "A" with 3/4" x 1-1/2" Wave Guide

DC Resonator Voltage	300	volts
DC Reflector Voltage Range▲	-65 to -120	volts
DC Resonator Current	25	ma
DC Reflector Current	less than 7	μa

(continued on next page)

□,▲: See next page.

2K26
KLYSTRON

Half-Power Electronic-Tuning Frequency Change■	55	Mc
Power Output	120	mw

▲ Adjusted for maximum power output at the given operating frequency.

■ Change in frequency between the two half-power points when the reflector voltage is varied above and below the point of maximum power output corresponding to the given frequency.

□ The coaxial output line is coupled to the specified wave guide through the wide-band coaxial coupling unit shown on following pages.

INSTALLATION NOTES

A socket for the 2K26 may be obtained by removing the clip from the No.4 pin position of an octal socket and drilling the No.4 opening large enough to admit the coaxial line and the surrounding coupling unit. To guard against excessive strain on the coaxial output line, the tube must be securely fastened by a clamp on the base of the socket mounting. Bumping or continued pressure on the output line will seriously damage the tube. The proper area for clamping on the shoulder of the header skirt is shown on the Outline Drawing.

2K26
KLYSTRON

OPERATING NOTES

All tabulated data and curve information shown for the 2K26 were taken with the specified coupling unit and wave guide. It is important that this coupling unit or its electrical equivalent be used to insure tube interchangeability and satisfactory tuning characteristics. In addition, the standing-wave ratio of the coupler should not exceed 0.8 db. (1.1 voltage-standing-wave ratio).

In most applications the cathode of the 2K26 is operated at a negative potential with respect to ground so that the tube shell, which is integral with the resonator, is at ground potential. In those applications which do not operate with the shell at ground potential, it is essential that the 2K26 be surrounded by a grounded shield and tuned with an insulated tool, in order to protect the user from contact with high voltage. The shield design should permit adequate ventilation to assure that ambient temperature, as measured with a thermometer inserted between the metal tube shell and the shield, will be less than the maximum rated value. Ambient temperature changes will cause the resonator to expand or contract, producing a change in frequency. For best frequency stability, the 2K26 should be operated at nearly constant ambient temperature and with a well-regulated power supply.

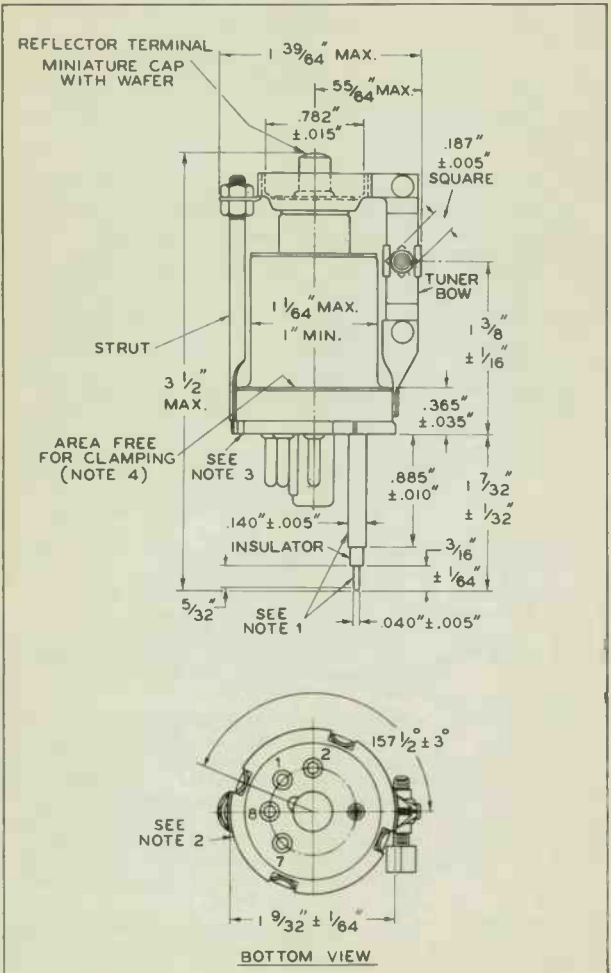
Shielding of the reflector and resonator voltage leads as close to the tube as possible is essential to avoid modulation of the tube output by any external voltages. In addition, the connection to the reflector terminal must be insulated to withstand the total acceleration and reflector voltage. To avoid damage to the tube, the reflector potential must never become positive with respect to the cathode.

Tuning of the 2K26 is accomplished by mechanical and electronic means. The mechanical tuning system is designed to permit approximate adjustment of frequency, but is not recommended for use where continual or frequent adjustment of frequency is required. Approximately five full turns of the frequency-adjustment screw are sufficient to tune the tube over its rated frequency range. The electronic tuning range is dependent upon reflector voltage, the type of load and the kind of coupling to the load.

Voltage modes are regions within the total range of reflector voltage in which oscillations will occur. The typical operating conditions and curves shown for type 2K26 apply to mode "A", the only mode recommended for this tube.

2K26

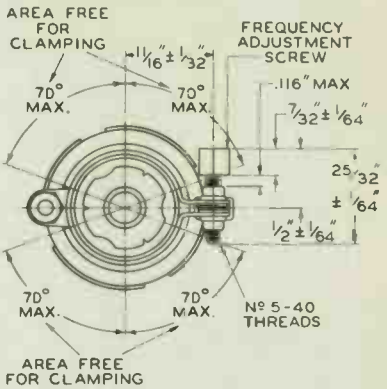
2K26
KLYSTRON



RCA

2K26

KLYSTRON



TOP VIEW

NOTE 1: THE INNER AND OUTER CONDUCTORS OF THE COAXIAL OUTPUT LINE ARE CONCENTRIC WITHIN 0.010".

NOTE 2: BASE-PIN AND COAXIAL-OUTPUT-LINE POSITIONS ARE HELD TO TOLERANCES SUCH THAT PINS AND OUTPUT LINE WILL FIT FLAT-PLATE GAUGE HAVING (a) THICKNESS OF 1-7/32", (b) 4 HOLES WITH DIAMETER OF 0.1030" ± 0.0005" FROM TOP SURFACE OF GAUGE TO A DEPTH OF 0.25" AND THEN WITH DIAMETER INCREASED BY APPROXIMATELY 1/64" FOR REMAINING DEPTH OF HOLE, SO LOCATED ON A 0.6870" ± 0.0005" DIAMETER CIRCLE THAT THE DISTANCE ALONG THE CHORD BETWEEN ANY TWO ADJACENT HOLE CENTERS IS 0.2630" ± 0.0005", (c) ONE HOLE WITH DIAMETER OF 0.1600" ± 0.0005" TO DEPTH OF 1-7/32" WHOSE CENTER IS LOCATED ON THE SPECIFIED PIN CIRCLE A DISTANCE DETERMINED BY LAYING OFF ON THE TOP SURFACE OF THE GAUGE COUNTERCLOCKWISE FROM THE LAST OF THE FOUR HOLES TWO CONSECUTIVE CHORDS EACH 0.2630" ± 0.0005", AND (d) A CENTER HOLE WITH A MINIMUM DIAMETER OF 0.400" TO CLEAR THE BASE PLUG AND KEY. PIN AND OUTPUT-LINE FIT IN GAUGE SHALL BE SUCH THAT GAUGE TOGETHER WITH SUPPLEMENTARY WEIGHT TOTALING 2 LBS. WILL NOT BE LIFTED WHEN PINS AND COAXIAL OUTPUT LINE ARE WITHDRAWN.

NOTE 3: SMALL-WAFER OCTAL 4-PIN BASE WITH PIN No. 4 REPLACED BY COAXIAL OUTPUT LINE.

NOTE 4: MINIMUM WIDTH OF SHOULDER IS 0.045".

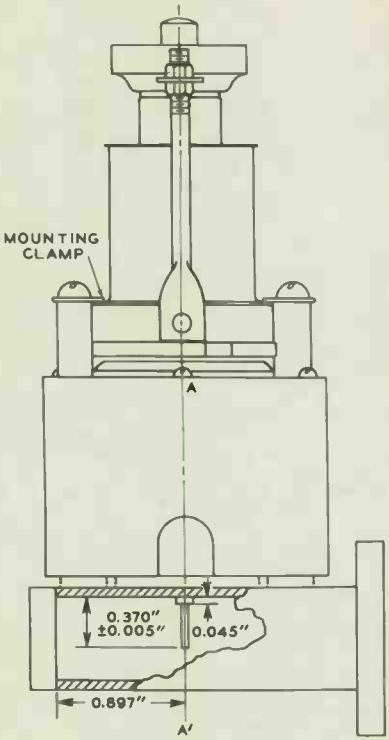
RCA

2K26

KLYSTRON

COUPLING ARRANGEMENT

RCA-2K26 Coupled to a 3/4" x 1-1/2" Wave Guide Through a Coaxial Transducer Coupling Circuit

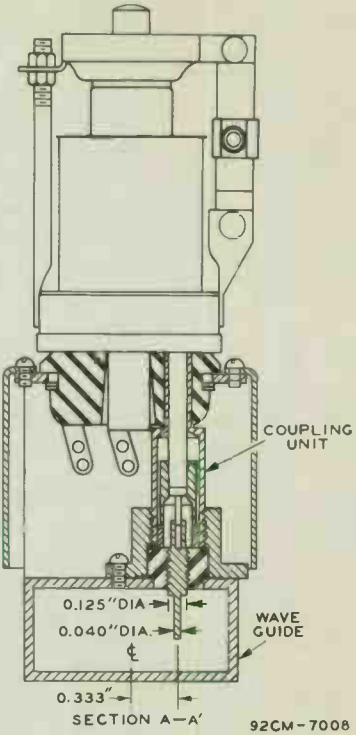


TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

2K26

KLYSTRON

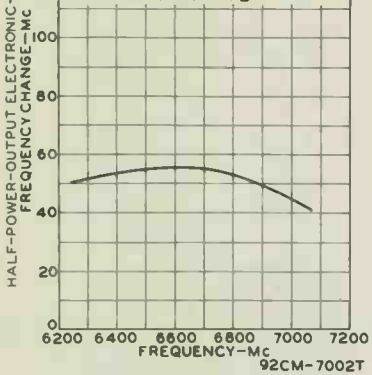
COUPLING ARRANGEMENT (Cont'd)



2K26
KLYSTRON

OPERATION CHARACTERISTIC

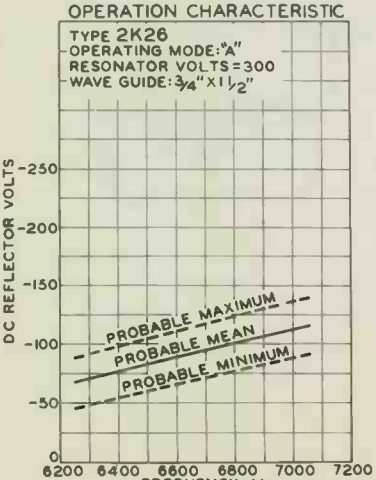
TYPE 2K26
OPERATING MODE: "A"
RESONATOR VOLTS = 300
REFLECTOR VOLTS: INITIALLY ADJUSTED FOR OPTIMUM POWER OUTPUT AND THEN VARIED TO OBTAIN HALF-POWER POINTS
WAVE GUIDE: 3/4" X 1 1/2"



92CM-7002T

OPERATION CHARACTERISTIC

TYPE 2K26
OPERATING MODE: "A"
RESONATOR VOLTS = 300
WAVE GUIDE: 3/4" X 1 1/2"



92CM-7004T

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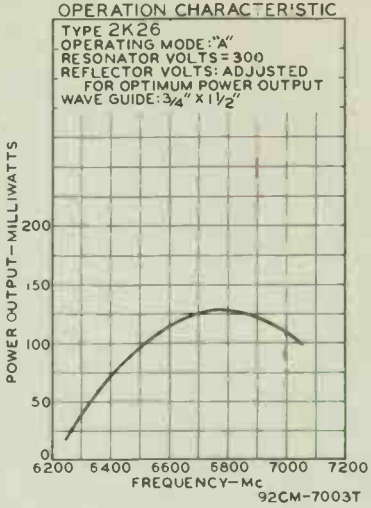
2K26
KLYSTRON



2K56
KLYSTRON

SINGLE-RESONATOR, REFLEX TYPE

Frequency: 3840 to 4460 Mc.

GENERAL DATA

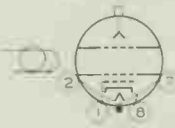
Electrical:

Heater, for Unipotential Cathode:		
Voltage	6.3 ± 0.5	ac or dc volts
Current	0.44	amp
Frequency Range	3840 to 4460	Mc

Mechanical:

Mounting Position	Any
Dimensions, Terminal Connections, and Mechanical Tuning Mechanism	See Outline Drawing
Resonant Cavity	Integral Part of Tube
Envelope	Metal
Cap	Miniature with Wafer
Base	Small-Wafer Octal 4-Pin with Pin No.4 replaced by Coaxial Output Line

BOTTOM VIEW



NOTE: COAXIAL OUTPUT LINE PASSES THROUGH VACANT PIN POSITION NO.4

CW OSCILLATOR – Class C

Maximum Ratings, *Absolute Values*:

DC RESONATOR VOLTAGE	330 max.	volts
DC REFLECTOR VOLTAGE:		
Positive Value	0 max.	volts
Negative Value	400 max.	volts
DC RESONATOR CURRENT	37 max.	ma
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	50 max.	volts
Heater positive with respect to cathode	50 max.	volts
AMBIENT TEMPERATURE OF SHELL	110 max.	°C
TEMPERATURE OF COAXIAL OUTPUT LINE	90 max.	°C

Typical Operation □ at 4150 Mc in Mode "A" with 1" x 2" Wave Guide

DC Resonator Voltage	300	volts
DC Reflector Voltage Range▲	−85 to −150	volts
DC Resonator Current	25	ma
DC Reflector Current	less than 7	μa

(continued on next page)

□,▲: See next page.

2K56

2K56
KLYSTRON

Half-Power Electronic-Tuning Frequency Change▪	35	Mc
Power Output	90	mw

▲ Adjusted for maximum power output at the given operating frequency.

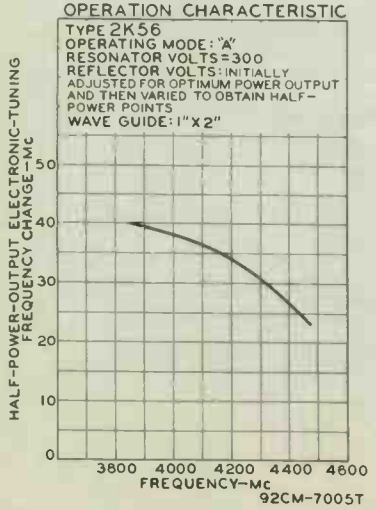
▪ Change in frequency between the two half-power points when the reflector voltage is varied above and below the point of maximum power output corresponding to the given frequency.

□ The coaxial output line is coupled to the specified wave guide through the wide-band coaxial coupling unit shown on the following pages.

INSTALLATION and OPERATING NOTES for the 2K56 are the same as those shown for the 2K26, except that consideration should be given to the different coupling unit and wave guide required for the 2K56.

OUTLINE DIMENSIONS for Type 2K56 are the same as those for Type 2K26

OPERATION CHARACTERISTIC



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2K56
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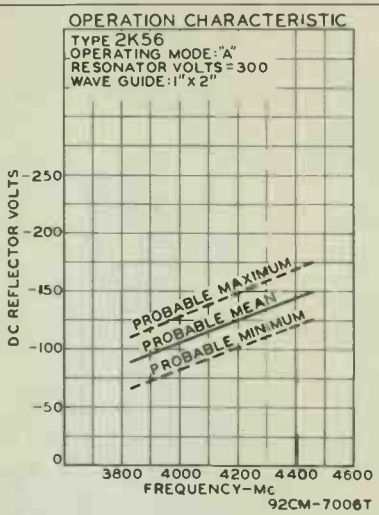
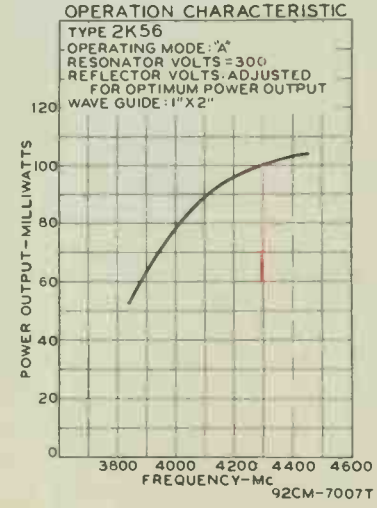
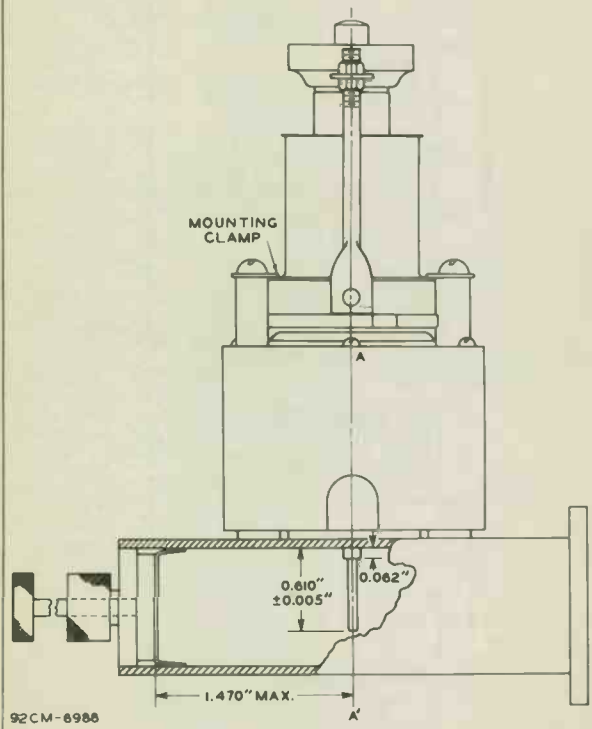




2K56
KLYSTRON

COUPLING ARRANGEMENT

RCA-2K56 Coupled to a 1" x 2" Wave Guide Through a Coaxial Transducer Coupling Circuit

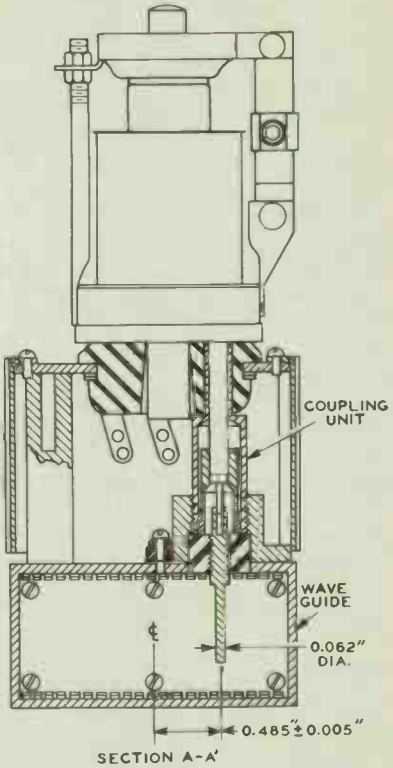


RCA

2K56

KLYSTRON

COUPLING ARRANGEMENT (Cont'd)



RCA

4J50

MAGNETRON

FORCED-AIR COOLED

Fixed Frequency: 9375 ± 30 Mc

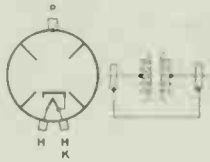
GENERAL DATA

Electrical:

Heater for Unipotential Cathode:		
Voltage	13.75 ± 10%	ac or dc volts
Current	3.15	amp
Starting Current: The maximum instantaneous starting current must never exceed 12 amperes, even momentarily.		
Minimum Cathode Heating Time	4	minutes
Frequency	9375 ± 30	Mc
Maximum Frequency Pulling at VSWR of 1.5/1	15	Mc
Maximum Frequency Change with Anode Temperature Change	0.25	Mc/°C

Mechanical:

Dimensions and Terminal Connections: See *Dimensional Outline*



Connector (For heater terminal and heater-cathode terminal) . . . Ucinite* No. 115764 with built-in capacitor, or equivalent

Mounting Position . . . . . Any

Air Flow:

To Fins -- An air stream should be directed along the cooling fins toward the body of the tube. The stream may be obtained from a rectangular nozzle about 3-1/4" by 3/4" located so that the plane through the 3-1/8" side is parallel with the plane of a cooling fin and so that the nozzle is centered on the body of the tube. Adequate flow should be provided so that the temperature of the anode block does not exceed 150°C.

To Heater-Cathode Terminal -- Adequate flow should be provided to maintain the temperature of the heater-cathode terminal below 155°C.

Weight (Approx.) . . . . . 9-1/2 lbs

PULSED OSCILLATOR SERVICE

Maximum and Minimum Ratings, *Absolute Values:*

For Duty Cycle of 0.001 max.

PEAK ANODE VOLTAGE	21 max.	23 max.	kv
PEAK ANODE CURRENT	18 max.	27.5 max.	amp
PEAK POWER INPUT•	380 max.	635 max.	kw
AVERAGE POWER INPUT	0.38 max.	0.635 max.	kw
PULSE DURATION	6.0 max.	1.2 max.	μsec

* Ucinite Div. of United-Carr Fastener Corp., Newtonville 60, Mass.

• For atmospheric pressures greater than 60 centimeters of mercury, operation at pressures lower than 60 centimeters of mercury may result in arc-over with consequent damage to the tube.

4J50

4J50

MAGNETRON

OPERATION TIME IN ANY 100-MICROSECOND INTERVAL . .	6.0 max.	6.0 max.	μsec
RATE OF RISE OF VOLT. PULSE .	110 max. 70 min.	110 max. 70 min.	kv/μsec kv/μsec
ANODE-BLOCK TEMPERATURE . . .	150 max.	150 max.	°C
HEATER-CATHODE TERMINAL TEMPERATURE	165 max.	165 max.	°C

Typical Operation▲ with Load-Voltage Standing-Wave Ratio Equal to or Less than 1.05

With Duty Cycle of	*0.001*	*0.001*	*0.001*	
Heater Voltage	See Operating Considerations			
Magnetic Field	Supplied by permanent magnet integral with tube			
Peak Anode Voltage	20	21.0	21.5	kv
Peak Anode Current	18	23.5	27.5	amp
Pulse Repetition Rate	200	333	1000	cps
Pulse Duration	1	3	5	μsec
Maximum RF Bandwidth	1.0	1.0	3.0	Mc
Peak Power Output	140	185	240	kw

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	3.0	3.75	amp
Peak Anode Voltage	–	20	23	kv
Peak Power Output	2	225	–	kw

Note 1: With 13.75 volts ac or dc on heater.

Note 2: With peak anode current = 27.5 amperes corresponding to a peak anode voltage in the order of 21500 volts, anode-block temperature (approx.) = 100°C, pulse duration = 1 microsecond, and maximum load-voltage standing-wave ratio equal to or less than 1.05.

▲ It is essential that the input circuit be designed so that if arcing occurs the energy per pulse delivered to the tube cannot greatly exceed the normal energy per pulse. To satisfy this requirement, it is recommended that pulsers of the discharging-network type be used.

OPERATING CONSIDERATIONS

Rated voltage (13.75 volts) should be applied to the heater for at least 4 minutes to allow the cathode to reach normal operating temperature. When the cathode has reached normal operating temperature, high-voltage pulses, negative with respect to the anode (ground), may be applied to the heater-cathode terminal. As soon as the 4J50 starts to oscillate, the heater voltage (E_f) must be reduced approximately in accordance with the following formula depending on the value of average power input (P_i) to the tube:

P_i up to 100 watts: $E_f = 13.75$ volts

P_i greater than 100 watts: $E_f = 14\ (1-0.000895P_i)$ volts

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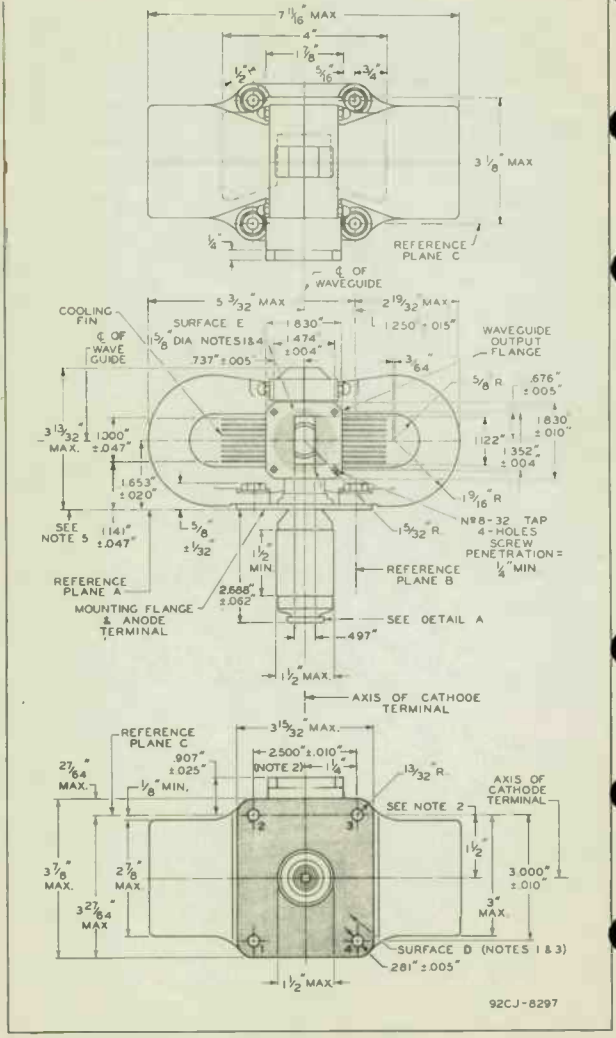
4J50

MAGNETRON

This formula applies to the conditions involving the pulse durations and pulse repetition rates under Typical Operation. If the 4J50 is to be operated with pulse durations and repetition rates different from those shown, write for recommendations as to required reduction in heater voltage to *Commercial Engineering, RCA, Harrison, New Jersey*, giving complete details as to the proposed service. When the tube is oscillating, the cathode is subjected to considerable electron bombardment which raises the temperature of the cathode. The magnitude of such heating is a function of the total dissipation and must be compensated by reduction of the heater voltage in order to prevent overheating of the cathode. Failure to start the tube at rated heater voltage and to reduce the heater voltage as soon as oscillation starts may seriously affect tube life. The heater should be protected against input pulse power by a suitable capacitor connected in shunt with the heater leads as near the input stem as possible in order to limit high transient voltages from developing across the heater.

4J50

4J50
MAGNETRON

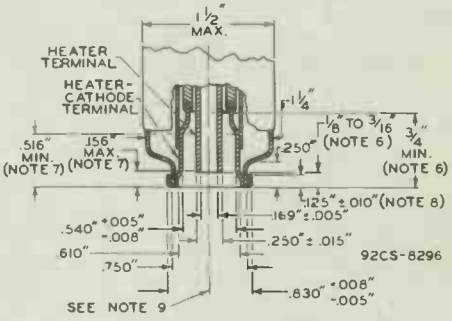


RCA

4J50

MAGNETRON

DETAIL A



Reference plane A is defined as the plane through a plane surface on which the mounting flange rests.

Reference plane B is defined as the plane which is perpendicular to plane A and plane C and passes through the exact center of mounting flange holes No.3 and No.4.

Reference plane C is defined as the plane which is perpendicular to plane A and passes through the exact centers of mounting flange holes No.2 and No.3.

NOTE 1: THE WAVEGUIDE OUTPUT FLANGE AND THE MOUNTING FLANGE ARE MADE SO THAT THEY MAY BE USED TO PROVIDE A HERMETIC SEAL AT SURFACE D AND SURFACE E.

NOTE 2: THE AXIS OF THE HEATER-CATHODE TERMINAL WILL BE WITHIN THE CONFINES OF A CYLINDER WHOSE RADIUS IS 3/64" AND WHOSE AXIS IS PERPENDICULAR TO REFERENCE PLANE A AND LOCATED AS DIMENSIONED FROM PLANES B AND C.

NOTE 3: ALL POINTS ON MOUNTING SURFACE D WILL BE WITHIN 0.005" OF MOUNTING PLANE A.

NOTE 4: WHEN RESTING ON A PLANE SURFACE, SURFACE E OF THE WAVEGUIDE OUTPUT FLANGE HAS A FLATNESS SUCH THAT A 0.005" THICKNESS GAUGE 1/8" WIDE WILL NOT ENTER BETWEEN SURFACE E AND THE PLANE SURFACE.

NOTE 5: NO PART OF THE TUBE SUPPORT FASTENED TO THE MOUNTING FLANGE SHOULD EXTEND BEYOND THE SURFACE OF A CYLINDER WHOSE RADIUS IS 3/4" AND WHOSE AXIS IS PERPENDICULAR TO REFERENCE PLANE A AND LOCATED AS DIMENSIONED FROM PLANES B AND C.

NOTE 6: THESE DIMENSIONS DEFINE EXTREMITIES OF THE 0.169" INTERNAL DIAMETER OF THE CYLINDRICAL HEATER TERMINAL.

RCA

4J50

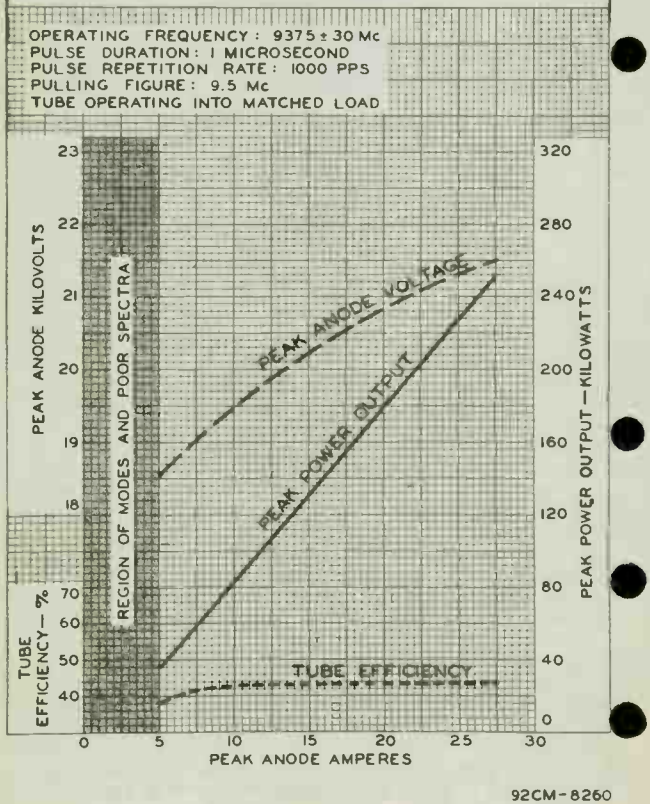
MAGNETRON

NOTE 7: THESE DIMENSIONS DEFINE EXTREMITIES OF THE 0.540" INTERNAL DIAMETER OF THE CYLINDRICAL HEATER-CATHODE TERMINAL.

NOTE 8: NO PART OF THE CONNECTOR DEVICE FOR THE HEATER AND HEATER-CATHODE TERMINALS SHOULD BEAR AGAINST THE UNDERSIDE OF THIS LIP.

NOTE 9: THE HEATER TERMINAL AND THE HEATER-CATHODE TERMINAL ARE CONCENTRIC WITHIN 0.010".

PERFORMANCE CHART



92CM-8260

4J52*
MAGNETRON

FORCED-AIR COOLED

Fixed Frequency: 9375 ± 30 Mc

GENERAL DATA

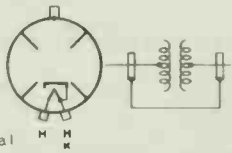
Electrical:

Heater, for Unipotential Cathode:

Voltage	12.6 ± 10%	ac or dc volts
Current	2.1	amp
Starting Current: The maximum instantaneous starting current must never exceed 8 amperes, even momentarily		
Minimum Cathode Heating Time	4	minutes
Frequency	9375 ± 30	Mc
Maximum Frequency Pulling	15	Mc
Maximum Frequency Change with Anode Temperature Change	0.25	Mc/°C

Mechanical:

Dimensions and Terminal Connections: See Outline Drawing



Connector (For heater terminal and heater–cathode terminal) . . . Ucinite* No. 115316 or No. 115462 with built-in capacitor, or equivalent.

Mounting Position . . . . . Any

Dimensions . . . . . See Outline Drawing

Air Flow to Fins:

An air stream should be directed along the cooling fins toward the body of the tube. The stream may be obtained from a rectangular nozzle 3-1/4" by 3/4" located so that the plane through the 3-1/4" side is parallel with the plane of a cooling fin and so that the nozzle is centered on the body of the tube. Adequate flow should be provided so that the temperature of the anode block does not exceed 150°C.

Weight (Approx.) . . . . . 5–1/2 lbs

PULSED OSCILLATOR SERVICE

Maximum Ratings, *Absolute Values:*

For Duty Cycle of 0.002 max.

PEAK ANODE VOLTAGE	16 max.	16 max.	kv
PEAK ANODE CURRENT	20 max.	30 max.	amp
PEAK POWER INPUT•	300 max.	450 max.	kw
AVERAGE POWER INPUT	0.3 max.	0.45 max.	kw
PULSE DURATION	5.0 max.	1.7 max.	μsec
OPERATION TIME IN ANY 100-MICROSECOND INTERVAL	6.0 max.	6.0 max.	μsec
ANODE-BLOCK TEMPERATURE	150 max.	150 max.	°C

■ Data shown for this type are in accord with JAN-1A Specification 4J52, 30 January 1952.

* Ucinite Div. of United-Carr Fastener Corp., Newtonville 60, Mass.

• For atmospheric pressures greater than 60 centimeters of mercury. Operation at pressures lower than 60 centimeters of mercury may result in arc-over with consequent damage to the tube.

4J52

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Typical Operation with Load-Voltage Standing-Wave Ratio Equal to or Less Than 1.05▲:

With Duty Cycle of	*0.0006*	*0.001*	*0.001*	
Heater Voltage	See Operating Considerations			
Magnetic Field	Supplied by permanent magnet internal with tube			
Peak Anode Voltage	15	15	15	kv
Peak Anode Current	15	15	15	amp
Pulse Repetition Rate	2000	1000	200	cps
Pulse Duration	0.3	1	5	μsec
Maximum RF Bandwidth	9	3	1	Mc
Maximum Rate of Rise of Voltage Pulse	130	130	100	kv/μsec
Peak Power Output	80	80	80	kw

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	1.8	2.4	amp
Peak Anode Voltage	—	14	16	kv
Peak Power Output	2	65	—	kw

Note 1: With 12.6 volts ac or dc on heater.

Note 2: With peak anode current = 15 amperes corresponding to a peak anode voltage in the order of 15000 volts, anode-block temperature (approx.) = 100°C, and maximum load-voltage standing-wave ratio equal to or less than 1.05.

▲ It is essential that the input circuit be designed so that if arcing occurs the energy per pulse delivered to the tube cannot greatly exceed the normal energy per pulse. To satisfy this requirement, it is recommended that pulsers of the discharging-network type be used.

OPERATING CONSIDERATIONS

Rated voltage (12.6 volts) should be applied to the heater for at least 4 minutes to allow the cathode to reach normal operating temperature. When the cathode has reached normal operating temperature, high-voltage pulses, negative with respect to the anode (ground), may be applied to the heater-cathode terminal. As soon as the 4J52 starts to oscillate, the heater voltage (E_f) must be reduced approximately in accordance with the following formula depending on the value of average power input (P_i) to the tube:

P_i up to 130 watts: $E_f = 12.6 \text{ volts} - 0.04P_i$

P_i from 130 to 450 watts: $E_f = 10.5 \text{ volts} - 0.02P_i$

where P_i is the average power input to the tube. This formula applies to conditions for pulse durations of 1 microsecond or less and for pulse repetition rates of 1000 pps or more. Normal pulse shape and regulation are assumed; the effect of power supply regulation is not considered. For longer pulse durations and lower pulse

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MAGNETRON

repetition rates, the heater voltage must be increased. The increase in heater voltage is often between 1 and 2 volts depending on the particular application. Rates of rise of the voltage pulse faster than those indicated under Typical Operation are not recommended because they tend to cause unstable operation. A very poor regulation characteristic during the first part of the pulse may indicate, if unstable operation occurs, that an increase in heater voltage is desirable. Increasing the heater voltage under these conditions may, however, decrease the life of the tube. When the tube is oscillating, the cathode is subjected to considerable electron bombardment which raises the temperature of the cathode. The magnitude of the heating is a function of the total dissipation and must be compensated by reduction of the heater voltage in order to prevent overheating of the cathode. Failure to start the tube at rated heater voltage and to reduce the heater voltage as soon as oscillation starts may seriously affect tube life. The heater should be protected against input pulse power by placing a suitable capacitor in shunt with the heater leads as near the input stem as possible in order to limit high transient currents from developing across the heater.

4J52

RCA

4J52

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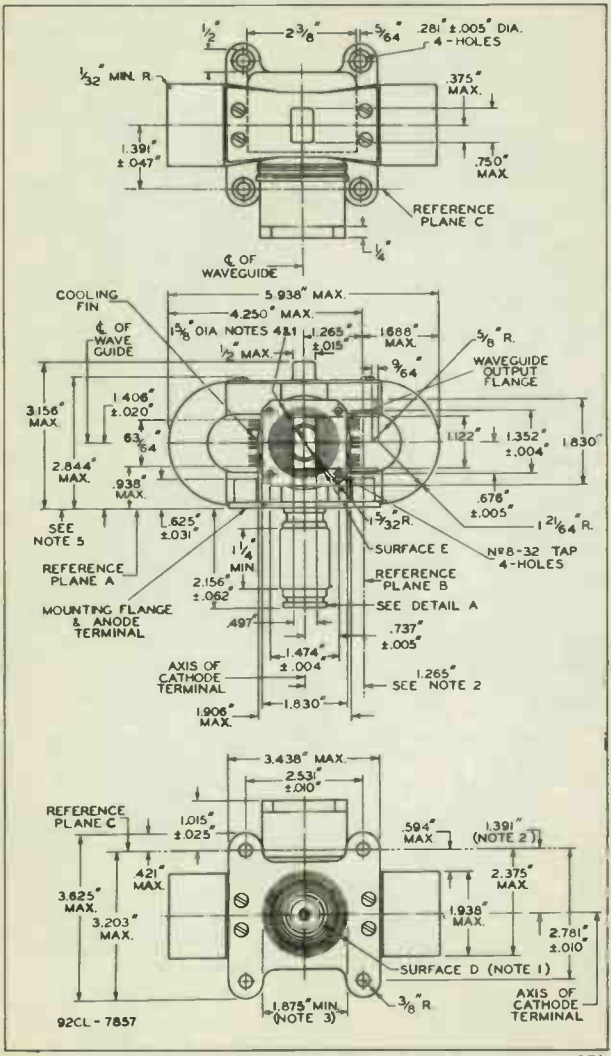

OCT. 1, 1953

CE-7857A

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

4J52
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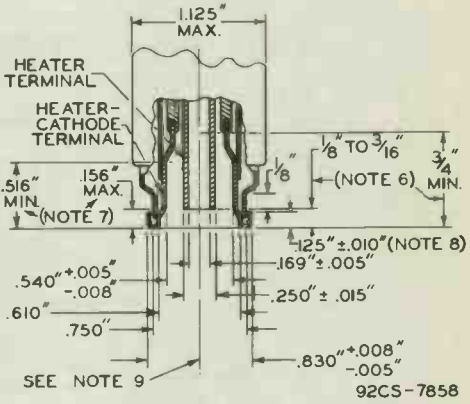
DETAIL A



Reference Plane A is defined as the plane through a plane surface on which the mounting flange rests.

Reference Plane B is defined as the plane which is perpendicular to plane A and plane C and passes through the exact center of mounting flange holes No.3 and No.4.

Reference Plane C is defined as the plane which is perpendicular to plane A and passes through the exact centers of mounting flange holes No.2 and No.5.

NOTE 1: THE WAVEGUIDE OUTPUT FLANGE AND THE MOUNTING FLANGE ARE MADE SO THAT THEY MAY BE USED TO PROVIDE A HERMETIC SEAL AT SURFACE D AND SURFACE E.

NOTE 2: THE AXIS OF THE HEATER-CATHODE TERMINAL WILL BE WITHIN THE CONFINES OF A CYLINDER WHOSE RADIUS IS 3/64" AND WHOSE AXIS IS PERPENDICULAR TO REFERENCE PLANE A AND LOCATED ON THE TRUE CENTER OF THE MOUNTING FLANGE.

NOTE 3: WHEN RESTING ON A PLANE SURFACE (REFERENCE PLANE A), THE SURFACE D HAS A FLATNESS SUCH THAT A 0.010" THICKNESS GAUGE 1/8" WIDE WILL NOT ENTER BETWEEN SURFACE D AND THE PLANE SURFACE. ALSO, THE MOUNTING-FLANGE SURFACE OUTSIDE OF SURFACE D WILL BE WITHIN 0.010" OF THE PLANE SURFACE.

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MAGNETRON

NOTE 4: WHEN RESTING ON A PLANE SURFACE, SURFACE E OF THE WAVEGUIDE OUTPUT FLANGE HAS A FLATNESS SUCH THAT A 0.005" THICKNESS GAUGE 1/8" WIDE WILL NOT ENTER BETWEEN SURFACE E AND THE PLANE SURFACE.

NOTE 5: NO PART OF THE TUBE SUPPORT FASTENED TO THE MOUNTING FLANGE SHOULD EXTEND BEYOND THE SURFACE OF A CYLINDER WHOSE RADIUS IS 5/8" AND WHOSE AXIS IS PERPENDICULAR TO REFERENCE PLANE A AND LOCATED AT THE TRUE CENTER OF THE MOUNTING FLANGE.

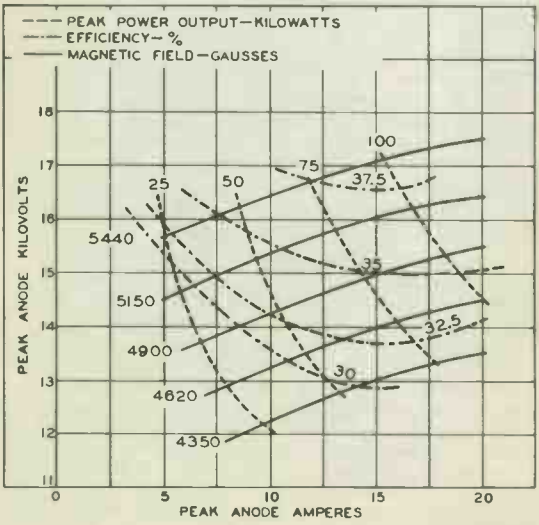
NOTE 6: THESE DIMENSIONS DEFINE EXTREMITIES OF THE 0.169" INTERNAL DIAMETER OF THE CYLINDRICAL HEATER TERMINAL.

NOTE 7: THESE DIMENSIONS DEFINE EXTREMITIES OF THE 0.540" INTERNAL DIAMETER OF THE CYLINDRICAL HEATER-CATHODE TERMINAL.

NOTE 8: NO PART OF THE CONNECTOR DEVICE FOR THE HEATER AND HEATER-CATHODE TERMINALS SHOULD BEAR AGAINST THE UNDERSIDE OF THIS LIP.

NOTE 9: THE HEATER TERMINAL AND THE HEATER-CATHODE TERMINAL ARE CONCENTRIC WITHIN 0.010".

PERFORMANCE CHART



92CM-7843

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

4B26/2000

HALF-WAVE GAS RECTIFIER

HOT-CATHODE TYPE

Filament	Thoriated Tungsten	
Voltage	2.2	a-c volts
Current	18	amp.
Overall Length		6-5/8" ± 3/8" ◄
Maximum Diameter		3-1/4" ◄
Bulb		GT-25
End Terminal		*See Outline Drawing*
Base		Mogul Screw
Mounting Position		Any

Maximum Ratings Are Absolute Values

RECTIFIER

Peak Inverse Anode Voltage:		◄
In Single-Phase, Half-Wave Circuit	375 max.	volts
In Single-Phase, Full-Wave Circuit	250 max.	volts
In Polyphase Circuit	250 max.	volts
Peak Anode Current	36 max.	amp. ◄
D-C Output Current	6 max.	amp.
Characteristics:		
Instantaneous Starting Anode Voltage*	13 approx.	volts
Tube Voltage Drop	8 approx.	volts

* To insure starting throughout tube life, an anode-supply voltage of not less than 20 volts (rms) is recommended. The actual design value above this minimum will depend on the nature of the load on the tube in any particular application.

If the output of the 4B26/2000 is filtered, the filter should be of the choke-input type.

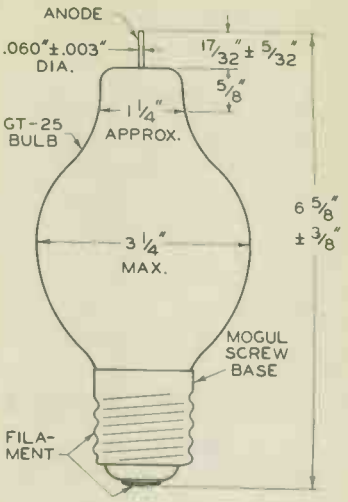
Suitable circuits for use with the 4B26/2000 are the same as those shown for Type 872-A/872.

◄ Indicates a change.

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

4B26

HALF-WAVE GAS-RECTIFIER



92CM-6147R1

< Indicates a change.

26A6
R-F AMPLIFIER PENTODE

MINIATURE REMOTE-CUTOFF TYPE

For use with 12-cell storage-battery supply

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage	26.5	ac or dc volts
Current	0.07	amp
Direct Interelectrode Capacitances:[o]		
Grid No.1 to Plate	0.0035 max.	μμf
Input	6.0	μμf
Output	5.0	μμf

Mechanical:

Mounting Position	Any
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
Base	Miniature Button 7-Pin
Basing Designation for BOTTOM VIEW	$7BK_1$

Pin 1 – Grid No.1
Pin 2 – Grid No.3, Internal Shield
Pin 3 – Heater
Pin 4 – Heater
Pin 5 – Plate
Pin 6 – Grid No.2
Pin 7 – Cathode

CLASS A_1 AMPLIFIER

Maximum Ratings, *Design-Center Values*:

PLATE VOLTAGE	250 max.	volts
GRID-No.2 (SCREEN) VOLTAGE	100 max.	volts
GRID-No.2 SUPPLY VOLTAGE	250 max.	volts
PLATE DISSIPATION	3 max.	watts
GRID-No.2 DISSIPATION	0.4 max.	watt
GRID-No.1 (CONTROL GRID) VOLTAGE:		
Negative bias value	50 max.	volts
Positive bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts

Typical Operation and Characteristics:

Plate Voltage	26.5	250	volts
Grid No.3 (Suppressor)	Connected to cathode at socket		
Grid-No.2 Voltage	26.5	100	volts
Grid-No.1 Voltage:			
From a grid-No.1 resistor of	2	–	megohms
From a cathode resistor of	–	125	ohms

[o] with external shield connected to cathode.

26A6

R-F AMPLIFIER PENTODE

Plate Resistance (Approx.)	0.25	1.0	megohm
Transconductance	2000	4000	μmhos
Grid-No.1 Bias (Approx.) for transconductance of 40 μmhos	–	-25	volts
Grid-No.1 Bias (Approx.) for transconductance of 20 μmhos	-8	–	volts
Plate Current	1.7	10.5	ma.
Grid-No.2 Current	0.7	4.0	ma.

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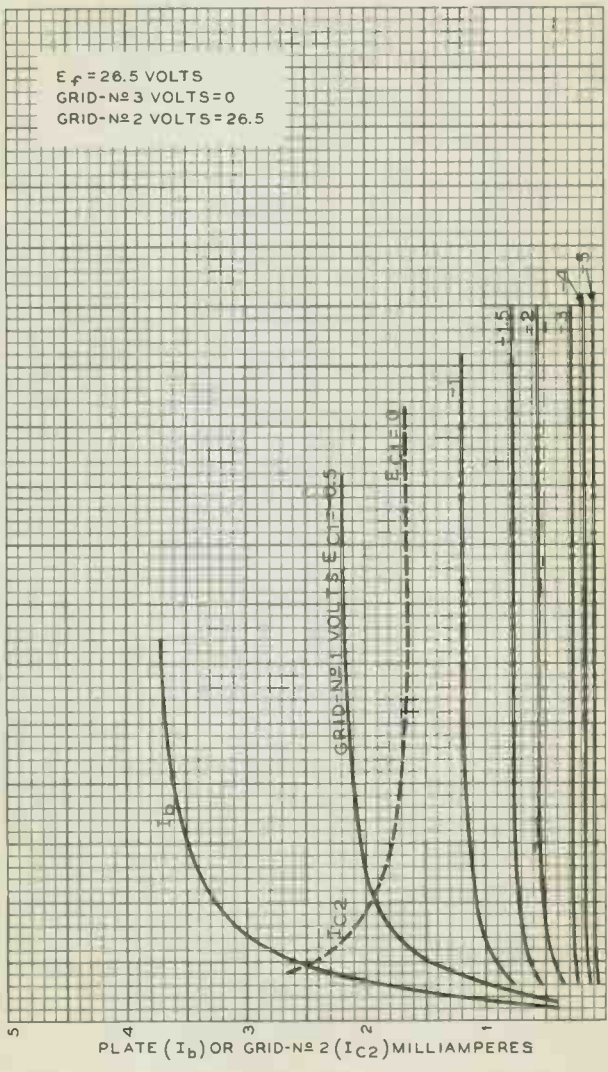
26A6

AVERAGE PLATE CHARACTERISTICS



JULY 24, 1948 TUBE DEPARTMENT 92CM-6788
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

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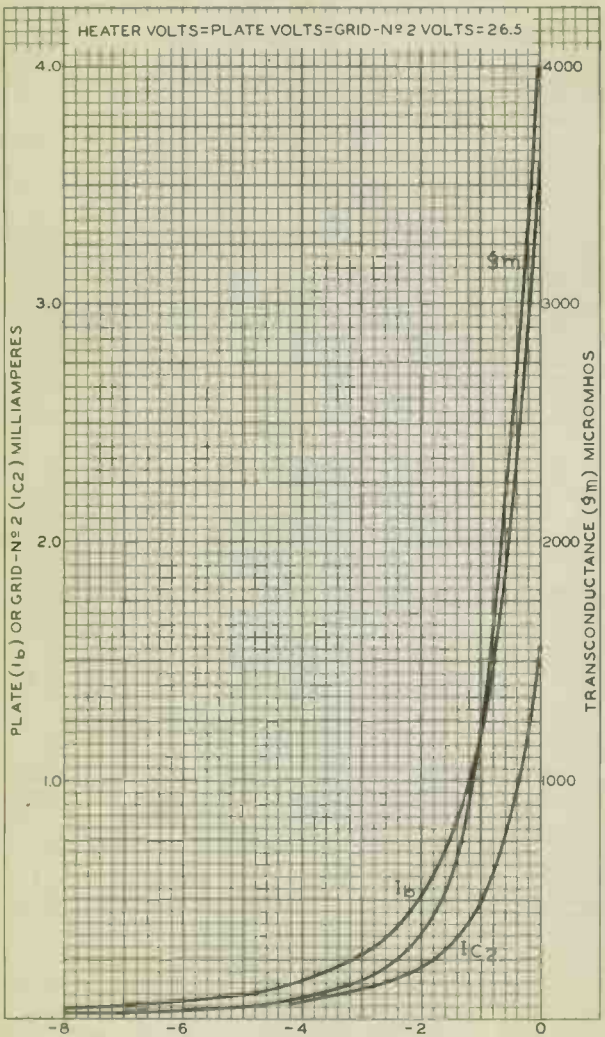
26A6

AVERAGE CHARACTERISTICS



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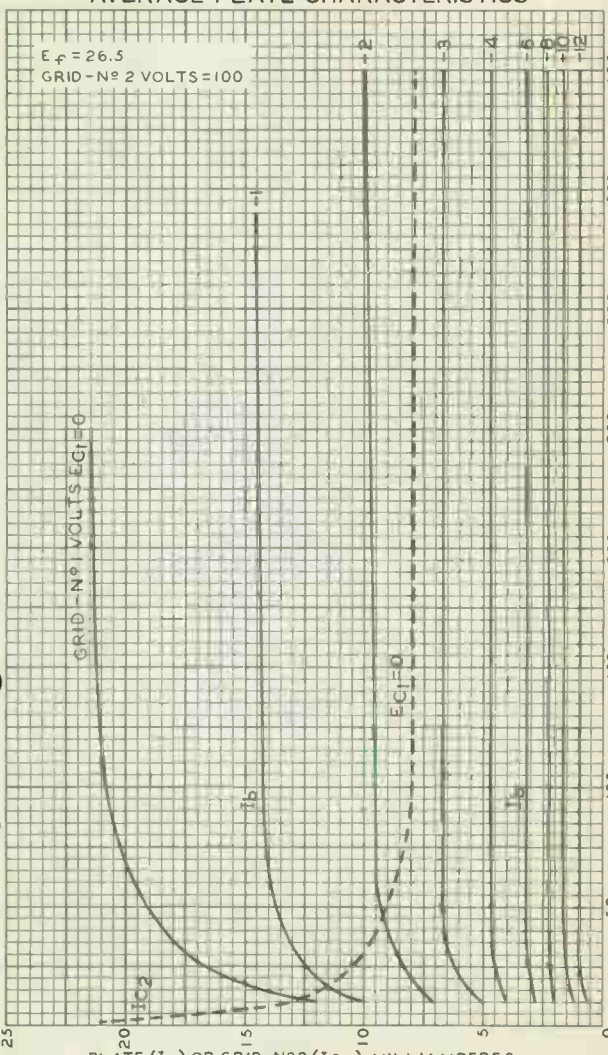
26A6

AVERAGE PLATE CHARACTERISTICS



26A7-GT

TWIN BEAM POWER TUBE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage	26.5	ac or dc volts
Current	0.6	amp
Direct Interelectrode Capacitances (Approx.):°		
Grid No.1 to plate▲	1.2	μμf
Grid No.1 to cathode & grid No.3, grid No.2, and heater▲	16	μμf
Plate to cathode & grid No.3, grid No.2, and heater▲	13	μμf
Grid No.1 of unit No.1 to grid No.1 of unit No.2	0.2	μμf
Plate of unit No.1 to plate of unit No.2	0.2	μμf
Grid No.1 of unit No.1 to plate of unit No.2	0.2	μμf
Grid No.1 of unit No.2 to plate of unit No.1	0.2	μμf

Mechanical:

Mounting Position	Any
Maximum Overall Length	3-13/16"
Maximum Seated Length	3-1/4"
Maximum Diameter	1-9/32"
Bulb	T-9
Base	Intermediate-Shell Octal 8-Pin (JETEC No.B8-6), or Short Intermediate-Shell Octal 8-Pin (JETEC No.B8-58)
Basing Designation for BOTTOM VIEW	8BU

Pin 1 – Grid No.1 of Unit No.1
Pin 2 – Cathode, Grid No.3 of Units No.1 & No.2
Pin 3 – Grid No.1 of Unit No.2

Pin 4 – Plate of Unit No.2
Pin 5 – Grid No.2 of Units No.1 & No.2
Pin 6 – Heater
Pin 7 – Heater
Pin 8 – Plate of Unit No.1

AMPLIFIER - Class A_1

Values are for Each Unit

Maximum Ratings, *Design-Center Values*:

PLATE VOLTAGE	50 max.	volts
GRID-No.2 (SCREEN) VOLTAGE	50 max.	volts
PLATE DISSIPATION	2 max.	watts

° Without external shield.
▲ Each unit.

→ Indicates a change.

26A7-GT

TWIN BEAM POWER TUBE

GRID-No.2 INPUT	0.5 max.		watt
→ PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	90 max.		volts
Heater positive with respect to cathode	90 max.		volts
→ **Typical Operation and Characteristics (Each unit):**			
Plate Voltage	26.5		volts
Grid-No.2 Voltage	26.5		volts
Grid-No.1 (Control-Grid) Voltage	-4.5		volts
Peak AF Grid-No.1 Voltage	4.5		volts
Zero-Signal Plate Current	20		ma
Max.-Signal Plate Current	20.5		ma
Zero-Signal Grid-No.2 Current	1.9		ma
Max.-Signal Grid-No.2 Current	5.5		ma
Transconductance	5700		μmhos
Load Resistance	1500		ohms
Total Harmonic Distortion	7		%
Max.-Signal Power Output	180		mw
→ **Maximum Circuit Values:**			
Grid-No.1-Circuit Resistance:			
For maximum rated conditions:			
With cathode bias	0.5 max.		megohm
With fixed bias	0.1 max.		megohm
For conditions where the maximum design values of plate voltage and grid-No.2 voltage do not exceed 26.5 volts:			
With grid-resistor bias	0.5 max.		megohm

AF POWER AMPLIFIER - Class AB_1

Unless otherwise specified, values are on a Per-Tube Basis

Maximum Ratings, *Design-Center Values*:			
PLATE VOLTAGE	50 max.		volts
GRID-No.2 (SCREEN) VOLTAGE	50 max.		volts
PLATE DISSIPATION (Per unit)	2 max.		watts
GRID-No.2 INPUT (Per unit)	0.5 max.		watt
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	90 max.		volts
Heater positive with respect to cathode	90 max.		volts
Typical Push-Pull Operation:			
Plate Voltage	26.5		volts
Grid-No.2 Voltage	26.5		volts
Grid-No.1 (Control-Grid) Voltage	-7		volts
Peak AF Grid-No.1-to-Grid No.1 Voltage	14		volts
Zero-Signal Plate Current	19		ma

→ Indicates a change.

26A7-GT

TWIN BEAM POWER TUBE

Max.-Signal Plate Current	30		ma
Zero-Signal Grid-No.2 Current (Approx.)	2		ma
Max.-Signal Grid-No.2 Current (Approx.)	8.5		ma
Effective Load Resistance (Plate to plate)	2500		ohms
Total Harmonic Distortion	5		%
Max.-Signal Power Output	500		mw

Maximum Circuit Values:

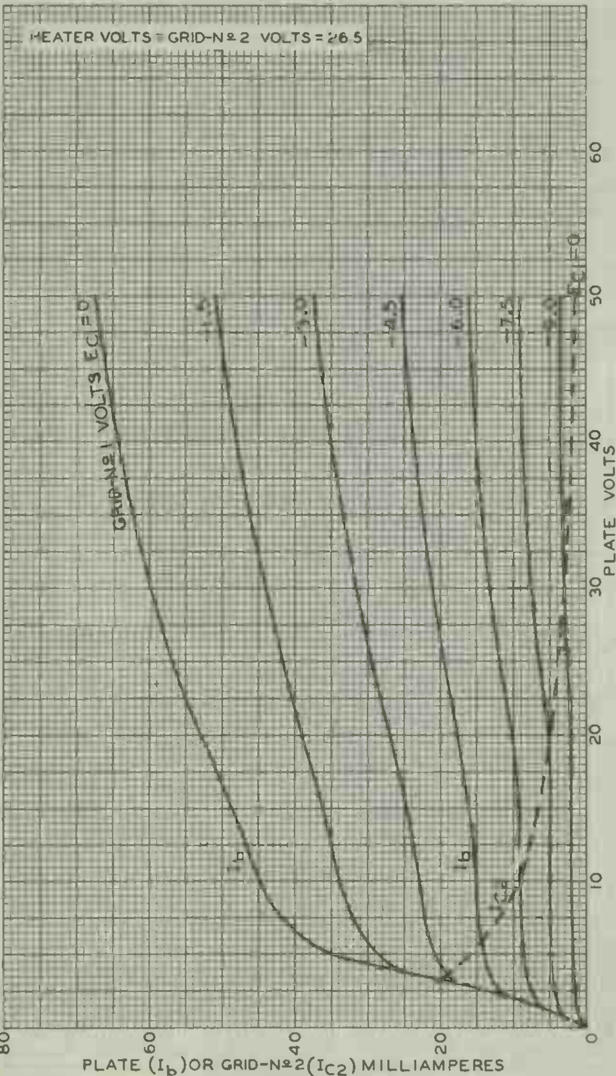
Grid-No.1-Circuit Resistance:			
For maximum rated conditions:			
With cathode bias	0.5	max.	megohm
With fixed bias	0.1	max.	megohm
For conditions where the maximum design values of plate voltage and grid-No.2 voltage do not exceed 26.5 volts:			
With grid-resistor bias	0.5	max.	megohm

→ Indicates a change.

RCA

26A7-GT

AVERAGE PLATE CHARACTERISTICS
EACH UNIT-PENTODE CONNECTION



JAN. 3, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

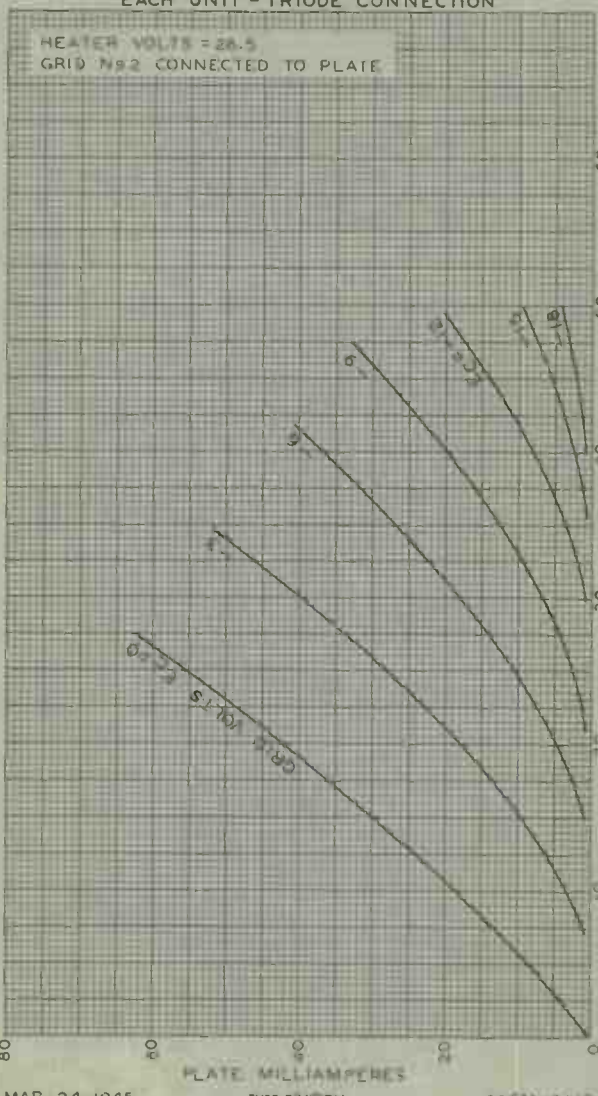
92CM-6509R1

RCA

26A7-GT

AVERAGE PLATE CHARACTERISTICS

EACH UNIT - TRIODE CONNECTION

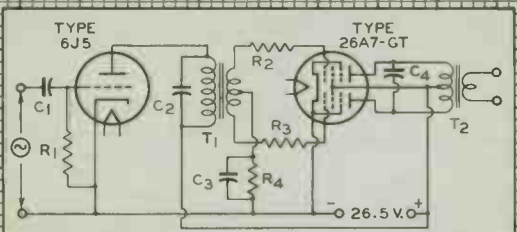


26A7-GT

OPERATION CHARACTERISTICS

PUSH-PULL CIRCUIT

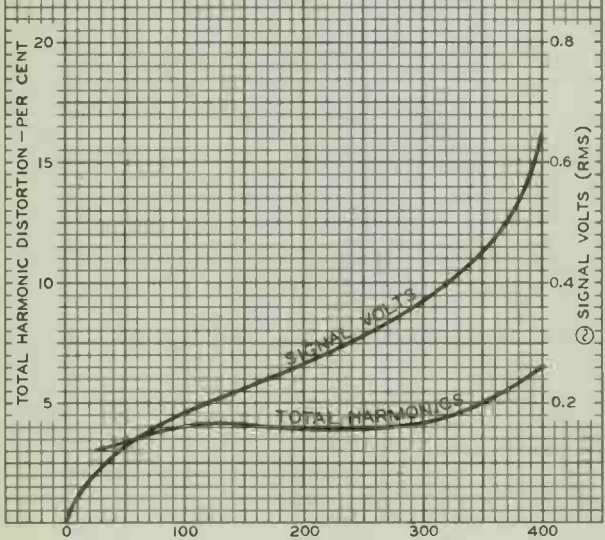
HEATER VOLTS = 26.5



C_1, C_4 = 0.01 μf
C_2 = 0.002 μf
C_3 = 1.0 μf
R_1 = 2.2 MEGOHMS
R_2, R_3 = 100 OHMS
R_4 = 0.2 MEGOHM

T_1 = INTERSTAGE COUPLING TRANSFORMER: TURNS RATIO (PRIMARY TO ½ SECONDARY) = 3:1

T_2 = OUTPUT TRANSFORMER: PLATE-TO-PLATE LOAD, 2000 OHMS



RCA

26C6
DUPLEX-DIODE TRIODE

MINIATURE TYPE

For use with 12-cell storage-battery supply

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage	26.5	ac or dc volts
Current	0.07	amp
Direct Interelectrode Capacitances:[o]		
Triode Unit: Grid to Plate	2.0	μμf
Grid to Cathode & Heater	1.8	μμf
Plate to Cathode & Heater	1.4	μμf

Mechanical:

Mounting Position	Any
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
Base	Miniature Button 7-Pin
Basing Designation for BOTTOM VIEW	7BT

Pin 1 – Triode Grid
Pin 2 – Cathode
Pin 3 – Heater
Pin 4 – Heater
Pin 5 – Diode Plate No.2
Pin 6 – Diode Plate No.1
Pin 7 – Triode Plate

TRIODE UNIT – Class A_1 AMPLIFIER

Maximum Ratings, *Design-Center Values:*

PLATE VOLTAGE	250 max.	volts
PLATE DISSIPATION	2.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts

Characteristics:

Plate Voltage	26.5	250	volts
Grid Voltage:			
From a fixed supply of	–	-9	volts
From a grid resistor of	2.0	–	megohms
Amplification Factor	17	16	
Plate Resistance	15500	8500	ohms
Transconductance	1100	1900	μmhos
Plate Current	1.1	9.5	ma.

Typical Operation with Resistance Coupling:

See RESISTANCE-COUPLED AMPLIFIER CHART, Type 6R7.

[o] With external shield connected to cathode. Values are approximate.

26C6

DUPLEX-DIODE TRIODE

DIODE UNITS – Two

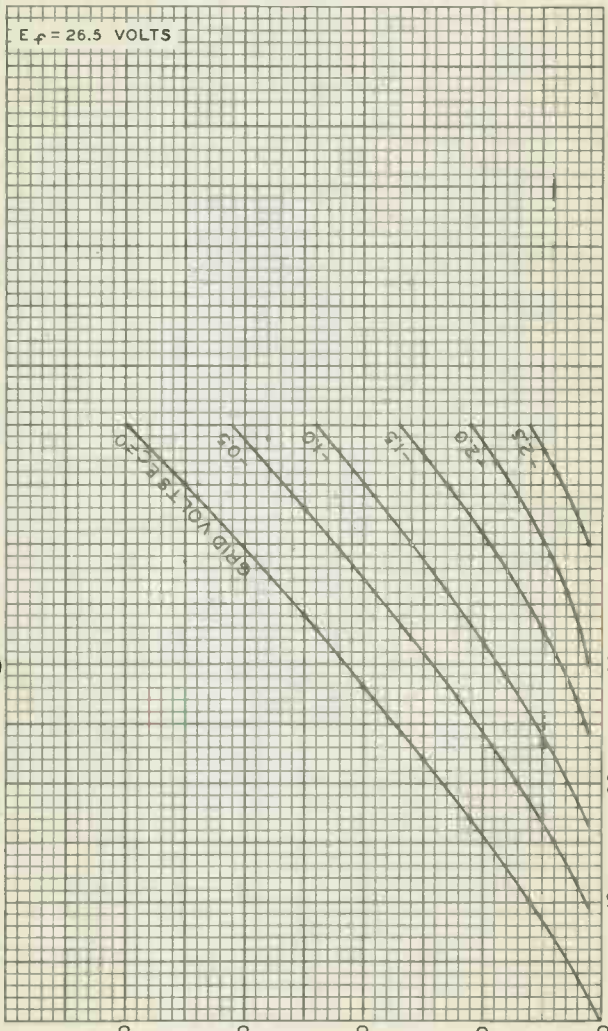
The two diode plates are placed around a cathode, the sleeve of which is common to the triode unit. Each diode plate has its own base pin. Diode curves in the front of the RECEIVING TUBE SECTION apply to the 26C6.

Additional curves applying to the 26C6 are shown under Types 6R7, and 6SR7

RCA

26C6

AVERAGE PLATE CHARACTERISTICS



JUNE 10, 1946

TUBE DEPARTMENT

92CM-6772

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

26D6
PENTAGRID CONVERTER
MINIATURE TYPE

For use with 12-cell storage-battery supply

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage	26.5	ac or dc volts
Current	0.07	amp
Direct Interelectrode Capacitances:		
Grid #3 to All Other Electrodes (RF Input)	7.5●	μμf
Plate to All Other Electrodes (Mixer Output)	14●	μμf
Grid #1 to All Other Electrodes (Osc. Input)	5.8●	μμf
Grid #3 to Plate	0.30 max.●	μμf
Grid #1 to Grid #3	0.15 max.●	μμf
Grid #1 to Plate	0.03 max.●	μμf
Grid #1 to External Shield and All Other Electrodes Except Cathode & Grid No.5	2.9	μμf
Grid #1 to Cathode & Grid #5	2.8▲	μμf
Cathode to External Shield and All Other Electrodes Except Grid #1	15.5	μμf

Mechanical:

Mounting Position	Any
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
Base	Miniature Button 7-Pin
Basing Designation for BOTTOM VIEW	7CH

Pin 1 – Grid No.1
Pin 2 – Cathode, Grid No.5
Pin 3 – Heater
Pin 4 – Heater
Pin 5 – Plate
Pin 6 – Grid No.2, Grid No.4
Pin 7 – Grid No.3

CONVERTER

Maximum Ratings, *Design-Center Values*:

PLATE VOLTAGE	300 max. volts
GRIDS-No.2 & No.4 (SCREEN) VOLTAGE	100 max. volts
GRIDS-No.2 & No.4 SUPPLY VOLTAGE	300 max. volts
PLATE DISSIPATION	1.0 max. watt
GRIDS-No.2 & No.4 DISSIPATION	1.0 max. watt
TOTAL CATHODE CURRENT	14 max. ma.
GRID-No.3 (CONTROL GRID) VOLTAGE:	
Negative bias value	50 max. volts
Positive bias value	0 max. volts
PEAK HEATER-CATHODE VOLTAGE:	
Heater negative with respect to cathode	90 max. volts
Heater positive with respect to cathode	90 max. volts

● with external shield connected to cathode.
▲ with external shield connected to other electrodes.

RCA

26D6

PENTAGRID CONVERTER

Characteristics - *Separate Excitation:*[□]

Plate Voltage	26.5	100	250	volts
Grids-No.2 & No.4 Voltage	26.5	100	100	volts
Grid-No.3 Voltage	-0.5	-1.5	-1.5	volts
Grid-No.1 (Oscillator-Grid) Resistor	20000	20000	20000	ohms
Plate Resistance (Approx.)	–	0.5	1.0	megohm
Conversion Transconductance	270	455	475	µmhos
Conversion Transconductance (Approx.)*	–	4	4	µmhos
Conversion Transconductance (Approx.)**	8	–	–	µmhos
Plate Current	0.45	2.8	3.0	ma.
Grids-No.2 & No.4 Current	1.6	8.0	7.8	ma.
Grid-No.1 Current	0.1	0.5	0.5	ma.
Total Cathode Current	2.15	11.3	11.3	ma.

Characteristics of Oscillator Section:[▲]

Plate Voltage	26.5	100	volts
Grids-No.2 & No.4 Voltage	26.5	100	volts
Grid-No.3 Voltage	0	0	volts
Grid-No.1 Voltage	0	0	volts
Amplification Factor	–	22	
Transconductance	4500	7200	µmhos
Plate Current	5.5	27	ma.

□ The characteristics shown with separate excitation correspond very closely with those obtained in a self-excited oscillator circuit operating with zero bias.

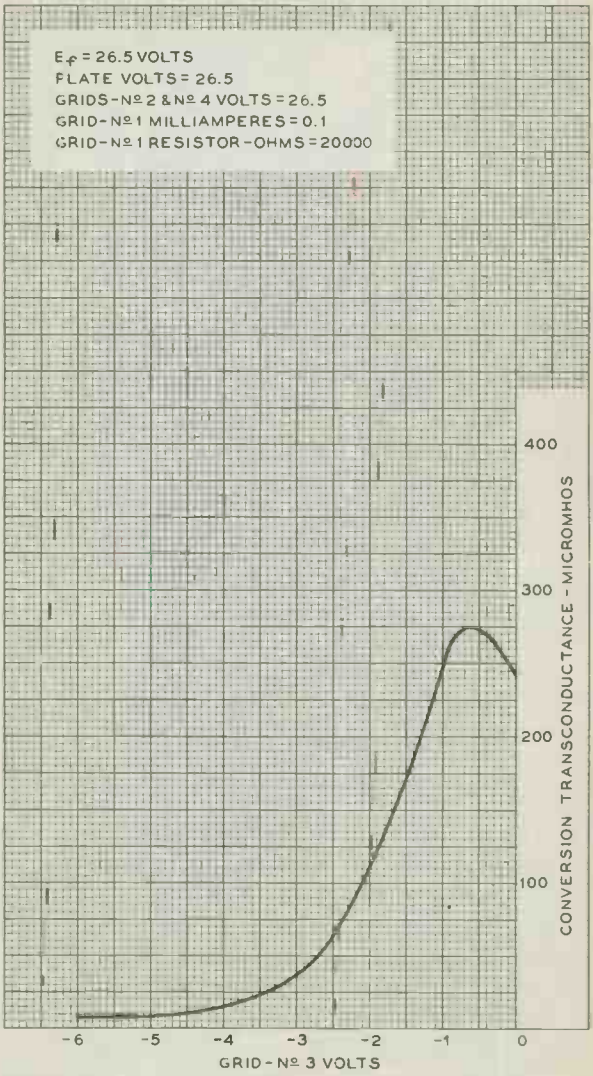
* with grid-No.3 bias of -30 volts.

** with grid-No.3 bias of -6 volts.

▲ Measured between grid No.1 and grids-No.2 and No.4 connected to plate (not oscillating).

The curves under Type 6BE6 also apply to the 26D6

26D6
OPERATION CHARACTERISTICS
WITH SEPARATE OSCILLATOR EXCITATION



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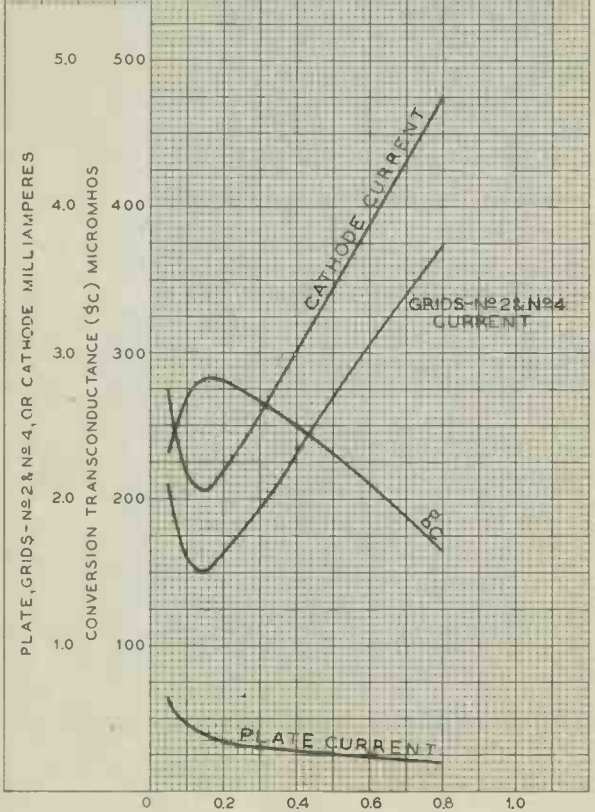
26D6

OPERATION CHARACTERISTICS
WITH SEPARATE OSCILLATOR EXCITATION

E_f = 26.5 VOLTS
PLATE VOLTS = 26.5
GRIDS - Nº 2 & Nº 4 VOLTS = 26.5
GRID - Nº 1 RESISTOR - OHMS = 20000
GRID - Nº 3 VOLTS = -0.5



559

LIGHTHOUSE DIODE

GENERAL DATA

Electrical:

Heater for Unipotential Cathode:
- Voltage . . . . . 6.3 ± 5% . . . . ac or dc volts
- Current . . . . . 0.75 . . . . . amp.

Direct Interelectrode Capacitance (Approx.):
- Plate to Cathode . . . . 2.70 . . . . . μμf

Mechanical:

Operating Position . . . . . Any
Mounting . . . . . Tube should be supported by its metal shell and not by its base or other terminals
Dimensions and Terminals . . . . . See Outline Drawing
Base . . . . . Small H-Wafer Octal 6-Pin

BOTTOM VIEW

Pin 1 – Internal Con. Do Not Use
Pin 2 – Heater
Pin 3 – Cathode
Pin 5 – Cathode
Pin 7 – Heater
Pin 8 – Cathode

Shell (S) – RF Terminal
Disc – Plate Terminal

HALF-WAVE RECTIFIER

Maximum Ratings, *Design-Center Values*:

PEAK INVERSE PLATE VOLTAGE	200 max.	volts
PEAK PLATE CURRENT	180 max.	ma.
AVERAGE PLATE CURRENT	27 max.	ma.
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode. .	90 max.	volts
Heater positive with respect to cathode. .	90 max.	volts
PLATE-SEAL TEMPERATURE*	150 max.	°C

* Under extremely high ambient temperature, the plate-seal temperature must never exceed 200°C.

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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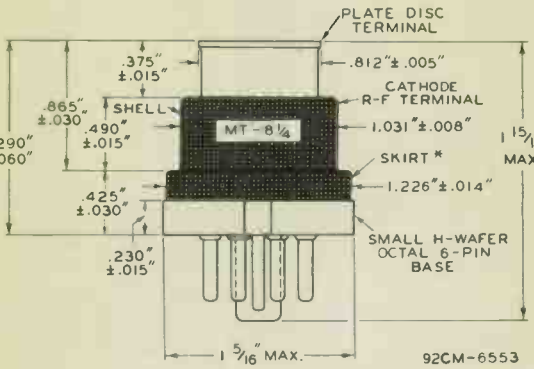
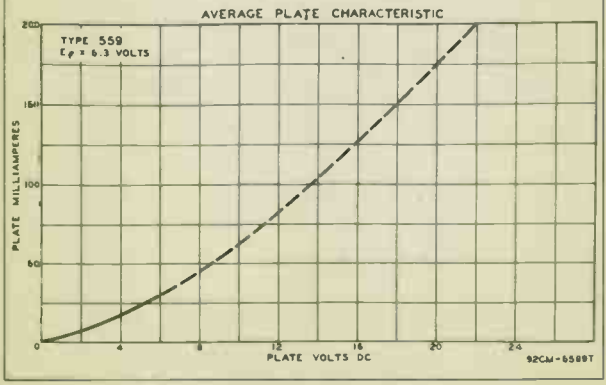
LIGHTHOUSE DIODE



MAXIMUM ECCENTRICITY OF ℄ (AXIS) OF THE FOLLOWING ITEMS WITH RESPECT TO ℄ OF SHELL AS REFERENCE IS:

PLATE DISC TERMINAL: 0.020"
SKIRT: 0.035"

*NOT TO BE USED FOR RF CONTACT IN NEW EQUIPMENT DESIGNS.



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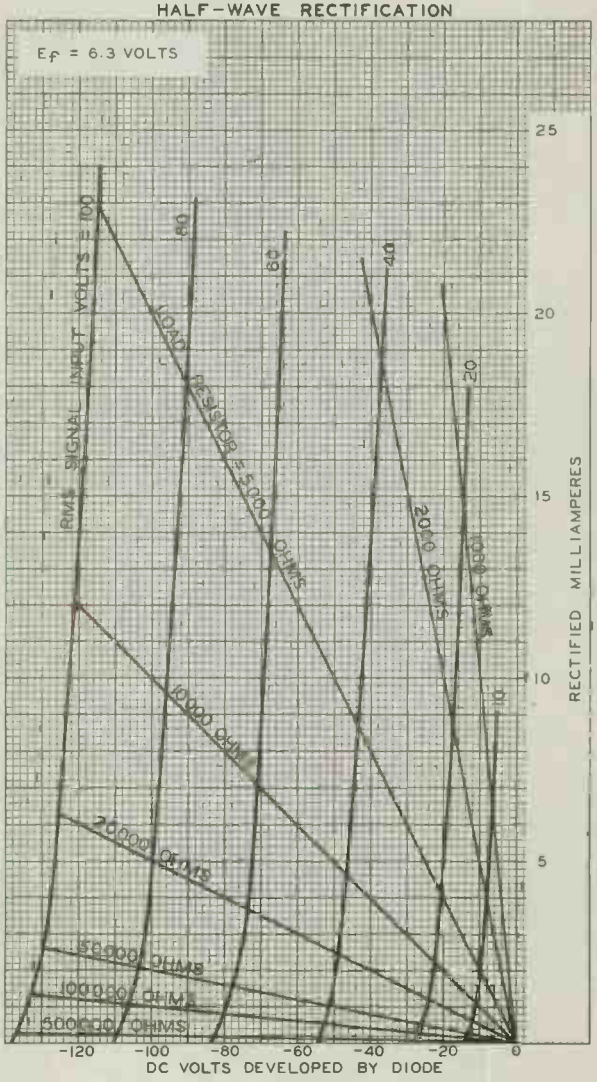
AVERAGE CHARACTERISTICS
HALF-WAVE RECTIFICATION



579-B

HALF-WAVE HIGH-VACUUM RECTIFIER

DATA

Electrical:

Filament, Thoriated Tungsten:

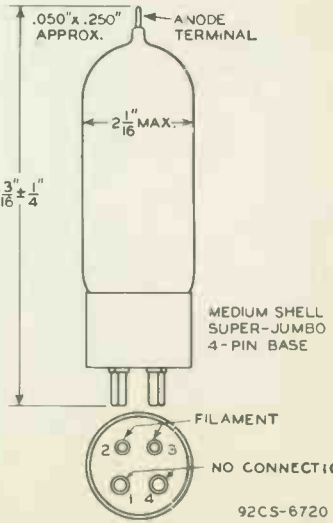
Voltage	2.5 ± 5%	volts
Current	6	amp

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

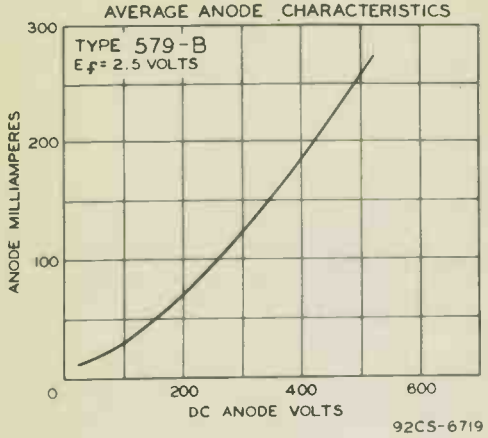
Maximum Ratings, Absolute Values:

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



579-B

HALF-WAVE HIGH-VACUUM RECTIFIER



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

864

AMPLIFIER

LOW MICROPHONIC DESIGN

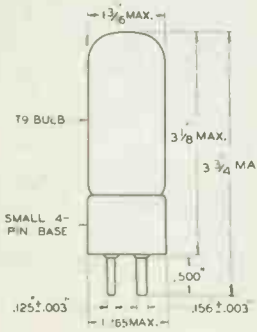
Filament	Coated	
Voltage	1.1	d-c volts
Current	0.25	amp.
Direct Interelectrode Capacitances:		
Grid to Plate	5.3	μμf
Grid to Filament	3.3	μμf
Plate to Filament	2.1	μμf
Maximum Overall Length		3-3/4"
Maximum Diameter		1-3/16"
Bulb		T-9
Base		Small 4-Pin

AMPLIFIER - Class A

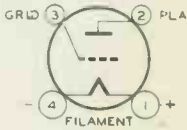
Operating Conditions and Characteristics:

Filament Voltage	1.1	1.1	d-c volts
Plate Voltage	90	135 max.	volts
Grid Voltage	-4.5	-9	volts
Amplification Factor	8.2	8.2	
Plate Resistance	13000	12700	ohms
Mutual Conductance	610	645	μmhos
Plate Current	2.9	3.5	ma.

If a grid-coupling resistor is used, its maximum value should not exceed 2.0 megohms.



TUBE SYMBOL & TOP VIEW OF SOCKET CONNECTIONS



BOTTOM VIEW OF BASE

92C-451P3

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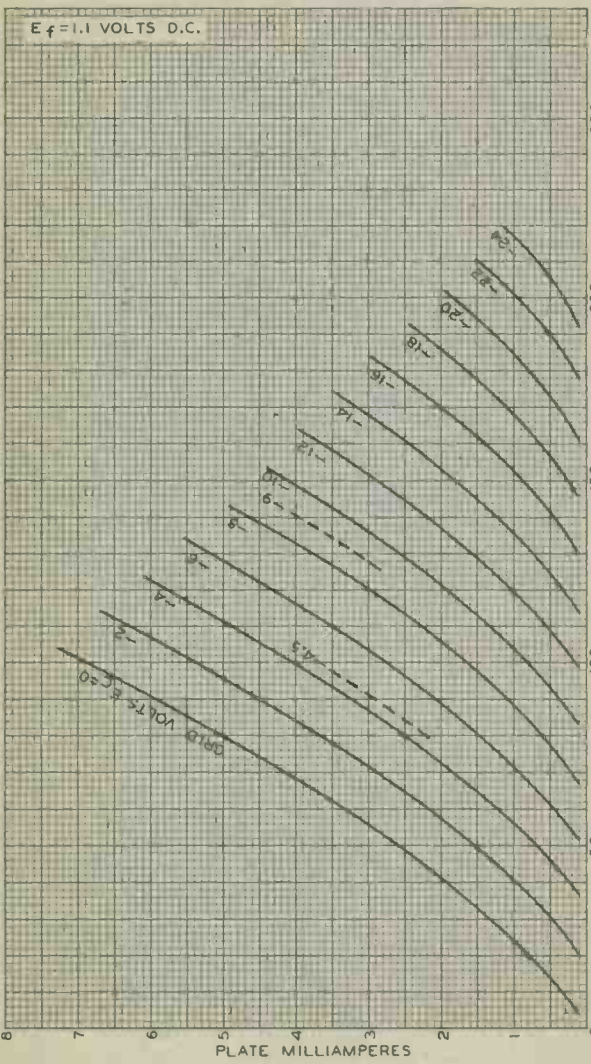
RADIO CORPORATION OF AMERICA, HARRISON, N.J.

RCA

864

AVERAGE PLATE CHARACTERISTICS



874

VOLTAGE REGULATOR

GLOW DISCHARGE

Cathode	Cold	
Maximum Overall Length		5-3/8"
Maximum Seated Height		4-3/4" ←
Maximum Diameter		2-1/16"
Bulb		ST-16 ←
Base		Medium 4-Pin Bayonet
Pin 1 - Cathode		Pin 3 - Anode
Pin 2 - Jumper*		Pin 4 - Jumper*
Mounting Position		Any

BOTTOM VIEW (4S)

Maximum and Minimum Ratings Are Absolute Values

REGULATOR SERVICE

D-C Anode Supply Voltage*	130 min.	volts ←
D-C Operating Current (Continuous)	50 max. 10 min.	ma. ma.
Ambient Temperature Range	-55 to +90	°C ←
Characteristics:		
D-C Starting Voltage (Approx.)	115	volts
D-C Operating Voltage (Approx.)	90	volts
D-C Operating Current (Continuous)	10 to 50	ma.
Regulation (10 to 50 ma.)	7	volts

• With suitable socket connections, jumper within base acts as switch to open power-supply circuit when voltage regulator tube is removed from socket.

* Not less than indicated supply voltages should be provided to insure "starting" throughout tube life.

Sufficient resistance must always be used in series with this type to limit the current through the tube to 50 milliamperes under continuous (steady state) operating conditions. During the interval of 5 to 10 seconds which may be required for the regulated tubes in associated equipment to warm up and draw plate current, a maximum current of 100 milliamperes is permissible provided each such starting period is followed by a steady-state operating period of at least several minutes. Unless this precaution is observed, tube performance will be impaired. ←

In voltage-regulator tubes of the glow-discharge type, regulation is somewhat dependent on past operating conditions. For example, the regulation value of a tube operated for a protracted period at 10 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 50 milliamperes. Likewise, the regulation value may change somewhat after a long idle period.

← Indicates a change.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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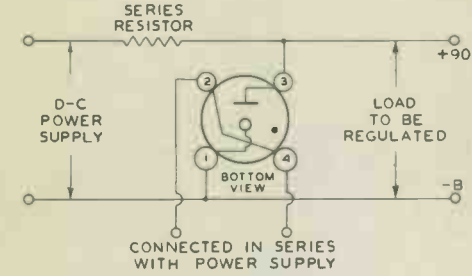
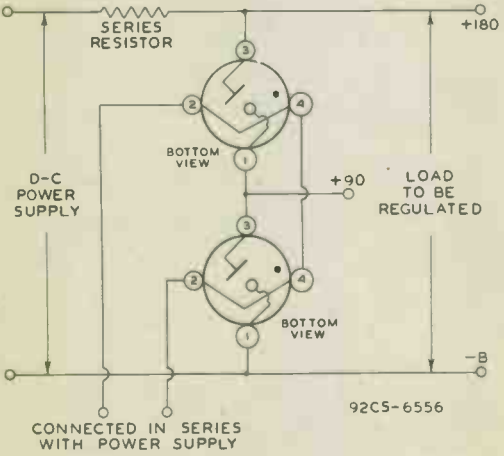
VOLTAGE REGULATOR

TYPICAL CIRCUIT CONNECTIONS





878

HALF-WAVE HIGH-VACUUM RECTIFIER

FOR USE WITH CATHODE-RAY TUBES

Filament	Tungsten	
Voltage	2.5	a-c volts
Current	5.0	amp.
Overall Length		7" to 7-5/8"
Maximum Diameter		1-13/16"
Bulb		T-14
Cap		Medium Metal Skirted
Base		Medium 4-Pin

Operating Conditions:

Filament Voltage	2.5	a-c volts
A-C Plate Voltage (RMS)	7100 max.	volts
Peak Inverse Voltage	20000 max.	volts
D-C Output Current (Continuous)	5 max.	ma.

The 878 is for use in suitable rectifying devices to supply the d-c voltage requirements of cathode-ray tubes.

It is important that the filament transformer secondary be insulated to withstand the maximum peak inverse voltage encountered in the installation.

The *maximum peak plate current* of the 878 is limited by the available emission from the filament. In normal operation, the peak current is practically independent of the size of input filter condenser and is approximately 20 milliamperes.

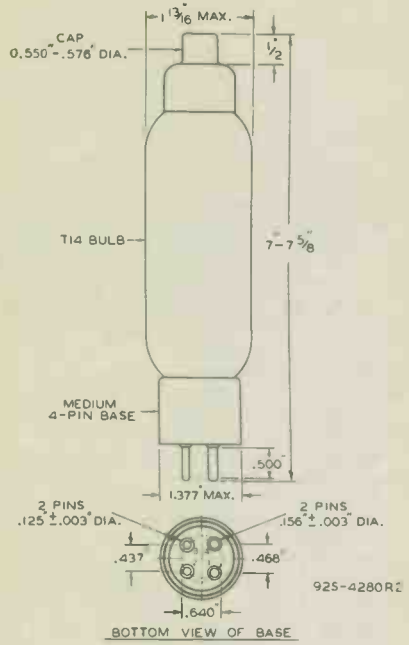
Filter requirements are ordinarily met by the use of a 0.5 to 2.0 μf condenser shunted across the bleeder circuit. The shunt condenser should have a rating sufficient to withstand the instantaneous peak value of the a-c input voltage. If this filtering is inadequate for a definite application, a two-section filter is recommended.

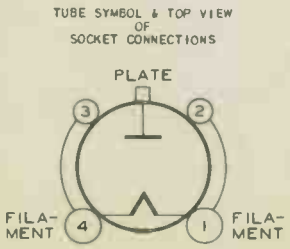
In a *voltage-doubler circuit*, two 878's may be operated to deliver approximately twice the voltage obtainable from a half-wave rectifier circuit for the same a-c input voltage. However, a separate filament-supply winding is required for each tube.

878

878

HALF-WAVE HIGH-VACUUM RECTIFIER





954
DETECTOR AMPLIFIER PENTODE
ACORN TYPE

Especially for wavelengths as short as 0.7 meter

Heater	Coated Unipotential Cathode	
Voltage	6.3	a-c or d-c volts
Current	0.15	amp.
Direct Interelectrode Capacitances:		
Grid to Plate•	0.007 max.	μμf
Input	3.4	μμf
Output	3.0	μμf
Overall Length		1-11/16" ± 3/16"
Overall Diameter		1-3/32" ± 1/16"
Bulb	*See Outline in GENERAL SECTION*	T-4½
End Terminal		Two
Base		Small Radial 5-Pin
Pin 1 - Heater		Pin 5 - Cathode
Pin 2 - Grid No.2 •		P - Plate
Pin 3 - Grid No.3		G_1 - Grid No.1
Pin 4 - Heater		
RCA Socket		Stock No.9925
RCA Grid & Plate Clips		Stock No.9939
Mounting Position		Any

P is on Long Part of Bulb: Top
G_1 is on Short Part of Bulb: Bottom

BOTTOM VIEW (5CB)

Maximum and Minimum Ratings Are Design-Center Values

A-F AMPLIFIER

D-C Plate Voltage		250 max.	volts
D-C Screen (Grid No.2) Voltage		100 max.	volts
D-C Grid (No.1) Voltage		-3 min.	volts
Plate Dissipation		0.5 max.	watt
Screen Dissipation		0.1 max.	watt
D-C Heater-Cathode Potential		90 max.	volts
Characteristics— Class A_1 Amplifier:			
D-C Plate Voltage	90	250	volts
Suppressor (Grid No.3)	Connected to cathode at socket		
D-C Screen Voltage	90	100	volts
D-C Grid Voltage▪	-3	-3	volts
Plate Resistance	1.0	Greater than 1.0	megohm
Transconductance	1100	1400	μmhos
D-C Plate Current	1.2	2.0	ma.
D-C Screen Current	0.5	0.7	ma.
Typical Operation with Resistance-Coupling:			
Plate-Supply Voltage○		250	volts
Suppressor	Connected to cathode at socket		
D-C Screen Voltage		50	volts
D-C Grid Voltage▪		-2.1	volts
Load Resistance		0.25	megohm
D-C Plate Current		0.5	ma.
Second Harmonic Distortion		5	%
Voltage Output		40 to 50 RMS	volts
Voltage Gain		100 approx.	

•, ▪, ○: See next page. ← Indicates a change.

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

954

DETECTOR AMPLIFIER PENTODE

(continued from preceding page)

DETECTOR

D-C Plate Voltage	250 max.	volts
D-C Screen (Grid No. 2) Voltage	100 max.	volts
→ D-C Heater-Cathode Potential	80 max.	volts
Typical Operation — Biased Detector:		
Plate-Supply Voltage○	250	volts
Suppressor (Grid No. 3)	Connected to cathode at socket	
D-C Screen Voltage	100	volts
D-C Grid (No. 1) Voltage	-6 approx.	volts
Load Resistance	0.25	megohm
D-C Plate Current	Adjusted to 0.1 ma. with no input signal	
Cathode Resistor	20000 to 50000	ohms

● With shield baffle.

■ Under maximum rated conditions, the resistance in the grid circuit should not exceed 0.[illegible] megohm with fixed bias, or 1.[illegible] megohm with cathode bias.

○ This is a plate-supply voltage value. The voltage effective at the plate will be plate-supply voltage minus the voltage drop in load caused by the plate current.

R-F grounding by means of condensers placed close to the tube terminals is required if the full capabilities of the 954 for ultra-high-frequency uses are to be obtained. It is important in the cases of the plate and control-grid circuits that separate r-f grounding returns be made to a common point in order to avoid r-f interaction through common return circuits. It may also be advisable in some applications to supplement the action of the by-pass condensers by r-f chokes placed close to the condensers in the return or supply lead for the grid, the screen, the suppressor, the plate, and the heater.

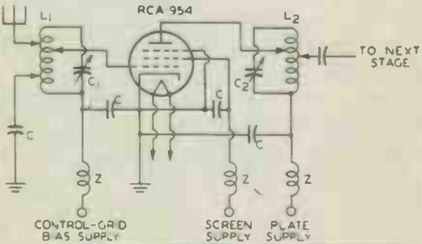
TYPICAL R-F AMPLIFIER CIRCUIT

For ultra-high frequencies, coils L1 and L2 may be tapped at suitable points determined by test to reduce effect of tube loading on circuit impedances.

Because electronic plate loading is not serious in a pentode, the use of coil L2 with tapped plate connection may not be necessary to give satisfactory results.

The condensers should all be of high quality and be designed for ultra-high frequency operation.

The license extending to the purchaser of tubes appears in the License Notice accompanying them. Information contained herein is furnished without assuming any obligations.



92CM-4386R2

WAVE-LENGTH RANGE		2.75 TO 5.3 METERS APPROX.	1 TO 3 METERS APPROX.	0.8 METER APPROX.
L_1, L_2	TURNS	10	4	5
	WIRE	No. 16 B.C.*	No. 16 B.C.*	No. 30 B.C.*
	OUTSIDE DIA.	3/8	3/8	1/8
	LENGTH	3/4	5/16	1/8
C_1, C_2 (VARIABLE)		3 TO 25 μμf	3 TO 25 μμf	3 TO 4 μμf
C		100 TO 500 μμf	100 TO 500 μμf	100 TO 500 μμf
Z	TURNS	15	15	15
	WIRE	No. 30	No. 30	No. 30
	OUTSIDE DIA.	1/4	1/4	1/4
	WINDING	S.L.○	S.L.○	S.L.○

*B.C. = BARE COPPER ○S.L. = SINGLE LAYER

← Indicates a change. NOTE: THE ABOVE DATA ARE NECESSARILY APPROXIMATE

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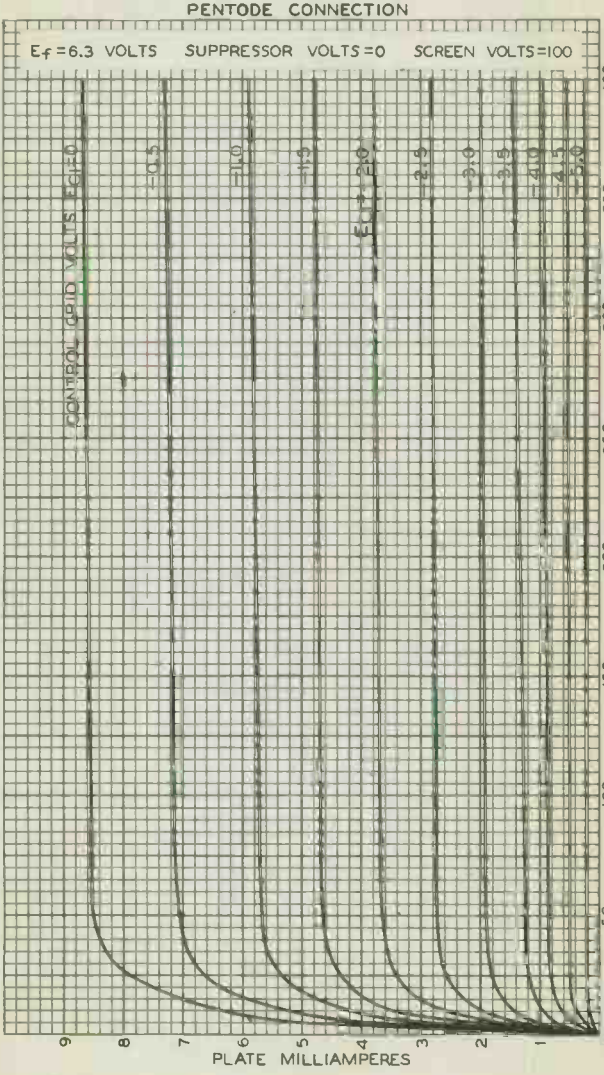
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

954

AVERAGE PLATE CHARACTERISTICS

PENTODE CONNECTION



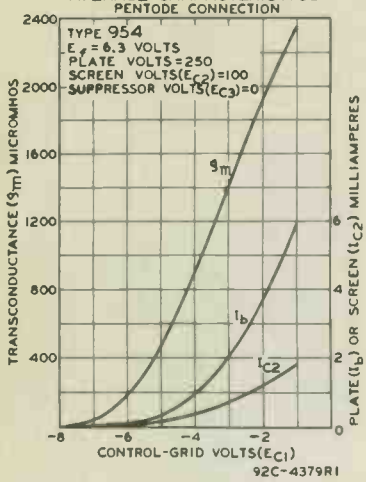
MAR. 11, 1935

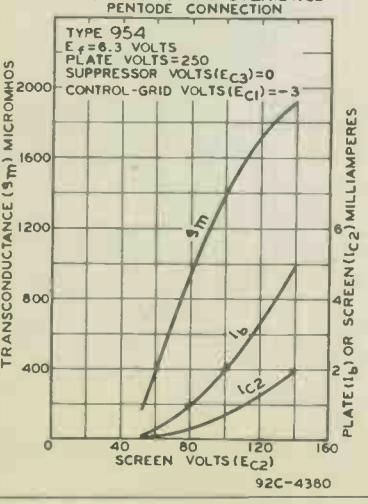
RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY INC.

92C-4378

954

CHARACTERISTICS CURVES





955

DETECTOR, AMPLIFIER, OSCILLATOR

ACORN TYPE

Especially for wavelengths between 0.5 meter and 5 meters

Heater	Coated Unipotential Cathode		
Voltage	6.3	a-c or d-c	volts
Current	0.15		amp.
Direct Interelectrode Capacitances:•			
Grid to Plate	1.4		μμf
Grid to Cathode	1.0		μμf
Plate to Cathode	0.6		μμf
Overall Length		1-7/32"	± 5/32"
Overall Diameter		1-3/32"	± 1/16"
Bulb	*See Outline on GENERAL SECTION*		T-4½
Base			Small Radial 5-Pin ←
Pin 1 - Heater			Pin 4 - Heater
Pin 2 - Plate			Pin 5 - Cathode
Pin 3 - Grid			
RCA Socket			Stock No. 9925
Mounting Position			Any

Short Part of Bulb: Bottom

BOTTOM VIEW (EBC)

Maximum Ratings Are Design-Center Values

A-F AMPLIFIER

D-C Plate Voltage	250 max.	volts
Plate Dissipation	1.6 max.	watts
D-C Heater-Cathode Potential	90 max.	volts ←

Typical Operation and Characteristics — Class A₁ Amplifier:

D-C Plate Voltage	90	135	180	250	volts
D-C Grid Voltage*	-2.5	-3.75	-5	-7	volts
Amplification Factor	25	25	25	25	
Plate Resistance	14700	13200	12500	11400	ohms
Transconductance	1700	1900	2000	2200	μmhos
D-C Plate Current	2.5	3.5	4.5	6.3	ma.
Load Resistance	–	–	20000	–	ohms
Second Harmonic Dist.	–	–	5	–	%
Power Output	–	–	135	–	mw

Typical Operation with Resistance-Coupling:

Plate-Supply Voltage°	180	volts
D-C Grid Voltage*	-3.5	volts
Load Resistance	250000	ohms
Plate Current	0.42	ma.
Second Harmonic Distortion	5	%
Voltage Output	45 RMS	volts
Voltage Gain	20 approx.	

R-F POWER AMPLIFIER & OSCILLATOR - Class C

Plate Modulated or C.W.

D-C Plate Voltage	180 max.	volts
D-C Plate Current	8 max.	ma.
D-C Grid Current	2 max.	ma.
D-C Heater-Cathode Potential	90 max.	volts ←
Typical Operation:		
D-C Plate Voltage	180	volts
D-C Grid Voltage	-35 approx.	volts
D-C Plate Current	7	ma.

•, *, °: See next page. ← Indicates a change.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

955

DETECTOR, AMPLIFIER, OSCILLATOR

(continued from preceding page)

D-C Grid Current	1.5 approx.	ma.
Power Output**	0.5 approx.	watt

DETECTOR

Typical Operation:	Biased	Grid-Leak	
Plate-Supply Voltage ■	180	45	volts
Grid Voltage	-7 approx.	Grid Return to Cathode	volts
Load Resistance	0.25	-	megohm
Plate Current	Adjusted to 0.2 ma. approx. with no input signal.	-	ma.
Cathode Resistor	50000 approx.	-	ohms
Grid Leak	-	1 to 5	megohms
Grid Condenser	-	0.00025	µf

● With no external shield.

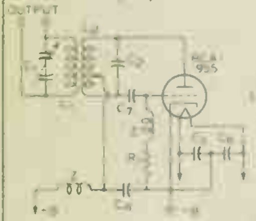
* Under maximum rated conditions, the resistance in the grid circuit should not exceed 0.1 megohm with fixed bias, or 0.5 megohm with cathode bias.

■ This is a plate-supply voltage value. The voltage effective at plate will be plate-supply voltage minus the voltage drop in load caused by plate current.

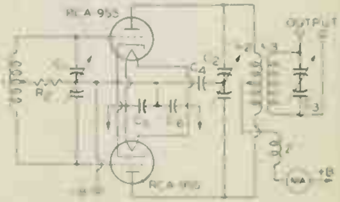
** At 5 meters. Only moderate reduction in this value will be found for wavelengths as low as 1 meter. Below 1 meter, the power output decreases as the wavelength is decreased.

R-F grounding by means of condensers placed close to the tube pins is required if the full capabilities of the 955 for ultra-high-frequency uses are to be obtained.

U-H-F OSCILLATOR
Hartley Type



PUSH-PULL U-H-F OSCILLATOR
Tuned-Plate Tuned-Grid Type



92CM-6518

[illegible] DEPEND ON FREQUENCY RANGE DESIRED
C_4, [illegible]
[illegible]
R_1 [illegible] OHMS, [illegible] WATT
R_2 [illegible] OHMS, [illegible] WATT
[illegible] R-F CHOKE

 ← Indicates a change.

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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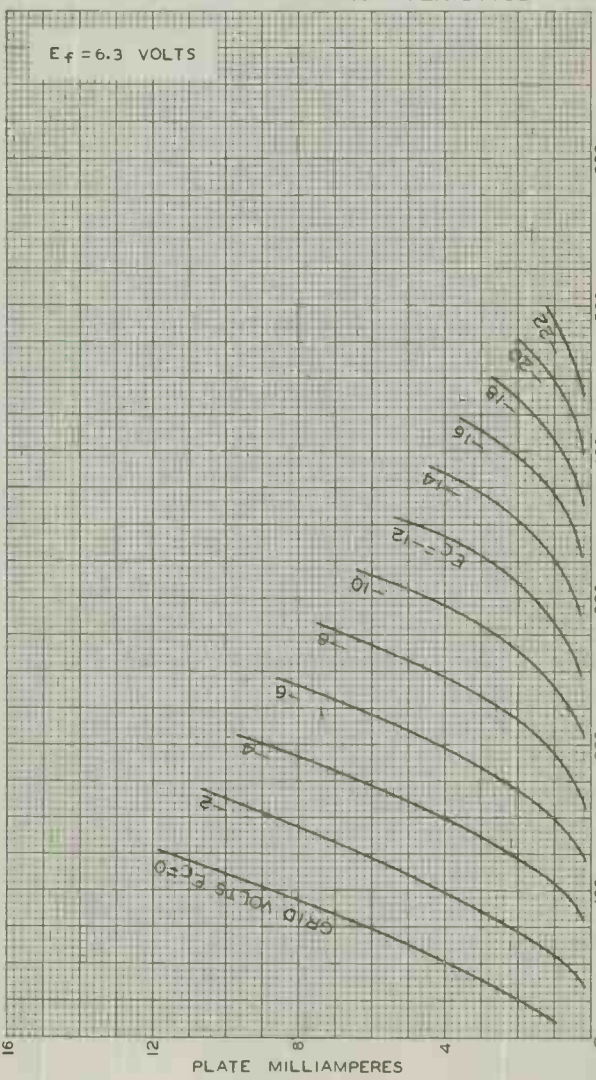
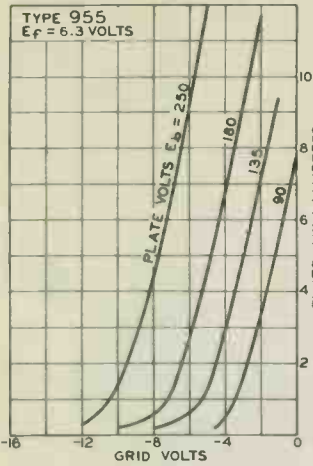
AVERAGE PLATE CHARACTERISTICS



955

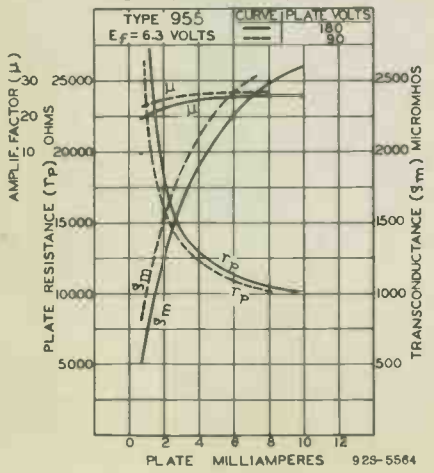
CHARACTERISTICS CURVES

AVERAGE CHARACTERISTICS



92C-5563R1

AVERAGE CHARACTERISTICS



92S-5564

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92C-5563R1
92S-5564

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SUPER-CONTROL R-F AMPLIFIER PENTODE

ACORN TYPE

Especially for wavelengths as short as 1.7 meter

Heater	Coated Unipotential Cathode	
Voltage	6.3	a-c or d-c volts
Current	0.15	amp.
Direct Interelectrode Capacitances:		
Grid to Plate*	0.007 max.	μμf
Input	3.4	μμf
Output	3.0	μμf
Overall Length		1-11/16" ± 3/16"
Overall Diameter		1-3/32" ± 1/16"
Bulb	*See Outline in GENERAL SECTION*	T-4½
End Terminals		Two
Base		Small Radial 5-Pin ←
Pin 1 – Heater		Pin 5 – Cathode
Pin 2 – Grid No.2		P – Plate
Pin 3 – Grid No.3		G_1 – Grid No.1
Pin 4 – Heater		
RCA Socket		Stock No.9925
RCA Grid & Plate Clips		Stock No.9939
Mounting Position		Any

P is on Long Part of Bulb: Top
G_1 is on Short Part of Bulb: Bottom

BOTTOM VIEW (5BB)

Maximum and Minimum Ratings Are Design-Center Values

AMPLIFIER

D-C Plate Voltage	250 max.	volts
D-C Screen (Grid No.2) Voltage	100 max.	volts
Grid (No.1) Voltage	-3 min.	volts
Plate Dissipation	1.7 max.	watts
Screen Dissipation	0.3 max.	watt
D-C Heater-Cathode Potential	80 max.	volts ←
Characteristics— Class A_1 Amplifier:		
D-C Plate Voltage	250	volts
Suppressor (Grid No.3) Connected to cathode at socket		
D-C Screen Voltage	100	volts
D-C Grid (No.1) Voltage*	-3	volts
Plate Resistance	0.7 approx.	megohm
Transconductance	1800	μmhos
Grid Bias for Transcond. of approx. 2 μmhos	-45	volts
D-C Plate Current	6.7	ma.
D-C Screen Current	2.7	ma.

MIXER — In Superheterodyne Circuit

D-C Plate Voltage		250 max.	volts
D-C Screen Voltage		100 max.	volts
D-C Heater-Cathode Potential		80 max.	volts ←
Typical Operation:			
D-C Plate Voltage	100	250	volts
Suppressor	Connected to cathode at socket		
D-C Screen Voltage	100	100	volts
D-C Grid Voltage	-10	-10 approx.	volts

The grid bias shown is minimum for an oscillator peak voltage of 9 volts. These values are optimum. ←

●,* : See next page. ← Indicates a change.

RCA

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SUPER-CONTROL R-F AMPLIFIER PENTODE

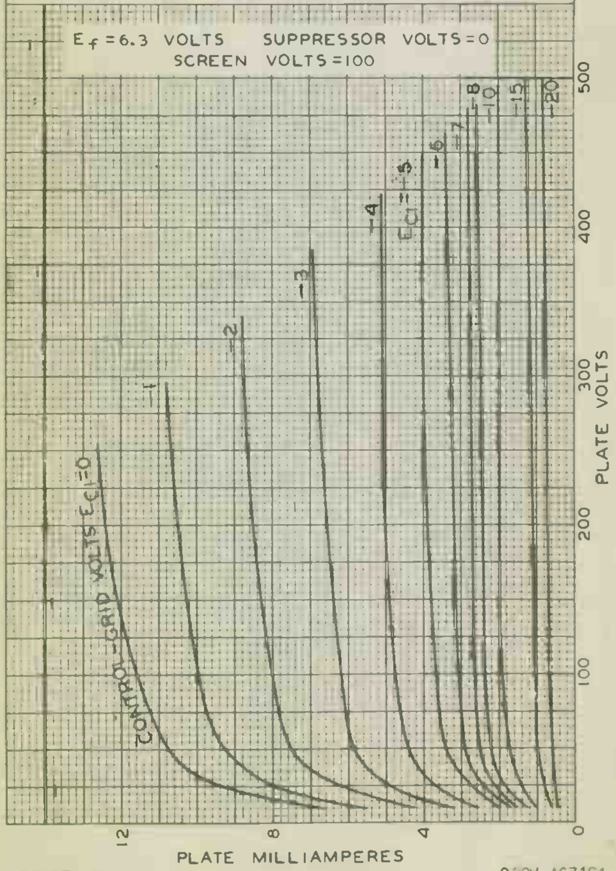
(continued from preceding page)

● with shield baffle.

* Under maximum rated conditions, the resistance in the grid circuit should not exceed 0.5 megohm with fixed bias, or 1.0 megohm with cathode bias.

Typical R-F Amplifier Circuit for the 956 is the same as that for Type 954.

AVERAGE PLATE CHARACTERISTICS

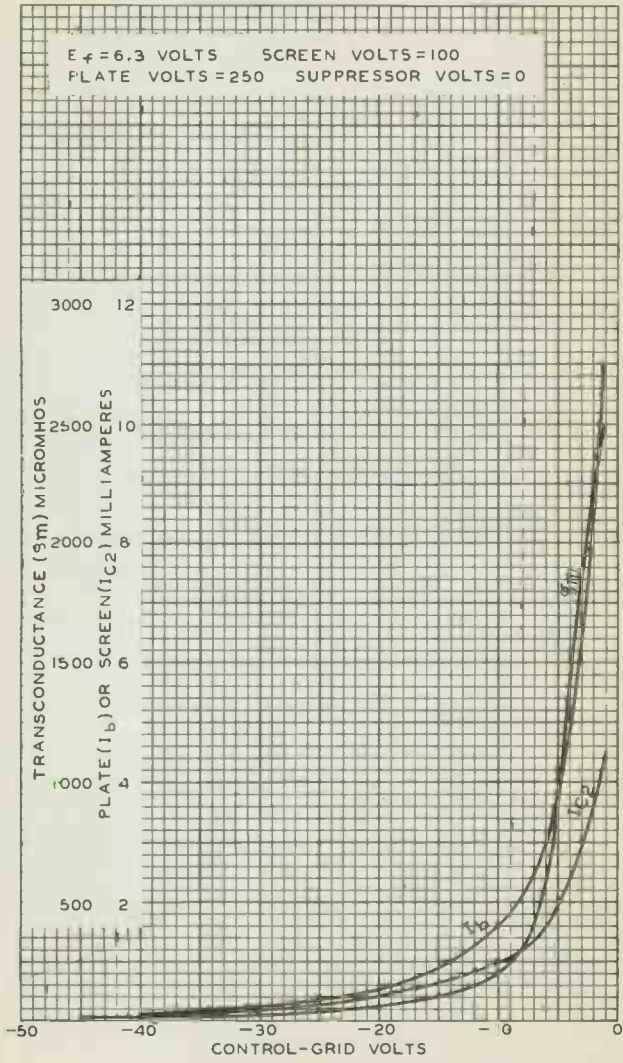


JUNE [illegible]0, 1944

9[illegible]CM-4671[illegible]1

956

AVERAGE CHARACTERISTICS



RCA

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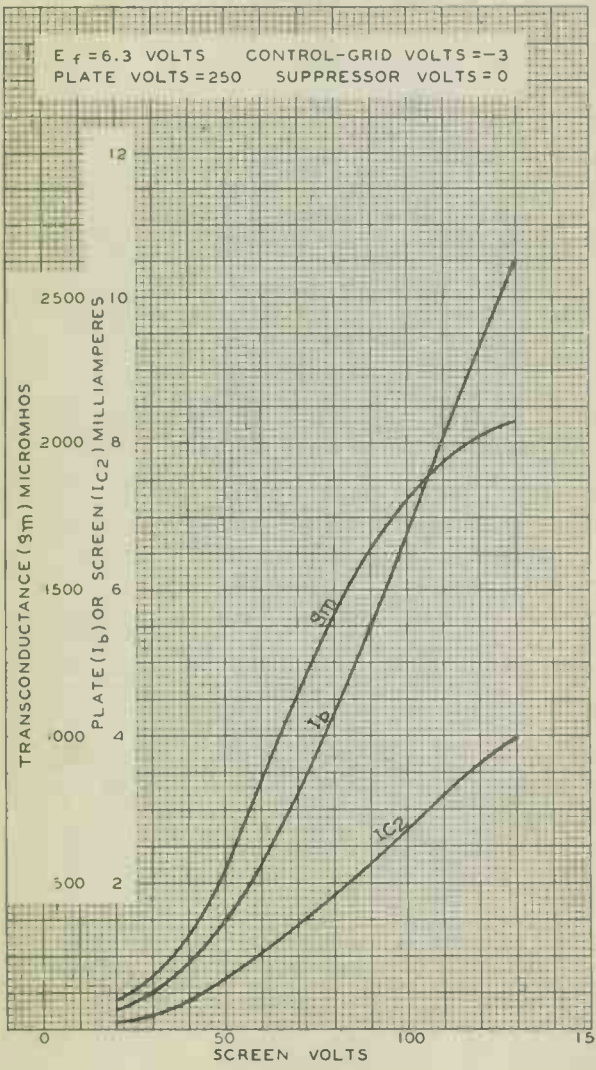
AVERAGE CHARACTERISTICS



957

DETECTOR, AMPLIFIER, OSCILLATOR

ACORN TYPE

Filament	Coated	
Voltage	1.25	d-c volts
Current	0.05	amp.
Direct Interelectrode Capacitances:		
Grid to Plate	1.2	μμf
Grid to Filament	0.3	μμf
Plate to Filament	0.7	μμf
Overall Length		1-7/32" ± 5/32"
Overall Diameter		1-3/32" ± 1/16"
Bulb	See Outline in GENERAL SECTION	T-4½
Base		Small Radial 5-Pin
Pin 1 – Filament		Pin 5 – Filament –
Pin 2 – Plate		AA' – Plane of
Pin 3 – Grid		Electrodes
Pin 4 – Filament –		
RCA Socket		Stock No. 9925
Mounting Position		Vertical◊

Short Part of Bulb: Bottom

BOTTOM VIEW (5BD)

Maximum Ratings Are Design-Center Values

AMPLIFIER

D-C Plate Voltage	135 max.	volts
Characteristics — Class A, Amplifier:		
D-C Plate Voltage	135	volts
D-C Grid Voltage*	-5	volts
Amplification Factor	13.5	
Plate Resistance	20800 approx.	ohms
Transconductance	650	μmhos
D-C Plate Current	2	ma.

◊ with no external shield.

△ Horizontal operation permitted if plane of electrodes is vertical (plate on edge).

* under maximum rated conditions, the resistance in the grid circuit should not exceed 0.1 megohm with fixed bias, or 0.5 megohm with cathode bias.

R-F grounding by means of condensers placed close to the tube pins is required if the full capabilities of the 957 for ultra-high-frequency uses are to be obtained.

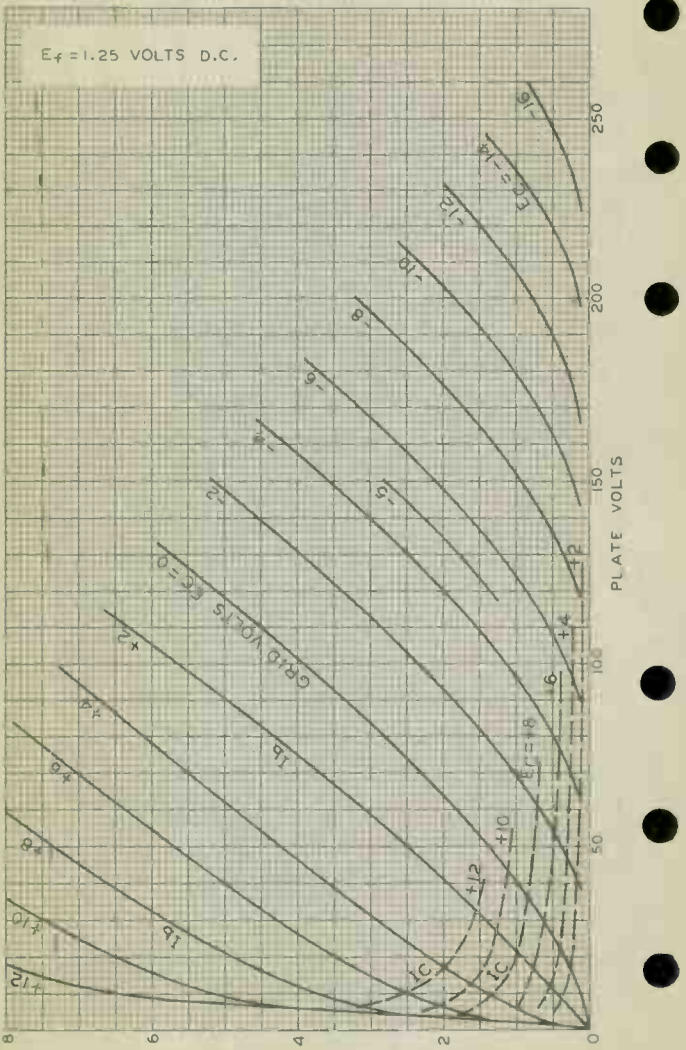
← Indicates a change.

957

RCA

957

AVERAGE PLATE CHARACTERISTICS



958-A

AMPLIFIER TRIODE

ACORN TYPE

Filament	Coated	
Voltage	1.25	d-c volts
Current	0.10	amp.
Direct Interelectrode Capacitances:◇		
Grid to Plate	2.6	μμf
Grid to Filament	0.6	μμf
Plate to Filament	0.8	μμf
Overall Length		1-7/32" ± 5/32"
Overall Diameter		1-3/32" ± 1/16"
Bulb	*See Outline in GENERAL SECTION*	T-4½
Base		Small Radial 5-Pin
Pin 1 - Filament +		Pin 5 - Filament -
Pin 2 - Plate		AA' - Plane of Electrodes
Pin 3 - Grid		
Pin 4 - Filament -		
RCA Socket		Stock No. 9925
Mounting Position		Vertical◇

Short Part of Bulb: Bottom

BOTTOM VIEW (5ED)

Maximum Ratings Are Design-Center Values

A-F AMPLIFIER

D-C Plate Voltage	135 max.	volts
D-C Plate Current	5 max.	ma.
Plate Dissipation	600 max.	mw
Characteristics — Class A_1 Amplifier:		
D-C Plate Voltage	135	volts
D-C Grid Voltage*	-7.5	volts
Amplification Factor	12	
Plate Resistance	10000	ohms
Transconductance	1200	μmhos
D-C Plate Current	3	ma.

R-F POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy

*Key-down conditions per tube without modulation**

D-C Plate Voltage	135 max.	volts
D-C Grid Voltage	-50 max.	volts
D-C Plate Current	7 max.	ma.
D-C Grid Current	1 max.	ma.
D-C Plate Input	950 max.	mw
Plate Dissipation	600 max.	mw
Typical Operation at Moderate Frequencies:		
D-C Plate Voltage	135	volts
D-C Grid Voltage●	-20	volts
	20000	ohms
	2500	ohms
Peak R-F Grid Voltage	40	volts
D-C Plate Current	7	ma.
D-C Grid Current**	1 approx.	ma.
Driving Power**	35 approx.	mw
Power Output	600	mw

◇, *, **, ●: See next page.

958-A

AMPLIFIER TRIODE

(continued from preceding page)

‡ With no external shield.

○ Horizontal operation permitted if plane of electrodes is vertical (plate on edge).

* Under maximum rated conditions, the resistance in the grid circuit should not exceed 0.1 megohm with fixed bias, or 0.5 megohm with cathode bias.

% Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

● Obtained by a grid resistor (2000Ω), cathode resistor (250Ω), or fixed supply.

●● Subject to wide variation as explained under Tube Ratings in General Section.

NOTE: The 958-A is capable of producing a useful power output at frequencies up to approx. 350 megacycles.

R-F grounding by means of condensers placed close to the tube pins is required if the full capabilities of the 958-A for ultra-high-frequency uses are to be obtained.

958-A

AVERAGE PLATE CHARACTERISTICS

JUNE 15, 1944

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6334RI

959

DETECTOR AMPLIFIER PENTODE

ACORN TYPE

Filament	Oxide	
Voltage	1.25	d-c volts
Current	0.05	amp.
Direct Interelectrode Capacitances:		
Grid to Plate°	0.015 max.	μμf
Input	1.8	μμf
Output	2.5	μμf
Overall Length		1-11/16" ± 3/16"
Overall Diameter		1-3/32" ± 1/16"
Bulb		T-4½
End Terminals	*See Outline in GENERAL SECTION*	Two
Base		Small Radial 5-Pin
Pin 1 – Filament		P – Plate
Pin 2 – Grid No.2		G_1 – Grid No.1
Pin 3 – Grid No.3		AA' – Plane of Electrodes
Pin 4 – Filament –		
Pin 5 – Filament –		
RCA Socket		Stock No. 9925
RCA Grid & Plate Clips		Stock No. 9939
Mounting Position		Vertical◊

P is on Long Part of Bulb: Top
G_1 is on Short Part of Bulb: Bottom

BOTTOM VIEW (5BE)

Maximum Ratings are Design-Center Values

AMPLIFIER

D-C Plate Voltage	145 max.	volts
D-C Screen (Grid No.2) Voltage	67.5 max.	volts
Characteristics — Class A_1 Amplifier:		
D-C Plate Voltage	135	volts
Suppressor (Grid No.3) Connected to Filament(-) at socket		
D-C Screen Voltage	67.5	volts
D-C Grid (No.1) Voltage #	-3	volts
Plate Resistance	0.8 approx.	megohm
Transconductance	600	μmhos
D-C Plate Current	1.7	ma.
D-C Screen Current	0.4	ma.

° with shield baffle.

◊ Horizontal operation permitted if plane of electrodes is vertical (plate on edge).

Under maximum rated conditions, the resistance in the grid circuit should not exceed 0.1 megohm with fixed bias, or 0.5 megohm with cathode bias.

R-f grounding by means of condensers placed close to the tube terminals is required if the full capabilities of the 959 for ultra-high-frequency uses are to be obtained. It is important in the cases of the plate and control-grid circuits that separate r-f grounding returns be made to a common point in order to avoid r-f inter-action through common return circuits. It may also be advisable in some applications to supplement the action of the by-pass condensers by r-f chokes placed close to the condensers in the return or supply lead for the grid, the screen, the suppressor, the plate, and the filament.

←Indicates a change.

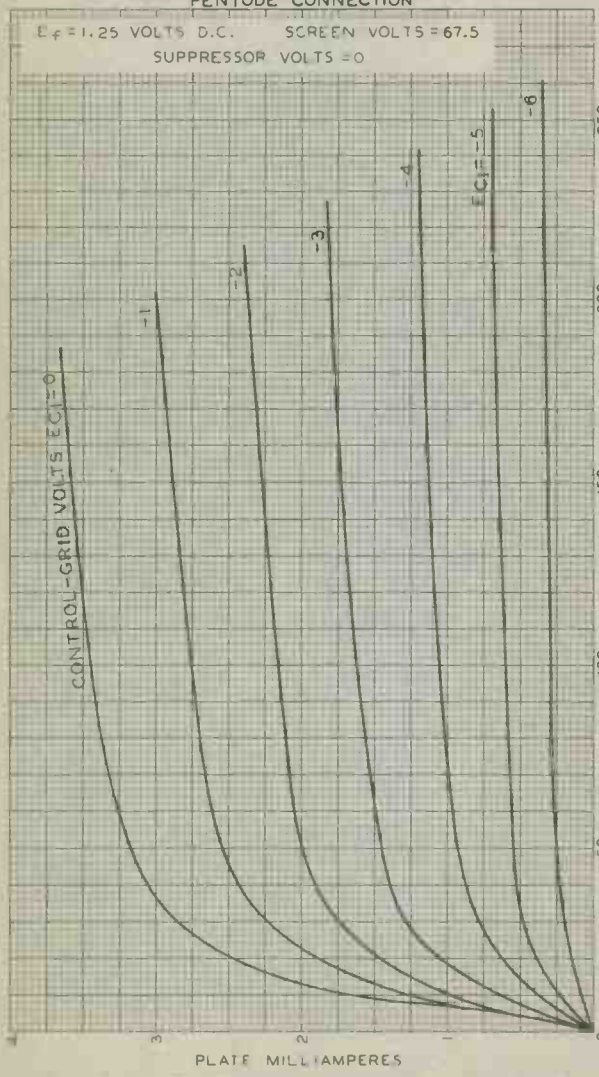
RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

959

959

AVERAGE PLATE CHARACTERISTICS

PENTODE CONNECTION



RCA

991

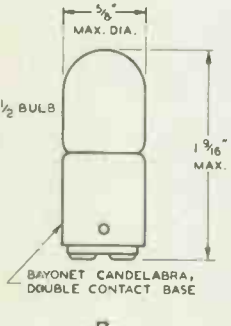
VOLTAGE REGULATOR

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 Δ	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.

Δ For d-c operating current between 0.4 and 2 ma.



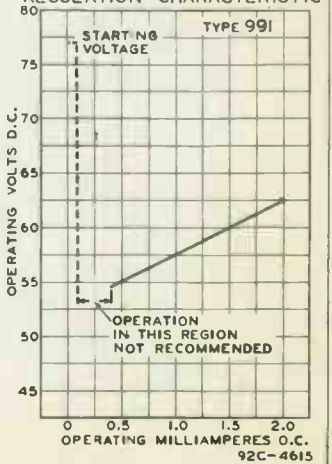
BOTTOM VIEW OF BASE

92C-4614

TUBE MOUNTING POSITION

VERTICAL OR HORIZONTAL

REGULATION CHARACTERISTIC



92C-4615

1602

AMPLIFIER TRIODE

For applications critical as to microphonics.
Previously designated as RCA-10 Special.

Filament	Thoriated Tungsten	
Voltage	7.5	a-c or d-c volts
Current	1.25	amp.
Amplification Factor	8	
Direct Interelectrode Capacitances (approx.):		
Grid to Plate	7	μμf
Grid to Filament	4	μμf
Plate to Filament	3	μμf
Maximum Overall Length		5-5/8"
Maximum Diameter		2-3/16"
Bulb		S-17
Base		Medium 4-Pin Bayonet

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

A-F POWER AMPLIFIER & MODULATOR - Class A

D-C Plate Voltage			425 max.	volts
Plate Dissipation			12 max.	watts
Typical Operation:				
Filament Voltage	7.5	7.5	7.5	a-c volts
D-C Plate Voltage	250	350	425	volts
D-C Grid Voltage	-23.5	-32	-40	volts
Peak A-F Grid Voltage	18.5	27	35	volts
D-C Plate Current	10	16	18	ma.
Plate Resistance	6000	5150	5000	ohms
Transconductance	1330	1550	1600	umhos
Load Resistance	13000	11000	10200	ohms
U.P.O. (5% second harmonic)	0.4	0.9	1.6	watts

A-F POWER AMPLIFIER & MODULATOR - Class B

D-C Plate Voltage			425 max.	volts
Max-Signal D-C Plate Current *			60 max.	ma.
Max-Signal Plate Input *			25 max.	watts
Plate Dissipation *			12 max.	watts
Typical Operation:				
Unless otherwise specified, values are for 2 tubes				
Filament Voltage	7.5	7.5	7.5	a-c volts
D-C Plate Voltage	250	350	425	volts
D-C Grid Voltage	-28	-40	-50	volts
Peak A-F Grid-to-Grid Volt.	220	240	260	volts
Zero-Sig. D-C Plate Cur.	8	8	8	ma.
Max-Sig. D-C Plate Cur.	110	110	110	ma.
Load Resistance (per tube)	1000	1500	2000	ohms
Effective Load Res. (plate to plate)	4000	6000	8000	ohms
Max-Signal Driving Power	2.1	2.3	2.5	approx. watts
Max-Signal Power Output	13	20	25	approx. watts

* Averaged over any audio frequency cycle of sine-wave form.
Indicates a change.

RCA MANUFACTURING COMPANY INC.

1602

AMPLIFIER TRIODE

(continued from preceding page)

R-F POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0				
D-C Plate Voltage		450	max.	volts
D-C Plate Current		45	max.	ma.
Plate Input		18	max.	watts
Plate Dissipation		15	max.	watts
Typical Operation:				
Filament Voltage	7.5	7.5	a-c	volts
D-C Plate Voltage	350	450		volts
D-C Grid Voltage	-40	-53		volts
Peak R-F Grid Voltage	75	85		volts
D-C Plate Current	40	40		ma.
D-C Grid Current **	1	1	approx.	ma.
Driving Power ° **	2	2.3	approx.	watts
Power Output	3	4.5	approx.	watts

° At crest of a-f cycle with modulation factor of 1.0.

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0				
D-C Plate Voltage		350	max.	volts
D-C Grid Voltage		-200	max.	volts
D-C Plate Current		50	max.	ma.
D-C Grid Current		15	max.	ma.
Plate Input		17.5	max.	watts
Plate Dissipation		10	max.	watts
Typical Operation:				
Filament Voltage	7.5	7.5	a-c	volts
D-C Plate Voltage	250	350		volts
D-C Grid Voltage	-95	-135		volts
Peak R-F Grid Voltage	195	235		volts
D-C Plate Current	45	45		ma.
D-C Grid Current **	15	15	approx.	ma.
Driving Power **	3	3.5	approx.	watts
Power Output	5.5	8	approx.	watts

R-F POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Key-down conditions per tube without modulation #				
D-C Plate Voltage		450	max.	volts
D-C Grid Voltage		-200	max.	volts
D-C Plate Current		60	max.	ma.
D-C Grid Current		15	max.	ma.
Plate Input		27	max.	watts
Plate Dissipation		15	max.	watts
Typical Operation:				
Filament Voltage	7.5	7.5	a-c	volts
D-C Plate Voltage	350	450		volts
D-C Grid Voltage	-90	-115		volts
Peak R-F Grid Voltage	190	215		volts

**, #: See next page.

←Indicates a change.

1602

AMPLIFIER TRIODE

(continued from preceding page)

D-C Plate Current	55	55	ma.
D-C Grid Current **	15	15	ma.
Driving Power **	3	3.3	approx. watts
Power Output	9	13	approx. watts

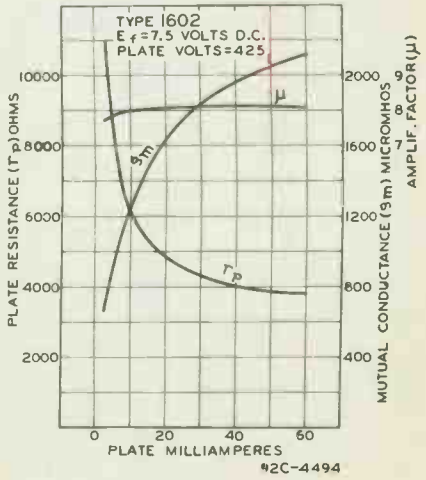
* Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

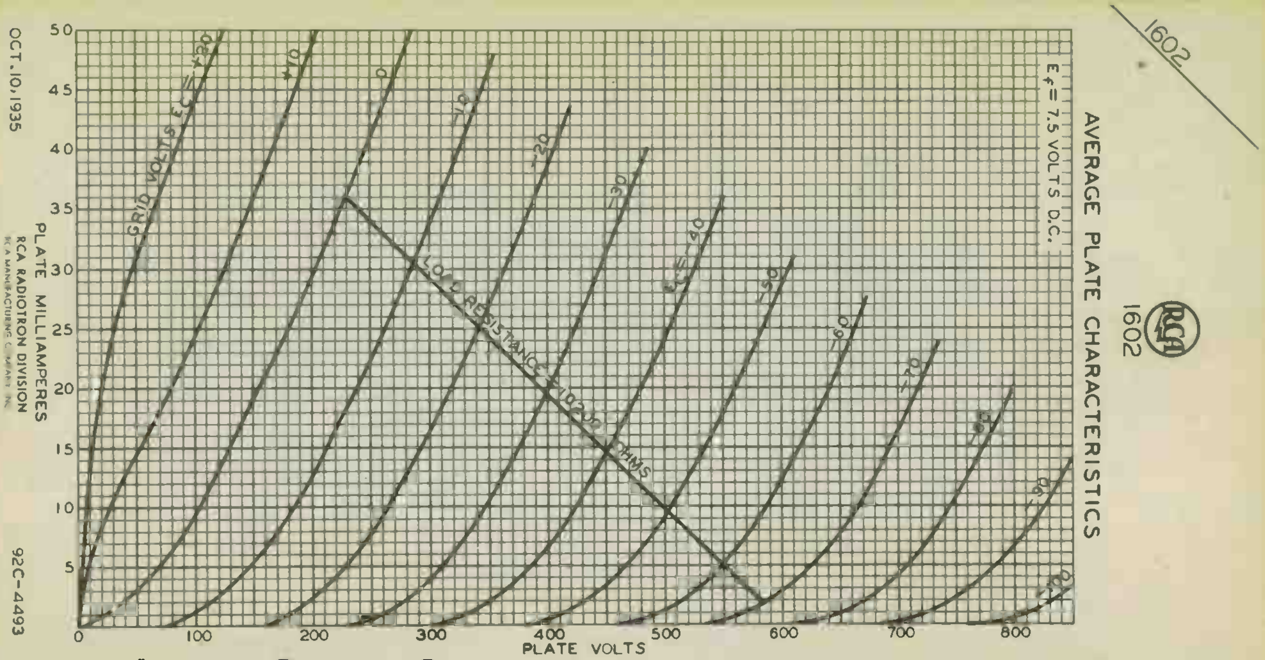
** Subject to wide variations as explained on sheet TRANS. TUBE RATINGS.

For use of the 1602 at the higher frequencies, refer to sheet TRANS. TUBE RATINGS vs Frequency.

OUTLINE DIMENSIONS, TUBE SYMBOL, and SOCKET CONNECTIONS for the 1602 are the same as for the 841.

AVERAGE CHARACTERISTICS





AVERAGE PLATE CHARACTERISTICS
1602
RCA
E_f = 7.5 VOLTS D.C.
GRID VOLTS E_c = +20
+10
0
-10
-20
-30
E_c = -40
-50
-60
-70
-90
-100
LOAD RESISTANCE = 10200 OHMS
PLATE MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
600
700
800
5
10
15
20
25
30
35
40
45
50
OCT. 10, 1935
RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.
92C-4493

RCA

1603

TRIPLE-GRID DETECTOR AMPLIFIER

For applications critical as to microphonics, noise, and hum

Heater ■	Coated Unipotential Cathode	
Voltage	6.3	a-c or d-c volts
Current	0.3	amp.
Direct Interelectrode Capacitances: ▲		
Triode Connection (Approx.) - Grids #2 & #3 tied to plate		
Grid to Plate	2.0	μμf
Grid to Cathode	3.0	μμf
Plate to Cathode	10.5	μμf
Pentode Connection		
Grid to Plate	0.007 max.	μμf
Input	4.6	μμf
Output	6.5	μμf
Overall Length		4-11/16" to 4-15/16"
Seated Height		4-1/16" to 4-5/16"
Maximum Diameter		1-9/16"
Bulb		ST-12
Cap		Small Metal
Base		Small 6-Pin
Pin 1 - Heater		Pin 5 - Cathode
Pin 2 - Plate		Pin 6 - Heater
Pin 3 - Screen		Cap - Grid
Pin 4 - Suppressor		
Mounting Position		Any

BOTTOM VIEW

SINGLE-TUBE AMPLIFIER

Plate Voltage	250 max.	volts
Screen Voltage	180 max.	volts

Typical Operation and Characteristics - Class A_1 Amplifier:

	Pentode Connection			*Triode Connection*		
Plate	100	250	250	180	250	volts
Screen	100	100	180	-	-	volts
Grid	-3	-3	-3	-4.3	-8	volts
Suppressor	Tied to cath. at socket					
Amp. Fact.	-	-	-	20●	20●	
Plate Res.	1.0	□	0.9	0.011	0.0105	megohm
Transcond.	1185	1225	2000	1800	1900	μmhos
Grid Bias #	-7	-7	-	-	-	volts
Plate Cur.	2	2	8.3	5.3	6.5	ma.
Screen Cur.	0.5	0.5	2.1	-	-	ma.

□ Greater than 1.5. ● Approx. # Approx., for cath. cur. cut-off.

PUSH-PULL AMPLIFIER - Tricde Connection

Typical Operation - Class A_1 Amplifier:
Unless otherwise specified, values are for 2 tubes

Plate	90	volts
Grid	-2.5	volts
Cathode Resistor	625	ohms
Plate Current	4.0	ma.
Load Res. (plate to plate)	10000	ohms
Power Output	40	mw

DETECTOR

Typical Operation as Biased Detector:

Plate Supply◊	100	100	250	250	volts
Screen	12	50	50	100	volts
Grid	-1.16	-1.83	-1.95	-4.3	volts
Cathode Res.	18000	10000	3000	10000	ohms
Suppressor	Connected to cathode at socket				
Cath. Cur. (no sig.)	0.063	0.133	0.65	0.43	ma.
Plate Resistor *	1.00	0.75	0.25	0.50	megohm
Blocking Condenser	0.01	0.01	0.03	0.03	μf
Grid Resistor *	1.00	0.50	0.25	0.25	megohm
R-F Signal (RMS)••	1.05	1.60	1.18	1.37	volts

■ In circuits where the cathode is not directly connected to the heater, the potential difference between heater and cathode should be kept as low as possible.

▲ The internal shield in the dome of the 1603 is connected to the cathode within the tube.

○ With close-fitting shield connected to cathode.

◊ Voltage at plate will be "Plate Supply" voltage minus voltage drop in plate resistor caused by plate current.

* For the following amplifier tube.

•• See next page.

→ Indicates a change.

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY INC

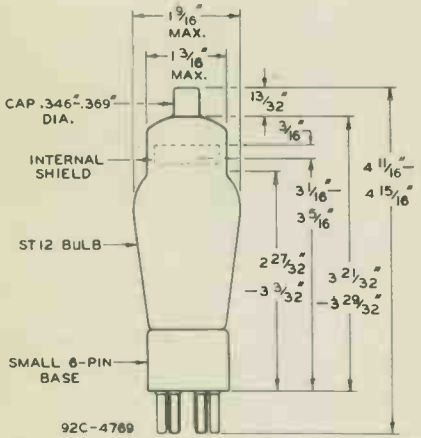
1603

TRIPLE-GRID DETECTOR AMPLIFIER

(continued from preceding page)

** With these signal values modulated 20%, the voltage output under each set of conditions is 17 peak volts at the grid of the following amplifier. This value is sufficient to insure full audio output from a 42 (for 6.3-volt operation) or a 2A5 (for 2.5-volt operation) under 250-volt plate conditions.

For Curves, refer to types 6J7 and 57. For additional Data, refer to RESISTANCE-COUPLED AMPLIFIER CHART.



RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY INC

1609

AMPLIFIER PENTODE

For applications critical as to microphonics

Filament	Coated	
Voltage	1.1	d-c volts
Current	0.25	amp.
Direct Interelectrode Capacitances:°		
Grid to Plate	1.0	μμf
Input	7	μμf
Output	7	μμf
Maximum Overall Length		4-3/16"
Maximum Seated Height		3-9/16"
Maximum Diameter		1-9/16"
Bulb		ST-12
Base		Small 5-Pin
Pin 1 - Filament +		Pin 4 - Screen
Pin 2 - Plate		Pin 5 - Filament -
Pin 3 - Grid		
Mounting Position		Any

BOTTOM VIEW

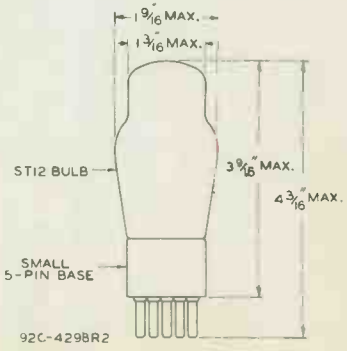
Maximum Ratings Are Absolute Values

A-F AMPLIFIER

Plate Voltage	135 max.	volts
Screen Voltage	67.5 max.	volts
Typical Operation and Characteristics - Class A_1 Amplifier:		
Plate	135	volts
Screen	67.5	volts
Grid *	-1.5	volts
Plate Res.	0.4 approx.	megohm
Transcond.	725	μmhos
Plate Cur.	2.5	ma.
Screen Cur.	0.65	ma.

° Without shield.

* The d-c resistance in the grid circuit of the 1609 should not exceed 0.5 megohm for fixed-bias conditions.



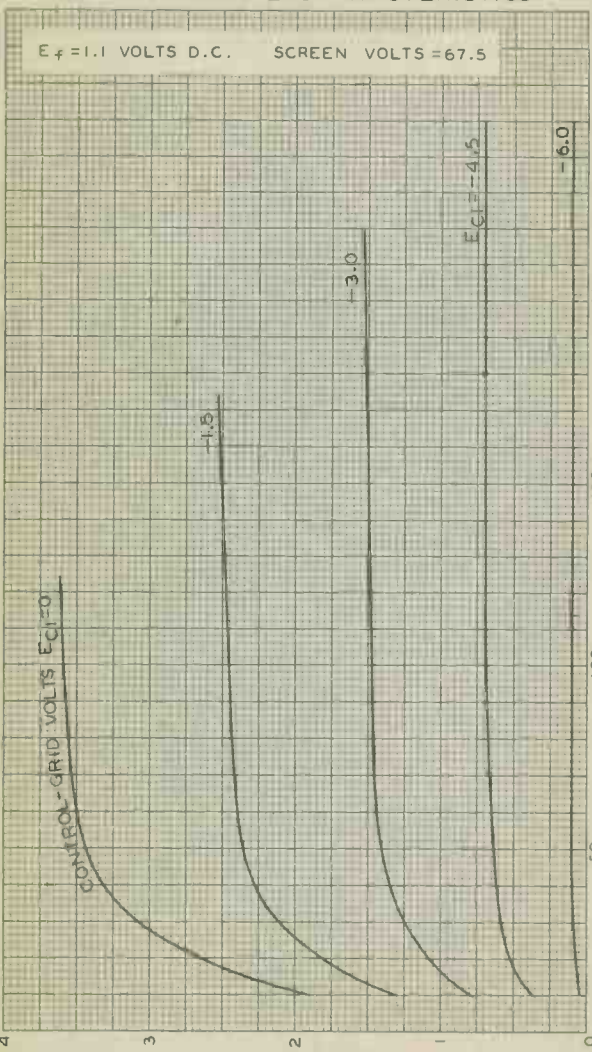
→← Indicates a change.

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

1609

1609

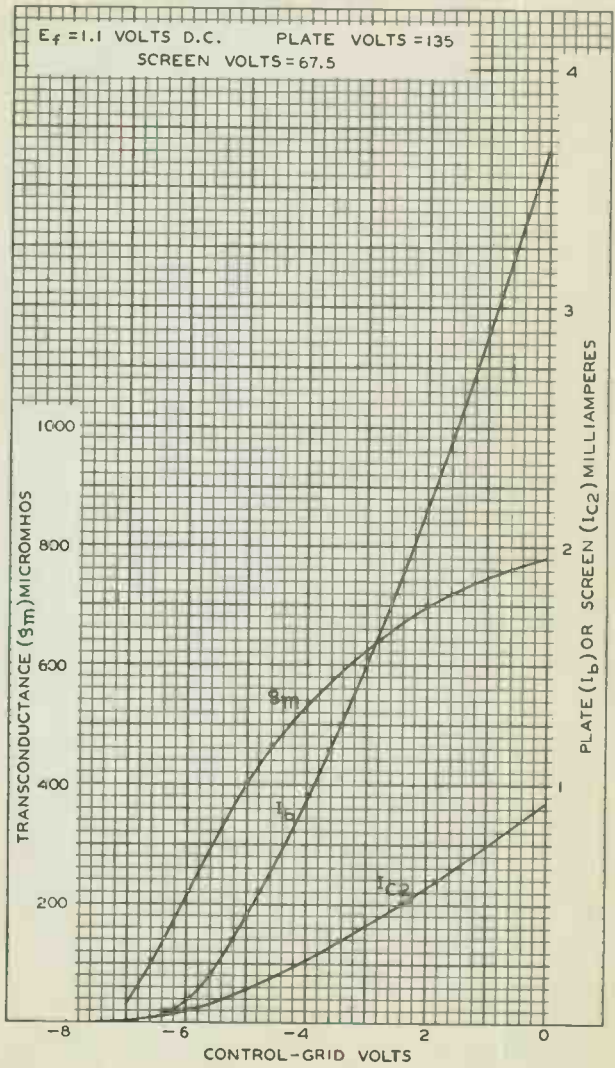
AVERAGE PLATE CHARACTERISTICS



JAN. 26, 1937 RCA VICTOR DIVISION 92C-4721

1609

AVERAGE CHARACTERISTICS



JAN. 12, 1942

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92C-6355

1611

1611

POWER AMPLIFIER PENTODE

The 1611 is a power pentode intended for use as a relay tube in equipment on ships for automatically announcing SOS signals. To meet the special requirements of such service, the 1611 features an i_p-e_g characteristic having suitable slope and minimized variation between tubes. Physical characteristics of the 1611 are the same as those of Type 6F6.

RCA-1611 is available only through Radiomarine Corporation of America, 75 Varick Street, New York, N. Y.

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

1612

PENTAGRID AMPLIFIER

For applications critical as to microphonics

Heater ■	Coated Unipotential Cathode	
Voltage	6.3	a-c or d-c volts
Current	0.3	amp.
Direct Interelectrode Capacitances: ○		
Grid #1 to Grid #3	0.20 max.	μμf
Grid #1 to Plate	0.001 max.	μμf
Grid #3 to Plate	0.10 max.	μμf
Grid #1 to All Other Electrodes	7.5	μμf
Grid #3 to All Other Electrodes	10	μμf
Plate to All Other Electrodes	11	μμf
Maximum Overall Length		3-1/8"
Maximum Seated Height		2-9/16"
Maximum Diameter		1-5/16"
Bulb		Metal Shell, MT-8
Cap		Miniature
Base		Small Wafer Octal 7-Pin
Pin 1 - Shell		Pin 5 - Grid #3
Pin 2 - Heater		Pin 7 - Heater
Pin 3 - Plate		Pin 8 - Cathode
Pin 4 - Grids #2 & #4		Cap - Grid #1
Mounting Position		Any

Maximum Ratings Are Design-Center Values

AMPLIFIER

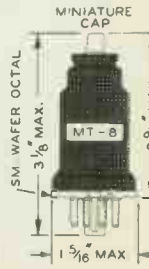
Plate Voltage	250 max.	volts
Screen Voltage	100 max.	volts
Plate Dissipation	1.5 max.	watts ←
Screen Dissipation	1.0 max.	watt ←
Typical Operation and Characteristics - Class A_1 Amplifier:		
Plate	250	volts
Screen (Grids #2 & #4)	100	volts
Control Grid (Grid #1)	-3	volts
Control Grid (Grid #3)	-3	volts
Plate Res.	0.6	megohm ←
Transcond. (Grid #1 - Plate)	1100	umhos
Transcond. (Grid #1 - Plate)*	5 approx.	umhos
Plate Cur.	5.3	ma.
Screen Cur.	6.5	ma.

■ In circuits where the cathode is not directly connected to the heater, the potential difference between heater and cathode should be kept as low as possible.

○ With shell connected to cathode.

* With Grid #1 bias = -15 volts; Grid #3 bias = -15 volts.

Curves under type 6L7 also apply to the 1612.



← Indicates a change.

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

1620

1620

TRIPLE-GRID DETECTOR AMPLIFIER

For applications critical as to microphonics

Heater■	Coated Unipotential Cathode	
Voltage	6.3	a-c or d-c volts
Current	0.3	amp.
Direct Interelectrode Capacitances:○		
Pentode Connection		
Grid to Plate	0.005 max.	μμf
Input	7.0	μμf
Output	12.0	μμf
Maximum Overall Length		3-1/8"
Maximum Seated Height		2-9/16"
Maximum Diameter		1-5/16"
Bulb		Metal Shell, MT-8
Cap		Miniature
Base		Small Wafer Octal 7-Pin
Pin 1 - Shell		Pin 5 - Suppressor
Pin 2 - Heater		Pin 7 - Heater
Pin 3 - Plate		Pin 8 - Cathode
Pin 4 - Screen		Cap - Grid
Mounting Position	BOTTOM VIEW	Any

Maximum Ratings Are Design-Center Values

AMPLIFIER - Pentode Connection

Plate Voltage	250 max.	volts
Screen Voltage	100 max.	volts
Typical Operation and Characteristics - Class A_1 Amplifier:		
Plate	100	250 volts
Screen	100	100 volts
Grid #	-3	-3 volts
Suppressor	Connected to cathode at socket	
Plate Res.	1.0	▲ meg ohm
Transcond.	1185	1225 μmhos
Grid Bias for cathode current cut-off	-7	-7 volts
Plate Cur.	2.0	2.0 ma.
Screen Cur.	0.5	0.5 ma.

AMPLIFIER - Triode Connection○○

Plate Voltage	250 max.	volts
Typical Operation and Characteristics - Class A_1 Amplifier:		
Plate	180	250 volts
Grid #	-5.3	-8 volts
Amp. Fact.	20	20
Plate Res.	11000	10500 ohms
Transcond.	1800	1900 μmhos
Plate Cur.	5.3	6.5 ma.

■ For cathode-bias operation of the 1620 a minimum cathode-resistor by-pass condenser of 25 μf is recommended to minimize hum, particularly in circuits where the 1620 is followed by high-gain stages. When a 25 μf condenser or larger is used, the voltage difference between heater and cathode is not critical, but it should be kept as low as possible. If less than a 25 μf condenser is used, positive or negative biasing of the heater with respect to the cathode is required, but the bias value chosen for minimum hum should be within the range of +5 to +50 volts or -5 to -50 volts.

○ With shell connected to cathode.

Under maximum rated conditions, the d-c resistance in the grid circuit should not exceed 1.0 megohm.

▲ Greater than 1.0 megohm.

○○ Screen and suppressor tied to plate.

← Indicates a change.

OUTLINE DIMENSIONS for the 1620 are the same as for 1612.

Curves under Type 6J7 also apply to the 1620.

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

1621

POWER AMPLIFIER PENTODE

For applications requiring continuity of service

Heater ■	Coated Unipotential Cathode	
Voltage	6.3	a-c or d-c volts
Current	0.7	amp.
Direct Interelectrode Capacitances (Approx.):◇		
Grid to Plate	0.20	μμf
Input	7.5	μμf
Output	11.5	μμf
Maximum Overall Length		3-1/4"
Maximum Seated Height		2-11/16"
Maximum Diameter		1-5/16"
Bulb		Metal Shell, MT-8
Base		Small Wafer Octal 7-Pin
Pin 1 - Shell		Pin 5 - Grid
Pin 2 - Heater		Pin 7 - Heater
Pin 3 - Plate		Pin 8 - Cathode
Pin 4 - Screen		
Mounting Position	BOTTOM VIEW	Any

Maximum Ratings Are Design-Center Values

PUSH-PULL AMPLIFIER - Triode Connection†

Recommended with Cathode-Bias Operation only.

Plate Voltage	300 max.	volts
Plate Dissipation	8.3 max.	watts

Typical Operation - Class A_1 Amplifier:

Unless otherwise specified, values are for 2 tubes

Plate Supply *	327.5	volts
Cathode Resistor ▲	500	ohms
Peak A-F Grid-to-Grid Voltage	54	volts
Zero-Sig. Plate Current	55	ma.
Max.-Sig. Plate Current	59	ma.
Load Resistance (plate-to-plate)	5000	ohms
Total Harmonic Distortion	1	%
Power Output	2	watts

* Actual voltage between cathode and plate will be plate-supply voltage minus drop in cathode resistor.

▲ Type of input coupling used should not introduce too much resistance in the grid circuit. Transformer- or impedance-coupling devices are recommended. The grid circuit may have a resistance as high as, but not greater than, 0.5 megohm provided the heater voltage is not allowed to rise more than 10% above rated value under any condition of operation.

PUSH-PULL AMPLIFIER - Pentode Connection

Plate Voltage	300 max.	volts
Screen Voltage	300 max.	volts
Plate Dissipation	7.9 max.	watts
Screen Input	1.9 max.	watts

Typical Operation - Class A_1 Amplifier:

Unless otherwise specified, values are for 2 tubes

Plate	300	volts
Screen	300	volts
D-C Grid Voltage #	-30	volts
Peak A-F Grid-to-Grid Voltage	60	volts
Zero-Sig. Plate Current	38	ma.
Max.-Sig. Plate Current	69	ma.

■, †, ◇: See next page. ← Indicates a change.

1621

POWER AMPLIFIER PENTODE

(continued from preceding page)

Zero-Sig. Screen Current	[illegible]	ma.
Max.-Sig. Screen Current	13	ma.
Load Resistance (plate-to-plate)	4000	ohms
Total Harmonic Distortion	3	%
Power Output	[illegible]	watts

■ In circuits where the cathode is not directly connected to the heater, the potential difference between heater and cathode should be kept as low as possible.

▸ With shell connected to cathode.

† Screen connected to plate.

Type of input coupling used should not introduce too much resistance in the grid circuit. Transformer- or impedance-coupling devices are recommended. When the grid circuit has a resistance not higher than 0.05 megohm, fixed bias may be used; for higher values, cathode bias is required. With cathode bias, the grid circuit may have a resistance as high as, but not greater than, 0.5 megohm provided the heater voltage is not allowed to rise more than 10% above rated value under any conditions of operation.

OUTLINE DIMENSIONS for the 1621 are the same as those for Type 6F6.

Curves under Type 6F6 also apply to the 1621.

1622

BEAM POWER AMPLIFIER

For applications requiring continuity of service

Heater ■	Coated Unipotential Cathode	
Voltage	6.3	a-c or d-c volts
Current	0.9	amp.
Direct Interelectrode Capacitances (approx.): ○		
Grid to Plate	0.4	μμf
Input	10	μμf
Output	12	μμf
Maximum Overall Length		4-5/16"
Maximum Seated Height		3-3/4"
Maximum Diameter		1-9/16" ± 1/16" →
Bulb		Metal Shell, MT-10
Base		Small Wafer Octal 7-Pin
Pin 1 - Shell		Pin 5 - Grid
Pin 2 - Heater		Pin 7 - Heater
Pin 3 - Plate		Pin 8 - Cathode
Pin 4 - Screen		
Mounting Position	BOTTOM VIEW (7AC)	Any

Maximum Ratings Are Design-Center Values

PUSH-PULL AMPLIFIER

Plate Voltage	300 max.	volts
Screen Voltage	250 max.	volts
Plate Dissipation	13.2 max.	watts
Screen Dissipation	1.4 max.	watts
Typical Operation - Class A_1 Amplifier:		
Unless otherwise specified, values are for 2 tubes		
Plate Voltage	300	volts
Screen Voltage	250	volts
D-C Grid Voltage #	-20	volts
Peak A-F Grid-to-Grid Voltage	40	volts
Zero-Sig. Plate Current	86	ma.
Max.-Sig. Plate Current	125	ma.
Zero-Sig. Screen Current	4	ma.
Max.-Sig. Screen Current	10.5	ma.
Load Resistance (plate to plate)	4000	ohms
Total Harmonic Distortion	1	%
Power Output	10	watts

■ The heater voltage should never fluctuate so that it exceeds 7 volts. The potential difference between heater and cathode should be kept as low as possible.

\# The type of input coupling used should not introduce too much resistance in the grid circuit. Transformer- or impedance-coupling devices are recommended. When the grid circuit has a resistance not higher than 0.1 megohm, fixed bias may be used; for higher values, cathode bias is required. With cathode bias, the grid circuit may have a resistance not to exceed 0.5 megohm, provided the heater voltage is not allowed to rise more than 10% above the rated value under any condition of operation.

○ With shell connected to cathode.

Curves under Type 6L6 also apply to the 1622 within the limitations of its maximum ratings.

→ Indicates a change.

1629

ELECTRON-RAY TUBE

INDICATOR TYPE WITH TRIODE UNIT

Heater	Coated Unipotential Cathode	
Voltage	12.6	a-c or d-c volts
Current	0.15	amp.
Overall Length		3-15/16" ± 3/16"
Seated Height		3-3/8" ± 3/16" ←
Maximum Diameter		1-3/16"
Bulb		T-9
Base		Small Shell Octal 7-Pin
Pin 1 - No Connection		Pin 5 - Grid
Pin 2 - Heater		Pin 7 - Heater
Pin 3 - Plate		Pin 8 - Cathode
Pin 4 - Target		
Mounting Position		Any▲ ←

BOTTOM VIEW (7AL)

Maximum and Minimum Ratings Are Design-Center Values

INDICATOR SERVICE

Plate-Supply Voltage		250 max.	volts
Target Voltage		250 max. 125 min.	volts ←
D-C Heater-Cathode Potential		90 max.	volts ←
Typical Operation:			←
Plate and Target Supply Voltage	200	250	volts
Series Triode Plate Resistor□	1	1	megohm
Target Current † ◊	3	4	ma.
Triode-Plate Current◊	0.19	0.24	ma.
Triode-Grid Voltage (Approx.)			
For shadow angle of 0°	-6.5	-8.0	volts
For shadow angle of 90°	0	0	volts

□ Designated as R in the circuit diagram under Type 6E5, in the Receiving Tube Section.

† Subject to wide variation.

◊ For triode-grid bias of 0 volts.

▲ The plane of the ray-control electrode passes through the tube axis and base key.

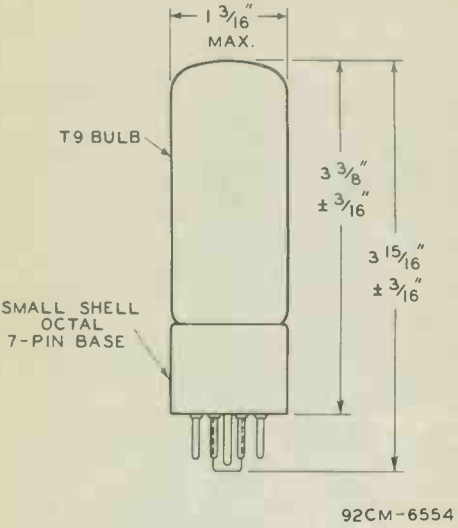
Curves for Type 1629 are the same as for the 6E5 in the Receiving-Tube Section.

← Indicates a change.

1629

1629

ELECTRON-RAY TUBE



1631

BEAM POWER AMPLIFIER

For applications critical as to uniformity of characteristics

Heater	Coated Unipotential Cathode	
Voltage	12.6	a-c or d-c volts
Current	0.45	amp.
Plate Dissipation		16 max. watts

Other ratings, characteristics, dimensions, and socket connections for the 1631 are the same as those for Type 6L6. Typical operating data for the 6L6 also apply to the 1631 within the limitation of the maximum plate-dissipation rating.

1632

BEAM POWER AMPLIFIER

For applications critical as to uniformity of characteristics

Heater	Coated Unipotential Cathode	
Voltage	12.6	a-c or d-c volts
Current	0.6	amp.
Plate Voltage		117 max. volts
Screen Voltage		117 max. volts
Plate Dissipation		5.5 max. watts

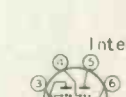
Dimensions and socket connections for the 1632 are the same as for Type 25L6. Typical operating data for the 1632 are the same within its plate voltage and dissipation limitations as for the 25L6.

1633

TWIN-TRIODE AMPLIFIER

For applications critical as to matching of the two triode units

Heater	Coated Unipotential Cathode		
Voltage	25		a-c or d-c volts
Current	0.15		amp.
Direct Interelectrode Capacitances (Approx.):[o]			
	Triode Unit T_1	*Triode Unit T_2*	
Grid to Plate	3.6	3.6	μμf
Grid to Cathode	3.0	2.8	μμf
Plate to Cathode	0.8	1.2	μμf
Maximum Overall Length			3-5/16"
Maximum Seated Height			2-3/4"
Maximum Diameter			1-5/16"
Bulb			T-9
Base			Intermediate Shell Octal 8-Pin
Pin 1 - Grid T_2		Pin 5 - Plate T_1	
Pin 2 - Plate T_2		Pin 6 - Cathode T_1	
Pin 3 - Cathode T_2		Pin 7 - Heater	
Pin 4 - Grid T_1		Pin 8 - Heater	
Mounting Position			Any



BOTTOM VIEW (8BD)

For convenience, one triode unit is identified as T_1; the other as T_2.

o See next page.

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

1633

TWIN-TRIODE AMPLIFIER

(continued from preceding page)

Maximum And Minimum Ratings Are Design-Center Values

AMPLIFIER - Each Unit

Plate Voltage	300 max.	volts
Grid Voltage	0 min.	volts
Cathode Current	20 max.	ma.
Plate Dissipation	2.5 max.	watts
D-C Heater-Cathode Potential	90 max.	volts
Characteristics - Class A_1 Amplifier:		
Plate Voltage	250	volts
Grid Voltage[#]	-8	volts
Amplification Factor	18	
Plate Resistance	6900	ohms
Transconductance	2600	μmhos
Plate Current	11.5	ma.

[o] with no external shield.

[#] The d-c resistance in the grid circuit should not exceed 1.0 megohm under maximum rated conditions per unit.

Curves for Type 1633 are the same as for the 6J6, and 6SN7-GT.

1634

TWIN-TRIODE AMPLIFIER

For applications critical as to matching of the two triode units

Maximum ratings, characteristics, dimensions, and socket connections for the 1634 are the same as for Type 12SC7.

1635

HIGH-MU TWIN POWER TRIODE

GENERAL DATA

Electrical:

Heater for Unipotential Cathode:		
Voltage	6.3	ac or oc volts
Current	0.6	amp

Mechanical:

Mounting Position	Any
Maximum Overall Length	3-5/16"
Maximum Seated Length	2-3/4"
Maximum Diameter	1-5/16"
Bulb	T-9
Base	Intermediate-Shell Octal 8-Pin
Basing Designation for BOTTOM VIEW	G-8B

Pin 1 – No Connection
Pin 2 – Heater
Pin 3 – Plate of Unit No.2
Pin 4 – Grid of Unit No.2

Pin 5 – Grid of Unit No.1
Pin 6 – Plate of Unit No.1
Pin 7 – Heater
Pin 8 – Cathode

AF POWER AMPLIFIER – Class B

Maximum Ratings, *Design-Center Values*:

DC PLATE VOLTAGE	300 max.	volts
PEAK PLATE CURRENT (per plate)	90 max.	ma.
PLATE DISSIPATION (per plate)	3 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts

Typical Operation:

Values are for 2 units unless otherwise specified

DC Plate Voltage	300	300	volts
DC Grid Voltage	0	0	volts
Peak AF Grid-to-Grid Voltage	70	108•	volts
Zero-Signal DC Plate Current	6.6	6.6	ma.
Max.-Signal DC Plate Current	54	54	ma.
Peak Grid Current (per unit)	38	39	ma.
Plate-Supply Impedance	0	1000•	ohms
Effective Load Resistance (plate-to-plate)	12000	12000	ohms
Effective Grid-Circuit Impedance (per unit)	0	516••	ohms
Total Harmonic Distortion	4	5	%
Max.-Signal Power Output	10.4	10.4	watts

•, ••: See next page.

←Indicates a change.

1635

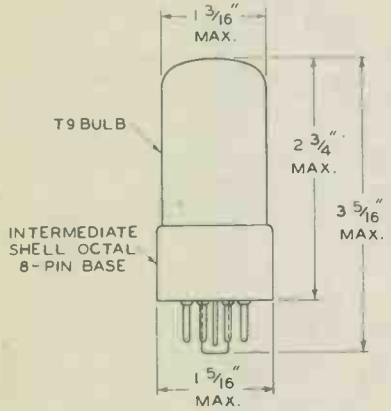
1635

HIGH-MU TWIN POWER TRIODE

• Includes peak voltage drop through the grid-circuit impedance.

• Practical design value.

•• At 400 cycles for class B stage in which the effective resistance per grid circuit is 500 ohms, and the leakage reactance of the coupling transformer is 50 millihenrys. The driver stage should be capable of supplying the grids of the class B stage with the specified values of low distortion.

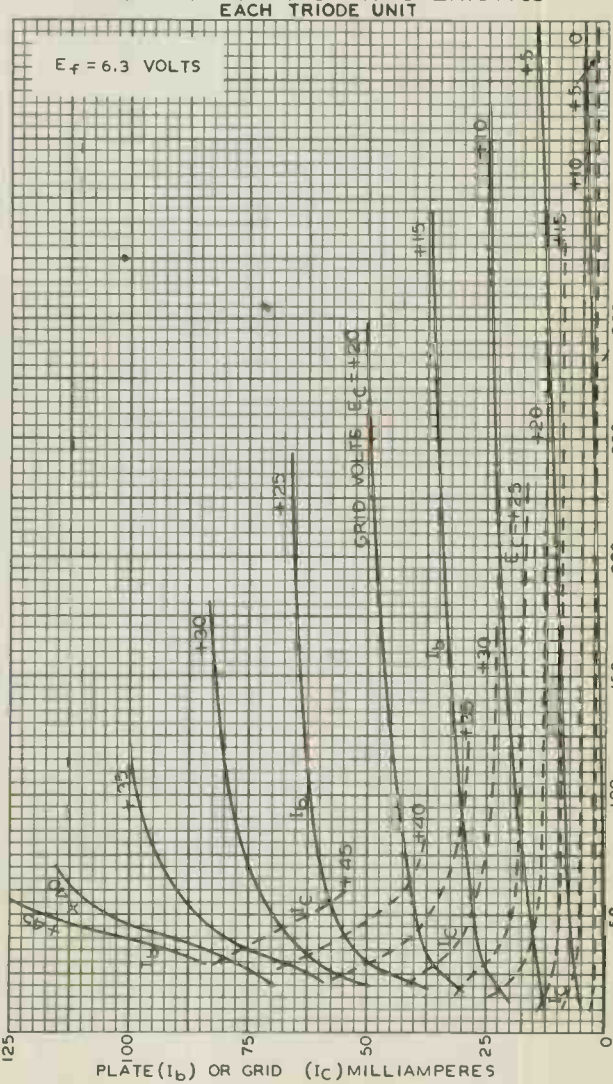


92C-6393

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

1635

AVERAGE PLATE CHARACTERISTICS
EACH TRIODE UNIT



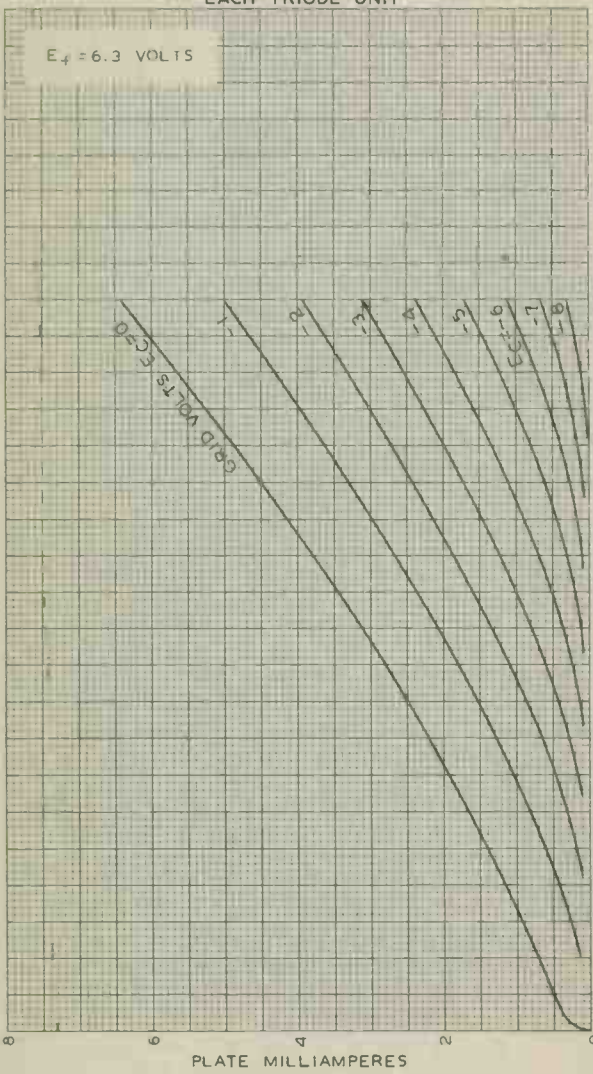
FEB. 26, 1942

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92C-6358

1635

1635
AVERAGE PLATE CHARACTERISTICS
EACH TRIODE UNIT



FEB. 27, 1942 RCA RADIOTRON DIVISION 92C-6369

1644

TWIN-PENTODE POWER AMPLIFIER

For applications critical as to matching of the pentode units

Maximum Ratings,
Characteristics, Curves,
Dimensions, and Socket Connections
for Type 1644
are the same as those for Type 12L8-GT.

1654
HALF-WAVE VACUUM RECTIFIER

MINIATURE TYPE

GENERAL DATA

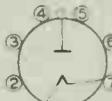
Electrical:

Filament, Coated:		
Voltage	1.4	ac or dc volts
Current	0.05	amp
Direct Interelectrode Capacitance (Approx.):[o]		
Plate to Filament	1.4	μμf

[o] with no external shield.

Mechanical:

Mounting Position	Any
Maximum Overall Length	2-7/16"
Maximum Seated Length	2-3/16"
Maximum Diameter	3/4"
Bulb	T-5-1/2
Base	Small-Button Miniature 7-Pin
Basing Designation for BOTTOM VIEW	2Z



Pin 1 – Filament –
Pin 2 – Internal Con. Do Not Use
Pin 3 – Internal Con. Do Not Use
Pin 4 – No Connection
Pin 5 – No Connection
Pin 6 – Internal Con. Do Not Use
Pin 7 – Filament + } Plate
Bulb Terminal } Plate

HALF-WAVE RECTIFIER

Maximum Ratings, *Design-Center Values*:[•]

PEAK INVERSE PLATE VOLTAGE	4300 max.	volts ←
PEAK PLATE CURRENT[■]	6 max.	ma
AVERAGE PLATE CURRENT	1 max.	ma

Typical Operation:

AC Plate-Supply Voltage	1500	volts ←
Filter-Input Capacitor	0.025	μf
Total Effective Plate-Supply Impedance	150000	ohms ←
DC Output Current	1	ma
DC Output Voltage (At Input to Filter)[▲]	1230	volts ←

Circuit Values:

A plate-supply impedance of 150000 ohms is required in order that the "hot-switching" current will not exceed the permissible value of 15 ma. under conditions of normal line-voltage fluctuation. For plate-supply voltages lower than 1500 volts, the plate-supply impedance may be decreased provided the resultant peak-current rating of 6 ma. and the "hot-switching" current of 15 ma. are not exceeded.

•,■,▲ See next page.
← Indicates a change.

1654

1654
HALF-WAVE VACUUM RECTIFIER

- These ratings apply to the 1654 when it is operated from a power supply having a frequency up to 500 cycles per second. If a contemplated application involves higher supply frequencies, please write, stating the proposed operating frequency, to Commercial Engineering, RCA, Harrison, N. J., as to the required reduction in ratings.
- → A peak value of 15 ma. for 0.1 second is permitted under conditions of "hot-switching", i.e., switching the plate circuit "on" while the filament is hot.

* Values are approximate. → Indicates a change.

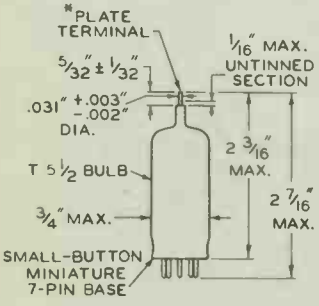
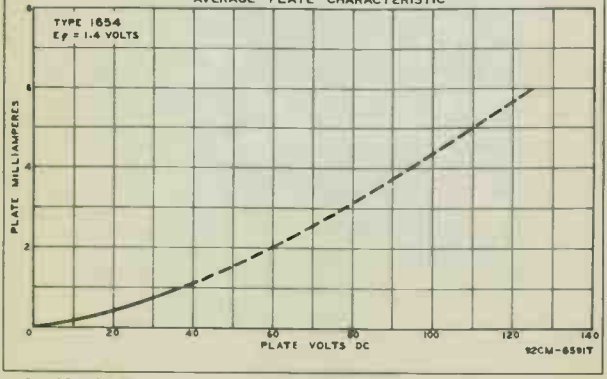


*PLATE TERMINAL AT TIP MAY BE ECCENTRIC WITH RESPECT TO BASE AXIS BY 1/8" MAX.

AVERAGE PLATE CHARACTERISTIC



RCA

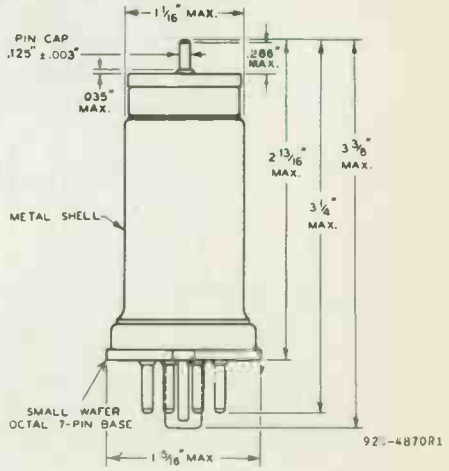
1851

TELEVISION AMPLIFIER PENTODE

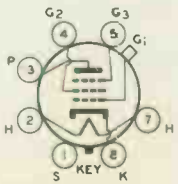
Heater ▲	Coated Unipotential Cathode	
Voltage	6.3	a-c or d-c volts
Current	0.45	amp.
Direct Interelectrode Capacitances: °		
Grid to Plate	0.02 max.	μμf
Input	11.5	μμf
Output	5.2	μμf
Maximum Overall Length		3-3/8"
Maximum Diameter		1-5/16"
Bulb		Metal Shell, MT-8
Cap		Pin Cap
Base		Small Wafer Octal 7-Pin

° with shell connected to cathode.

For additional data and curves, refer to Type 1852. The 1851 and 1852 are identical electrically except for capacitances.



BOTTOM VIEW OF SOCKET CONNECTIONS



G_1 = GRID
G_2 = SCREEN
G_3 = SUPPRESSOR
H = HEATER
K = CATHODE
P = PLATE
S = SHELL

MOUNTING POSITION

VERTICAL: Base up or down.
HORIZONTAL: Permissible with Pins #2 & #7 in vertical plane.

AVERAGE PLATE CHARACTERISTICS

RCA
1851

$E_f = 6.3$ VOLTS CONTROL-GRID VOLTS = 0

PLATE VOLTS

100 200 300 400 500

PLATE MILLIAMPERES

0 10 20 30 40

SCREEN VOLTS E_{c2}=100

E_{c2}=150

150

125

100

75

50

FEB. 14, 1938

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY INC.

92C-4877

1851

1945

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. -15 min.	volts 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

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.

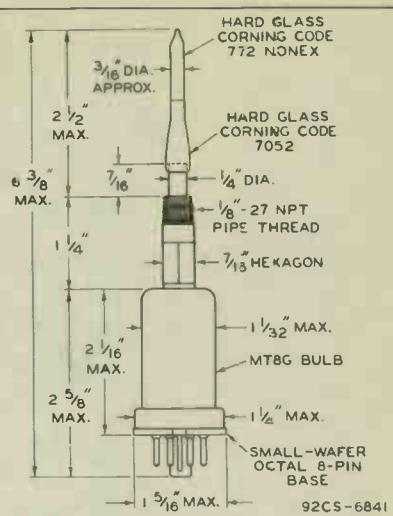
Suitable support should be provided for the 1945. In a glass system, it should be supported by a suitable clamp encircling the metal shell. The clamp should be lined with an asbestos pad so that the clamp does not place a strain on the welds. In a metal system, the 1945 can usually be supported by the pipe coupling.

For safety reasons, it is advisable to have the metal shell of the 1945 at ground potential (positive polarity).

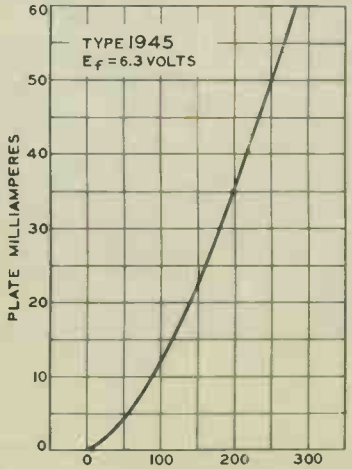
RCA

1945

VACUUM-GAUGE TUBE



AVERAGE PLATE CHARACTERISTIC



1946
VACUUM-GAUGE TUBE

THERMOCOUPLE TYPE

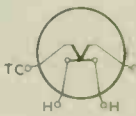
DATA

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)		5-1/4"
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:

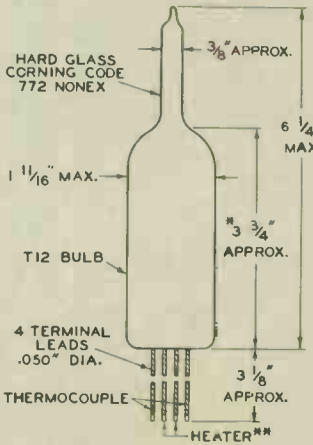
H - Heater



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

1946

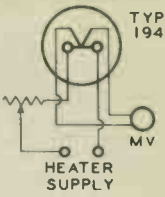
RCA

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



GAS PRESSURE – MM OF Hg

1.0
0.1
0.01
0.001

THERMOCOUPLE EMF – MILLIVOLTS

0 2 4 6 8 10 12

MAR. 11, 1947

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6852

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

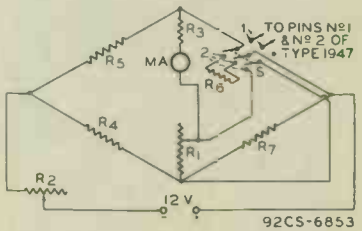
Maximum Ratings, *Absolute Values*:

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

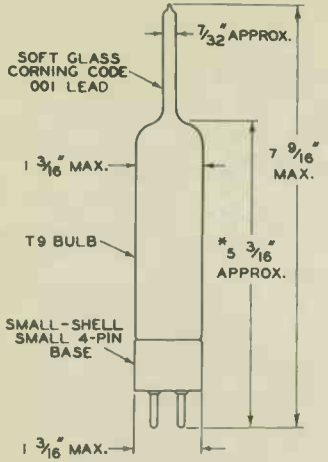
STEP 1: With switch S in position 2, adjust R2 so that meter reads 2.5 milliamperes.

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 adjustment and with switch S in position 1, proceed to use gauge.

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.

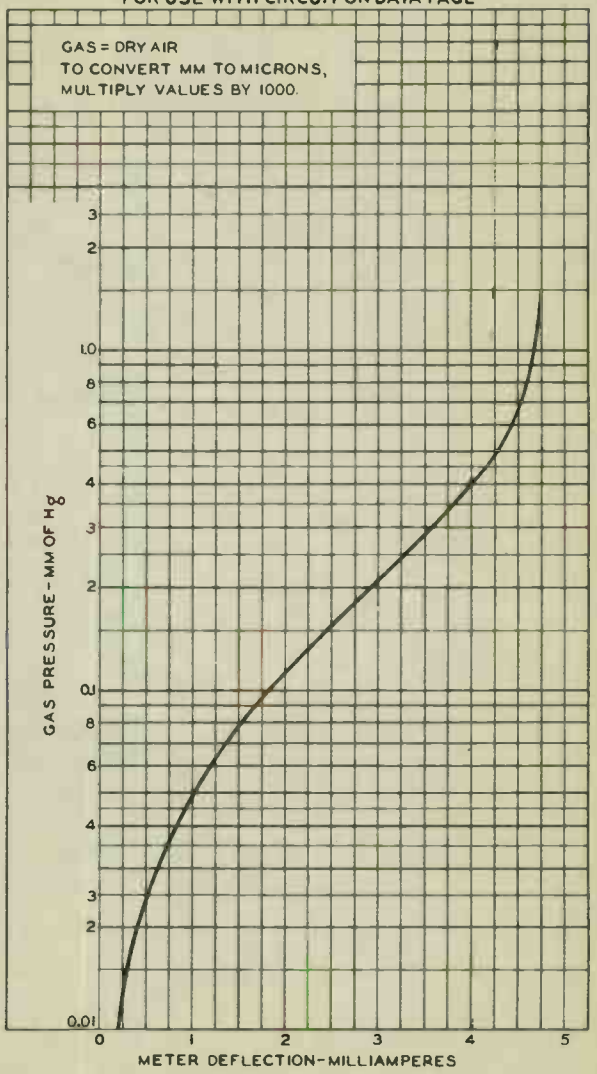
92CS-6816

RCA

1947

CALIBRATION CURVE

FOR USE WITH CIRCUIT ON DATA PAGE



MARCH 10, 1947

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6849

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

1949

RCA

1949

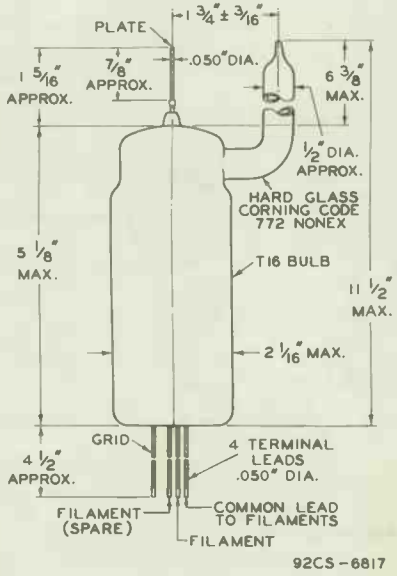
VACUUM-GAUGE TUBE

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.

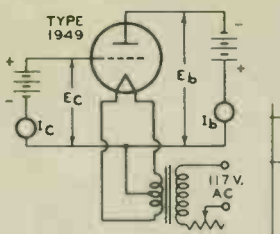


92CS-6817

RCA

1949

CALIBRATION CURVES



GAS = DRY AIR
GRID MILLIAMPERES(I_c) = 10
PLATE VOLTS(E_b) = −22.5
TO CONVERT MM TO MICRONS,
MULTIPLY VALUES BY 1000

GAS PRESSURE — MM OF Hg

GRID VOLTS (E_c) = +80, +110, +160

PLATE MICROAMPERES (I_b)

MAR. 11, 1947

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6851

1950

VACUUM-GAUGE TUBE

SOFT-GLASS BULB, IONIZATION TYPE

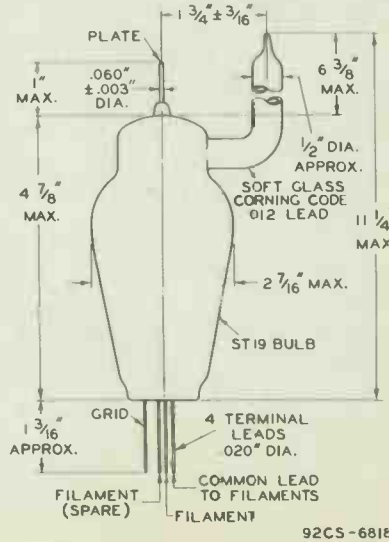
DATA

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.



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			

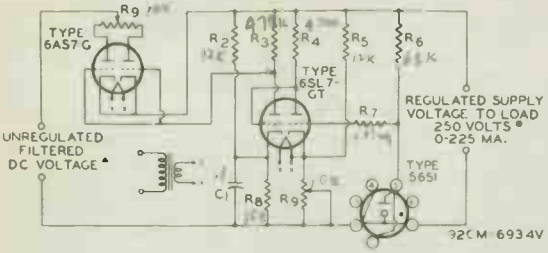
* A supply voltage of not less than this value should be provided to insure "starting" throughout tube life.

□ 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.

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, 15000 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.

6264-A

Medium-Mu Triode

GLASS-METAL PENCIL TYPE
FAST WARM-UP TIME — INTEGRAL PLATE RADIATOR
STURDY COAXIAL-ELECTRODE STRUCTURE

For Mobile or Aircraft Applications as a Frequency-Multiplier, RF-Power-Amplifier, or Oscillator Tube

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC):		
Under transmitting conditions	6 ± 10%	volts
Under standby conditions	6.3 max.	volts
Current at 6 volts	0.28	amp
Amplification Factor	40	
Transconductance, for dc plate ma. = 18.5 and dc plate volts = 200	6800	μmhos

Direct Interelectrode Capacitances:

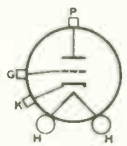
	Without External Shield	*With External Shield*▲	
Grid to plate	1.75	1.5	μμf
Grid to cathode	2.95	–	μμf
Plate to cathode	0.07 max.	–	μμf

Mechanical:

Terminal Connections (See *Dimensional Outline*):

H – Heater

K – Cathode



G – Grid

P – Plate

Operating Position . . . . . Any
Dimensions and Terminal Connections . . . . . See *Dimensional Outline*
Radiator . . . . . Integral part of tube
Cooling:

In many applications, the 6264-A does not require forced-air cooling. The radiator in combination with a connector having adequate heat conduction capability will generally provide adequate cooling under conditions of free circulation of air. The cooling must be sufficient to limit the plate-seal temperature to 175° C. When conditions do not provide adequate circulation of air, provision should be made to direct a blast of cooling air from a small blower through the radiator fins. The quantity of air should be sufficient to limit the plate-seal temperature to 175° C. See *Curves*.

Incoming-Air Temperature . . . . . 40 max. °C

Plate-Seal Temperature (Measured on plate seal)	175 max.	°C
Weight (Approx.)	24 grams (0.85 oz)	
Socket for Heater Pins	Grayhill No.22-3, Cinch No.54A16325, or equivalent	

RF POWER AMPLIFIER AND OSCILLATOR — Class C Telegraphy

Key-down conditions per tube without amplitude modulation[•]

Maximum Ratings, *Absolute-Maximum Values:*

For Altitudes up to 60,000 ft

	CCS★	ICAS♦	
DC PLATE VOLTAGE	330 max.	400 max.	volts
DC GRID VOLTAGE	-100 max.	-100 max.	volts
DC PLATE CURRENT	40 max.	55 max.	ma
DC GRID CURRENT	25 max.	25 max.	ma
DC CATHODE CURRENT	55 max.	70 max.	ma
PLATE INPUT	13.2 max.	22 max.	watts
PLATE DISSIPATION	8 max.	13 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	50 max.	50 max.	volts
Heater positive with respect to cathode	50 max.	50 max.	volts

Typical Operation as Oscillator in Cathode-Drive Circuit:

	At 500 Mc		
	CCS★	ICAS♦	
DC Plate-to-Grid Voltage	325	380	volts
DC Cathode-to-Grid Voltage♦	25	30	volts
DC Plate Current	35	35	ma
DC Grid Current (Approx.)	11	13	ma
Useful Power Output (Approx.)	5♦	6♦	watts

	At 1700 Mc	
	CCS★	
DC Plate-to-Grid Voltage	263	volts
DC Cathode-to-Grid Voltage♦	13	volts
DC Plate Current	40	ma
DC Grid Current (Approx.)	13	ma
Useful Power Output (Approx.)	1♦	watt

Typical Operation as RF Power Amplifier in Cathode-Drive Circuit at 500 Mc:

	CCS★	ICAS♦	
DC Plate-to-Grid Voltage	342	395	volts
DC Cathode-to-Grid Voltage♦	42	45	volts
DC Plate Current	35	40	ma
DC Grid Current (Approx.)	13	15	ma
Driver Power Output (Approx.)	2.4	3	watts
Useful Power Output (Approx.)	7.5♦	10♦	watts

Maximum Circuit Values:

Grid-Circuit Resistance. . . .	0.1 max.	0.1 max.	megohm

FREQUENCY MULTIPLIER

Maximum Ratings, *Absolute-Maximum Values:*

For Altitudes up to 60,000 ft

	CCS*	ICAS♦	
DC PLATE VOLTAGE	300 max.	350 max.	volts
DC GRID VOLTAGE.	-125 max.	-140 max.	volts
DC PLATE CURRENT	33 max.	45 max.	ma
DC GRID CURRENT.	25 max.	25 max.	ma
DC CATHODE CURRENT	45 max.	55 max.	ma
PLATE INPUT.	9.9 max.	15.9 max.	watts
PLATE DISSIPATION.	6 max.	9.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	50 max.	50 max.	volts
Heater positive with respect to cathode	50 max.	50 max.	volts

Typical Operation as Tripler to 510 Mc in Cathode-Drive Circuit:

	CCS*	ICAS♦	
DC Plate-to-Grid Voltage . . .	410	472	volts
DC Cathode-to-Grid Voltage♣. .	110	122	volts
DC Plate Current	26	36.5	ma
DC Grid Current (Approx.). . .	4.1	5.8	ma
Driver Power Output (Approx.).	2.75	4.5	watts
Useful Power Output (Approx.).	2.1	3.4	watts

Maximum Circuit Values:

Grid-Circuit Resistance. . . .	0.1 max.	0.1 max.	megohm

▲ A flat plate shield 1-1/8" diameter located parallel to the plane of the grid flange and midway between the grid flange and the radiator plate terminal. The shield is tied to the cathode.

● Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

★ Continuous Commercial Service.

♦ Intermittent Commercial and Amateur Service.

♣ From a gric resistor, or from a suitable combination of grid resistor and fixed supply or grid resistor and cathode resistor.

♠ This value of useful power is measured at load of output circuit having an efficiency of about 75%.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current	1	0.265	0.295	ma
Grid-to-Plate Capacitance. . . .	-	1.5	2	μμf
Grid-to-Cathode Capacitance. . .	-	2.5	3.4	μμf
Plate-to-Cathode Capacitance . .	-	-	0.07	μμf
Reverse Grid Current	1,2	-	0.5	μa

	Note	Min.	Max.	
Plate Current (1)	1,3	13	24	ma
Plate Current (2)	1,4	–	55	μa
Amplification Factor	1,3	30	50	
Transconductance	1,3	5400	8200	μmhos
Heater-Cathode Leakage Current:				
Heater negative with respect to cathode	1,5	–	100	μa
Heater positive with respect to cathode	1,6	–	100	μa
Emission Voltage	1,7	–	10	volts
Leakage Resistance:				
From grid to plate and cathode tied together	1,8	25	–	megohms
From plate to grid and cathode tied together	1,9	25	–	megohms
Power Output	1,10	6.5	–	watts
Change in Power Output	11	–	0.5	watt

Note 1: With 6 volts ac or dc on heater.

Note 2: With dc plate voltage of 200 volts, dc grid voltage of -2 volts, grid resistor of 0.5 megohm.

Note 3: With dc plate supply voltage of 200 volts, cathode resistor of 100 ± 1% ohms, and cathode bypass capacitor of 1000 μf.

Note 4: With dc plate voltage of 200 volts, dc grid voltage of -12 volts, cathode resistor of 0 ohms.

Note 5: With 50 volts dc between heater and cathode, heater negative with respect to cathode.

Note 6: With 50 volts dc between heater and cathode, heater positive with respect to cathode.

Note 7: With dc voltage on grid and plate which are tied together adjusted to produce a cathode current of 30 ma.

Note 8: With grid 100 volts negative with respect to plate and cathode which are tied together.

Note 9: With plate 300 volts negative with respect to grid and cathode which are tied together.

Note 10: With dc plate voltage of 350 volts, grid resistor adjusted to give a dc plate current of 50 milliamperes in a cavity-type oscillator operating at 500 Mc and having an efficiency of approximately 75 per cent.

Note 11: At end of Power-Oscillation test, reduce heater voltage to 5 volts and note change in power output.

SPECIAL TESTS & PERFORMANCE DATA

Low-Pressure Voltage Breakdown Test:

This test is performed on a sample lot of tubes from each production run. Tubes are tested in a chamber at an air pressure equivalent to an altitude of 60,000 feet. Breakdown will not occur when an rms voltage of 500 volts is applied between the plate cylinder and grid flange.

Low-Frequency Vibration Performance:

This test (MIL-E-1D, paragraph 4.9.19.1) is performed on a sample lot of tubes from each production run under the following conditions:

Heater voltage of 6 volts, dc plate supply voltage of 200 volts, grid voltage of -2 volts, and plate load resistor of 10,000 ohms. The tubes are vibrated in a plane perpendicular to the tube axis at 25 cycles per second at an acceleration of 2.5 g. The rms output voltage across the plate load resistor as a result of vibration of the tube will not exceed 100 millivolts.

High-Frequency Vibration Performance:

This test (similar to MIL-E-1D, paragraph 4.9.19.2) is performed on a sample lot of tubes from each production run. The tube is vibrated perpendicular tc its axis, with no voltages applied to the tube. Vibration frequency is 40 to 60 cps and acceleration is 10 g. At the end of this test, tubes will not show temporary or permanent shorts or open circuits and will meet the following limits:

Heater-Cathode Leakage Current. . . . . 100 max. μa
For conditions shown under *Characteristics Range Values Notes 1,5 and 1,6.*

Low-Frequency Vibration (rms) . . . . . 100 max. mv
For conditions shown above under *Low-Frequency Vibration Performance.*

Plate Current (2) . . . . . 55 max. μa
For conditions shown under *Characteristics Range Values Notes 1,4.*

Shorts and Continuity Test:

This test (MIL-E-1D, paragraph 4.7.5) is performed on all tubes from each production run. In this test, a tube is considered inoperative if it shows a permanent or temporary short or open circuit, an air leak, or reverse grid current in excess of 1 microampere for the conditions shown under *Characteristics Range Values, Notes 1,2.*

Heater Cycling Life Performance:

This test (similar to MIL-E-1D, paragraph 4.11.7) is performed on a sample lot of tubes from each production run. With 6 volts on heater and no voltage on plate and grid, the heater is cycled three minutes on and three minutes off for at least 2000 cycles. At the end of this test, tubes will not show temporary or permanent shorts or opens, and are required to meet the following limits:

Grid-Plate and Cathode Leakage Resistance . 25 min. megohms
For conditions shown under *Characteristics Range Values Notes 1,8.*

Heater-Cathode Leakage Current. . . . . 150 max. μa
For conditions shown under *Characteristics Range Values Notes 1,5.*

1-Hour Stability Life Performance:

This test is performed on a sample lot of tubes from each production run to insure that the tubes have been properly stabilized. Tubes are operated under the following conditions: heater voltage of 6 volts, plate dissipatior of 2.5

to 3 watts. At the end of 1 hour, the change in transconductance value for each tube, referred to its initial transconductance reading, will not exceed 15% of the initial value, for conditions shown under *Characteristics Range Values, Notes 1,2.*

50-Hour Survival Life Performance:

This test is performed on a sample lot of tubes from each production run to insure a low percentage of early inoperatives. Life-test conditions are the same as those specified for *1-Hour Stability Life Performance* except that all voltages are cycled at the rate of 110 minutes on and 10 minutes off. At the end of 50 hours, the tubes are required to meet the following limits:

Power Output	5 min.	watts
For conditions shown under *Characteristics Range Values Notes 1,7.*		
Plate Current (2).	100 max.	μa
For conditions shown under *Characteristics Range Values Notes 1,3.*		

Shorts and Continuity Test specified above.

Intermittent Dynamic Life Performance:

This test is performed on a sample lot of tubes from each production run to insure high quality of rf performance. Each tube is life-tested in a cavity-type oscillator at 500 ± 15 Mc under the following conditions:

Heater voltage of 6 volts, plate supply voltage of 400 volts, grid resistor is adjusted to give a dc plate current of 40 ma. and value is recorded, cathode resistor of 0 ohms, plate-circuit load resistance of 100 ± 5 ohms, heater positive with respect to cathode by 50 volts, and plate-seal temperature of 175° C min. Heater voltage is cycled at a rate of 110 minutes on and 10 minutes off.

At the end of 500 hours, the tube will not show permanent shorts or open circuits and will be criticized for the total number of defects in the sample lot and for the number of tubes failing to meet the following limits:

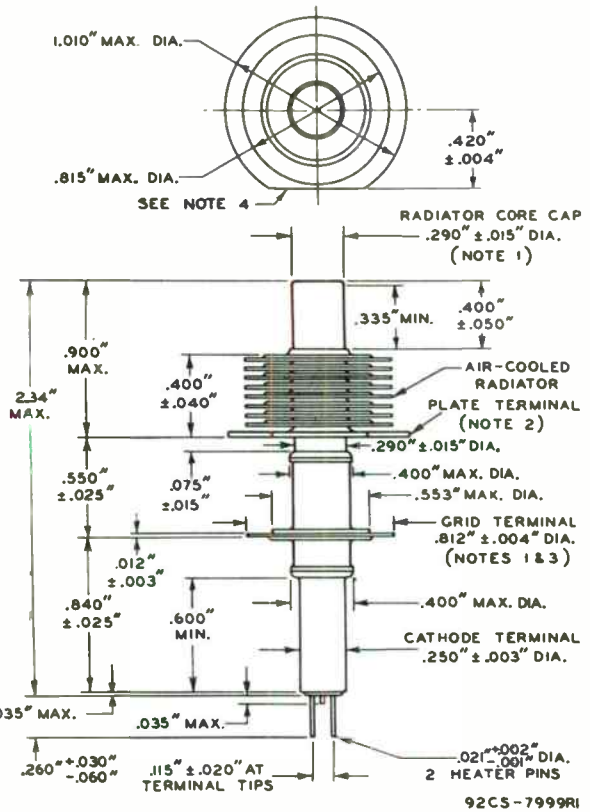
Reverse Grid Current	1 max.	μa
For conditions shown under *Characteristics Range Values Notes 1,2.*		
Power Output	5 min.	watts
For conditions shown under *Characteristics Range Values Notes 1,7.*		

OPERATING CONSIDERATIONS

The *heater* leads of the 6264-A should not be soldered to circuit elements. The heat of the soldering operation may crack the glass seals of the heater pins and damage the tube.

The *cathode* should preferably be connected to one side of the heater. When, in some circuit designs, the heater is not

connected directly to the cathode, precautions must be taken to hold the peak heater-cathode voltage to the maximum values shown in the tabulated data.



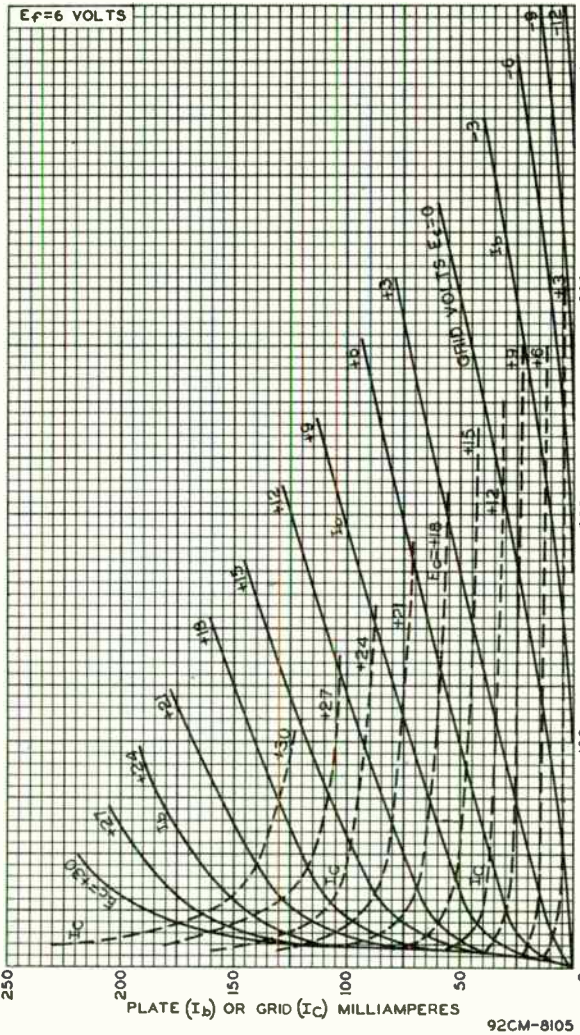
NOTE 1: MAXIMUM ECCENTRICITY OF CENTER LINE (AXIS) OF RADIATOR-CORE CAP OR GRID-TERMINAL FLANGE WITH RESPECT TO THE CENTER LINE (AXIS) OF THE CATHODE TERMINAL IS 0.015".

NOTE 2: TILT OF PLATE-TERMINAL FIN OF RADIATOR WITH RESPECT TO ROTATIONAL AXIS OF CATHODE CYLINDER IS DETERMINED BY CHUCKING THE CATHODE TERMINAL, ROTATING THE TUBE, AND GAUGING THE TOTAL TRAVEL DISTANCE OF THE PLATE-TERMINAL FIN PARALLEL TO THE AXIS AT A POINT APPROXIMATELY 0.020" INWARD FROM THE STRAIGHT EDGE OF THE PLATE-TERMINAL FIN FOR ONE COMPLETE ROTATION. THE TOTAL TRAVEL DISTANCE WILL NOT EXCEED 0.025".

NOTE 3: TILT OF GRID-TERMINAL FLANGE WITH RESPECT TO ROTATIONAL AXIS OF CATHODE TERMINAL IS DETERMINED BY CHUCKING THE CATHODE TERMINAL, ROTATING THE TUBE, AND GAUGING THE TOTAL TRAVEL DISTANCE OF THE GRID-TERMINAL FLANGE PARALLEL TO THE AXIS AT A POINT APPROXIMATELY 0.020" INWARD FROM ITS EDGE FOR ONE COMPLETE ROTATION. THE TOTAL TRAVEL DISTANCE WILL NOT EXCEED 0.025".

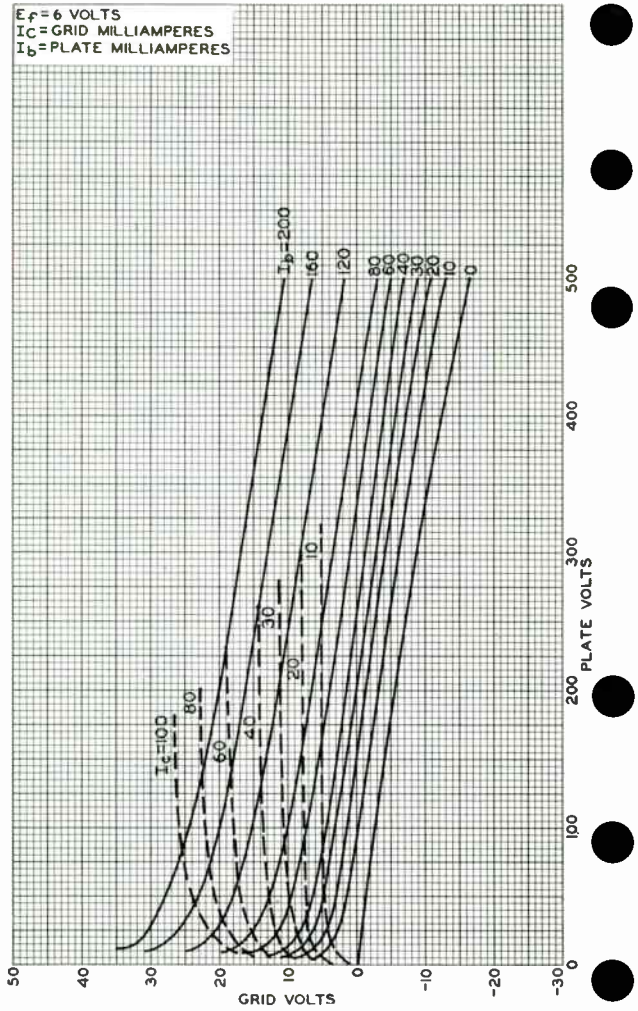
NOTE 4: THE STRAIGHT EDGE ON THE PERIMETER OF THE LARGE FIN (PLATE TERMINAL) IS PARALLEL TO A PLANE THROUGH THE CENTERS OF THE HEATER PINS AT THEIR SEALS WITHIN 15°.

AVERAGE CHARACTERISTICS



6264-A

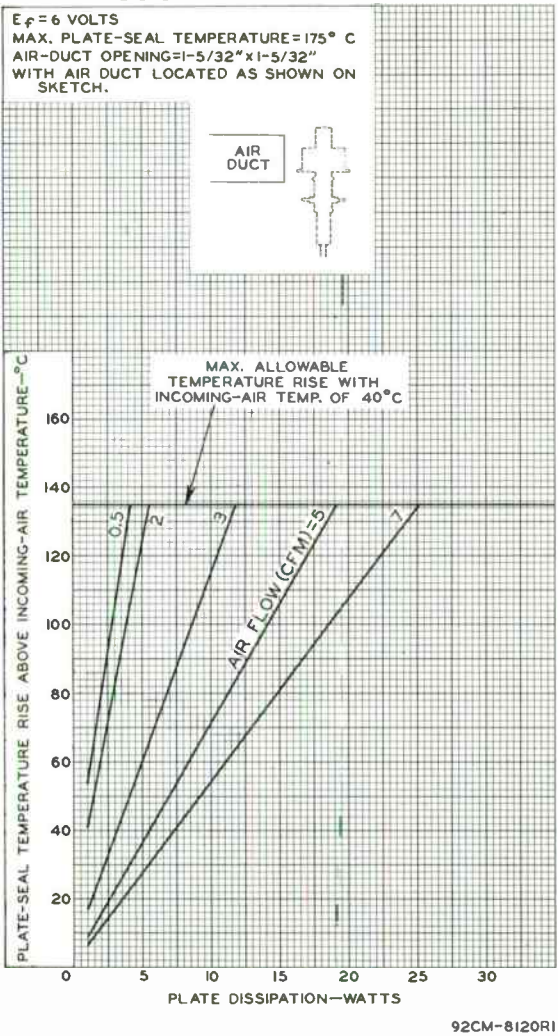
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



92CM-8106

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.

COOLING REQUIREMENTS



92CM-8120RI

Tunable Oscillator Triode

PENCIL TYPE WITH INTEGRAL RESONATORS

For Radiosonde Service at Frequencies between 1660 and 1700 Mc

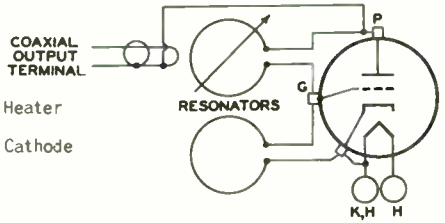
GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage range (AC or DC)	5.2 to 6.6▲	volts
Current at 6 volts	0.16	amp
Frequency (Approx.)	1680●	Mc
Tuning Range	1660 to 1700	Mc
RF Coaxial Output Terminal:		
Characteristic impedance (Approx.)	50	ohms
Tuning Screws (2):		
Maximum Torque (Absolute) at tuning-range stops	6.5	oz-in.

Mechanical:

Operating Position . . . . . Any
Dimensions . . . . . See *Dimensional Outline*
Tunable Resonators (2) . . . . . Integral part of tube
Weight (Approx.) . . . . . 0.8 oz
Terminal Connections (See *Dimensional Outline*):



UHF OSCILLATOR — Class C

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

At frequencies between 1660 and 1700 Mc and altitudes up to 100,000 feet

DC PLATE-TO-GRID VOLTAGE	130 max.	volts
DC PLATE CURRENT	34 max.	ma
DC GRID CURRENT	8 max.	ma
PLATE INPUT	4 max.	watts
PLATE DISSIPATION	3.6 max.	watts
AMBIENT-TEMPERATURE RANGE	-55 to +75	°C

Typical Operation as Cathode-Driven Oscillator:

At frequency of	*1660*	*1680*	*1700*	*Mc*
Heater Voltage	6	6	6	volts
DC Plate-to-Grid Voltage	124.5	124	123	volts

At frequency of	*1660*	*1680*	*1700*	*Mc*
DC Cathode-to-Grid Voltage	7.5	6.75	6	volts
From grid resistor of	1500	1500	1500	ohms
DC Cathode Current	35	31.5	32	ma
DC Grid Current	5	4.5	6	ma
Useful Power Output (Approx.)	575	575	475	mw

Circuit Values:

Grid-Circuit Resistance	2400 max.	ohms
	1300 min.	ohms

▲ This range of heater voltage is for radiosonde applications in which the heater is supplied from batteries and in which the equipment design requirements of minimum size, light weight, and high efficiency are the primary considerations even though the average life expectancy of the 7533 in such service is only a few hours.

● As supplied, tubes are adjusted to 1680 ± 4 Mc.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	0.135	0.157	amp
Grid Resistor	2	1300	2400	ohms
Useful Power Output (1)	3	250	–	mw
Plate Current (1)	4	–	34	ma
Useful Power Output (2)	5	250	–	mw
Plate Current (2)	6	–	34	ma
Useful Power Output (3)	7	270	–	mw

Note 1: With 5.2 volts on heater.

Note 2: With heater voltage of 6.6 volts, dc plate supply voltage of 117 volts, plate load resistor of 50 ohms, frequency adjusted to 1660 +3 −1 Mc., output VSWR of 1.1 maximum, and grid resistor adjusted to give plate current as close as possible to, but not exceeding 33 ma. Record Grid-Resistor value.

Note 3: With frequency and grid-resistor value of Note 2, decrease heater voltage and plate supply voltage to 5.2 volts and 95 volts, respectively, and measure Useful Power Output.

Note 4: With heater voltage of 6.6 volts, plate supply voltage of 117 volts, plate load resistor of 50 ohms, using same value of grid resistor as determined in Note 2, frequency adjusted to 1700 +1 −3 Mc., and output VSWR of 1.1 maximum.

Note 5: Same as Note 4, except heater voltage and plate supply voltage are 5.2 volts and 95 volts, respectively.

Note 6: Same as Note 4, except frequency is adjusted to 1680 ± 4 Mc with VSWR of 1.1 maximum.

Note 7: Same as Note 6, except heater voltage and plate supply voltage values are 5.2 volts and 95 volts, respectively.

SPECIAL TESTS & PERFORMANCE DATA

Low-Pressure Voltage Breakdown Test:

This test (similar to MIL-E-1D, paragraph 4.9.12.1) is performed on a sample lot of tubes from each production run. Tubes are tested in a chamber at an air pressure equivalent to an altitude of 100,000 feet. Arcing will not occur when an rms voltage of 200 volts is applied between the plate terminal and the grid terminal and heater-cathode terminal tied together.

High-Frequency Vibration Performance:

This test (similar to MIL-E-1D, paragraph 4.9.19.2) is performed on a sample lot of tubes from each production run. The tube is vibrated in two planes, parallel and perpendicular respectively to its axis, with no voltages applied to the tube. Vibration frequency is 50-to-60 cps and acceleration is 10 g. At the end of this test, tubes will not show temporary or permanent shorts or open circuits.

Shorts and Continuity Test:

This test (similar to MIL-E-1D, paragraph 4.7.5) is performed on all tubes from each production run. In this test, a tube is considered inoperative if it shows a permanent or temporary short or open circuit.

Temperature-Frequency Performance:

This test is performed on a sample lot of tubes from each production run to determine the ability of this tube type to maintain the oscillator frequency without significant change when ambient temperature and operating voltages are reduced gradually during a given time interval. Tube under test is operated with a heater voltage of 6.6 volts, dc plate supply voltage of 117 volts, plate load resistor of 50 ohms, oscillator frequency of 1680 ± 4 Mc, output VSWR of 1.1 maximum, dc plate current of not more than 34 ma. obtained by adjusting the value of the grid resistor between 1300 and 2400 ohms, and at an ambient temperature of approximately 22° C for a period of 5 minutes. Record Oscillator Frequency. The ambient temperature is then gradually reduced to −40° C during a 30-minute operating period. Both the heater voltage and plate supply voltage are reduced simultaneously so that during the final 15-minute interval of this test period the heater voltage is 5.2 volts and the plate supply, voltage is 95 volts. Any change in frequency will not be more than +4 Mc or −1 Mc from the recorded initial test value. The rate of frequency change during this test will not exceed 2 Mc in any 15-second interval.

5-Hour Radiosonde Life Performance:

This test is performed on a sample lot of tubes from each production run under conditions of maximum-rated plate dissipation to insure excellent performance in radiosonde applications. Each tube tested is operated for 5 hours under the following conditions: heater voltage of 6.6 volts, dc plate supply voltage of 117 volts, plate load resistor of 50 ohms, dc plate current of 34 ma., obtained by adjusting the grid-resistor value between 1300 and 2400 ohms, oscillator frequency of 1680 ± 4 Mc and output VSWR of 1.1 maximum. At the end of 5 hours, the tubes will not show permanent shorts or open circuits, and will meet the following limits:

Useful Power Output (3) . . . . . 210 min. mw

For conditions shown under *Characteristics Range Values, Notes 6,7.*

Change in Useful Power
Output (3) From Initial Value . . . . . 30 max. %
For conditions shown under *Characteristics Range Values, Notes 6,7.*

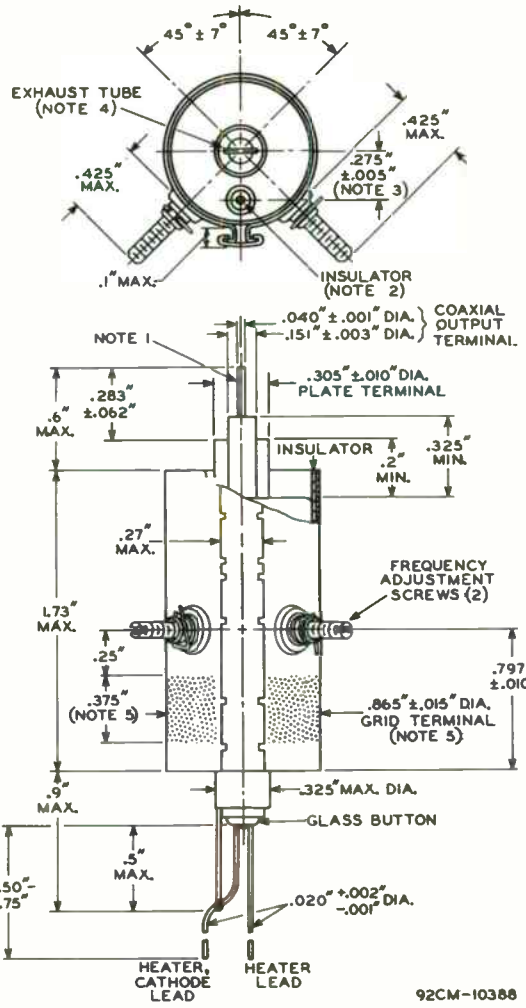
OPERATING CONSIDERATIONS

The *flexible heater leads* of the 7533 may be soldered to the circuit elements, but not closer than 3/4" from the surface of the glass button. Otherwise the heat of the soldering operation may crack the glass button and damage the tube.

Support for the 7533 should be provided by a suitable clamp around the metal shell of the tube, preferably in the indicated zone shown on the *Dimensional Outline.* Care must be taken to avoid clamping so tightly as to cause distortion of the resonator cavity with resultant change in operating frequency.

Connections to the grid terminal and to the plate terminal should be made by means of spring contacts only. Under no circumstances should connections be soldered to these terminals.

Accurate frequency adjustment in the 1660-to-1700-Mc operating range together with minimum frequency drift, may be obtained by using both tuning screws. Alternately turn each tuning screw not more than one-half turn at a time, in a clockwise direction to lower the frequency. Repeat this procedure until the desired lower frequency adjustment is reached. To reach a higher frequency, follow the same procedure except that the tuning screws are turned in a counterclockwise direction.



NOTE 1: THE AXES OF THE INNER AND OUTER CONDUCTORS OF THE COAXIAL OUTPUT TERMINAL COINCIDE WITHIN 0.010".

NOTE 2: THE END OF THE INSULATOR IN THE COAXIAL OUTPUT TERMINAL ALIGNS WITH THE EDGE OF THE OUTER CONDUCTOR (0.151" ± 0.003" DIAMETER) WITHIN 0.005".

NOTE 3: DISTANCE BETWEEN CENTER LINE OF PLATE TERMINAL AND CENTER LINE OF INNER CONDUCTOR (0.040" ± 0.001" DIAMETER).

NOTE 4: ORIENTATION OF PINCH-OFF IS NOT CONTROLLED.

NOTE 5: STIPPLED REGION (WHICH EXTENDS AROUND TUBE) INDICATES RECOMMENDED CLAMPING AND CONTACT AREA.

7553

High-Mu Triode

CERAMIC-METAL PENCIL TYPE
FAST WARM-UP TIME — STURDY COAXIAL-ELECTRODE STRUCTURE

For Use as a Low-Noise Amplifier Tube in Receiver Applications up to 1000 Mc

GENERAL DATA

Electrical:

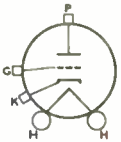
Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.225	amp
Cathode Warm-Up Time to reach 90% of operating plate current: For conditions: heater volts = 6.3, dc plate supply volts = 80, dc grid volts = 0, cathode resistor (ohms) = 0, and load resistor (ohms) = 10	10 max.	sec
Direct Interelectrode Capacitances:▲		
Grid to plate	2.4	μμf
Grid to cathode and heater	4.4	μμf
Plate to cathode and heater	0.03 max.	μμf
Heater to cathode	2.6	μμf
Cathode to plate	0.03 max.	μμf
Cathode to grid and heater	7	μμf
Plate to grid and heater	2.4	μμf

Characteristics, Class A_1 Amplifier:

Plate Supply Voltage	125	volts
Cathode Resistor	50	ohms
Amplification Factor	80	
Plate Resistance (Approx.)	6150	ohms
Transconductance	13000	μmhos
Plate Current	12.5	ma

Mechanical:

Operating Position . . . . . Any
Dimensions . . . . . See *Dimensional Outline*
Weight (Approx.) . . . . . 0.3 oz
Sockets:
Heater-terminals connector . . . . . Amerac● No.1018-88★ or Grayhill♦ No.22-5, or equivalent
Cavities (Including heater-terminals connector) . . . . . J-V-M No.D-7980◆ Series
Terminal Connections (See *Dimensional Outline*):



H - Heater
K - Cathode
G - Grid
P - Plate

7553

RF AMPLIFIER — Class A1
(Cathode-Drive Service)

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

For altitudes up to 100,000 feet and frequencies up to 1000 Mc

DC PLATE-TO-GRID VOLTAGE	250 max.	volts
DC CATHODE-TO-GRID VOLTAGE	0 min.	volts
DC PLATE CURRENT	25 max.	ma
PLATE DISSIPATION	2.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	50 max.	volts
Heater positive with respect to cathode	50 max.	volts
PLATE-SEAL TEMPERATURE	225 max.	°C

Typical CCS Operation:

	At 550 Mc	
DC Plate-to-Grid Supply Voltage	125	volts
Cathode Resistor	50	ohms
Input-Signal Level	−70	dbm
DC Plate Current	12.5	ma
Power Gain for a bandwidth of 5 Mc.	16.5	db
Noise Factor	6.5	db

Maximum Circuit Values:

Grid-Circuit Resistance:

For fixed-bias operation	Not recommended
For cathode-bias operation	0.25 max. megohm

▲ Without external shield.

● Amerac, Inc., Dunham Road, Beverly, Massachusetts.

★ For use with cavities.

♦ Grayhill, Inc., 561 Hillgrove Ave., LaGrange, Illinois.

♦ J-V-M Microwave Co., 9300 W. 47th St., Brookfield, Illinois. Indicated No. applies to a series of cavities covering range from 220 up to 1000 Mc. and above.

♠ Continuous Commercial Service.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	0.205	0.245	amp
Direct Interelectrode Capacitances:				
Grid to plate	–	2.1	2.8	μμf
Grid to cathode	–	3.8	4.8	μμf
Plate to cathode	–	–	0.03	μμf
Transconductance	1,2	10000	16000	μmhos
Reverse Grid Current	1,3	–	0.3	μa
Heater-Cathode Leakage Current	1,4	–	30	μa
Leakage Resistance:				
From grid to plate and cathode connected together	1,5	100	–	megohms
From plate to grid and cathode connected together	1,6	100	–	megohms
Plate Current (1)	1,2	8.5	16.5	ma

Plate Current (2)	1,7	–	50	μa
Plate Current (3)	1,8	100	–	μa
Power Gain	1,9	14	–	db
Noise Factor	1,9	–	7	db
Change in Power Gain	1,9,10	–	-1	db
Change in Noise Factor	1,9,10	–	+0.5	db

Note 1: With 6.3 volts ac or dc on heater.

Note 2: With dc plate supply voltage of 125 volts, and cathode resistor of 50 ohms shunted by 1000 μf.

Note 3: With dc plate voltage of 200 volts, grid resistor of 0.5 megohm, and dc grid voltage of -2 volts.

Note 4: With 60 volts dc between heater and cathode, and heater positive with respect to cathode.

Note 5: With grid 100 volts negative with respect to plate and cathode tied together.

Note 6: With plate 300 volts negative with respect to grid and cathode tied together.

Note 7: With dc plate voltage of 125 volts and dc grid voltage of -5 volts.

Note 8: With dc plate voltage of 125 volts and dc grid voltage of -2.5 volts.

Note 9: In a single-tube rf amplifier of the cavity type having a bandwidth of 5 Mc, signal input of -70 dbm, and operating frequency of 550 Mc.

Note 10: Reduce heater voltage to 5.7 volts. Change in Power-Gain and Noise-Factor values from those obtained with 6.3 volts on heater will not exceed indicated values.

SPECIAL TESTS & PERFORMANCE DATA

Low-Pressure Voltage Breakdown Test:

This test (similar to MIL-E-1D, paragraph 4.9.12.1) is performed on a sample lot of tubes from each production run. Tubes are tested in a chamber at an air pressure equivalent to an altitude of 100,000 feet. Breakdown will not occur when an rms voltage of 300 volts is applied between the plate cylinder and grid flange.

Low-Frequency Vibration Performance:

This test is performed on a sample lot of tubes from each production run under the following conditions: heater voltage of 6.3 volts, dc plate supply voltage of 125 volts, cathode resistor of 50 ohms, and plate load resistor of 10,000 ohms. The tubes are vibrated in a plane perpendicular to the tube axis at 40 cycles per second at an acceleration of 10 g. The rms output voltage across the plate load resistor as a result of vibration of the tube will not exceed 100 millivolts.

Variable-Frequency Vibration Performance:

This test is performed on a sample lot of tubes from each production run. Tube operating conditions are the same as for *Low-Frequency Vibration*. The tube is vibrated perpendicular to its major axis through a frequency range from 5 to 2000 cps and back. From 5 to 50 cps, the tube shall be vibrated at a constant displacement of 0.0400 ± 0.0025 inch. From 50 to 2000 cps, the tube shall be vibrated at a constant

acceleration of 10 ± 2 g. Total time to complete a sweep cycle shall be 10 ± 5 minutes. During the test, the tubes will not show an rms output voltage across the plate load resistor in excess of 150 millivolts. Each tube shall be vibrated for 60 seconds at the frequency which gives maximum vibrational noise output. If, at the end of 60 seconds the vibrational noise output is still increasing, the test shall continue until there is no further increase. The rms output voltage across the plate load resistor as a result of the vibration of the tube must not exceed the specified limit at any time during the test.

Shock Test:

This test (similar to MIL-E-1D, paragraph 4.9.20.5) is performed on a sample lot of tubes from each production run. Tubes are held rigid and are subjected in three different positions to an impact acceleration of 500 g, 5 blows in each position.

At the end of this test, tubes will not show permanent or temporary shorts or open circuits, and are required to meet the following limits:

Heater–Cathode Leakage Current. . . . . 60 max. μa

For conditions shown under *Characteristics Range Values, Notes 1,4.*

Low-Frequency Vibration Output. . . . . 200 max. mv

For conditions shown above under *Low-Frequency Vibration Performance.*

Change in transconductance. . . . . 10 max. %

From initial value for conditions shown under *Characteristics Range Values, Notes 1,2.*

Change in Reverse Grid Current. . . . . 1 max. μa

From initial value for conditions shown under *Characteristics Range Values, Notes 1,3.*

Fatigue Vibration Test:

This test (similar to MIL-E-1D, paragraph 4.9.20.6) is performed on a sample lot of tubes from each production run. Tubes are rigidly mounted and subjected to 2.5 g vibrational acceleration in two positions (X1, Y1) for 32 hours each. At the end of this test, tubes will meet the limits specified for the *Shock Test.*

Shorts and Continuity Test:

This test is performed on all tubes from each production run. In this test, a tube is considered inoperative if it shows a permanent or temporary short or open circuit, an air leak, or reverse grid current in excess of 1 microampere for the conditions shown under *Characteristics Range Values, Notes 1,4.*

Heater-Cycling Life Performance:

This test is performed on a sample lot of tubes from each production run. With 6.3 volts on heater and no voltage on plate or grid, the heater is cycled three minutes on and three minutes off for at least 2000 cycles. At the end of this test, tubes will not show temporary or permanent shorts or opens, and are required to meet the following limits:

Grid-to-Cathode Leakage Resistance. . . . 50 min. megohms

For conditions shown under *Characteristics Range Values, Notes 1,5.*

Heater-to-Cathode Leakage Current . . . . 60 max. μa

For conditions shown under *Characteristics Range Values, Notes 1,4.*

1-Hour Stability Life Performance:

This test is performed on a sample lot of tubes from each production run to insure that the tubes have been properly stabilized. Tubes are operated under the following conditions: heater voltage of 6.3 volts, plate supply voltage of 215 volts, and cathode resistor of 150 ohms. At the end of 1 hour, the change in transconductance value for each tube, referred to its initial transconductance reading, will not exceed 15 per cent of the initial value for conditions shown under *Characteristics Range Values, Notes 1,2.*

44-Hour Grid-Emission Life Performance:

This test is performed on a sample lot of tubes from each production run to insure excellent overall performance and to guard against epidemic failures of tubes to meet this test requirement. Tubes are operated under the following conditions: heater voltage of 7.5 volts, dc plate voltage of 215 volts, grid voltage of -2 volts, and grid resistor of 0.5 megohm. At the end of 44 hours, the reverse grid current will not exceed 2 microamperes when grid resistor is shorted and grid voltage is increased to -5 volts, other conditions remaining unchanged from the above values.

100-Hour Survival Life Performance:

This test is performed on a sample lot of tubes from each production run to insure a low percentage of early inoperatives. Life-test conditions are the same as those specified for *1-Hour Stability Life Performance* except that all voltages are cycled at the rate of 110 minutes on and 10 minutes off. At the end of 100 hours, the tubes will meet the following limits:

Transconductance. . . . . 8000 min. μmhos

For conditions shown under *Characteristics Range Values, Notes 1,2.*

Plate Current (2) . . . . . 50 max. μa

For conditions shown under *Characteristics Range Values, Notes 1,7.*

500-Hour Average Life Performance:

This test is performed on a sample lot of tubes from each production run to insure excellent overall performance and to guard against epidemic failures of tubes to meet any of the characteristics indicated below. Each tube is life tested under the following conditions: heater voltage of 6.3 volts, plate supply voltage of 215 volts, cathode resistor of 150 ohms, heater positive with respect to cathode by 67.5 volts, and plate-seal temperature of 225° C. Heater voltage is cycled at a rate of 110 minutes on and 10 minutes off. At the end of 500 hours, the tube will not show permanent shorts or open circuits, and will be criticized for the total number of defects in the sample lot and for the number of tubes failing to pass the following limits:

Reverse Grid Current.	1 max.	μa

For conditions shown under *Characteristics Range Values, Notes 1,3.*

Insulation Resistance:

Grid to plate and cathode	60 min.	megohms
Plate to grid and cathode	60 min.	megohms

For conditions shown under *Characteristics Range Values, Notes 1,5, and 1,6, respectively.*

Change in Noise Factor.	1 max.	db

From initial value for conditions shown under *Characteristics Range Values, Notes 1,9.*

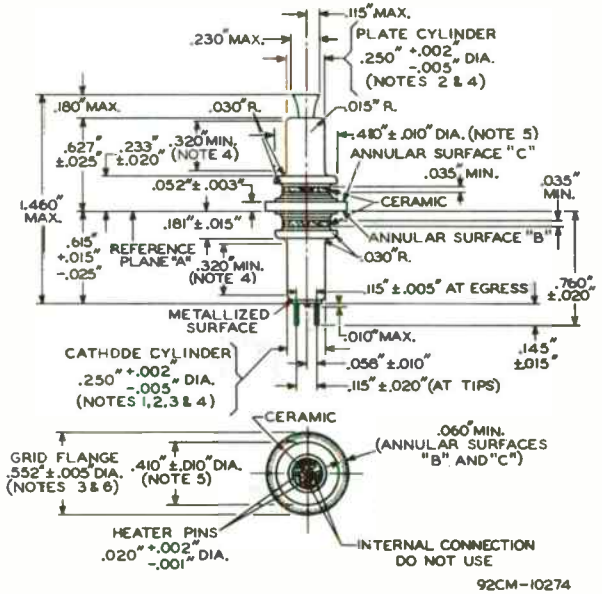
Change in Power Gain.	−2 max.	db

From initial value for conditions shown under *Characteristics Range Values, Notes 1,9.*

OPERATING CONSIDERATIONS

Connections to the cathode cylinder, grid flange, and plate cylinder should be made by flexible spring contacts. The connectors should make firm, large-surface contact, yet must be sufficiently flexible to insure that no part of the tube is subjected to excessive strain.

The *cathode* should preferably be connected to one side of the heater. When, in some circuit designs, the heater is not connected directly to the cathode, precautions must be taken to hold the peak heater-cathode voltage to the maximum-rated values shown in the tabulated data.



REFERENCE PLANE "A" IS DEFINED AS THAT PLANE AGAINST WHICH ANNULAR SURFACE "B" OF THE GRID FLANGE ABUTS.

ANNULAR SURFACE "B" IS ON THE SIDE OF THE GRID FLANGE TOWARD THE CATHODE CYLINDER.

ANNULAR SURFACE "C" IS ON THE SIDE OF THE GRID FLANGE TOWARD THE PLATE CYLINDER.

NOTE 1: WITH ANNULAR SURFACE "B" RESTING ON REFERENCE PLANE "A", THE AXIS OF THE CATHODE CYLINDER WILL BE WITHIN 2^{o} OF A LINE PERPENDICULAR TO REFERENCE PLANE "A".

NOTE 2: THE AXES OF THE PLATE CYLINDER AND CATHODE CYLINDER WILL COINCIDE WITHIN D.010".

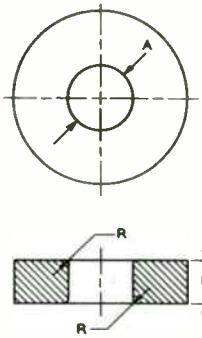
NOTE 3: THE AXES OF THE CATHODE CYLINDER AND GRID FLANGE WILL COINCIDE WITHIN D.005".

NOTE 4: THE DIAMETER ALONG THE D.320" MINIMUM LENGTH IS MEASURED WITH "GO" AND "NO-GO" RING GAUGES G_1-1 AND G_1-2, RESPECTIVELY.

NOTE 5: THIS DIAMETER IS MEASURED WITH "GO" AND "NO-GO" GAUGES G_2-1 AND G_2-2, RESPECTIVELY.

NOTE 6: THIS DIAMETER IS MEASURED WITH "GO" AND "NO-GO" GAUGES G_3-1 AND G_3-2, RESPECTIVELY.

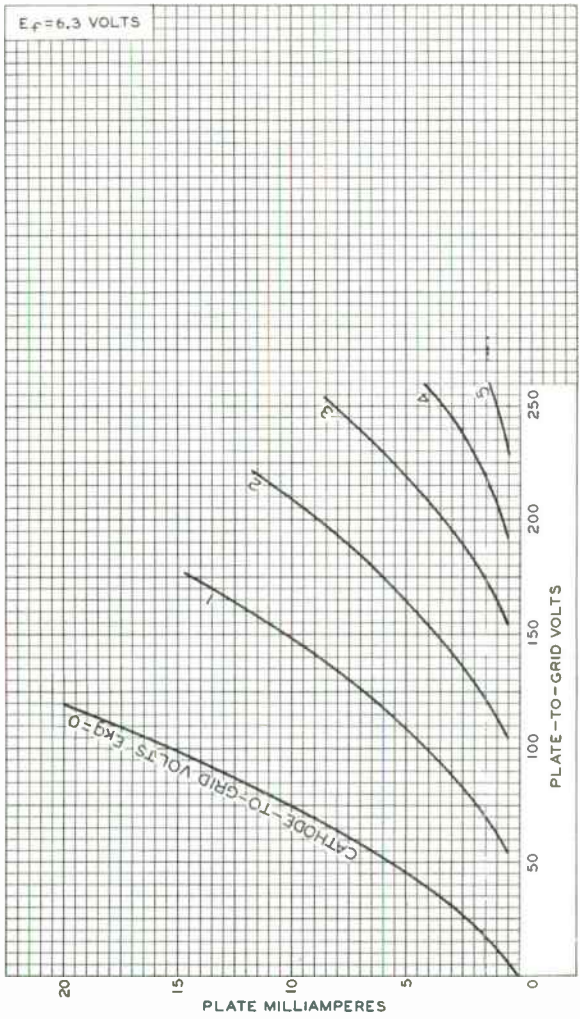
GAUGES



92CS-10370

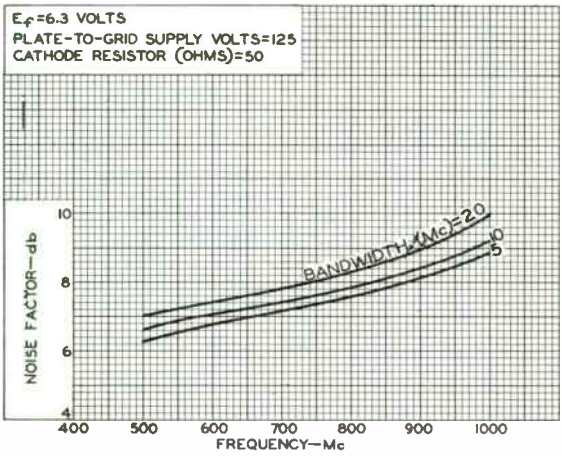
Gauge	Type	Dimension		
		Diameter A	Thickness B	Radius R
G_1-1	GO	0.25200" $^{+0.00000"}_{-0.00007"}$	0.320" $^{+0.001"}_{-0.000"}$	0.003" MAX.
G_1-2	NO-GO	0.24500" $^{+0.00007"}_{-0.00000"}$	–	–
G_2-1	GO	0.42000" $^{+0.00000"}_{-0.00007"}$	–	–
G_2-2	NO-GO	0.40000" $^{+0.00007"}_{-0.00000"}$	–	–
G_3-1	GO	0.55700" $^{+0.00000"}_{-0.00007"}$	–	–
G_3-2	NO-GO	0.54700" $^{+0.00007"}_{-0.00000"}$	–	–

AVERAGE PLATE CHARACTERISTICS
Cathode-Drive Service



92CM-10458

NOISE-FACTOR CHARACTERISTICS
Cathode-Drive Service



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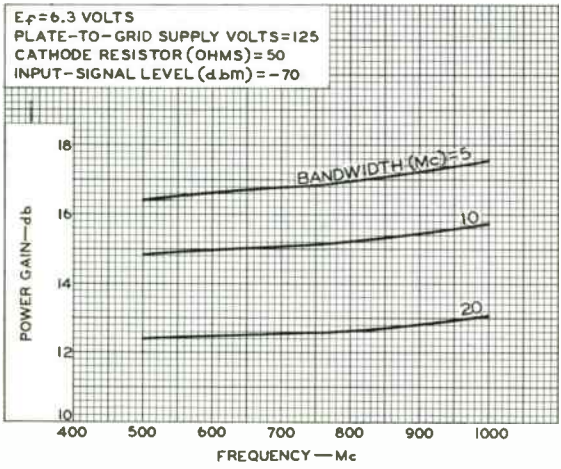
POWER-GAIN CHARACTERISTICS
Cathode-Drive Service



92CS-10456

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.

THYRATRON, IGNITRON, & GLOW-DISCHARGE TUBE CLASSIFICATION CHART

When choosing tube types, the equipment designer should refer to the RCA PREFERRED TYPES LIST and its companion list - TYPES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN - both of which appear in the General Section.

THYRATRONS

Maximum Cathode● Amp.		Maximum Peak Inverse Anode Volts		Filament (F) or Heater (H)			TUBE TYPE
Av.	Peak			Volts		Amp.	
Triodes							
Mercury-Vapor Types							
0.5	2.0	5000	40–80°C	2.5	F	5.0	5557
0.64	2.5	2500	25–70°	2.5	F	6.0	627
1.5	6.0	1250 200	−40 to +80° −40 to +100°	2.5	F	7.0	3C23
1.6 1.8	6.4 10.0	20000 15000	25–50° 25–55°	5.0	F	10.0	5563-A
2.5	15.0	1000	40–80°	5.0	H	4.5	5559
2.5	15.0	1000	40–80°	5.0	H	4.5	5°28/FG-67
4.0	15.0	10000	30–50°	5.0	H	10.0	677
6.4 2.5▲	40.0 77.0▲	2500 750▲	40–80° 40–90°	5.0	H	10.0	676
Gas Types							
0.04	0.2	350	−40 to +70°	2.5	H	2.6	629
0.075 0.075	0.3 0.3	300✱ 350✱	−75 to +90° −75 to +90°	6.3	H	0.6	884
Same as for Type 884				2.5	H	1.5	885
1.0	8.0	1250	−55 to +75°	2.5	F	6.3	C1K/6014
2.5	30	1250	−55 to +75°	2.5	F	9.0	C3J/5632
2.5	30	1250	−55 to +75°	2.5	F	9.0	C3J-A/5684
6.4	77	1250	−55 to +75°	2.5	F	21	C6J/5C21
6.4	77	1250	−55 to +75°	2.5	F	21	C6J-A/5685
16 18	160 100	1250	−55 to +75°	2.5	F	31	C16J/5665
Tetrodes							
Mercury-Vapor Types							
2.5	15.0	1000	40–80°	5.0	H	4.5	5560
2.5	30.0	1500	40–80°	5.0	H	5.0	632-B
3.2	40.0	2500	40–80°	5.0	H	5.0	672-A
6.4 2.5▲	40.0 77.0▲	2000 750▲	40–80° 30–95°	5.0 5.5▲	H H	10.0 11.0▲	172†
6.4 4.0✱	40.0 16.0✱	2500 10000✱	40–80° 25–50°	5.0	H	10.0	105

● In these two columns, values for filament types are for Maximum Anode Amperes.

▲ Welder-Control Service.

✱ Relaxation Oscillator (Sweep-Circuit Service).

♣ Relay & Grid-Controlled Rectifier Service.

□ Miniature type.

† Metal-shell type.

✱ Intermittent Service.

THYRATRON, IGNITRON, & GLOW-DISCHARGE TUBE CLASSIFICATION CHART

THYRATRONS (Cont'd)

Maximum Cathode● Amp.		Maximum Peak Inverse Anode Volts		Filament (F) or Heater (H)		TUBE TYPE
Av.	Peak			Volts	Amp.	
Tetrodes						
Gas Types						
0.025	0.1	500	-55 to +90°	6.3 H	0.15	5696□
0.1	0.5	1300	-75 to +90°	6.3 H	0.6	2D21□
0.1	1.0	1300	-55 to +90°	6.3 H	0.6	502-A†
0.2	1.0	360				
0.1	1.0	1300	-75 to +90°	6.3 H	0.6	2050
0.2	1.0	360				
0.5	5.0	1300	-75 to +90°	6.3 H	2.6	6012
0.8	8.0	1500	-75 to +90°	6.3 H	2.6	3D22-A

IGNITRONS

Maximum Ratings *For power-supply frequency from 25 to 60 cps*						TUBE TYPE
Av. Anode Amp.	Peak Anode Amp.	KVA Demand	Av'g'g. Time Sec.	RMS Supply Volts	Peak Inverse or Forward Volts	
AC Welder-Control Service‡						
22.4	550	100	22	250	-	
22.4	230	100	9.2	600	-	5550
12.1	1680	300	22	250	-	Size A
12.1	700	300	9.2	600	-	
56	1130	200	18	250	-	
56	470	200	7.5	600	-	5551
30.2	3350	600	18	250	-	Size B
30.2	1400	600	7.5	600	-	
113	360	600♦	0.5	2400	-	5554
75	720	1200	1.5	2400	-	
140	2240	400	14	250	-	
140	930	400	5.8	600	-	5552
75.6	6730	1200	14	250	-	Size C
75.6	2800	1200	5.8	600	-	
207	650	1105♦	0.5	2400	-	5555
135	1400	2400	1.66	2400	-	
355	4500	800	11	250	-	
355	1870	800	4.6	600	-	5553
192	13500	2400	11	250	-	Size D
192	5600	2400	4.6	600	-	

● In these two columns, values for filament types are for Maximum Anode Amperes.

‡ Ratings shown are on a per-tube basis with two tubes connected in inverse parallel.

□ Miniature type. † Metal-shell type. ♦ 100% duty.

THYRATRON, IGNITRON, & GLOW-DISCHARGE TUBE CLASSIFICATION CHART

IGNITRONS (Cont'd)

Maximum Ratings *For power-supply frequency from 25 to 60 cps*						TUBE TYPE
Av. Anode Amp.	Peak Anode Amp.	KVA Demand	Av'g'g. Time Sec.	RMS Supply Volts	Peak Inverse or Forward Volts	
Frequency-Changer Resistance-Welding Service						
56	336	–	6.25	–	1500	5822
16	1200	–	6.25	–	1500	
70	420	–	6.25	–	1200	
20	1500	–	6.25	–	1200	
Rectifier Service						
200	1800	–	–	–	900	5555
150	1200	–	–	–	2100	
100	900	–	–	–	900	5554
75	600	–	–	–	2100	
Intermittent Rectifier Service						
100	1600	–	6	–	500	5552
40	700	–	6	–	500	5551

GLOW-DISCHARGE TUBES

DC Operating Volts Approx.	DC Operating-Current Range Ma.	TUBE TYPE
Voltage-Regulator Types		
59	0.4 to 2	991
75	5 to 40	0A3
108	5 to 30	6B2□
108	5 to 30	6W74□†
108	5 to 40	0C3
151	5 to 30	6A2□
151	5 to 30	6C73□†
153	5 to 40	0D3
Voltage-Reference Type		
87	1.5 to 3.5	5651□

□ Miniature type.

† "Premium" type having very stable characteristics and intended for applications critical as to shock and vibration.

THYRATRON, IGNITRON, & GLOW-DISCHARGE TUBE CLASSIFICATION CHART

GLOW-DISCHARGE TUBES (Cont'd)			
Maximum Peak-Inverse Anode Volts	Maximum Cathode Ma.		TUBE TYPE
	Peak	Average	
Relay Types			
180	100	25	1C21
200	100	25	5B23□
225	100	25	0A4-G

□ Miniature type.

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.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

GRID-CONTROLLED RECTIFIER CIRCUITS

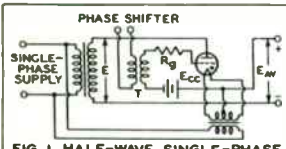


FIG. 1 HALF-WAVE SINGLE-PHASE

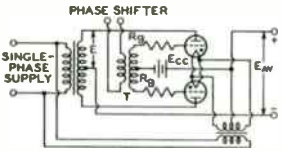


FIG. 2 FULL-WAVE SINGLE-PHASE

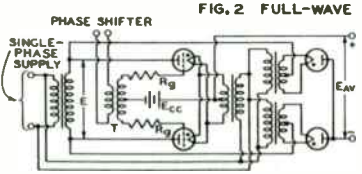


FIG. 3 SERIES SINGLE-PHASE

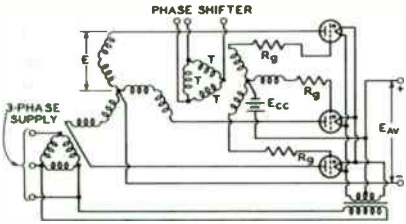


FIG. 4 HALF-WAVE THREE-PHASE

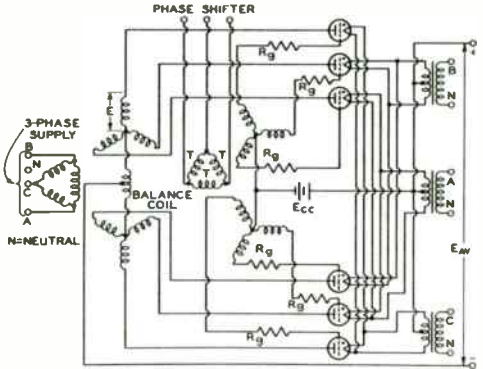


FIG. 5 PARALLEL THREE-PHASE (QUADRATURE OPERATION)

GRID-CONTROLLED RECTIFIER CIRCUITS

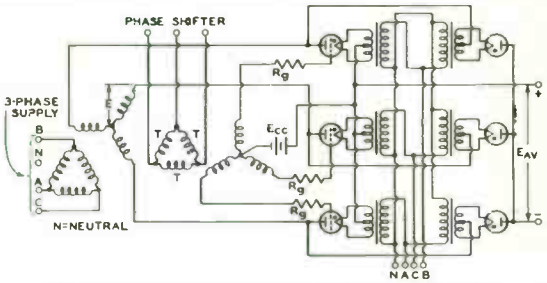


FIG. 6 SERIES THREE-PHASE (QUADRATURE OPERATION)

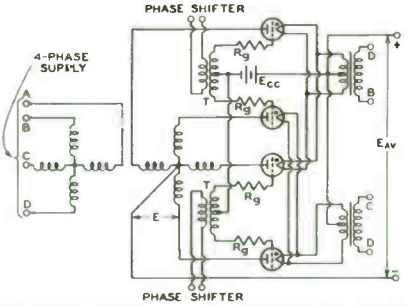


FIG. 7 HALF-WAVE FOUR-PHASE (QUADRATURE OPERATION)

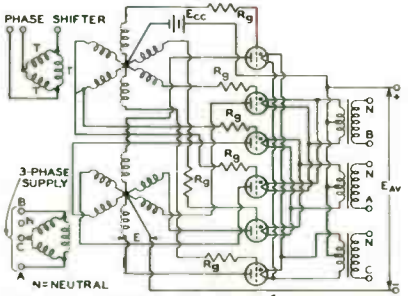


FIG. 8 HALF-WAVE SIX-PHASE (QUADRATURE OPERATION)

NOTE

T=PEAKING TRANSFORMER

92CL-8340

RCA

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.):[o]				
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	

[o] 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"
Envelope	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.

2D21

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.

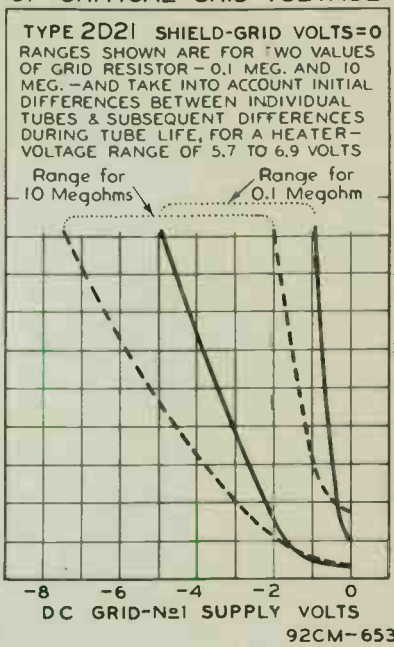
□ Approximately 180° out of phase with the anode voltage.

Sufficient resistance, including the tube load, must be used under any conditions of operation to prevent exceeding the current ratings.

→ Indicates a change.

2D21
THYRATRON

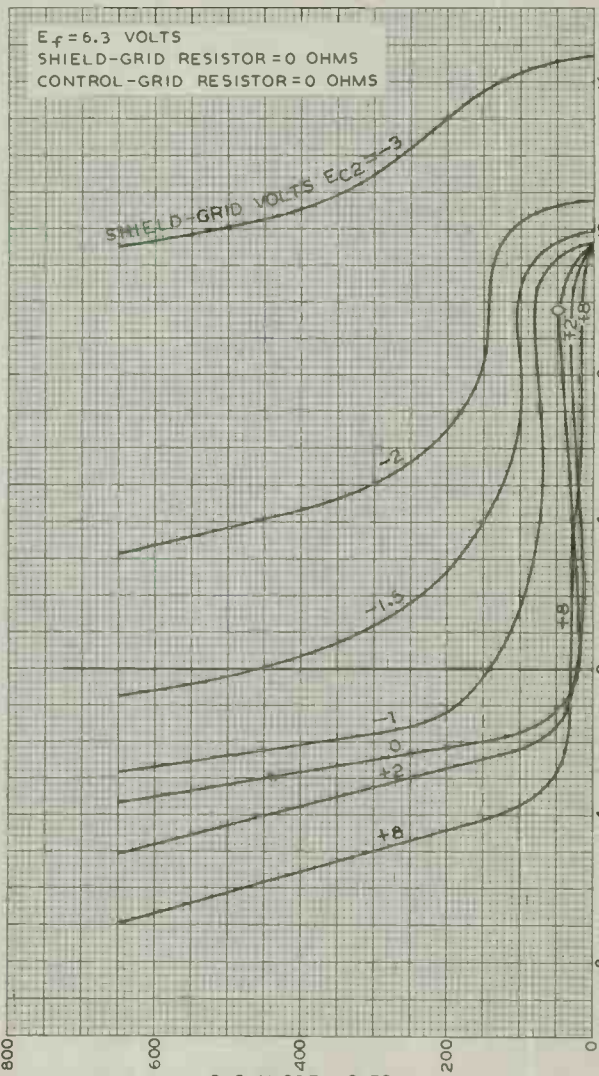
OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

2D21

AVERAGE CONTROL CHARACTERISTICS



MAY 2, 1944

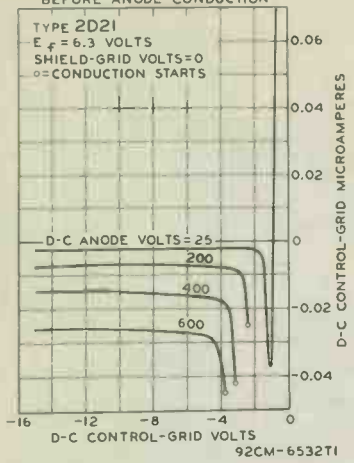
RCA VICTOR DIVISION

92CM—6531R1

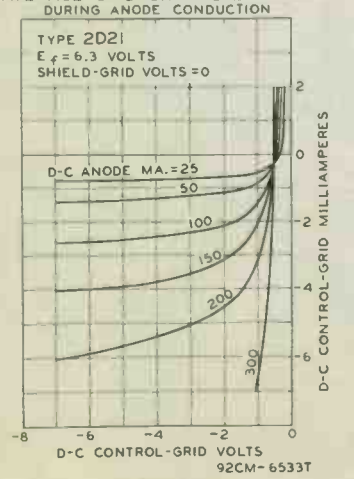
2D21

THYRATRON

AVERAGE GRID CHARACTERISTICS
BEFORE ANODE CONDUCTION



AVERAGE GRID CHARACTERISTICS
DURING ANODE CONDUCTION



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.):[o]		
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°C	−40° to +80°C	
PEAK ANODE VOLTAGE:			
Forward	200 max.	1250 max.	volts
Inverse	200 max.	1250 max.	volts

[o] without external shield. ← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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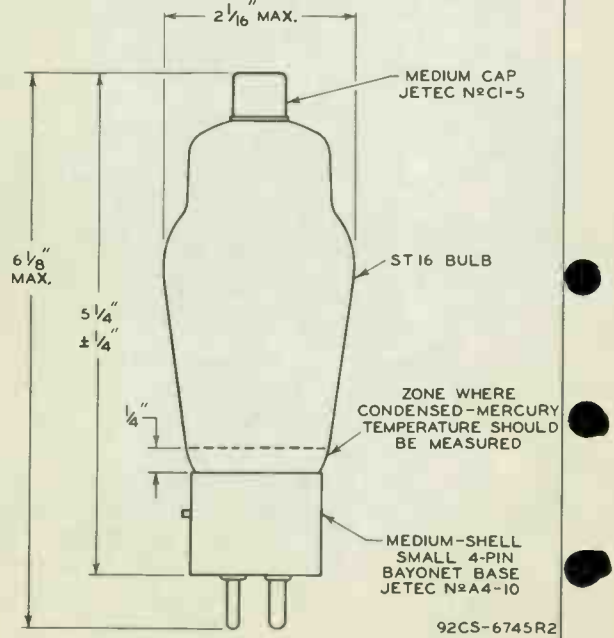
3C23

GAS-AND-MERCURY-VAPOR THYRATRON

	Operating Condensed-Mercury Temperature Range -40° to +100°C	-40° to +80°C	
GR'D 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.



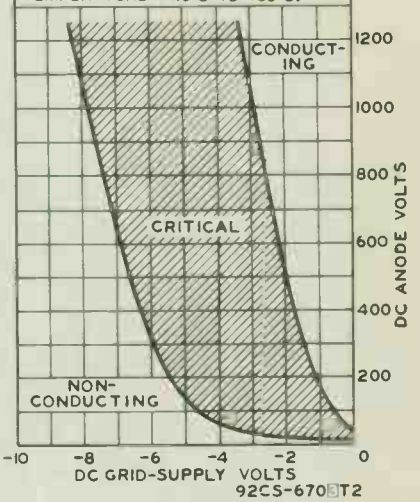
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

3C23

GAS-AND-MERCURY-VAPOR THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

RANGE IS FOR CONDITIONS WHERE: E_f=2.5 VOLTS AC ±5%; CIRCUIT RETURNS TO CENTER TAP OF FILAMENT TRANSFORMER. THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES. GRID RESISTOR=0 TO 100000 OHMS. CONDENSED-MERCURY TEMPERATURE=-40°C TO +80°C.



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

3D22
THYRATRON
GAS TETRODE

GENERAL DATA

Electrical:

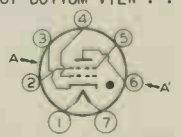
	Min.	Av.	Max.	
Heater, for Unipotential Cathode:				
Voltage (AC or DC)	5.7	6.3	6.9	volts
Current, with heater volts = 6.3	2.35	2.60	2.85	amp
Cathode:				
Heating Time, prior to tube conduction	30	–	–	sec
Outage Time, without reheating	–	–	3	sec
Direct Interelectrode Capacitances (Approx.):●				
Grid No.1 to Anode			0.1	μμf
Input			7	μμf
Output			3.6	μμf

● Without external shield, and with base shell floating.

Ionization Time (Approx.):		
For conditions: dc anode volts = 100; grid-No.1 square-pulse volts = +100; and peak anode amp. during conduction = 8	0.5	μsec
Deionization Time (Approx.):		
For conditions: dc anode volts = 125; grid-No.1 volts = -200, grid-No.1 resistor (ohms) = 1000; and dc anode amp. = 0.8	150	μsec
For conditions: dc anode volts = 125, grid-No.1 volts = -14.8; grid-No.1 resistor (ohms) = 1000; and dc anode amp. = 0.8	400	μsec
Maximum Critical Grid Current, with ac anode-supply volts (rms) = 460, and average anode amp. = 0.8	0.8	μamp
Anode Voltage Drop (Approx.)	10	volts
Grid-No.1 Control Ratio (Approx.) with 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.) with grid-No.1 resistor (megohms) = 0; grid-No.2 resistor (megohms) = 0 to 0.1; and grid-No.1 volts = -3	650	

Mechanical:

Mounting Position	Any
Maximum Overall Length	4-5/8"
Maximum Seated Length	4"
Maximum Diameter	2-3/8"
Bulb	T-16
Base	Medium-Metal-Shell Giant 7-Pin, Bayonet
Basing Designation for BOTTOM VIEW	7BV



Pin 1 – Heater
Pin 2 – Grid No.2
Pin 3 – Cathode
Pin 4 – Grid No.1
Pin 5 – Grid No.2
Pin 6 – Anode
Pin 7 – Heater

AA' = PLANE OF ELECTRODES

← Indicates a change.

3D22
THYRATRON

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 anode conduction	-100 max.	volts
→ Average, during anode conduction■	-10 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:		
Peak, before anode conduction	-200 max.	volts
→ Average, during anode conduction■	-10 max.	volts
→ CATHODE CURRENT:		
Peak	8 max.	amp
Average■	0.8 max.	amp
Surge, for duration of 0.1 sec. max.	30 max.	amp
GRID-No.2 CURRENT:		
→ Average■	+0.1 max.	amp
GRID-No.1 CURRENT:		
→ Average■	+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:

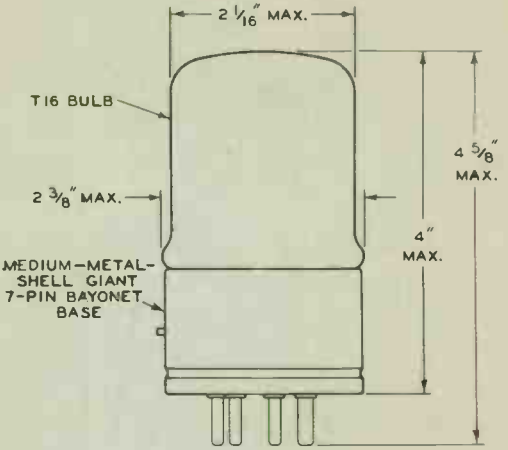
Grid-No.1-Circuit Resistance	2 max.	megohms

■ Averaged over any interval of 30 sec. max.

NOTE: Sufficient anode-circuit resistance, including tube load, must be used under all conditions of operation to prevent exceeding the current ratings of the tube.

→ Indicates a change.

3D22
THYRATRON



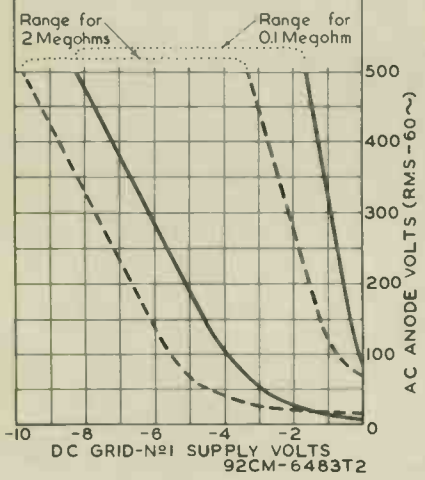
92CM-6569R1

RCA

3D22
THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

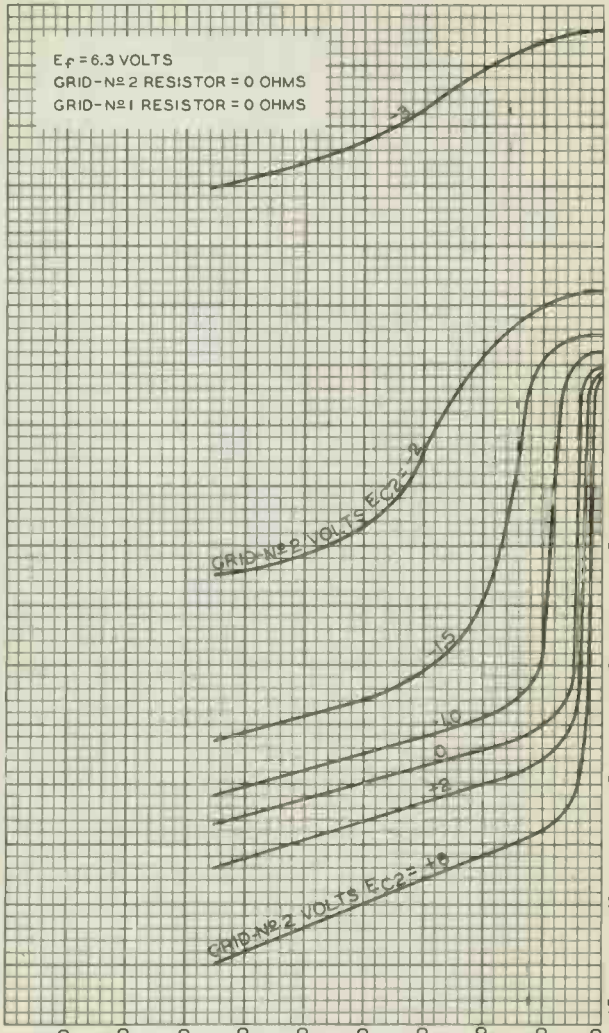
TYPE 3D22
GRID-№2 (SHIELD) VOLTS = 0
RANGES SHOWN ARE FOR TWO VALUES OF GRID RESISTOR - 0.1 MEG. AND 2 MEG - AND TAKE INTO ACCOUNT INITIAL DIFFERENCES BETWEEN INDIVIDUAL TUBES AND SUBSEQUENT DIFFERENCES DURING TUBE LIFE, FOR HEATER-VOLTAGE RANGE OF 5.7 TO 6.9 VOLTS, AND FOR AN AMBIENT TEMPERATURE RANGE OF -40 TO +90 °C.



RCA

3D22

AVERAGE CONTROL CHARACTERISTICS



JAN. 22, 1947

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

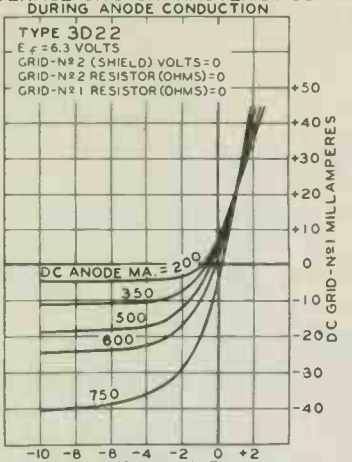
92CM-6831

RCA

3D22

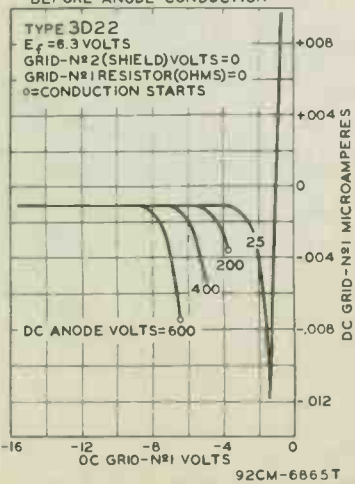
THYRATRON

AVERAGE GRID CHARACTERISTICS
DURING ANODE CONDUCTION



92CM-6830T

AVERAGE GRID CHARACTERISTICS
BEFORE ANODE CONDUCTION



92CM-6865T

3D22-A
GAS THYRATRON

NEGATIVE-CONTROL TETRODE TYPE

Supersedes Type 4D22

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 voltage 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 = 125, grid-No.1 square-pulse volts = +100, and peak anode amperes during conduction = 2	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 = 0.3	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 = 0.3	400	μsec

Maximum Critical Grid-No.1 Current:

For conditions: ac anode-supply volts = 460 (rms), and average anode amperes = 0.3	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.1 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	450	

° Without external shield.

* With all other electrodes and base shell connected to ground.

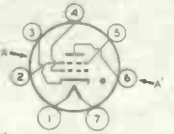
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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-18
Base	Medium-Metal-Shell Giant 7-Pin with Bayonet (JEDEC 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
Pin 5 – Grid No.2
Pin 6 – Anode
Pin 7 – Heater



AA'= PLANE OF ELECTRODES

RELAY AND GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, *Absolute Values:*

PEAK ANODE VOLTAGE:		
Forward	600 max.	volts
Inverse	1500 max.	volts
GRID-No.2 (SHIELD-GRID) VOLTAGE:		
Peak, before tube conduction	-300 max.	volts
Average#, during tube conduction	-10 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:		
Peak or DC, before tube conduction	-300 max.	volts
Average#, during tube conduction	-10 max.	volts
CATHODE CURRENT:		
Peak	6 max.	amp
Average#	0.9 max.	amp
Fault, for duration of 0.1 second max.	30 max.	amp
AVERAGE GRID-No.2 CURRENT#	40.1 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.

RADIO CORPORATION OF AMERICA HARRISON, N.J.

3D22-A
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 0.060" ± 0.005" (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	-9.7	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.

Grid-No.1 Supply Voltage (2)	-4.4	-9.7	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.

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.

3D22-A

GRID-CONTROLLED RECTIFIER CIRCUITS

DC Voltage Control

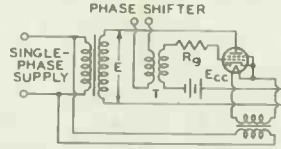


FIG. 1 HALF-WAVE SINGLE-PHASE

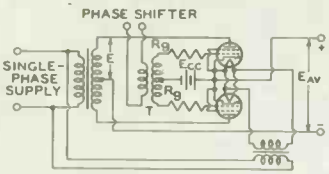


FIG. 2 FULL-WAVE SINGLE-PHASE

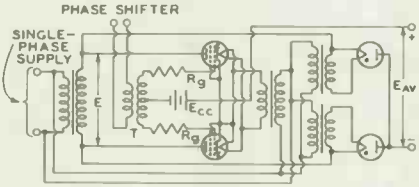


FIG. 3 SERIES SINGLE-PHASE

AC Voltage Control

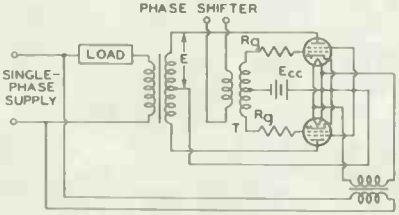


FIG.4 FULL-WAVE SINGLE-PHASE

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 Nº2 AND Nº1 TO CATHODE (PIN 3)

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

3D22-A

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_{dc} = Peak DC Output Voltage
E_r = Major Ripple Voltage (RMS)
f = Supply Frequency
f_r = Major Ripple Frequency
P_{dc} = DC Power ($E_{av} \times I_{av}$)

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

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				
$P_{ac}/I_b E_{bmf}$	--	–	–	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	–

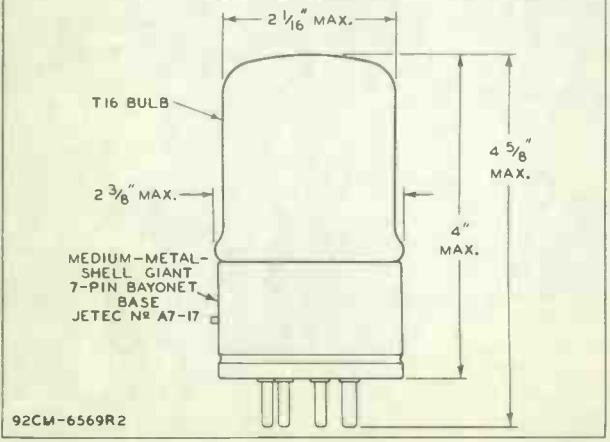
■: see next page.

3D22-A
GAS THYRATRON

RATIO	Fig. 1	Fig. 2	Fig. 3	Fig. 4
Power Ratios (Cont'd)				
Inductive Load■				
P_{ss}/P_{dc}	--	1.57	1.11	-
P_{sp}/P_{dc}	--	1.11	1.11	-
P_{pl}/P_{dc}	--	1.11	1.11	-

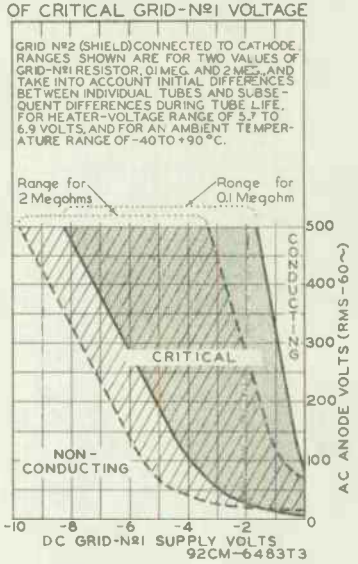
■ The use of a large filter-input choke is assumed, except for the circuit in Fig. 4.

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	230	0.8	184	-
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



3D22-A
GAS THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID-№1 VOLTAGE

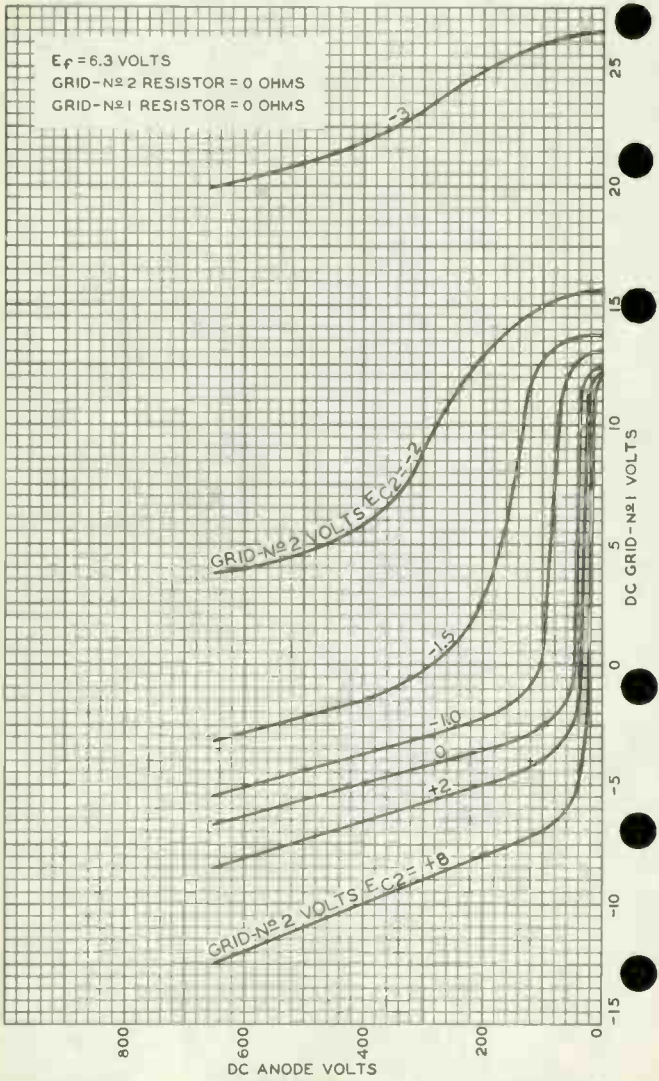


TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

3D22-A

3D22-A

AVERAGE CONTROL CHARACTERISTICS



JAN. 22, 1947

TUBE DIVISION

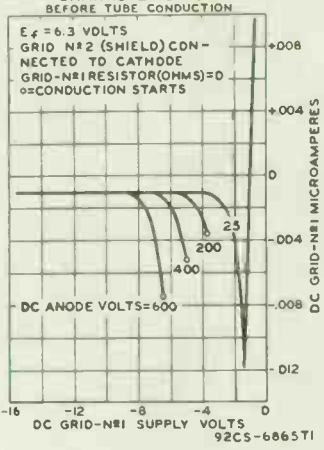
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6831

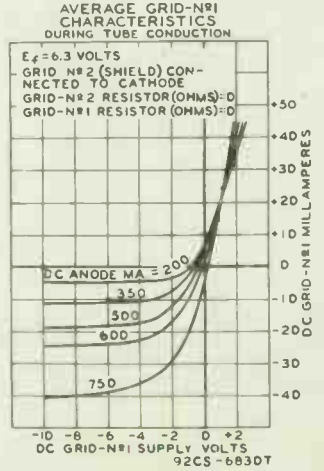
3D22-A

CHARACTERISTIC CURVES

AVERAGE GRID-N°1 CHARACTERISTICS
BEFORE TUBE CONDUCTION



AVERAGE GRID-N°1 CHARACTERISTICS
DURING TUBE CONDUCTION



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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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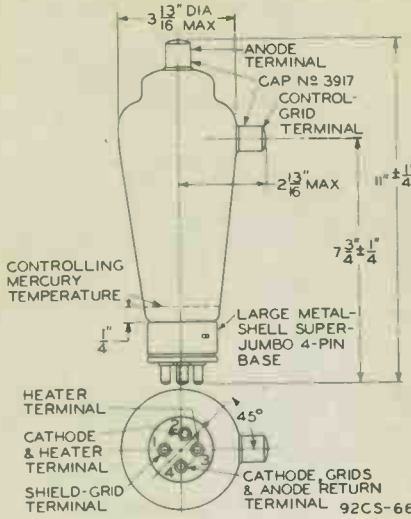
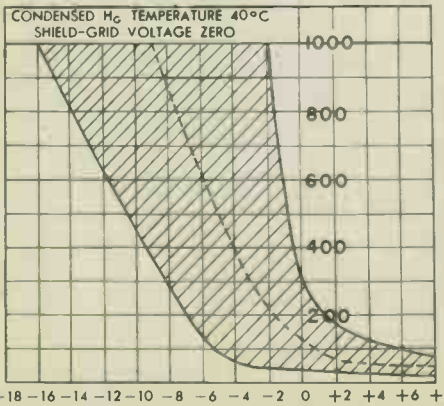
THYRATRON



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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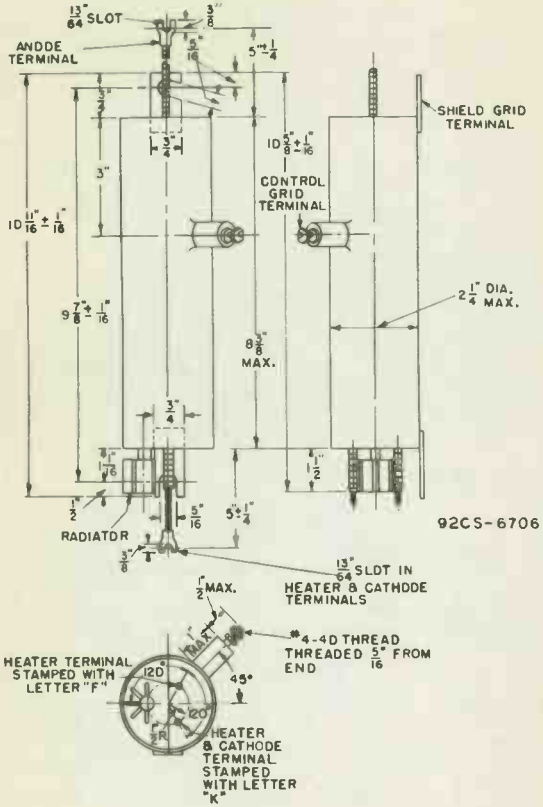
THYRATRON



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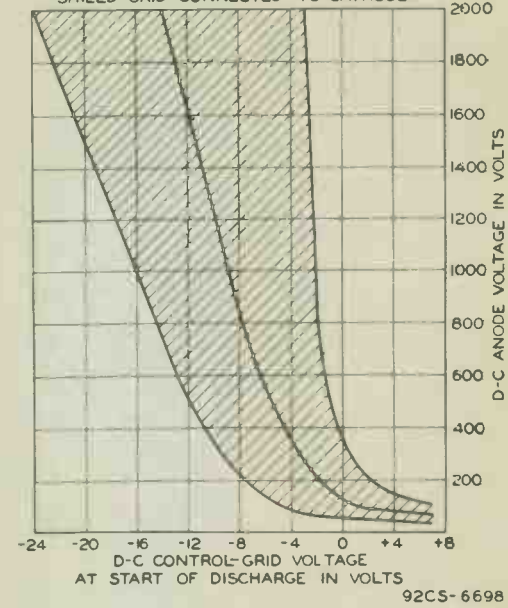
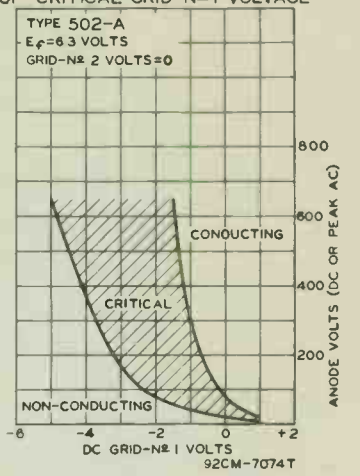
THYRATRON

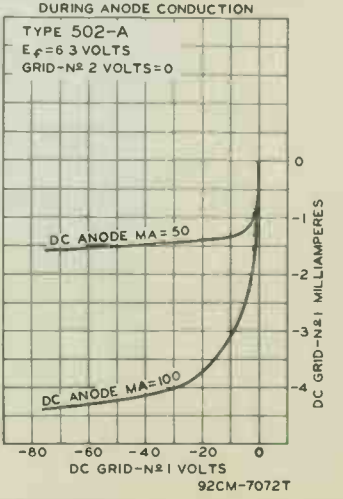


502-A
THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID-Nº 1 VOLTAGE



AVERAGE GRID CHARACTERISTICS DURING ANODE CONDUCTION



502-A
GAS THYRATRON

NEGATIVE-CONTROL TETRODE TYPE WITH METAL SHELL

GENERAL DATA

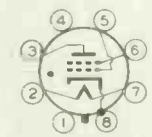
Electrical:

	Min.	Av.	Max.	
Heater, for Unipotential Cathode:				
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) = 100, 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.38-21)

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

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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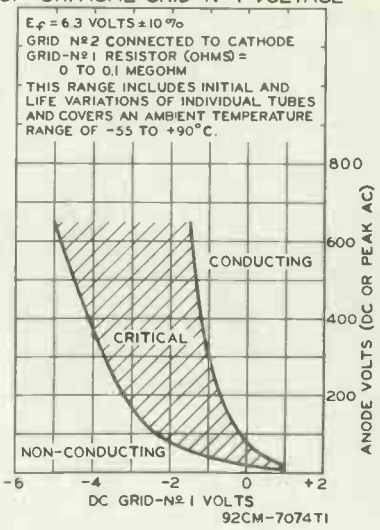
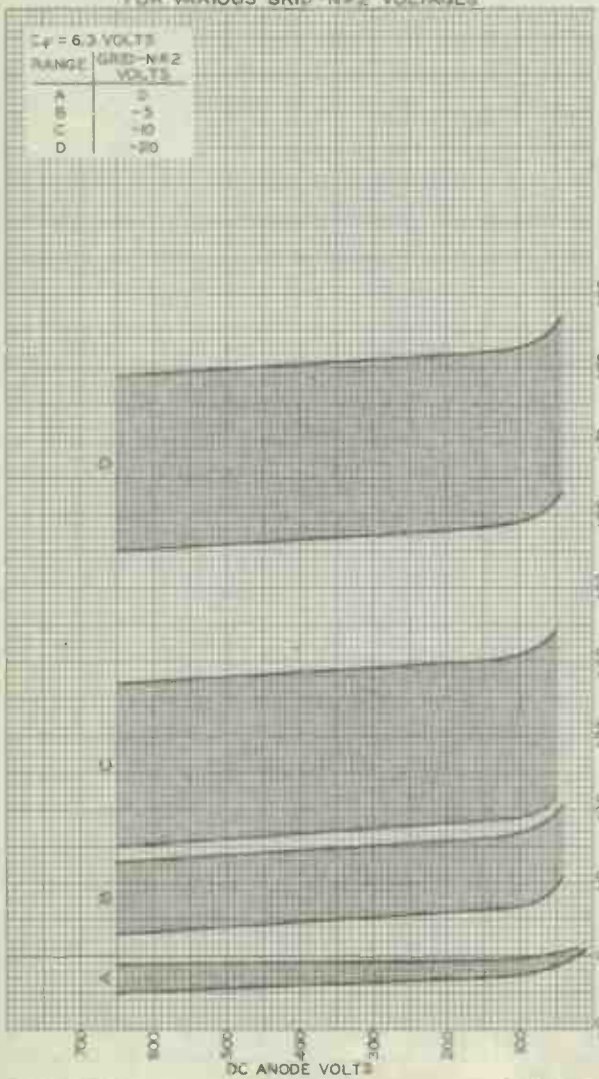
GAS THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID-Nº 1 VOLTAGE



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

502-A
OPERATIONAL RANGES OF CRITICAL GRID-N°1 VOLTAGE FOR VARIOUS GRID-N°2 VOLTAGES

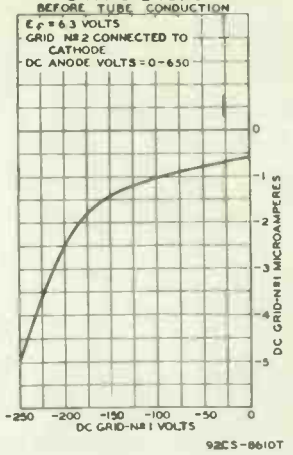


502-A

CHARACTERISTIC CURVES

MAXIMUM GRID-No.1 CHARACTERISTIC

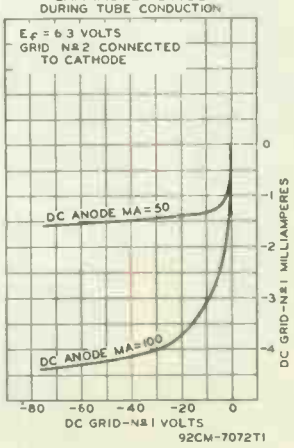
BEFORE TUBE CONDUCTION



92CS-8610T

AVERAGE GRID-No.1 CHARACTERISTICS

DURING TUBE CONDUCTION



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THYRATRON

MERCURY-VAPOR TETRODE

DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage*	5.0	volts
Current	6	amp
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to Anode	0.04	μμf
Grid No.2 to Anode	3	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	8-1/3" ± 1/4"
Maximum Diameter	2-5/16"
Bulb	T-18
Cap	No.3995
Base	Large Shell Super-Jumbo 4-Pin

Maximum Ratings, Absolute Values:
For frequencies up to 150 cycles

PEAK FORWARD ANODE VOLTAGE	1500 max.	volts
PEAK INVERSE ANODE VOLTAGE	1500 max.	volts
PEAK GRID-No.1 (CONTROL-GRID) VOLT.: Before Conduction	-1000 max.	volts
PEAK GRID-No.2 (SHIELD-GRID) VOLTAGE: Before Conduction	-300 max.	volts
PEAK ANODE CURRENT	30 max.	amp
AVERAGE ANODE CURRENT**	2.5 max.	amp
SURGE ANODE CURRENT for 0.1 sec., max.	150 max.	amp
GRID-No.1 CURRENT, Before Conduction (Grid Neg.)	2 max.	μamp
PEAK GRID-No.1 CURRENT	1.0 max.	amp
AVERAGE GRID-No.1 CURRENT**	0.25 max.	amp
PEAK GRID-No.2 CURRENT	1.0 max.	amp
AVERAGE GRID-No.2 CURRENT**	0.25 max.	amp
COND.-MERCURY TEMPERATURE RANGE ▲	40-80	°C

* Heater voltage must be applied at least 5 minutes before anode voltage is applied.

** Averaged over any 15-second interval.

▲ Recommended Condensed-Mercury Temperature 45-50°C.

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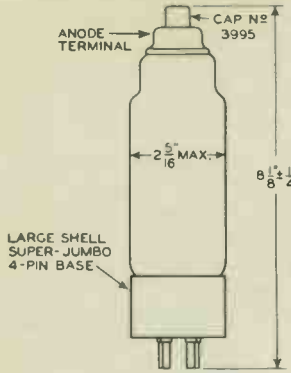
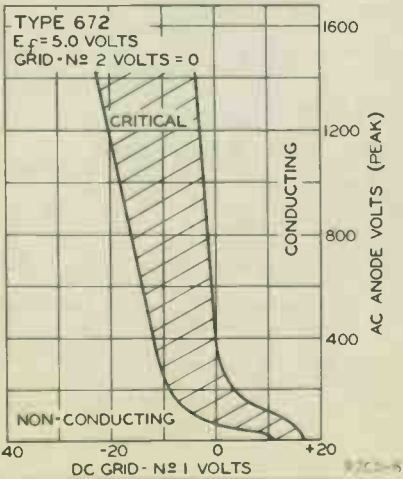
THYRATRON



92CS-6735

OPERATIONAL REGION OF CRITICAL GRID VOLTAGE



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TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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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.

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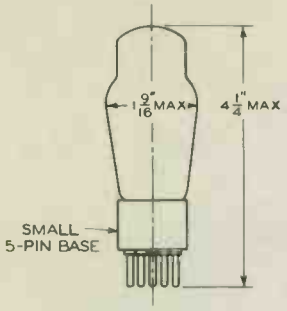
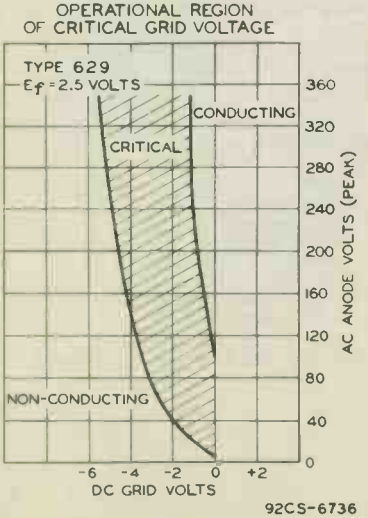
THYRATRON



92CS-6737



92CS-6736

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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THYRATRON
MERCURY-VAPOR TETRODE

Supersedes Type 672

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)

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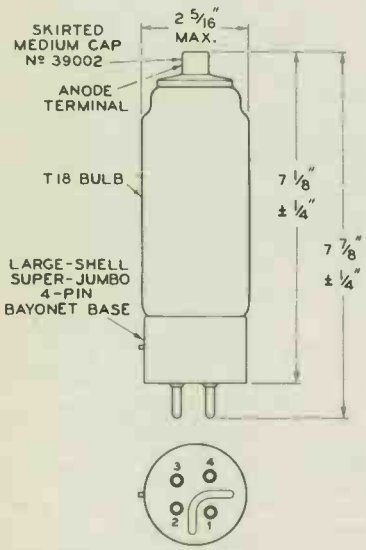
THYRATRON

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.



BOTTOM VIEW OF BASE

92CS-6735R1

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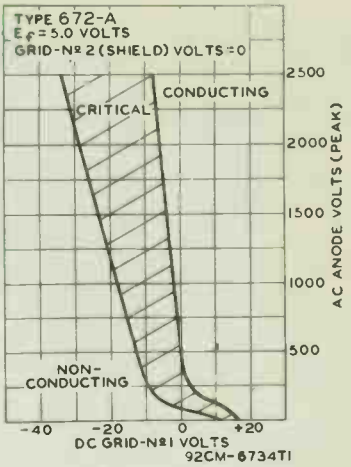
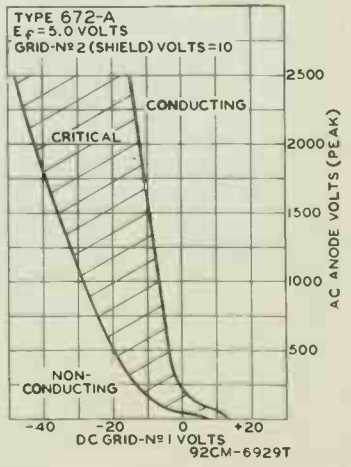
THYRATRON

OPERATIONAL RANGES OF CRITICAL GRID-Nº1 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

	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.

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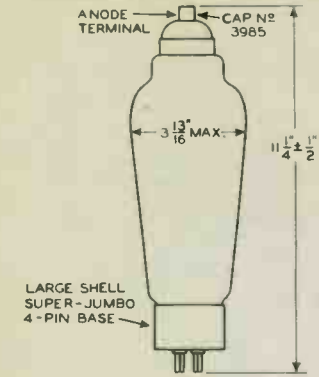
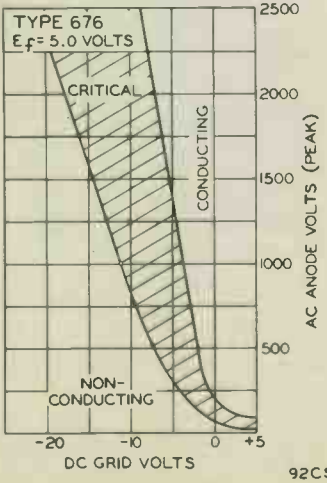
THYRATRON



OPERATIONAL REGION
OF CRITICAL GRID VOLTAGE



92CS-6732

677

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.

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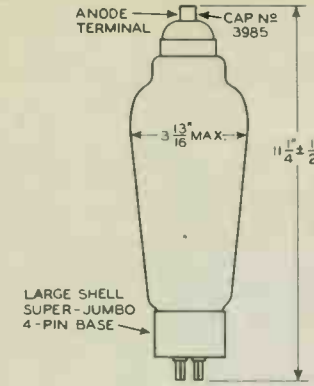
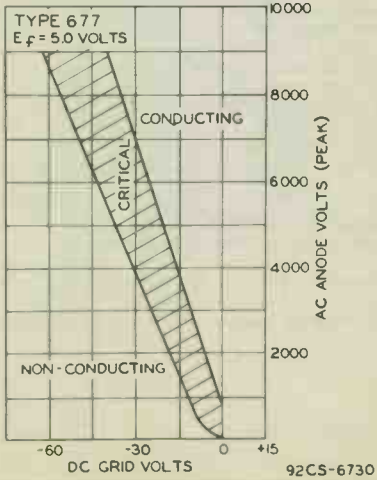
THYRATRON



OPERATIONAL REGION OF CRITICAL GRID VOLTAGE



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	$G\text{-}6O_2$	EA_2	

Pin 1 – No Connection
Pin 2 – Heater
Pin 3 – Anode
Pin 5 – Grid
Pin 7 – Heater
Pin 8 – Cathode

Pin 1 – Heater
Pin 2 – Anode
Pin 3 – Grid
Pin 4 – Cathode
Pin 5 – Heater

BOTTOM VIEWS

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

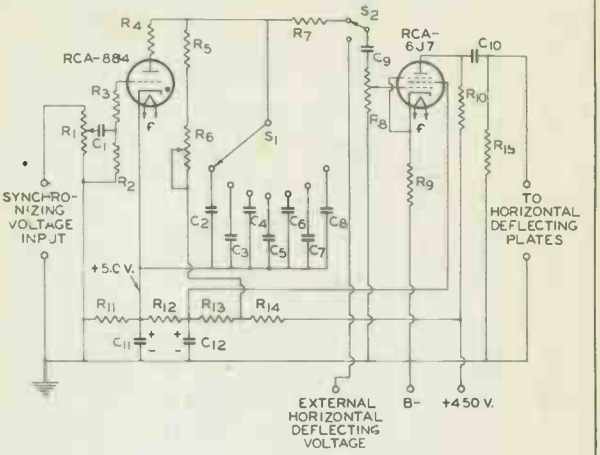
□ The heater voltage should be applied for 10 seconds before tube conduction occurs.

For an averaging period of 30 seconds.

→ Indicates a change.

884

LINEAR SWEEP-CIRCUIT OSCILLATOR AND AMPLIFIER



C_1 = 0.25 μf OR GREATER
C_2 = 0.25 μf 800 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

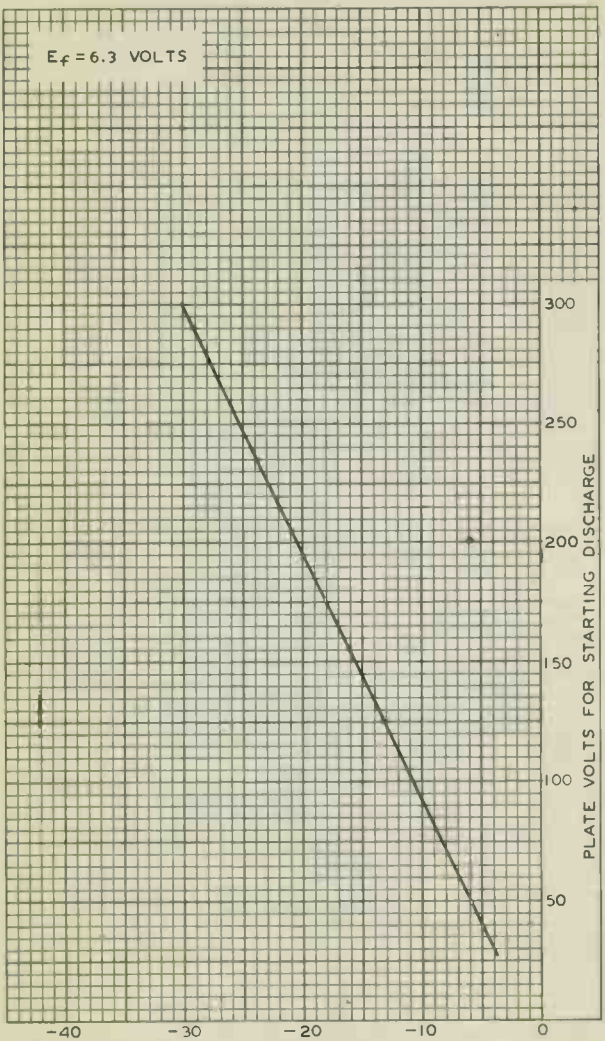
← Indicates a change.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

884

884

AVERAGE CONTROL CHARACTERISTIC



JAN. 4, 1945 RCA VICTOR DIVISION 92CM-4883R1
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

Ignitron

WATER-COOLED, METAL-JACKETED, MERCURY-POOL-CATHODE TYPE HAVING MOUNTING PLATE FOR THERMOSTATIC CONTROL

For Intermittent-Power-Rectifier and Resistance-Welding-Control Applications

GENERAL DATA

Electrical:

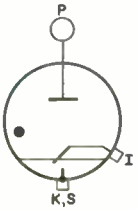
Cathode Excitation	Cyclic	
Cathode-Spot Starting	By Ignitor	
Minimum Requirements for Cathode Excitation:[a]		
Peak ignitor voltage required to fire	200	volts
Peak ignitor current required to fire	30	amp
Starting time at required ignitor voltage or current	100	μsec
Peak Tube Voltage Drop at peak anode amperes =		
3400	26	volts
176	13	volts

Mechanical:

Operating Position	Vertical, flexible lead up
Maximum Overall Length:	
Including flexible lead	23-13/16"
Excluding flexible lead	13"
Maximum Radius (Including water connections)	2-7/8"
Weight (Approx.)	4.5 lbs

Terminal Diagram:

P – Anode Terminal (Flexible lead)
K – Cathode Terminal (Bar opposite anode terminal)



I – Ignitor Terminal (Within jacket skirt at cathode end)
S – Shell

Thermal:

Cooling:		
Type	Water	
Minimum inlet-water temperature	0	°C
Maximum cooling-system temperature (Measured at thermostat mount):		
For Intermittent-Power-Rectifier Service	45	°C
For Resistance-Welding-Control Service at rms anode supply volts =		
600	45	°C
500	50	°C
250	55	°C

Typical cooling requirements for Resistance-Welding-Control Service at rms anode supply volts = 500:

Inlet Water Temperature (°C)	*Required Water Flow (gpm)*	*Pressure Drop (psi)*
With 100% load:		
15	1/4	0.4
30	1/2	0.75
40	1-1/2	3
With 50% load:		
15	1/16	0.1
30	1/8	0.2
40	1/4	0.4

Water-temperature rise with 100% load at flow of 1 gpm . . . . . 2 °C

Temperature Rise (Approx.), inlet water to thermostat, with 100% load at flow of 1 gpm . . . . . 4 °C

INTERMITTENT POWER-RECTIFIER SERVICE

Maximum Ratings, *Absolute-Maximum Values:*

For zero phase-control angle and frequencies from 50 to 60 cps

PEAK ANODE VOLTAGE:				
Forward	500 max.	1200 max.	1500 max.	volts
Inverse	500 max.	1200 max.	1500 max.	volts
ANODE CURRENT:[b]				
Peak	700 max.	600 max.	480 max.	amp
Corresponding average . . .	–	5 max.	4 max.	amp
Average	40 max.	22.5 max.	18 max.	amp
Corresponding peak	–	135 max.	108 max.	amp
AVERAGING TIME . . .	6 max.	10 max.	10 max.	sec
RATIO OF AVERAGE ANODE CURRENT TO PEAK ANODE CURRENT for maximum averaging time (seconds) = 0.2	–	0.166 max.	0.166 max.	
RATIO OF PEAK FAULT ANODE CURRENT TO PEAK ANODE CURRENT .	12.5 max.	12.5 max.	12.5 max.	
FAULT-ANODE-CURRENT DURATION	0.15 max.	0.15 max.	0.15 max.	sec

RESISTANCE-WELDING-CONTROL SERVICE

Maximum Ratings, *Absolute-Maximum Values:*

For two tubes in inverse parallel circuit, zero phase-control angle, frequencies from 25 to 60 cps, and rms supply voltages from 250 to 600 volts

DEMAND	600 max.	kva
Corresponding average anode current (Per tube)	30.2 max.	amp
AVERAGE ANODE CURRENT (Per Tube)[c]	56 max.	amp
Corresponding demand	200 max.	kva
AVERAGING TIME at rms supply volts =		
600[c]	11.25 max.	sec
250[c]	27 max.	sec
RMS ANODE CURRENT (Per Tube)[c]	See *Rating Chart*	
PEAK FAULT ANODE CURRENT (Per Tube)	Limited to 280% of maximum RMS Anode Current	

IGNITOR

Maximum Ratings, *Absolute-Maximum Values:*

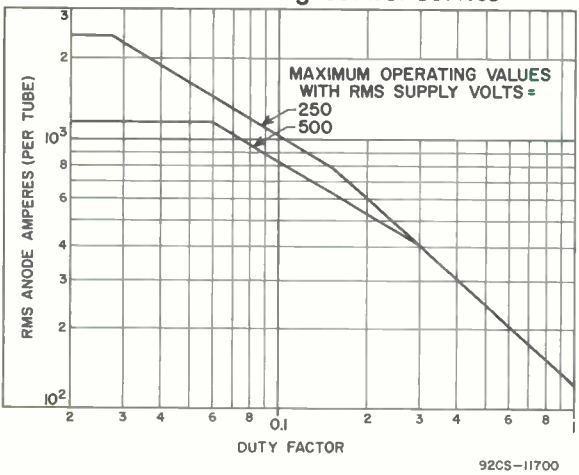
PEAK IGNITOR VOLTAGE:		
Positive	Equal to anode volts	
Negative	5 max.	volts
IGNITOR CURRENT:		
Peak	100 max.	amp
Average	1 max.	amp
RMS	10 max.	amp
AVERAGING TIME	5 max.	sec

[a] Ignition will occur if either the minimum peak ignitor voltage is applied or the minimum peak ignitor current flows for the minimum starting time.

[b] With the use of log-log graph paper, straight-line interpolation between tabulated points may be used to determine intermediate maximum ratings for Peak Anode Current and Average Anode Current.

[c] With the use of log-log graph paper, straight-line interpolation between tabulated points may be used to determine intermediate maximum ratings for RMS Anode Current and Average Anode Current or Averaging Time and RMS Supply Voltage.

ANODE-CURRENT RATING CHART
Resistance-Welding-Control Service



Ignitron

WATER-COOLED, METAL-JACKETED, MERCURY-POOL-CATHODE TYPE HAVING MOUNTING PLATE FOR THERMOSTATIC CONTROL

For Intermittent-Power-Rectifier and Resistance-Welding-Control Applications

GENERAL DATA

Electrical:

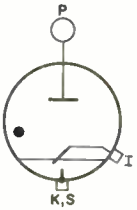
Cathode Excitation		Cyclic
Cathode-Spot Starting		By Ignitor
Minimum Requirements for Cathode Excitation:[a]		
Peak ignitor voltage required to fire	200	volts
Peak ignitor current required to fire	30	amp
Starting time at required ignitor voltage or current	100	μsec
Peak Tube Voltage Drop at peak anode amperes =		
6600	28	volts
440	14	volts

Mechanical:

Operating Position	Vertical, flexible lead up
Maximum Overall Length (Including flexible lead)	26-9/16"
Maximum Radius (Including water connections)	3-5/8"
Weight (Approx.)	10 lbs

Terminal Diagram:

P – Anode Terminal (Flexible lead)
K – Cathode Terminal (Bar opposite anode terminal)



I – Ignitor Terminal (Within jacket skirt at cathode end)
S – Shell

Thermal:

Cooling:		
Type		Water
Minimum inlet-water temperature	0	°C
Maximum cooling-system temperature (Measured at thermostat mount):		
For Intermittent-Power-Rectifier Service	45	°C
For Resistance-Welding-Control Service at rms anode supply volts =		
600	45	°C
500	50	°C
250	55	°C

Typical cooling requirements for Resistance-Welding-Control Service at rms anode supply volts = 500:

Inlet Water Temperature (°C)	*Required Water Flow* (gpm)	*Pressure Drop* (psi)
With 100% load:		
15	3/8	0.6
30	1/2	0.9
40	1-1/4	4
With 50% load:		
15	1/8	0.2
30	1/4	0.4
40	1/2	0.9

Water-temperature rise with 100% load at flow of 1 gpm . . . . . 5 °C

Temperature Rise (Approx.), inlet water to thermostat, with 100% load at flow of 1 gpm . . . . . 4 °C

INTERMITTENT POWER-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
ANODE CURRENT:		
Peak.	1600 max.	amp
Average	100 max.	amp
AVERAGING TIME.	6 max.	sec
PEAK FAULT ANODE CURRENT.	6000 max.	amp
FAULT-ANODE-CURRENT DURATION.	0.15 max.	sec

RESISTANCE-WELDING-CONTROL SERVICE

Maximum Ratings, *Absolute-Maximum Values:*

For two tubes in inverse parallel circuit, zero phase-control angle, frequencies from 25 to 60 cps, and rms supply voltages from 250 to 600 volts

DEMAND.	1200 max.	kva
Corresponding average anode current (Per tube).	75.6 max.	amp
AVERAGE ANODE CURRENT (Per Tube)[b]	140 max.	amp
Corresponding demand.	400 max.	kva
AVERAGING TIME at rms supply volts =		
600[b].	8.75 max.	sec
250[b].	21 max.	sec

RMS ANODE CURRENT (Per Tube)[b] . . . . . .See *Rating Chart*
PEAK FAULT ANODE CURRENT (Per Tube) . . . . . Limited to 280% of maximum RMS Anode Current

IGNITOR

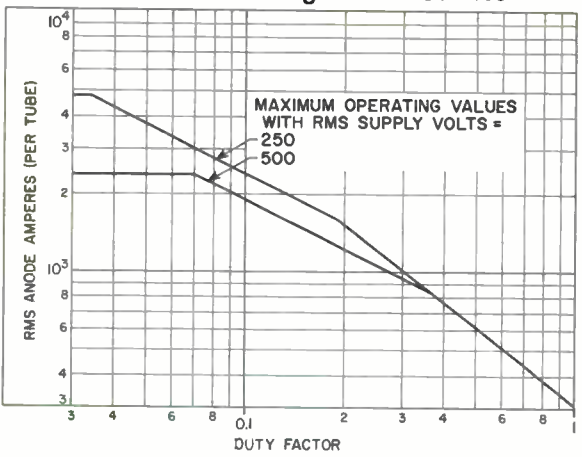
Maximum Ratings, *Absolute-Maximum Values:*

PEAK IGNITOR VOLTAGE:		
Positive	Equal to anode	volts
Negative	5 max.	volts
IGNITOR CURRENT:		
Peak	100 max.	amp
Average	1 max.	amp
RMS	10 max.	amp
AVERAGING TIME	5 max.	sec

[a] Ignition will occur if either the minimum peak ignitor voltage is applied or the minimum peak ignitor current flows for the minimum starting time.

[b] With the use of log-log graph paper, straight-line interpolation between tabulated points may be used to determine intermediate maximum ratings for RMS Anode Current and Average Anode Current or Averaging Time and RMS Supply Voltage.

ANODE-CURRENT RATING CHART
Resistance-Welding-Control Service



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.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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.

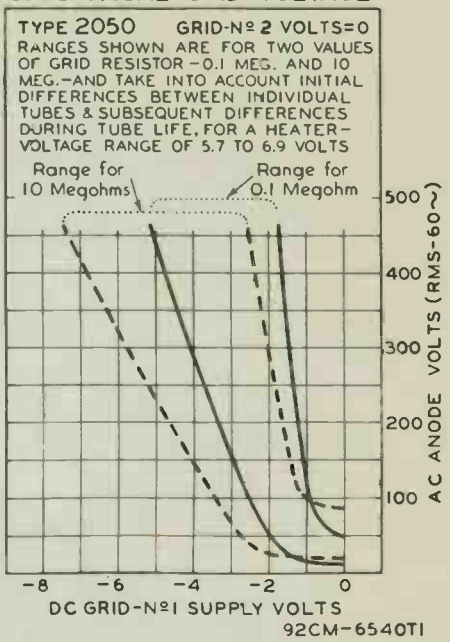
□ Approximately 180° out of phase with the anode voltage.

\# Sufficient resistance, including the tube load, must be used under any conditions of operation to prevent exceeding the current ratings.

→ Indicates a change.

2050
THYRATRON

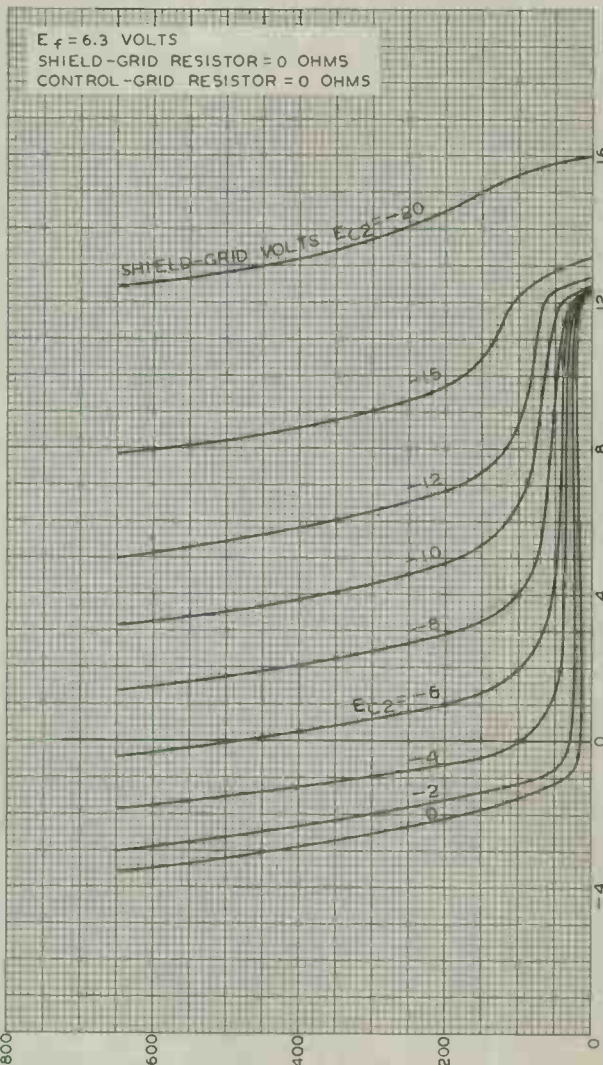
OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

2050

AVERAGE CONTROL CHARACTERISTICS



MAY 3, 1944

RCA VICTOR DIVISION

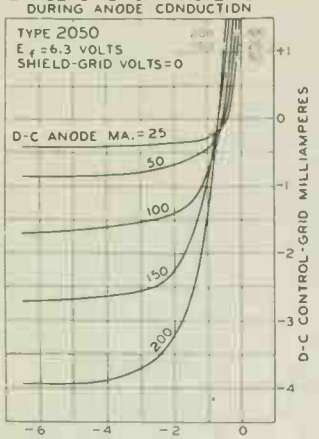
RADIO CORPORATION OF AMERICA

92CM-6274RI

2050

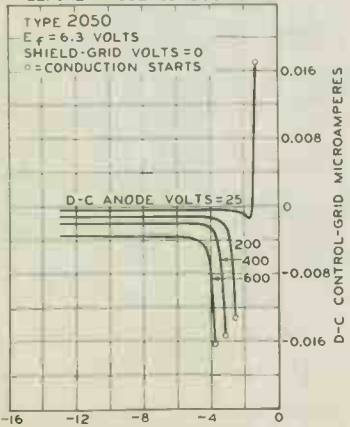
THYRATRON

AVERAGE GRID CHARACTERISTICS
DURING ANODE CONDUCTION



92CM-6275T

AVERAGE GRID CHARACTERISTICS
BEFORE ANODE CONDUCTION



92CM-6541T

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6275T
92CM-6541T

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.):[a]		
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)

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

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 unprecictable 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.

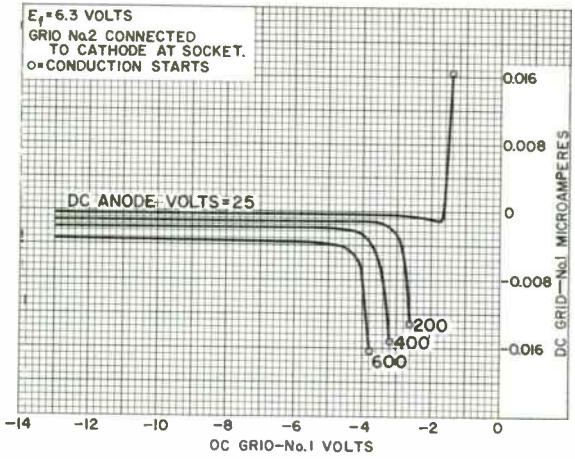
The *shield grid* (grid No.2) is normally connected to the cathode at socket. It may, however, be used as a control electrode because the control characteristic of grid No.1 may be shifted by varying the potential of grid No.2. As grid No.2 is made negative, the grid-No.1 characteristic is shifted in 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.

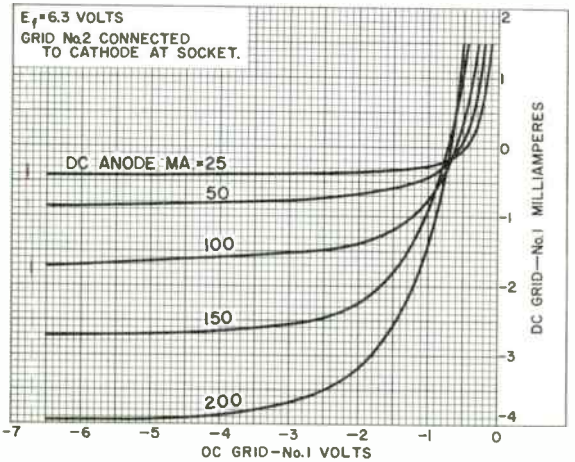
AVERAGE GRID-No.1 CHARACTERISTICS

Before Tube Conduction



92CS-6541R2

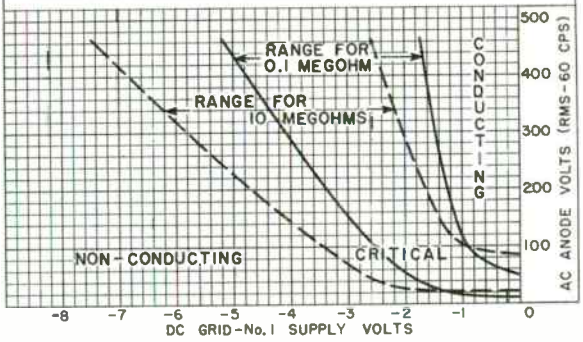
During Tube Conduction



92CS-6275R2

OPERATIONAL RANGE OF CRITICAL GRID-No.1 VOLTAGE

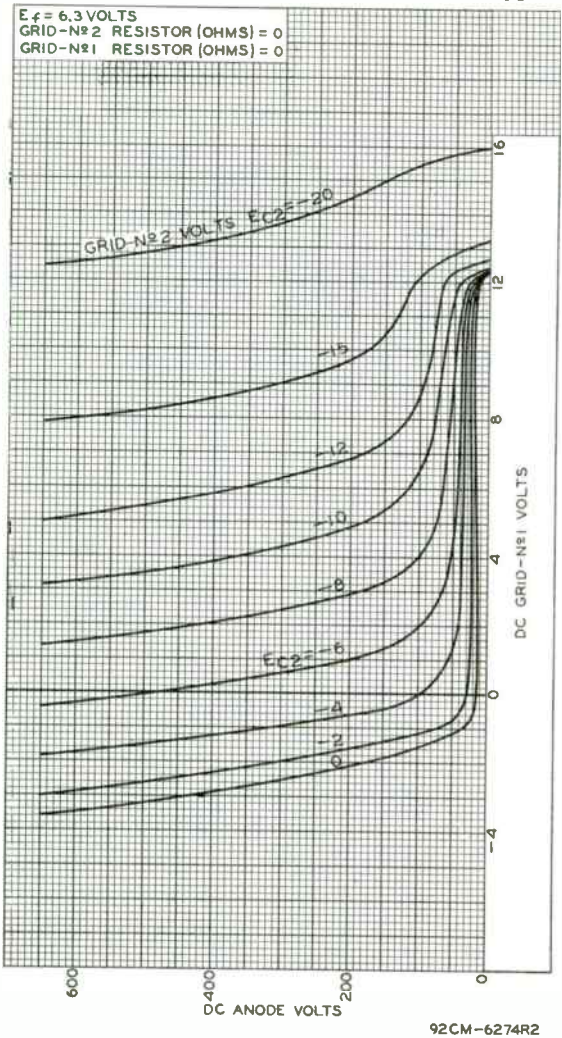
E_f = 6.3 ± 10 % VOLTS
GRID No.2 CONNECTED TO CATHODE AT SOCKET.
AMBIENT-TEMPERATURE RANGE (°C) = -75 TO +90
RANGES SHOWN ARE FOR TWO VALUES OF GRID-No.1 RESISTOR AND TAKE INTO ACCOUNT INITIAL DIFFERENCES BETWEEN INDIVIDUAL TUBES AND SUBSEQUENT DIFFERENCES DURING TUBE LIFE.



92CS-6540R3

2050-A

AVERAGE CONTROL CHARACTERISTICS



92CM-6274R2

SEALED, CLAMP-COOLED, MERCURY-POOL-CATHODE TYPE
For Resistance-Welding Control

GENERAL DATA

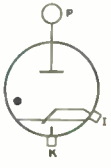
Electrical:

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.

	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.	%

ANODE CURRENT (Per tube):			
Peak	236 max.	708 max.	amp
Demand (RMS, during conduction)[e]	167 max.	500 max.	amp
Average (Averaged over any interval of 9.2 seconds maximum)[e]	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.

[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.

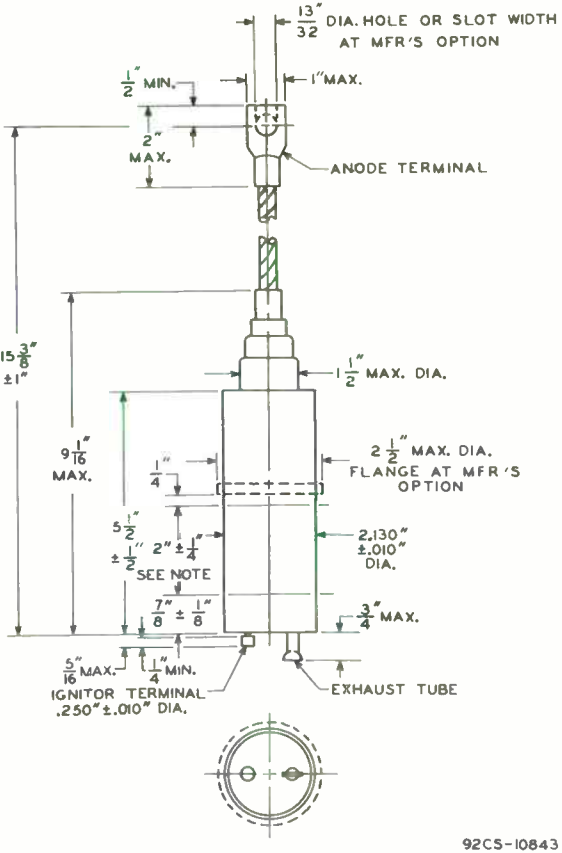
[b] *Column 1* represents operation at maximum average anode current; *Column 2* represents operation at maximum demand power.

[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.

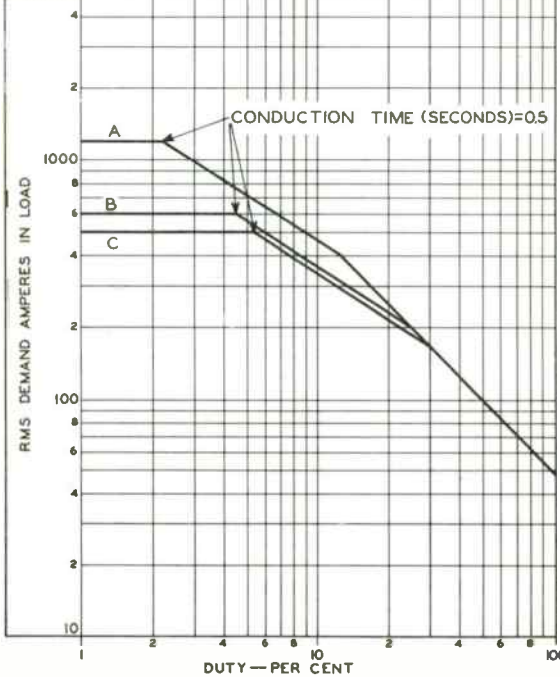


NOTE: CATHODE TERMINAL AND CLAMP-COOLED AREA.

RATING CHART 1
Resistance-Welding-Control Service

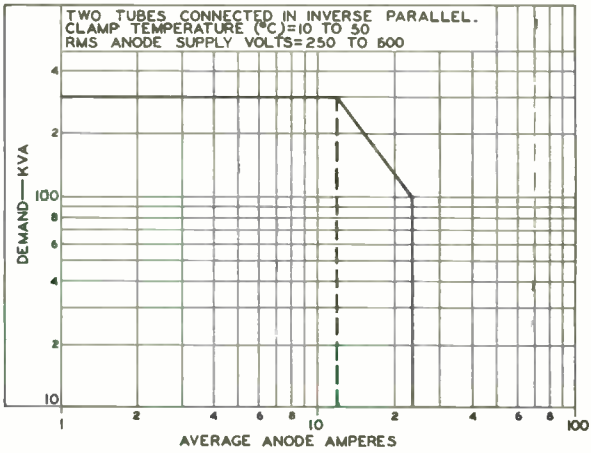
TWO TUBES CONNECTED IN INVERSE PARALLEL
CLAMP TEMPERATURE (°C)=10 TO 50

CURVE	RMS ANODE SUPPLY VOLTS	MAXIMUM AVERAGING TIME — SECONDS
A	250	22
B	500	11
C	600	9.2



92CM-10840RI

RATING CHART 2
Resistance-Welding-Control Service



92CS-10842R1

5551
IGNITRON
SIZE B

DATA

General:

Peak Voltage Drop	12 volts
Cooling:	
Type	Water
Minimum Flow	1 gallon/minute
Maximum Outlet Water Temperature	40°C
Minimum Inlet Water Temperature	10°C
Pressure Drop per tube, at Min. Flow	1.6 lb./sq.in.
Temp. Rise at Minimum Flow (Average current 40 amp/anode) Approx.	2°C
Mounting Position	Vertical, Flexible Lead Up
Max. Rigid Length (Approx.)	13-1/2"
Max. Diameter, including Cooling Connections	5-3/4"

AC WELDER-CONTROL SERVICE®

Ratings are for any voltage from 240 to 600 volts rms at frequencies from 25 to 60 cycles

Maximum Ratings, Absolute Values:

DEMAND	600 max.	kva
CORRESPONDING AVERAGE ANODE CURRENT	30.2 max.	amp
AVERAGE ANODE CURRENT	56 max.	amp
CORRESPONDING DEMAND	200 max.	kva
TIME OF AVERAGING ANODE CURRENT:		
At 500 volts rms	9 max.	sec
At 250 volts rms	18 max.	sec
SURGE ANODE CURRENT	■ peak	amp
PEAK POSITIVE IGNITOR VOLTAGE §	900 max.	volts
	200 min.	volts
PEAK NEGATIVE IGNITOR VOLTAGE	5 max.	volts
PEAK IGNITOR CURRENT §	100 max.	amp
	30 min.	amp
AVERAGE IGNITOR CURRENT*	1 max.	amp
IGNITION TIME §	100 max.	μsec

CURVES FOR THE 5551 IN THIS CLASS OF SERVICE ARE SHOWN UNDER TYPE 5550

INTERMITTENT RECTIFIER SERVICE

For frequencies from 25 to 60 cycles

Maximum Ratings, Absolute Values:

PEAK FORWARD ANODE VOLTAGE	500 max.	volts
PEAK INVERSE ANODE VOLTAGE	500 max.	volts
PEAK ANODE CURRENT	700 max.	amp
AVERAGE ANODE CURRENT#	40 max.	amp
SURGE ANODE CURRENT for 0.15 sec. max.	8000 max.	amp

*, ■, §, ®, #: See next page.

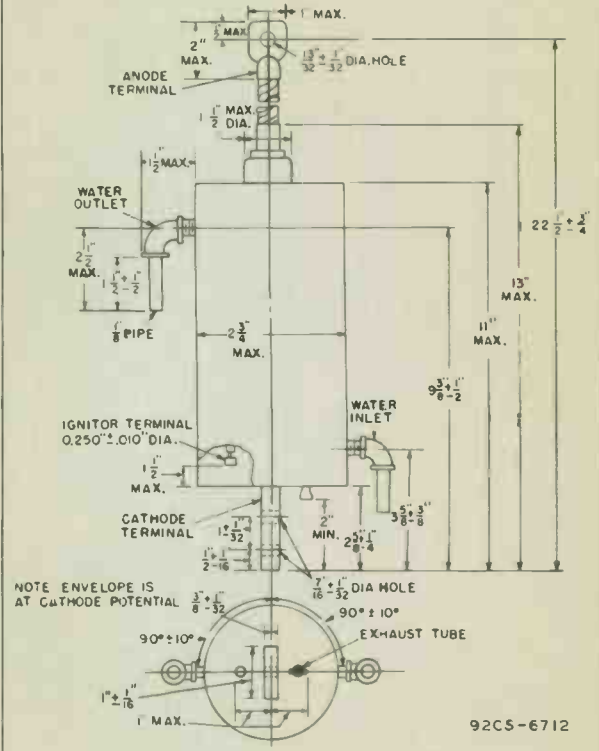
5551
IGNITRON

PEAK POSITIVE IGNITOR VOLTAGE §	900 max. 200 min.	volts volts
PEAK NEGATIVE IGNITOR VOLTAGE	5 max.	volts
PEAK IGNITOR CURRENT §	100 max. 30 min.	volts volts
AVERAGE IGNITOR CURRENT	1 max.	amp
IGNITION TIME §	100 max.	μsec

* Averaged over any 5-second interval.
\# Averaged over any 3-second interval.
■ Must be limited to 280% of maximum rms demand current.
● RMS demand-voltage, -current, and -kva are on the basis of full-cycle conduction(no phase delay)regardless of whether or not phase-control is used. Use the 250-volt rating for voltages below 250 volts.
§ Ignition will occur if either minimum peak positive ignitor potential is applied, or minimum peak ignitor current flows, for the rated maximum ignitor ignition time.

5551

IGNITRON



5552

IGNITRON

SIZE C

DATA

General:

Peak Voltage Drop	12	volts
Cooling:		
Type		Water
Minimum Flow	1.5	gal./min.
Pressure Drop per tube, at Minimum Flow	4.5	lb./sq.in. ←
Maximum Outlet Water Temperature	40	°C
Minimum Outlet Water Temperature	10	°C
Temp. Rise at Min. Flow (Average Current 100 amp/anode) Approx.	3	°C
Mounting Position	Vertical, Flexible Lead Up	
Maximum Rigid Length (Approx.)	14-1/2"	
Maximum Diameter, Including Cooling Connections	7-1/4"	

Terminal Connections:

I – Ignitor

K – Cathode

P – Anode

AC WELDER-CONTROL SERVICE®

Ratings are for any voltage from 250 to 600 volts rms at frequencies from 25 to 60 cycles per second

Maximum Ratings, *Absolute Values*:

Two Tubes in Inverse Parallel

DEMAND	1200	max.	kva
Average Anode Current at Maximum Demand.	75.6	max.	amp
ANODE CURRENT:			
Average*	140	max.	amp
Demand at Max. Average Anode Current	400	max.	kva
Fault:			←
At 600 volts rms	5600	max.	amp
At 250 volts rms	13450	max.	amp
PEAK IGNITOR VOLTAGE:			
Positive§	900	max.	volts
	200	min.	volts
Negative	5	max.	volts
IGNITOR CURRENT:			
Peak§	100	max.	amp
	30	min.	amp
Average**	1	max.	amp
IGNITOR IGNITION TIME§	100	max.	μsec

® RMS demand-voltage, -current, and -kva are on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase-control is used. Use the 250-volt rating for voltages below 250 volts.

* Averaged over any 5.8-second maximum interval for operation at 600 volts rms and over any 14-second maximum interval at 250 volts rms.

§,**: See next page.

← Indicates a change.

5552

5552

IGNITRON

INTERMITTENT RECTIFIER SERVICE

For frequencies from 25 to 60 cycles per second

Maximum Ratings, *Absolute Values*:

PEAK ANODE VOLTAGE:		
Forward	500 max.	volts
Inverse	500 max.	volts
ANODE CURRENT:		
Peak	1600 max.	amp
Average□	100 max.	amp
Fault, for 0.15 second maximum	6000 max.	amp
PEAK IGNITOR VOLTAGE:		
Positive§	900 max.	volts
	200 min.	volts
Negative	5 max.	volts
IGNITOR CURRENT:		
Peak§	100 max.	amp
	30 min.	amp
Average**	1 max.	amp
IGNITOR IGNITION TIME§	100 max.	μsec

§ Ignition will occur if either minimum peak positive Ignitor potential is applied, or minimum peak Ignitor current flows, for the rated maximum ignition time.

** Averaged over any 5-second maximum interval.

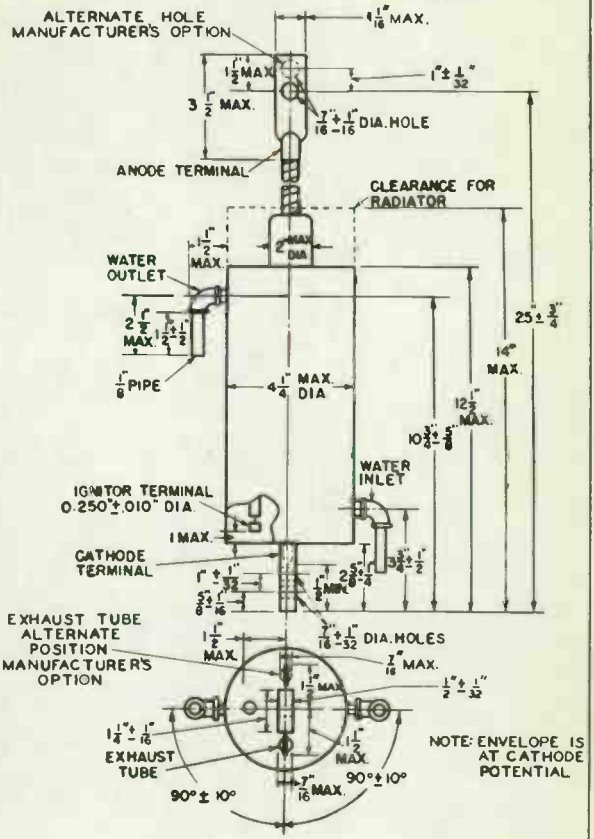
□ Averaged over any 6-second maximum interval.

Curves for the 5552 in AC Welder-Control Service are shown under Type 5550

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5552

IGNITRON



RCA

5553
IGNITRON
SIZE D

DATA

General:

Peak Voltage Drop	42 volts
Cooling:	
Type	Water
Minimum Flow	3 gal./min.
Pressure Drop per tube, at Minimum Flow	5.1 lb./sq. in.
Maximum Outlet Water Temperature	40 °C
Minimum Inlet Water Temperature	10 °C
Temp. Rise at Min. Flow (Average current 200 amp/anode), Approx.	5 °C
Mounting Position	Vertical, Flexible Lead Up
Maximum Rigid Length (Approx.)	20"
Maximum Diameter, including Cooling Connections	9-3/8"

AC WELDER-CONTROL SERVICE ⊕

Ratings are for any voltage from 250 to 600 volts rms at frequencies from 25 to 60 cycles

Maximum Ratings, Absolute Values:

DEMAND	2400 max.	kva
CORRESPONDING AVERAGE ANODE CUR.	192 max.	amp
AVERAGE ANODE CURRENT	355 max.	amp
CORRESPONDING DEMAND	800 max.	kva
TIME OF AVERAGING ANODE CURRENT:		
At 500 volts RMS	5.6 max.	sec
At 250 volts RMS	11 max.	sec
SURGE ANODE CURRENT	■ peak	amp
PEAK POSITIVE IGNITOR VOLTAGE §	900 max.	volts
	200 min.	volts
PEAK NEGATIVE IGNITOR VOLTAGE	5 max.	volts
PEAK IGNITOR CURRENT§	100 max.	amp
	30 min.	amp
AVERAGE IGNITOR CURRENT*	1 max.	amp
IGNITION TIME§	100 max.	μsec

CURVES FOR THE 5553 IN THIS CLASS OF SERVICE ARE SHOWN UNDER TYPE 5550

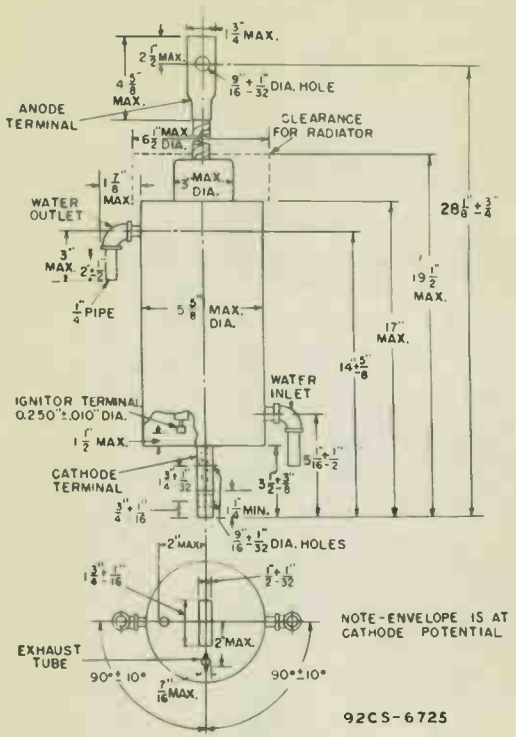
* Averaged over any 5-second interval.

■ Must be held to 280% of maximum demand rms current.

⊕ RMS demand-voltage, -current, and -kva are on the basis of full-cycle conduction(no phase delay)regardless of whether or not phase-control is used. Use the 250-volt rating for voltages below 250 volts.

§ Ignition will occur if either minimum peak positive ignitor potential is applied, or minimum peak ignitor current flows, for the rated maximum ignitor ignition time.

5553
IGNITRON



5554
IGNITRON

DATA

General:

Cathode	Pool Type
Number of Ignitors•	2
Number of Main Anodes	1
Number of Auxiliary Anodes	1
Peak Voltage Drop:	
At 100 Amp. Peak-Anode Current	12.6 volts
At 300 Amp. Peak Anode Current	14.4 volts
At 600 Amp. Peak Anode Current	17.3 volts
Cooling:	
Type	Water
Typical Flow	1.5 to 3 gal./min.
Pressure Drop at Above Flow	2 to 5 lb./sq.in.
Temperature Rise at Lower Rate of Flow (150 Amp per Anode)	6°C
Mounting Position	Vertical, Flexible Lead Up
Maximum Rigid Length (Approx.)	17-1/2"
Diameter, Including Cooling Couplings	7-1/2" ± 1/8"

RECTIFIER SERVICE

For frequencies from 25 to 60 Cycles, Phase Retard = 0

Maximum Ratings, Absolute Values:

PEAK FORWARD ANODE VOLTAGE	900 max.	2100 max.	volts
PEAK INVERSE ANODE VOLTAGE	900 max.	2100 max.	volts
PEAK ANODE CURRENT	900 max.	600 max.	amp
AVERAGE CONTINUOUS ANODE CUR.	100 max.	75 max.	amp
2-HOUR AVERAGE ANODE CURRENT*	150 max.	112.5 max.	amp
1-MINUTE AVERAGE ANODE CUR.**	200 max.	150 max.	amp
SURGE ANODE CURRENT for 0.15 sec. max.	6000 max.	4500 max.	amp
OUTLET WATER TEMPERATURE	60 max.	45 max.	°C
INLET WATER TEMPERATURE	6 min.	6 min.	°C
WATER FLOW, AT CONTINUOUS AVERAGE ANODE CUR. RATING	1.5 min.	1.5 min.	gpm
WATER FLOW, AT NO LOAD#	0.5 min.	0.5 min.	gpm
PEAK INVERSE AUXILIARY ANODE VOLTAGE:			
With Anode Conducting	25 max.	25 max.	volts
With Anode Not Conducting	150 max.	150 max.	volts
AVERAGE AUXILIARY ANODE CUR.	5 max.	5 max.	amp
PEAK POSITIVE IGNITOR VOLTAGE	900 max.	2100 max.	volts
PEAK NEGATIVE IGNITOR VOLTAGE	5 max.	--	volts
PEAK IGNITOR CURRENT	100 max.	--	volts
AVERAGE IGNITOR CURRENT##	2 max.	--	volts
IGNITION TIME	100 max.	--	volts

GENERAL REQUIREMENTS for SELF-EXCITATION and SEPARATE EXCITATION are given on the next page

•, *, **, #, ##: See next page.

5554

5554

IGNITRON

AC WELDER-CONTROL SERVICE

Ratings for 2400 volts rms, 25 to 60 cycles

Maximum Ratings, Absolute Values:

DEMAND	1200 max.	kva
CORRESPONDING AVERAGE ANODE CURRENT	75 max.	amp
AVERAGE ANODE CURRENT	113 max.	amp
CORRESPONDING DEMAND	600 max.	kva
TIME OF AVERAGING ANODE CURRENT:		
At 2400 v RMS	1.5 max.	sec
SURGE ANODE CURRENT, for 0.15 sec. max.	3000 max.	amp
WATER FLOW	1.5 min.	gpm
OUTLET WATER TEMPERATURE	30 max.	°C
PEAK INVERSE AUXILIARY ANODE VOLTAGE:		
With Anode Conducting	25 max.	volts
With Anode Not Conducting	150 max.	volts
AVERAGE AUXILIARY ANODE CUR.	5 max.	amp
PEAK POSITIVE IGNITOR VOLTAGE	2400 max.	volts
PEAK NEGATIVE IGNITOR VOLTAGE	5 max.	volts
PEAK IGNITOR CURRENT	100 max.	amp
AVERAGE IGNITOR CURRENT##	2 max.	amp
IGNITION TIME	100 max.	μsec

GENERAL REQUIREMENTS for SELF-EXCITATION and SEPARATE-EXCITATION are given below

SELF-EXCITATION (ANODE FIRING)

See Circuit 92CS-6722

PEAK IGNITOR VOLTAGE	150 min.	volts
PEAK IGNITOR CURRENT	40 min.	amp
Ignitor series resistance for anode firing at anode voltages of:		
600 volts or less	4	ohms
601 to 1000 volts (Approx.)	10	ohms
1001 to 1500 volts (Approx.)	20	ohms
1501 to 2000 volts (Approx.)	35	ohms
2001 to 2400 volts (Approx.)	50	ohms

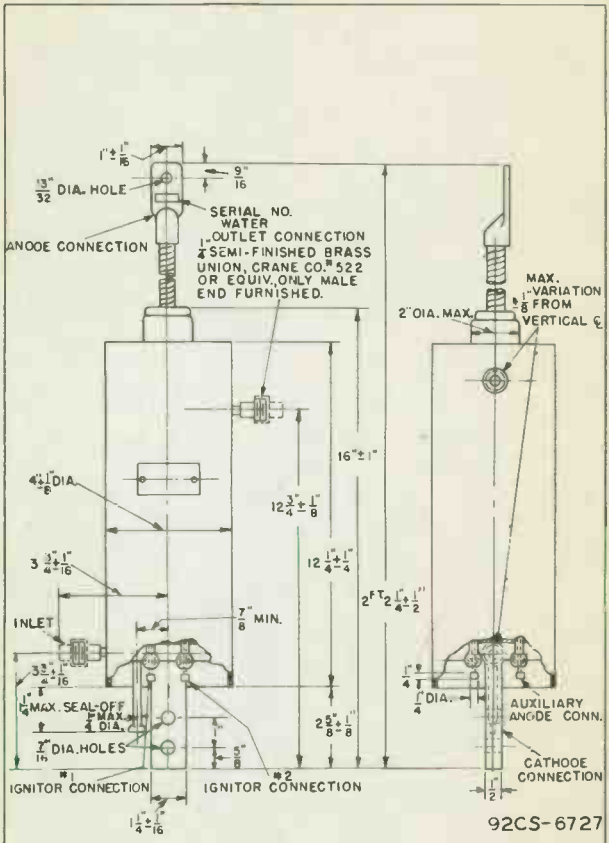
SEPARATE EXCITATION (CAPACITOR FIRING)

See Circuit 92CS-6722

Minimum volt-ampere requirements are shown on Curve 92CS-6723

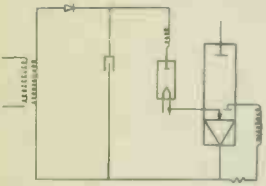
• Use only one ignitor at a time.
* Averaged over any 2-minute interval.
** Averaged over any 1-minute interval.
# For systems in which the flow of water is controlled by the load.
Averaged over any 10-second interval.

5554
IGNITRON

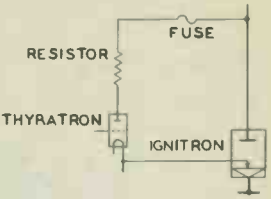


5554
IGNITRON

ELEMENTARY CIRCUIT FOR CAPACITOR FIRING

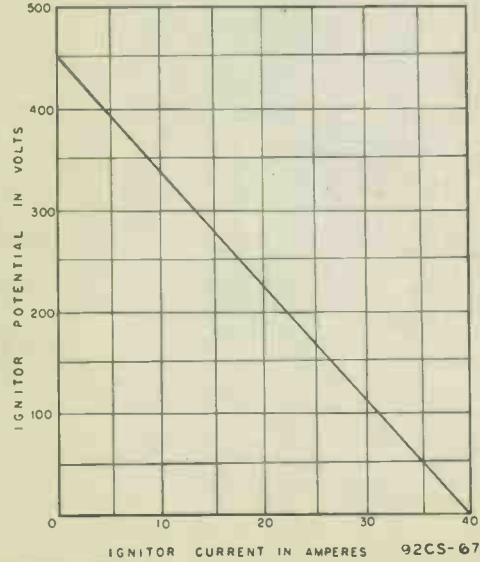


ELEMENTARY CIRCUIT FOR ANODE FIRING



92CS-6722

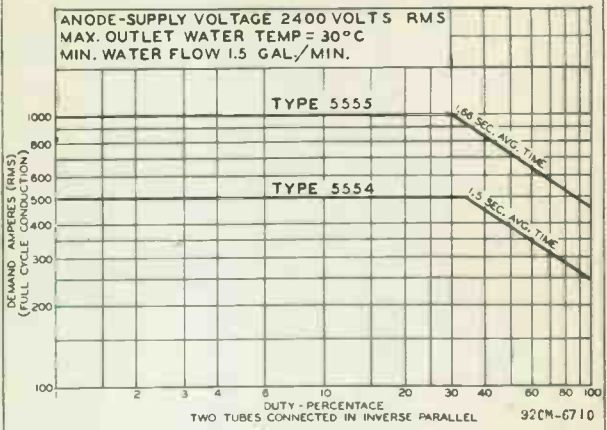
MINIMUM VOLT-AMPERE REQUIREMENTS FOR SEPARATE-EXCITATION FIRING SYSTEMS

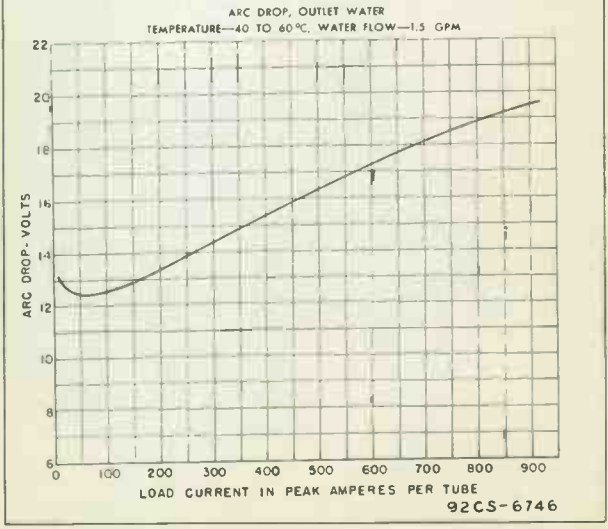


92CS-6723

5554
IGNITRON

WELDER-CONTROL SERVICE





Ignitron

WATER-COOLED, STEEL-JACKETED, MERCURY-POOL-CATHODE TYPE

For Power-Rectifier and Resistance-Welding-Control Applications

GENERAL DATA

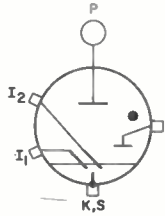
Electrical:

Cathode Excitation	Cyclic	
Cathode-Spot Starting	By Ignitor	
Minimum Requirements for Cathode Excitation:		
Peak ignitor voltage required to fire	150	volts
Peak ignitor current required to fire	40	amp
Starting time at required voltage or current	100	μsec
Tube Voltage Drop:		
At peak anode amperes = 600	16.2 ± 0.5	volts

Mechanical:

Operating Position	Vertical, flexible lead up
Length, Bottom of Cathode Terminal to Center of Hole in Anode Terminal	28-1'8" ± 3/4"
Maximum Radius (Including water connections)	4-9/16"
Weight (Approx.)	25 lbs

Terminal Diagram (See *Dimensional Outline*):



P – Anode
I_1 – Ignitor No.1[a]
I_2 – Ignitor No.2[a]
P_H – Holding Anode
K – Cathode
S – Shell

Thermal:

Cooling:		
Type	Water	
Minimum inlet-water temperature:		
For substantially constant loads	6	°C
For widely fluctuating loads	25	°C
Maximum outlet-water temperature for peak inverse anode volts =		
900	60	°C
2100	45	°C
Minimum water flow:		
At maximum-rated continuous average anode current	3	gpm
At no load	1	gpm
Maximum water-temperature rise	4.5	°C
Maximum pressure drop at water flow (gpm) = 3	6	psi

← Indicates a change.

POWER-RECTIFIER SERVICE

Maximum Ratings, *Absolute-Maximum Values:*

For zero phase-control angle and frequencies from 25 to 60 cps

PEAK ANODE VOLTAGE:			
Forward	900 max.	2100 max.	volts
Inverse	900 max.	2100 max.	volts
ANODE CURRENT:			
Peak	1800 max.	1200 max.	amp
Average:			
Continuous	200 max.	150 max.	amp
Averaged over any interval of 1 minute	400 max.	300 max.	amp
Fault, for duration of 0.15 second maximum	12000 max.	9000 max.	amp

RESISTANCE-WELDING-CONTROL SERVICE[b]

Two Tubes in Inverse-Parallel Circuit

Maximum Ratings, *Absolute-Maximum Values:*

For frequencies from 25 to 60 cps

	Column 1[c]	*Column 2*[c]	
SUPPLY VOLTAGE (RMS)	2400 max.	2400 max.	volts
DEMAND POWER (During conduction[d])	1105 max.	2400 max.	kva
ANODE CURRENT (Per tube):			
Average (Averaged over any interval of 1.66 seconds maximum	207 max.	135 max.	amp
Fault	6000 max.	6000 max.	amp

IGNITORS — Two[a]

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 10 seconds maximum	2 max.	amp
RMS	15 max.	amp

HOLDING ANODE

Maximum Ratings, *Absolute-Maximum Values:*

PEAK HOLDING-ANODE VOLTAGE:		
Forward	160 max.	volts

→ Indicates a change.

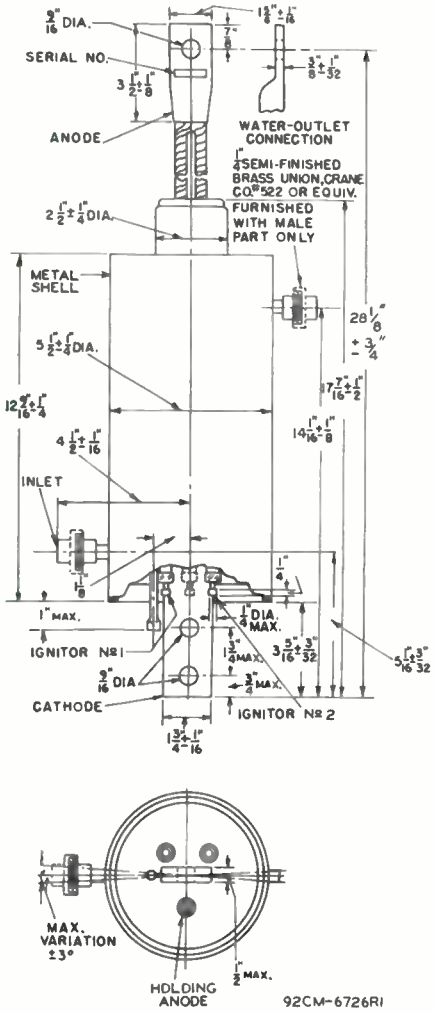
Inverse:		
Main anode conducting	25 max.	volts
Main anode not conducting	160 max.	volts
HOLDING-ANODE CURRENT:		
Peak	20 max.	amp
Average (Averaged over any interval of 10 seconds maximum)	5 max.	amp
RMS	10 max.	amp

[a] To insure longer life, this type is provided with two ignitors, only one which is used at a time.

[b] 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.

[c] *Column 1* represents operation at maximum average anode current; *Column 2* represents operation at maximum demand current.

[d] With the use of log-log paper, straight-line interpolation between tabulated points may be used for other detailed ratings of demand kva vs. average anode current.



5555
IGNITRON

DATA

General:

Cathode	Pool type
Number of Ignitors •	2
Number of Main Anodes	1
Number of Auxiliary Anodes	1
Peak Voltage Drop:	
At 100 Amp Peak Anode Current	12.6 volts
At 300 Amp Peak Anode Current	14.1 volts
At 600 Amp Peak Anode Current	16.2 volts
At 1200 Amp Peak Anode Current	19.1 volts
Cooling:	
Type	Water
Typical Flow	3 to 5 gal./min.
Pressure Drop at Above Flow	3 to 8 lb./sq.in.
Temp. Rise at Lower Rate of Flow (300 Amp per Anode)	7°C
Mounting Position	Vertical, Flexible Lead Up
Maximum Rigid Length (Approx.)	18-1/2"
Diameter, Including Cooling Couplings	9" ± 1/8"

RECTIFIER SERVICE

For Frequencies from 25 to 60 cycles, Phase Retard = 0

Maximum Ratings, Absolute Values:

PEAK FORWARD ANODE VOLTAGE	900 max.	2100 max.	volts
PEAK INVERSE ANODE VOLTAGE	900 max.	2100 max.	volts
PEAK ANODE CURRENT	1800 max.	1200 max.	amp
AVERAGE CONTINUOUS ANODE CUR.	200 max.	150 max.	amp
2-HOUR AVERAGE ANODE CUR.*	300 max.	225 max.	amp
1-MINUTE AVERAGE ANODE CUR.**	400 max.	300 max.	amp
SURGE ANODE CURRENT for 0.15 sec. max.	12000 max.	9000 max.	amp
OUTLET WATER TEMPERATURE	60 max.	45 max.	°C
INLET WATER TEMPERATURE	6 min.	6 min.	°C
WATER FLOW, AT CONTINUOUS AVERAGE ANODE CUR. RATING	3 min.	3 min.	gpm
WATER FLOW, AT NO LOAD#	1 min.	1 min.	gpm
PEAK INVERSE AUXILIARY ANODE VOLTAGE:			
With anode conducting	25 max.	25 max.	volts
With anode not conducting	150 max.	150 max.	volts
AVERAGE AUXILIARY ANODE CUR.	5 max.	5 max.	amp
PEAK POSITIVE IGNITOR VOLTAGE	900 max.	2100 max.	volts
PEAK NEGATIVE IGNITOR VOLTAGE	5 max.		volts
PEAK IGNITOR CURRENT	100 max.		amp
AVERAGE IGNITOR CURRENT##	2 max.		amp
IGNITION TIME	100 max.		μsec

GENERAL REQUIREMENTS for SELF-EXCITATION and SEPARATE EXCITATION are given on the next page

•, *, **, #, ##: See next page.

5555

5555
IGNITRON

AC WELDER - CONTROL SERVICE

Ratings for 2400 volts rms, 25 to 60 cycles

Maximum Ratings, Absolute Values:

DEMAND	2400 max.	kva
CORRESPONDING AVERAGE ANODE CURRENT	135 max.	amp
AVERAGE ANODE CURRENT	207 max.	amp
CORRESPONGING DEMAND	1105 max.	kva
TIME OF AVERAGING ANODE CURRENT at 2400 volts rms	1.66 max.	sec
SURGE ANODE CURRENT, for 0.15 sec.max.	6000 max.	amp
WATER FLOW	3 min.	gal./ min.
OUTLET WATER TEMPERATURE	30 max.	°C
PEAK INVERSE AUXILIARY ANODE VOLTAGE:		
With anode conducting	25 max.	volts
With anode not conducting	150 max.	volts
AVERAGE AUXILIARY ANODE CURRENT	5 max.	amp
PEAK POSITIVE IGNITOR VOLTAGE	2400 max.	volts
PEAK NEGATIVE IGNITOR VOLTAGE	5 max.	volts
PEAK IGNITOR CURRENT	100 max.	amp
AVERAGE IGNITOR CURRENT##	2 max.	amp
IGNITION TIME	100 max.	μsec

Demand-ampere requirements are shown on curve 92CM-6710 under type 5554

SELF-EXCITATION (ANODE FIRING)

See Circuit 92CS-6722 under type 5554

PEAK IGNITOR VOLTAGE	150 min.	volts
PEAK IGNITOR CURRENT	40 min.	amp
Ignitor series resistance for anode firing at anode voltages of:		
600 volts or less (Approx.)	4	ohms
601 to 1000 volts (Approx.)	10	ohms
1001 to 1500 volts (Approx.)	20	ohms
1501 to 2000 volts (Approx.)	35	ohms
2001 to 2400 volts (Approx.)	50	ohms

SEPARATE EXCITATION (CAPACITOR FIRING)

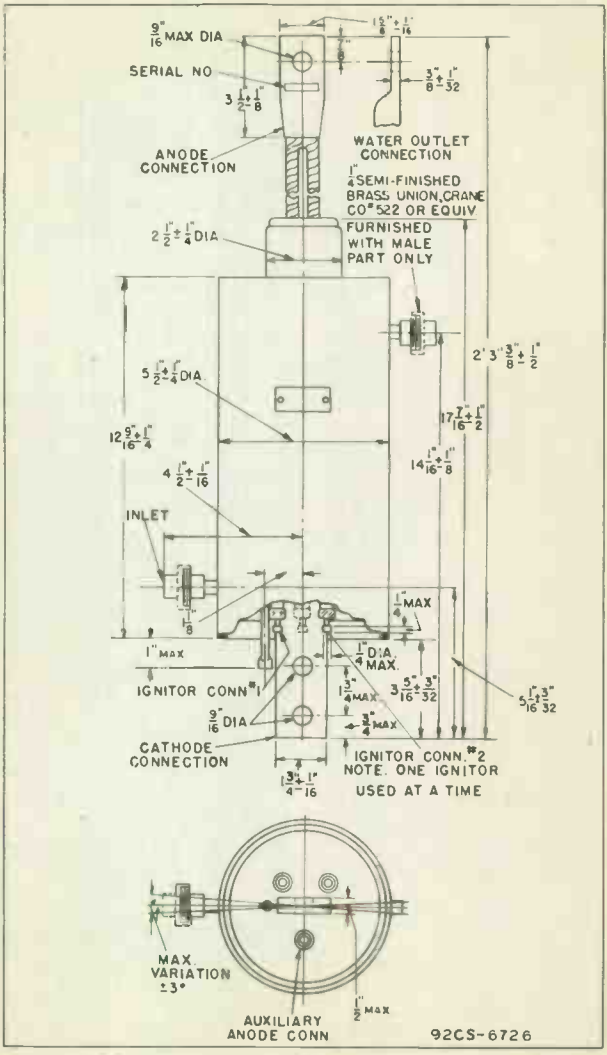
See Circuit 92CS-6722 under type 5554

Minimum volt-ampere requirements are shown on curve 92CS-6723 under type 5554

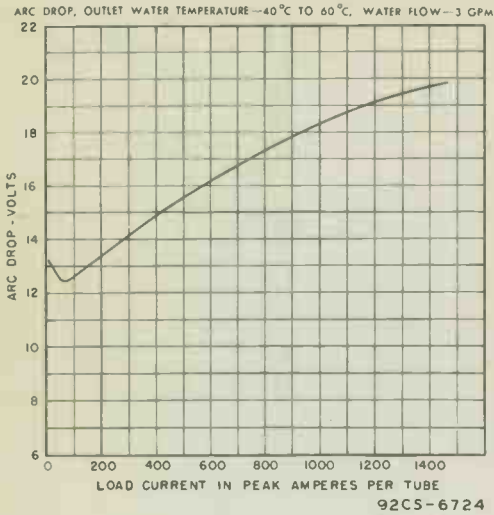
• Use only one ignitor at a time.
* Averaged over any 2-minute interval.
** Averaged over any 1-minute interval.
\# For systems in which the flow of water is controlled by the load.
\#\# Averaged over any 10-second interval.

RCA

5555
IGNITRON



5555
IGNITRON



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5557

MERCURY-VAPOR THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

GENERAL DATA

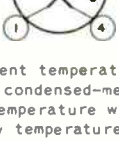
Electrical:

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.):[o]				
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

[o] without external shield.

* with filament volts = 2.38 and no heat-conserving enclosure.

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

RCA

5557

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.

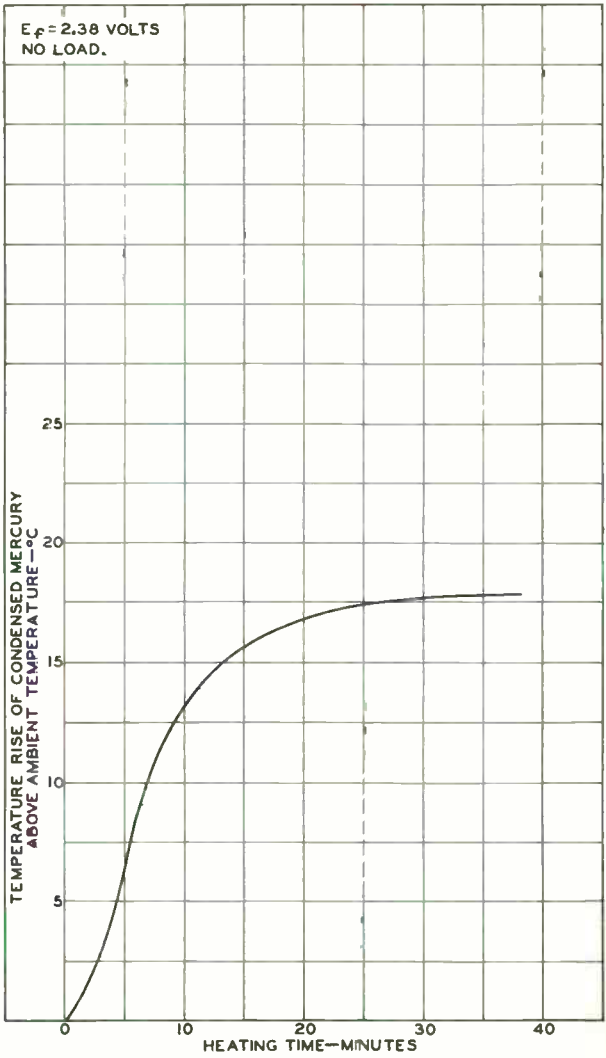
♦ Averaged over period of grid conduction.

DIMENSIONAL OUTLINE
for Type 5557 is the same as that shown for Type 3C23

→ Indicates a change.

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

5557
RATE OF RISE OF CONDENSED-MERCURY TEMPERATURE



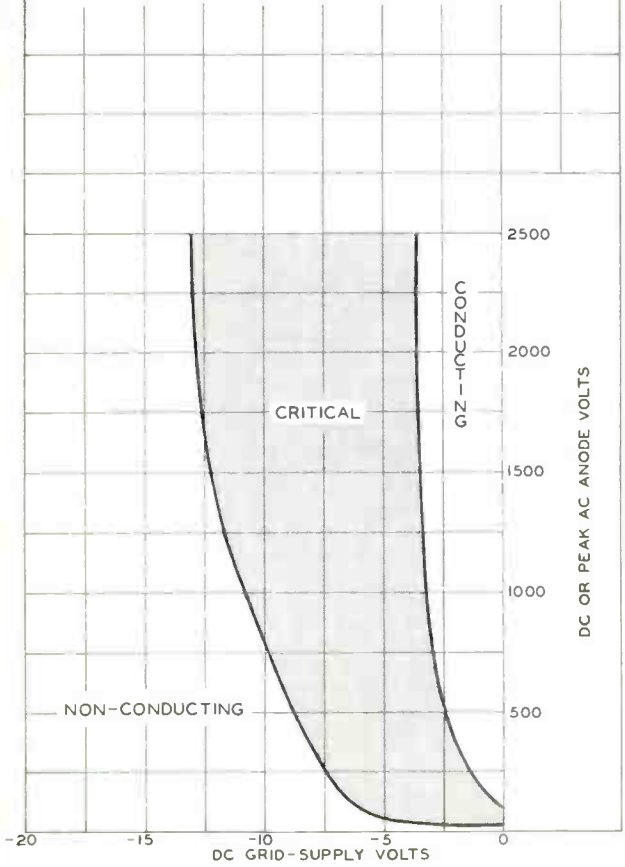
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9301T

5557

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

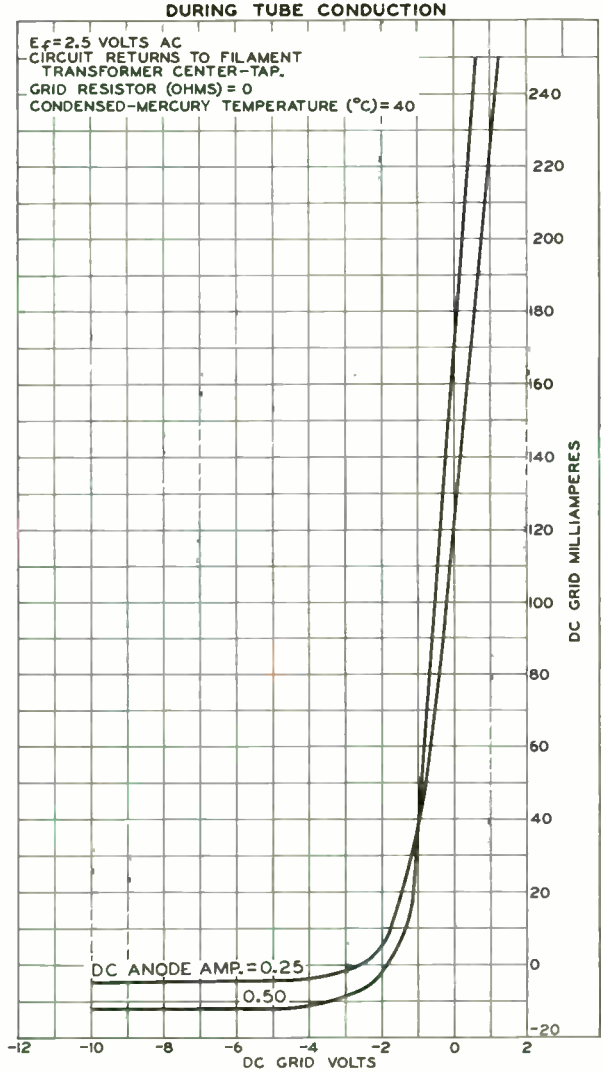
RANGE IS FOR CONDITIONS WHERE:
E_f = 2.5 VOLTS AC ± 5%
CIRCUIT RETURNS TO FILAMENT TRANSFORMER CENTER-TAP.
FILAMENT VOLTAGE AT PIN 1 IS (+) WHEN ANODE VOLTAGE IS (+).
THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES.
GRID RESISTOR (OHMS) = 1000
CONDENSED-MERCURY-TEMPERATURE RANGE = 40 TO 80 °C



RCA

5557

AVERAGE GRID CHARACTERISTICS
DURING TUBE CONDUCTION



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9302T

5559

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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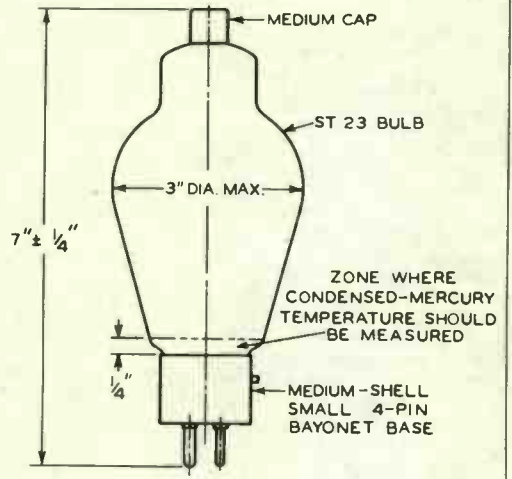
THYRATRON



RCA

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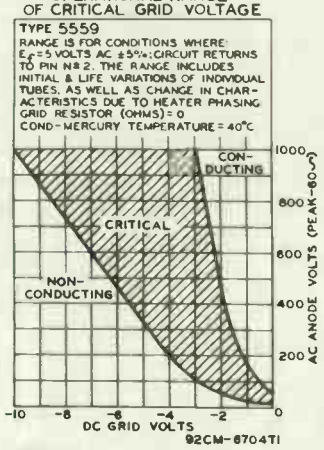
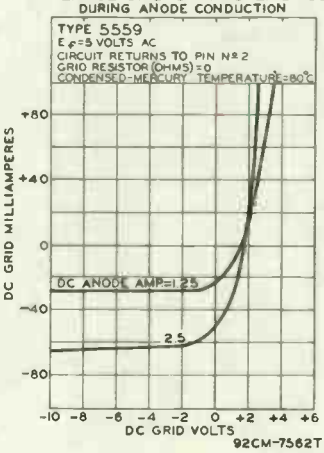
THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



AVERAGE GRID CHARACTERISTICS DURING ANODE CONDUCTION



RCA

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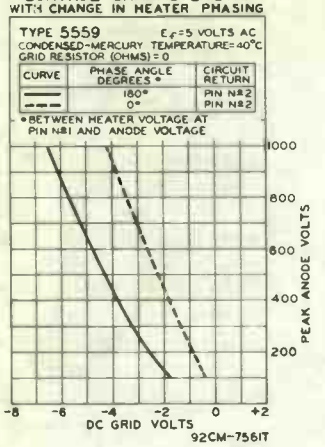
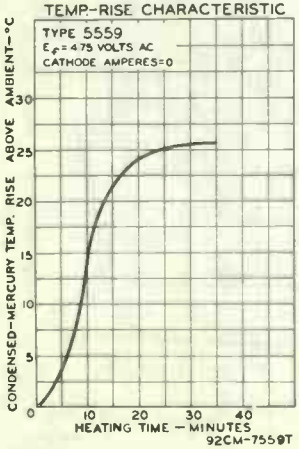
THYRATRON

SHIFT OF AVERAGE CONTROL CHARACTERISTIC WITH CHANGE IN HEATER PHASING



TEMP-RISE CHARACTERISTIC



RCA

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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	μμf
Grid No.1 to Cathode		4.4	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 (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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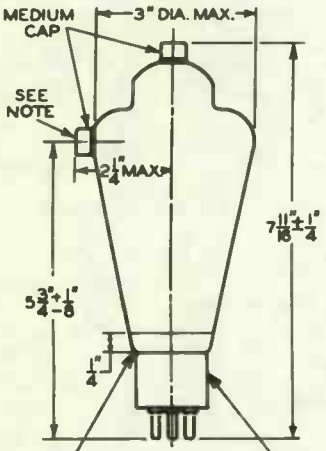
THYRATRON

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.



92CS-6742R1

NOTE: THE PLANE THROUGH TUBE AXIS AND CENTER OF GRID-№1 CAP IS 45° ± 5° FROM THE PLANE THROUGH THE TUBE AXIS AND CENTER OF BAYONET PIN. GRID-№1 CAP IS ON SAME SIDE AS PIN №3.

TEMPERATURE-RISE CHARACTERISTIC of the 5560 is the same as that shown for Type 5559

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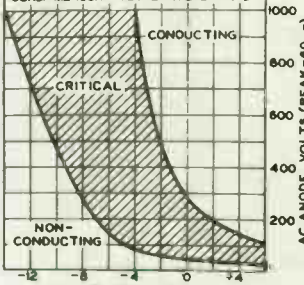
THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

TYPE 5560
RANGE IS FOR CONDITIONS WHERE: E_f = 5 VOLTS AC ±5 %; GRID-№ 2 (SHIELD) VOLTS = 0; CIRCUIT RETURNS TO PIN № 2. THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES, AS WELL AS CHANGE IN CHARACTERISTICS DUE TO HEATER PHASING.
GRID-№ 1 RESISTOR (OHMS) = 0
COND-MERCURY TEMPERATURE = 40°C



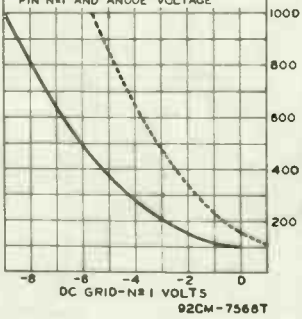
92CM-6705T1

SHIFT OF AVERAGE CONTROL CHARACTERISTIC WITH CHANGE IN HEATER PHASING

TYPE 5560 E_f = 5 VOLTS AC
GRID-№ 2 (SHIELD) VOLTS = 0
CONDENSED-MERCURY TEMPERATURE: 40°C
GRID-№ 1 RESISTOR (OHMS) = 0

CURVE	PHASE ANGLE DEGREES *	CIRCUIT RETURN
———	180°	PIN №2
- - - -	0°	PIN №2

*BETWEEN HEATER VOLTAGE AT PIN №1 AND ANODE VOLTAGE



92CM-7568T

RCA

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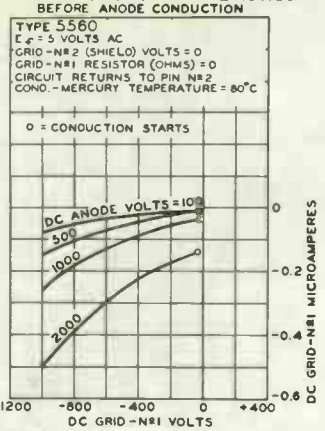
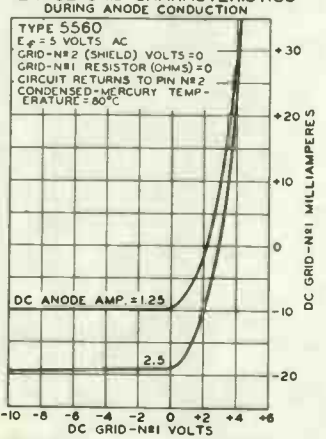
THYRATRON

AVERAGE GRID CHARACTERISTICS
BEFORE ANODE CONDUCTION



92CM-7556T

AVERAGE GRID CHARACTERISTICS
DURING ANODE CONDUCTION



92CM-7570T

5563
THYRATRON
MERCURY-VAPOR TRIODE

GENERAL DATA

Electrical:

Filament, Coated:		
Voltage	5	volts
Current	10	amp
Minimum Heating Time:		
At initial installation without anode voltage, for proper distribution of condensed mercury	15	minutes
During subsequent operation and prior to conduction, for bringing condensed-mercury temperature within operating range.	Not less than 60 seconds to provide adequate filament heating, longer, if required by low ambient temperatures.	
Direct Interelectrode Capacitances:[o]		
Grid to Anode	10 max.	μμf
Grid to Cathode	20 max.	μμf
Ionization Time	10 approx.	μseconds
Deionization Time	1000 approx.	μseconds
Anode Voltage Drop	15 approx.	volts
Grid Control Ratio[▲]	200 approx.	

[o] With no external shield.

Mechanical:

Mounting Position	Vertical, base down
Overall Length	10-1/8" to 11-1/16"
Maximum Diameter	3-7/8"
Cooling	Convection
Bulb	T-24
Cap	Skirted Medium No. 3985
Base	Medium-Metal-Shell Jumbo 4-Pin, Bayonet

BOTTOM VIEW

Pin 1 - Grid
Pin 2 - Filament, Internal Shield
Pin 3 - No Connection
Pin 4 - Filament
Cap - Anode

Maximum Ratings, *Absolute Values*:
For Anode-Supply Frequencies between 25 and 150 cps

COND. MERCURY TEMP. RANGE[□]	25 - 55	25 - 50	°C
PEAK ANODE VOLTAGE:			
Forward	10000 max.	15000 max.	volts
Inverse	10000 max.	15000 max.	volts
GRID VOLTAGE:			
Before Anode Conduction (Peak or DC)	-500 max.	-500 max.	volts
During Anode Conduction (Average)[●]	-10 max.	-10 max.	volts

▲,□,●: See next page.

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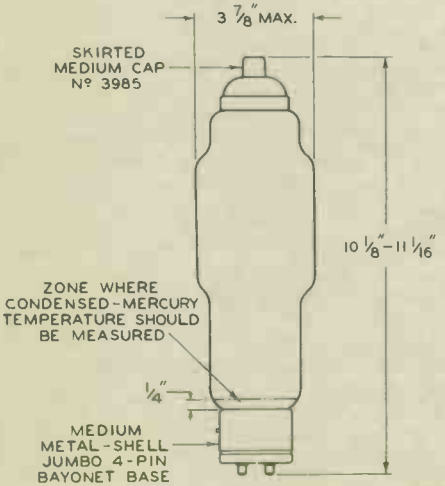
THYRATRON

CATHODE CURRENT:			
Peak	10 max.	6.4 max.	amp
Average	1.8 max.	1.6 max.	amp
Surge, for max. duration of 0.1 second . . .	200 max.	200 max.	amp
Averaging Time	1	1	cycle
GRID CURRENT:			
Peak	+1 max.	+1 max.	amp
Average	+0.1 max.	+0.1 max.	amp
Averaging Time	1	1	cycle
Maximum Circuit Values:			
Grid-Circuit Resistance. . .	0.1 max.	0.1 max.	megohm

▲ For conditions with 0.1-megohm grid resistor, circuit returns to pin No. 2 as datum of potential, and filament voltage at pin No. 4 1800 out of phase with the anode voltage.

□ Recommended operating value is 40° ± 5°C.

● Averaged over one conducting cycle.



92CS-6832

5563

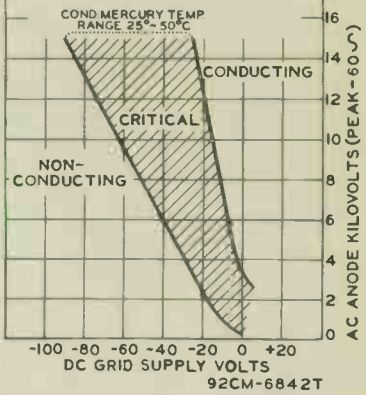
THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

TYPE 5563

RANGE IS FOR CONDITIONS WHERE:

E_f = 5 VOLTS AC ± 5%; CIRCUIT RETURNS TO PIN Nº2; FIL. VOLTAGE AT PIN Nº4 IS (-) WHEN ANODE VOLTAGE IS (+); GRID RESISTOR = 10000 OHMS; GRID-FILAMENT BYPASS CAPACITOR = 0.005 μf. THE RANGE INCLUDES INITIAL & LIFE VARIATIONS OF INDIVIDUAL TUBES.



5563

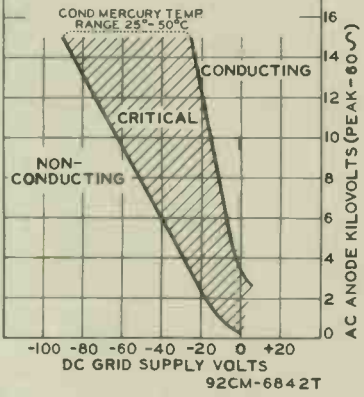
THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

TYPE 5563

RANGE IS FOR CONDITIONS WHERE:

E_f = 5 VOLTS AC ± 5%; CIRCUIT RETURNS TO PIN №2; FIL. VOLTAGE AT PIN №4 IS (−) WHEN ANODE VOLTAGE IS (+). GRID RESISTOR = 10000 OHMS; GRID-FILAMENT BYPASS CAPACITOR = 0.005 μf. THE RANGE INCLUDES INITIAL & LIFE VARIATIONS OF INDIVIDUAL TUBES.



92CM-6842T

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:[o]

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 = 20000	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

[o] Without external shield.

← Indicates a change.

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5563-A

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--1n-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.

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MERCURY-VAPOR THYRATRON

CONTROL SERVICE--Quadrature Operation[oo]

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

▲, ●●, oo, ♦, □, §: See next page.

← Indicates a change.

TUBE DIVISION
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5563-A

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□	6300	1.6	10
	10600▲	4700	1.8	8.5
Fig. 2 **Full-Wave** **Single-Phase** In-Phase Operation	7000□	6300	3.2	20
	5300▲	4700	3.6	17
Fig. 3 **Series** **Single-Phase** In-Phase Operation	14000□	12700	3.2	40
	10600▲	9500	3.6	34
Fig. 4 **Half-Wave** **Three-Phase** In-Phase Operation	8100□	9500	4.8	45
	6100▲	7100	5.4	38
Fig. 5 **Parallel** **Three-Phase** Quadrature Operation	8100□	9500	15.0	143
	6100▲	7100	15.0	106
Fig. 6 **Series** **Three-Phase** Quadrature Operation	8100□	19000	7.5	143
	6100▲	14200	7.5	106
			Resistive Load / *Inductive Load*	*Resistive Load* / *Inductive Load*
Fig. 7 **Half-Wave** **Four-Phase** Quadrature Operation	7000□	9000	10.0 / 10.0	90 / 90
	5300	6700	10.0 / 10.0	67 / 67
			Resistive Load / *Inductive Load*	*Resistive Load* / *Inductive Load*
Fig. 8 **Half-Wave** **Six-Phase** Quadrature Operation	7000□	9500	11.0 / 11.5	105 / 110
	5300▲	7100	11.0 / 11.5	78 / 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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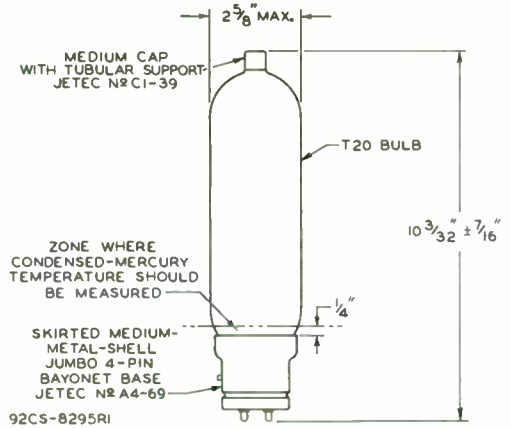
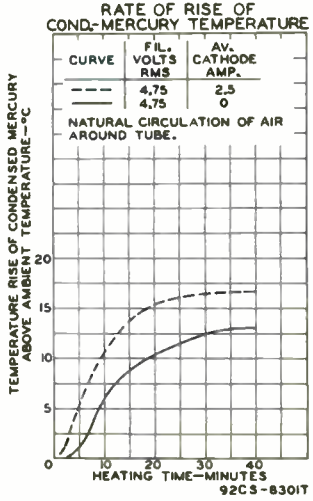
MERCURY-VAPOR THYRATRON





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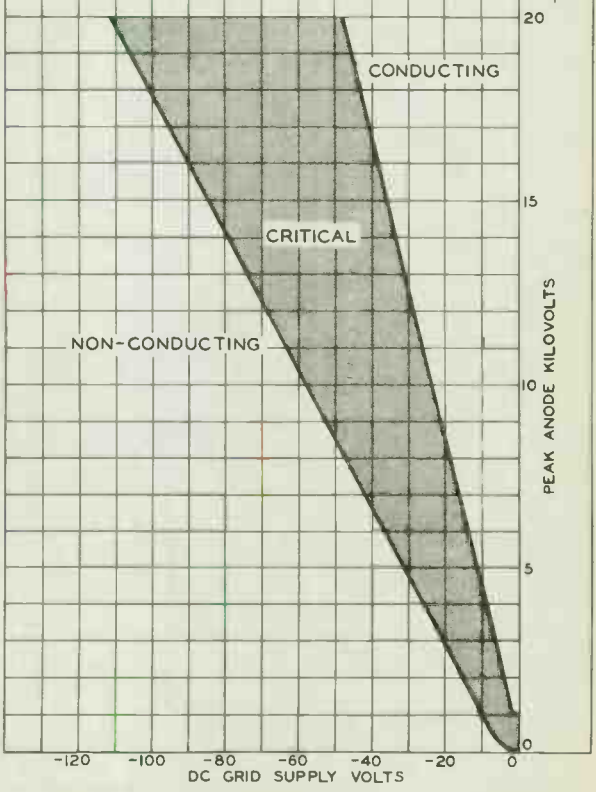
5563-A
OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

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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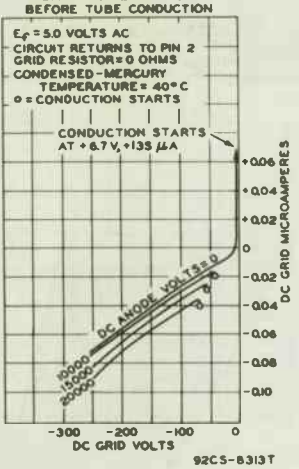
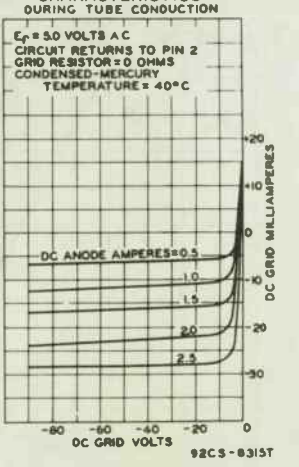
5563-A

CHARACTERISTIC CURVES

AVERAGE GRID CHARACTERISTICS
BEFORE TUBE CONDUCTION

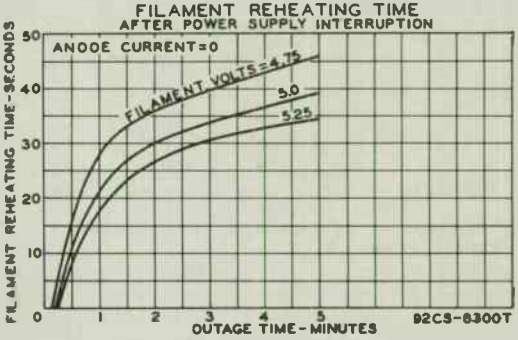


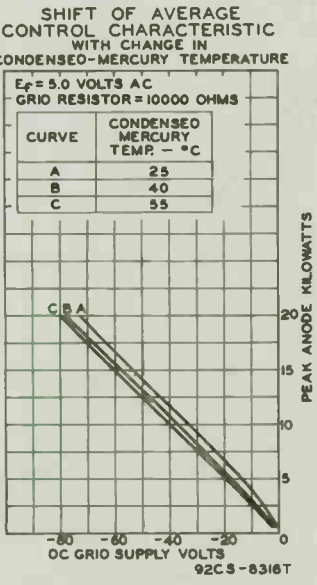
AVERAGE GRID CHARACTERISTICS
DURING TUBE CONDUCTION



5563-A

CHARACTERISTIC CURVES





TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

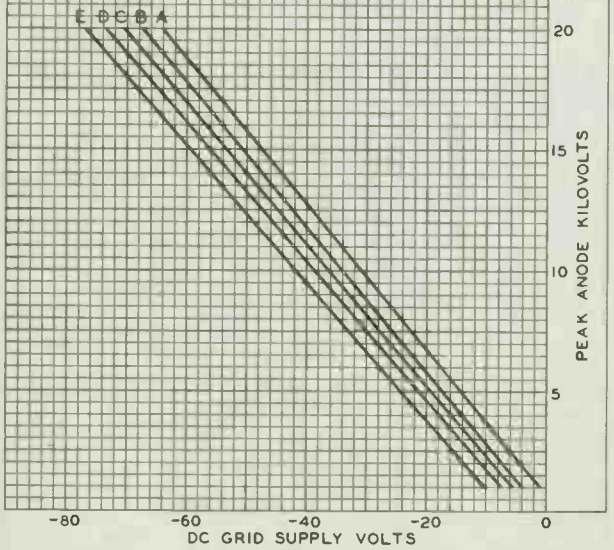
5563-A

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



APRIL 12, 1954

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8309

RCA

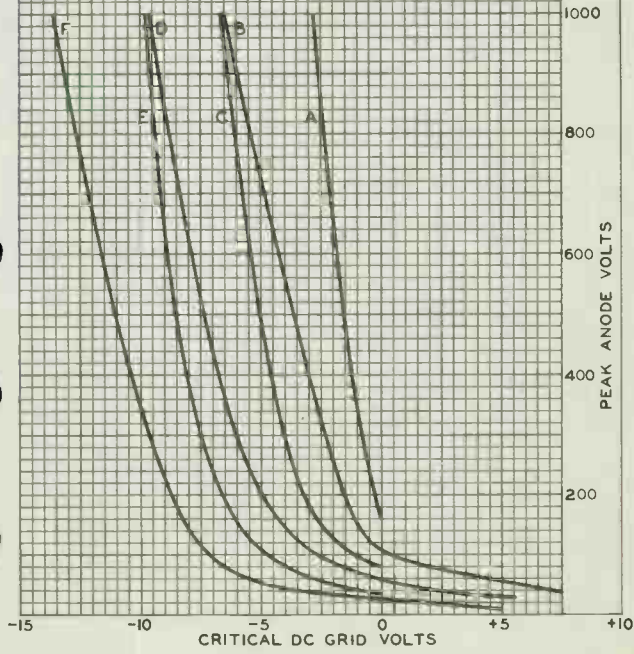
5563-A
SHIFT OF AVERAGE CONTROL CHARACTERISTICS WITH CHANGE IN FILAMENT PHASING AND CIRCUIT RETURN AT LOW ANODE VOLTAGES

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



RCA

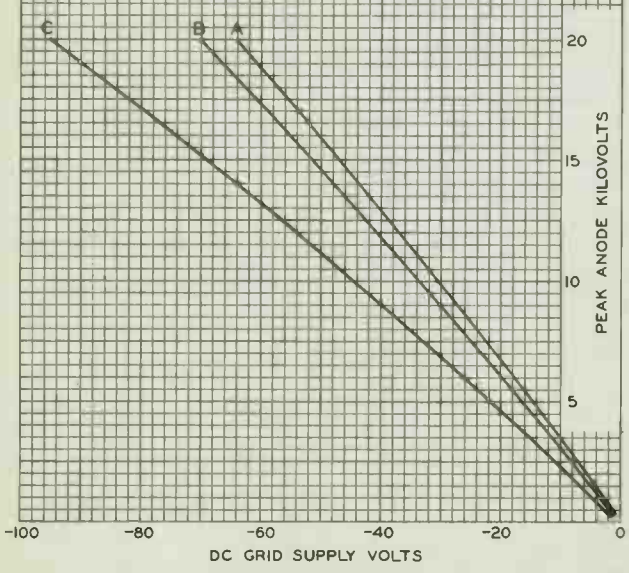
5563-A

SHIFT OF AVERAGE CONTROL CHARACTERISTICS WITH CHANGE IN GRID-RESISTOR VALUE

E_f = 5.0 VOLTS AC
CONDENSED-MERCURY TEMPERATURE = 40°C

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



RCA

5583

GAS PHOTOTUBE

WITH S-4 RESPONSE

DATA

General:

Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 angstroms
Cathode:	
Shape	Semi-Cylindrical
Minimum Projected Length*	11/16"
Minimum Projected Width*	7/16"
Direct Interelectrode Capacitance	2.0 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" ←
Bulb	T-5-1/4 ←
Mounting Position	Any
Base	Small-Shell Peewee 3-Pin
Basing Designation for BOTTOM VIEW	2F

Pin 1 – No Connection

Pin 2 – Anode
Pin 3 – Cathode

Maximum Ratings, *Absolute Values*:

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	100 max.	volts
PEAK CATHODE CURRENT	10 max.	μamp
PEAK CATHODE-CURRENT DENSITY	100 max.	μamp/sq.in.
AVERAGE CATHODE CURRENT°	2 max.	μamp
AMBIENT TEMPERATURE	75 max.	°C

Characteristics:

	Min.	Av.	Max.	
Dark Current at 90 Volts	–	–	0.050	μamp
Sensitivity:				
At 4000 angstroms	–	0.125	–	μamp/μwatt
Luminous:▲				
At 0 cps	75	135	205	μamp/lumen
At 5000 cps	–	124	–	μamp/lumen
At 10000 cps	–	108	–	μamp/lumen
Gas Amplification Factor	–	–	5.5	

Minimum Circuit Values:

DC Load Resistance:

With anode-supply voltage of 80 volts or less

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

With anode-supply voltage of 100 volts

For dc currents { above 1 μamp . . . 2.5 . . . . megohms
below 1 μamp . . . 0.1 . . . . megohm

*, °, ▲: see next page. ← Indicates a change.

5583

5583
GAS PHOTOTUBE

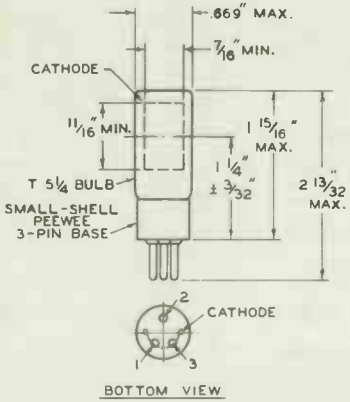
* On plane perpendicular to indicated direction of incident light.

O Averaged over any interval of 30 seconds maximum. Average current may be doubled when anode-supply voltage is limited to 80 volts.

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

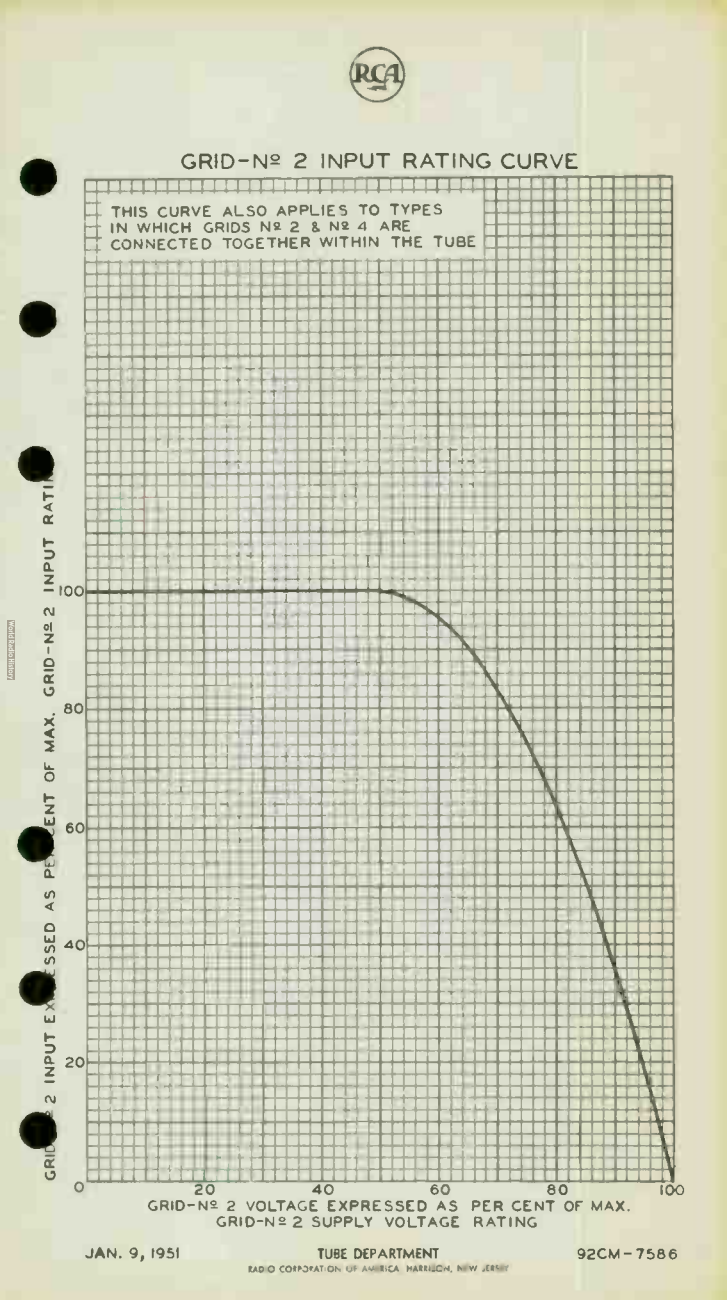
SPECTRAL-SENSITIVITY CHARACTERISTIC
and
FREQUENCY-RESPONSE CHARACTERISTIC
of Gas Phototube having S-4 Response
are shown at front of this Section

AVERAGE ANODE CHARACTERISTICS
of Type 5583 are the same
as those shown under Type 5581



92CM-6053R4

→ Indicates a change.


GRID-Nº 2 INPUT RATING CURVE
THIS CURVE ALSO APPLIES TO TYPES IN WHICH GRIDS Nº 2 & Nº 4 ARE CONNECTED TOGETHER WITHIN THE TUBE
GRID-Nº 2 INPUT EXPRESSED AS PER CENT OF MAX. GRID-Nº 2 INPUT RATING
0
20
40
60
80
100
20
40
60
80
100
GRID-Nº 2 VOLTAGE EXPRESSED AS PER CENT OF MAX. GRID-Nº 2 SUPPLY VOLTAGE RATING
JAN. 9, 1951
TUBE DEPARTMENT
92CM-7586
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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)	1-1/3" ± 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

RCA

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.

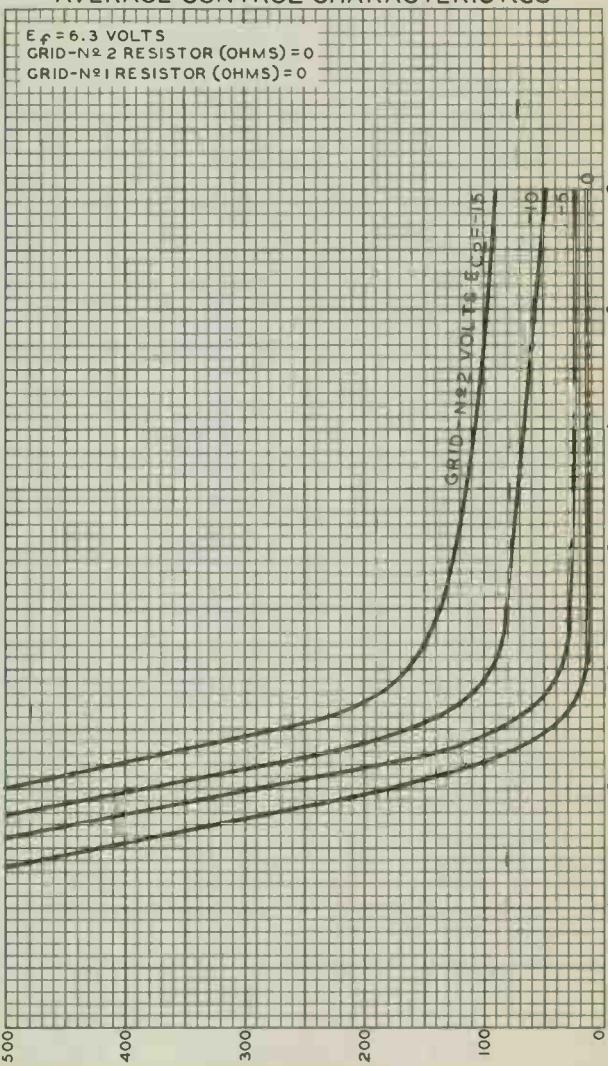
Sufficient resistance, including the tube load, must be used under any conditions of operation to prevent exceeding the current ratings.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5696

AVERAGE CONTROL CHARACTERISTICS



AUG. 6, 1948 TUBE DEPARTMENT 92CM-7044

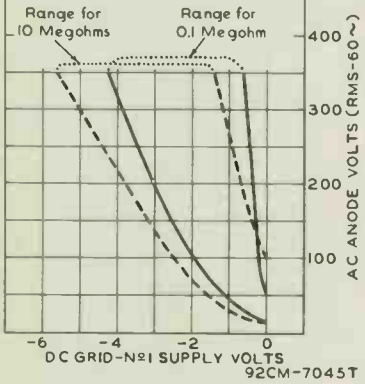
RADIO CORPORATION OF AMERICA HARRISON NEW JERSEY

5696

THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

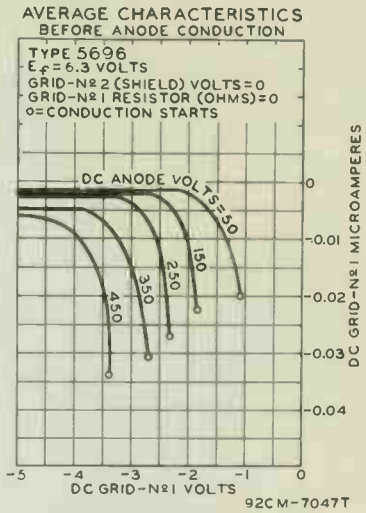
TYPE 5696
GRID-Nº2 (SHIELD) VOLTS=0
RANGES SHOWN ARE FOR TWO VALUES OF GRID RESISTOR-0.1 MEG. AND 10 MEG.-AND TAKE INTO ACCOUNT INITIAL DIFFERENCES BETWEEN INDIVIDUAL TUBES & SUBSEQUENT DIFFERENCES DURING TUBE LIFE, FOR A HEATER-VOLTAGE RANGE OF 5.7 TO 6.9 VOLTS AND FOR AN AMBIENT TEMPERATURE RANGE OF -55 TO +90 °C

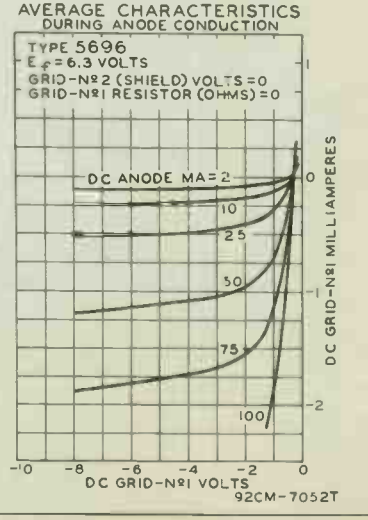


TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

5696

THYRATRON





TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5727

5727 PREMIUM TYPE

GAS THYRATRON

7-PIN MINIATURE TETRODE TYPE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage	6.3 ± 10%*	ac or dc volts
Current	0.6	amp
Cathode:		
Minimum heating time prior to tube conduction	20	sec
Direct Interelectrode Capacitances (Approx.):°		
Grid No.1 to anode	0.026	μμf
Grid No.1 to cathode, grid No.2, and heater	2.4	μμf
Anode to cathode, grid No.2, and heater	1.6	μμf
Ionization Time (Approx.):		
For dc anode volts = 100, grid-No.1 volts (square-wave pulse) = 50, peak anode amperes during conduction = 0.5	0.5	μsec
Deionization Time (Approx.):		
For dc anode volts = 125, dc anode amperes = 0.1, grid-No.1 resistor (ohms) = 1000, and grid-No.1 volts = -100	35	μsec
For dc anode volts = 125, dc anode amperes = 0.1, grid-No.1 resistor (ohms) = 1000, and grid-No.1 volts = -10	75	μsec
Maximum Critical Grid-No.1 Current: For anode-supply volts (rms) = 460, and average anode amperes = 0.1	0.5	μa
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	

Mechanical:

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"
Maximum Diameter	3/4"
Dimensional Outline	*See General Section*
Bulb	T5-1/2
Base	Small-Button Miniature 7-Pin (JETEC No.E7-1)

*,°: See next page.

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5727

GAS THYRATRON

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

RELAY AND GRID-CONTROLLED RECTIFIER SERVICE

Maximum and Minimum Ratings, *Absolute Values:*

For anode-supply frequency of 60 cps

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	−100 max.	volts
Average■, during tube conduction	−10 max.	volts
CATHODE CURRENT:		
Peak	0.5 max.	amp
Average■	0.1 max.	amp
Fault, for duration of 0.1 second 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
BULB TEMPERATURE (At hottest point on bulb surface)	150 max.	°C
AMBIENT TEMPERATURE	−75 min.	°C

Typical Operation 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	1	megohm
Anode-Circuit Resistance#	1200	2000	ohms

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	10 max.	megohms

*,○,■,□,#: See next page.

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

TENTATIVE DATA 1

RCA

5727

GAS THYRATRON

PULSE-MODULATOR SERVICE

For rectangular-wave shapes, duty cycle of 0.001 max., pulse duration of 5 μsec. max., and pulse-repetition rate of 500 pps max.

Maximum and Minimum Ratings, *Absolute Values:*

PEAK ANODE VOLTAGE:		
Forward	500 max.	volts
Inverse	100 max.	volts
GRID-No.2 (SHIELD-GRID) VOLTAGE:		
Peak, before tube conduction	−50 max.	volts
Average, during tube conduction	−10 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:		
Peak, before tube conduction	−100 max.	volts
Average, during tube conduction	−10 max.	volts
CATHODE CURRENT:		
Peak	10 max.	amp
Average	0.01 max.	amp
Rate of change	100 max.	amp/μsec
PEAK GRID-No.2 CURRENT	0.02 max.	amp
PEAK GRID-No.1 CURRENT	0.02 max.	amp
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	0 max.	volts
Heater positive with respect to cathode	0 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	150 max.	°C
AMBIENT TEMPERATURE	−75 min.	°C

Maximum and Minimum Circuit Values:

Grid-No.1-Circuit Resistance	0.5 max.	megohm
Grid-No.2-Circuit Resistance	25000 max. 2000 min.	ohms ohms

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Values are initial, unless otherwise specified

	Note	Min.	Max.	
Heater Current	1	540	660	ma
Grid-No.1 Supply Voltage for Tube Conduction (1)	1,2	-2.9	-4.5	volts
Grid-No.1 Supply Voltage for Tube Conduction (2)	1,3	-	-5.2	volts
Grid-No.1 Supply Voltage for Tube Conduction (3)	4,3	-	-6.4	volts
Anode-Supply Voltage for Tube Conduction (1)	1,5	-	38	volts
Anode-Supply Voltage for Tube Conduction (1) at 500 hours	1,5	-	50	volts
Anode-Supply Voltage for Tube Conduction (2)	6,5	-	50	volts

*,○,■,□,#: See next page.

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

RCA

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GAS THYRATRON

	Note	Min.	Max.	
Anode-Supply Voltage for Tube Conduction (3)	7,8	650	–	volts
RMS Grid-No.2 Supply Voltage for Tube Conduction (This voltage is 180° out of phase with anode-supply voltage). .	1,9	1.9	3.3	volts
Heater-Cathode Leakage Current:				
Heater 25 volts positive with respect to cathode . .	1	–	15	μa
Heater 100 volts negative with respect to cathode . .	1	–	15	μa
Heater-Cathode Leakage Current at 500 hours:				
Heater 25 volts positive with respect to cathode . .	1	–	20	μa
Heater 100 volts negative with respect to cathode . .	1	–	20	μa
Leakage Resistance: Grid-No.2 to anode.	1,10	760	–	megohms
Leakage Resistance: Grid-No.2 to anode at 500 hours.	1,10	380	–	megohms

Note 1: With 6.3 volts ac or dc on heater.

Note 2: With anode-supply volts (rms) = 460, grid-No.2 volts = 0, load resistor (ohms) = 3000, and grid-No.1 resistor (megohms) = 0.1.

Note 3: With anode-supply volts (rms) = 460, grid-No.2 volts = 0, load resistor (ohms) = 3000, and grid-No.1 resistor (megohms) = 10.

Note 4: With 7.0 volts ac or dc on heater.

Note 5: With grid-No.2 volts = 0, grid-No.1 volts = 0, load resistor (ohms) = 1000, and grid-No.1 resistor (megohms) = 0.1.

Note 6: With 5.7 volts ac or dc on heater.

Note 7: With 0 volts on heater.

Note 8: With grid-No.1 volts = -100, grid-No.2 volts = 0, and load resistor (ohms) = 10000.

Note 9: With anode-supply volts (rms) = 150, grid-No.1 supply volts (rms and in phase with anode-supply voltage) = 16.

Note 10: With grid-No.2 volts = ±380 with respect to anode and all other electrodes floating.

* For pulse-modulator service, tolerance is +10%, -5%.

○ Without external shield.

■ Averaged over any interval of 30 seconds maximum.

□ 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.

SPECIAL RATINGS AND PERFORMANCE DATA

Shock Rating:

Impact Acceleration . . . . . 750 max. g

This test is performed on a sample lot of tubes from each production run. Tubes are held rigid and are tested in

GAS THYRATRON

four different positions. At the end of this test, tubes will not show permanent or temporary shorts or open circuits, and are required to meet established limits for heater-cathode leakage current, grid-No.1 supply voltage for tube conduction (I) and anode-supply voltage for tube conduction (I).

Fatigue Rating:

Vibrational Acceleration. . . . . 2.5 max. g

This test is performed on a sample lot of tubes from each production run. Tubes are rigidly mounted and subjected in each of three positions to 2.5 g vibrational acceleration at 60 cycles per second for 32 hours. At the end of this test, tubes will not show permanent or temporary shorts or open circuits, and are required to meet established limits for heater-cathode leakage current, grid-No.1 supply voltage for tube conduction (I) and anode-supply voltage for tube conduction (I).

Heater-Cycling Life Performance:

Cycles of Intermittent Operation. . . . 2000 min. cycles

Under the following conditions: Heater volts = 7.5 cycled one minute on and one minute off, heater 100 volts negative with respect to cathode, and all other elements connected to ground.

Shorts and Continuity Test:

This test is performed on a sample lot of tubes from each production run. In this test a tube is considered inoperative if it shows a permanent or temporary short or open circuit.

1-Hour Stability Life Performance:

This test is performed on a sample lot of tubes from each production run to insure that tubes have been properly stabilized. Conditions of life testing are specified under 500-hour intermittent life performance, except test run at room temperature. Tubes are initially read for grid-No.1 supply voltage for tube conduction (I). At the end of 1 hour, grid-No.1 supply voltage is read. The variation in the 0-hour and 1-hour readings will not exceed 15 per cent. Tubes must also meet established limits of grid-No.1 supply voltage.

100-Hour Survival Life Performance:

This test is performed on a sample lot of tubes from each production run to insure a low percentage of early inoperatives. Conditions of life testing are specified under 500-hour intermittent life performance, except test run at room temperature. At the end of 100 hours, a tube is considered inoperative if it shows a permanent or

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GAS THYRATRON

temporary short or open circuit or fails to meet established limits of grid-No.1 supply voltage for tube conduction (1).

500-Hour Intermittent Life Performance:

This test is performed on a sample lot of tubes from each production run to insure high quality of the individual tube and to guard against epidemic failures of any of the characteristics indicated below. Life testing is conducted under the following conditions: Heater volts = 6.3, anode-supply volts (rms) = 460, grid-No.2 supply volts = 0, average anode milliamperes = 80, peak anode milliamperes = 500, grid-No.1 resistor (ohms) = 50000, and minimum bulb temperature (°C) = 150. At the end of 500 hours, tube will not show permanent shorts or open circuits and will be criticized for the total number of defects in the sample lot and for the number of tubes failing to pass established initial limits of heater current, grid-No.1 supply voltage (1), and 500-hour limits for anode-supply voltage (1), heater-cathode leakage current, and leakage resistance shown under CHARACTERISTICS RANGE VALUES.

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.

Curves shown under Type 2D21 also apply to the 5727

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

5728/FG-67

MERCURY-VAPOR THYRATRON

NEGATIVE/POSITIVE-CONTROL TRIODE TYPE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:

	Min.	Av.	Max.	
Voltage (AC or DC)	4.75	5.0	5.25	volts
Current at 5.0 volts	–	4.5	4.9	amp

Cathode:

Minimum Heating Time, prior to tube conduction	5	minutes
Maximum Outage Time, without reheating	*See Curves*	

Direct Interelectrode Capacitances (Approx., without external shield):

Grid to Anode	3.25	μμf
Grid to Cathode	8.9	μμf

Maximum Critical Grid Current with ac anode volts (rms) = 220	10	μamp
Anode Voltage Drop (Approx.)	16	volts
Ionization Time (Approx.): For conditions: dc anode-supply volts = 100, peak grid volts = +35, and peak anode amperes = 15	15	μsec
Deionization Time (Approx.): For conditions: dc anode volts = 120, dc grid-supply volts = -500, grid resistor (ohms) = 1000, and dc anode amperes = 2.5	5	μsec
For conditions: dc anode volts = 120, dc grid-supply volts = 0, grid resistor (ohms) = 1000, and dc anode amperes = 2.5	850	μsec

Mechanical:

Mounting Position	Vertical, base down
Maximum Overall Length	7"
Seated Length	5-1/8" ± 1/4"
Maximum Diameter	3"
Bulb	ST-23
Cap	Medium (JETEC No.C1-5)
Base	Medium-Shell Small 4-Pin, Bayonet (JETEC No.A4-10)

BOTTOM VIEW

Pin 1: Heater
Pin 2: Cathode (Grid & Anode Return)
Pin 3: Grid
Pin 4: Heater, Cathode

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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 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	25	°C
Full Load	31	°C

INVERTER SERVICE

Maximum Ratings, *Absolute Values:*

PEAK ANODE VOLTAGE:		
Forward	1000 max.	volts
Inverse	1000 max.	volts
GRID VOLTAGE:		
Peak, before anode conduction	-500 max.	volts
Average●, during anode conduction	-5 max.	volts
CATHODE CURRENT:		
Peak	15 max.	amp
Average●●	2.5 max.	amp
Fault, for duration of 0.1 sec. max.	200 max.	amp
GRID CURRENT:		
Average●	+0.3 max.	amp
CONDENSED-MERCURY TEMPERATURE RANGE	+40 to +80	°C

* With heater voltage = 4.75 volts and no heat-conserving enclosure.

● Averaged over one conducting cycle.

●● Averaged over any interval of 15 seconds maximum.

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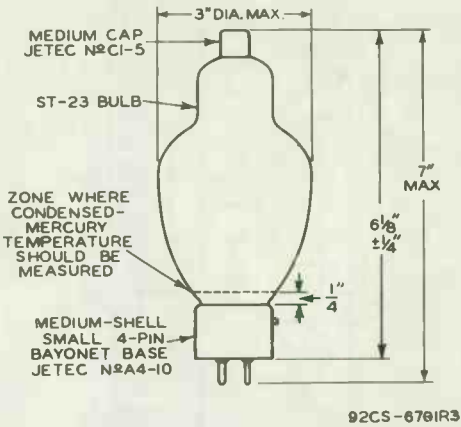
MERCURY-VAPOR THYRATRON



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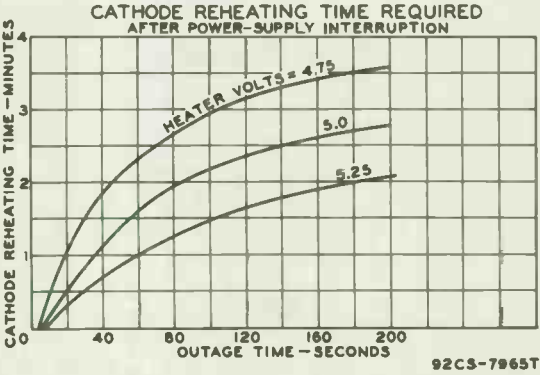

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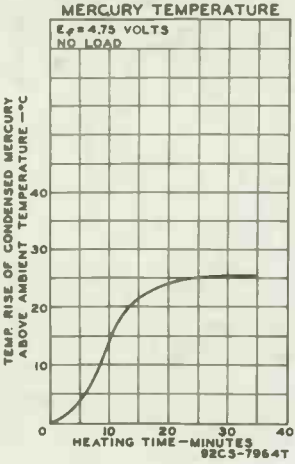
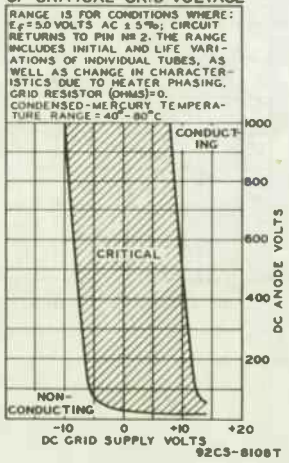
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5728/FG-67
CHARACTERISTIC CURVES

RATE OF RISE OF COND.-MERCURY TEMPERATURE



OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



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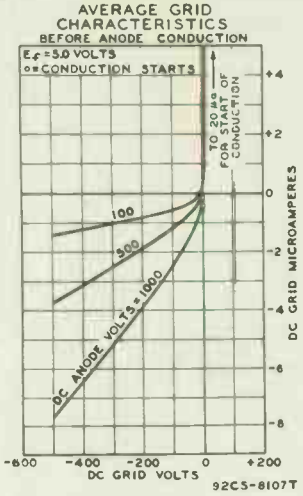
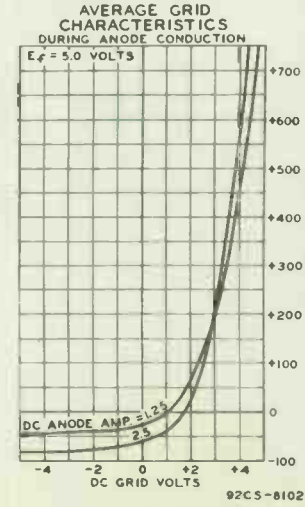
CHARACTERISTIC CURVES





Gas and Mercury-Vapor Thyratron

NEGATIVE-CONTROL TRIODE TYPE

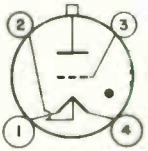
GENERAL DATA

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.):[a]		
Grid to anode	2	μμf
Grid to cathode	12	μμf
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

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.

Gas and Mercury-Vapor Thyratron

NEGATIVE-CONTROL TRIODE TYPE

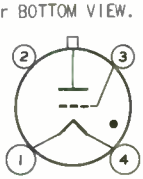
GENERAL DATA

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

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.

Gas and Mercury-Vapor Thyratron

NEGATIVE-CONTROL TRIODE TYPE

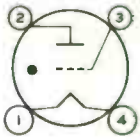
GENERAL DATA

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

CATHODE CURRENT:		
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.

Gas and Mercury-Vapor Thyratron

NEGATIVE-CONTROL TRIODE TYPE

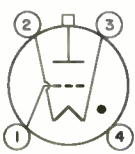
GENERAL DATA

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

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.

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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 = 460 (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

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GAS THYRATRON

→ Basing Designation for BOTTOM VIEW . . . . . 6C(0)

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 oositive 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

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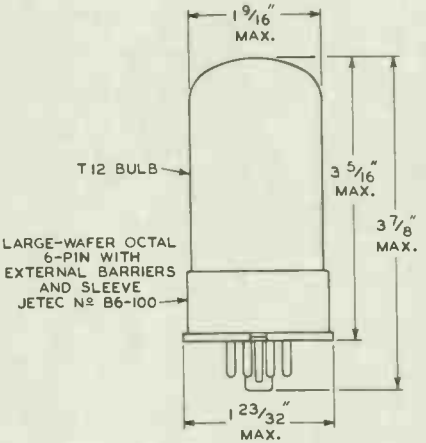
GAS THYRATRON

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.



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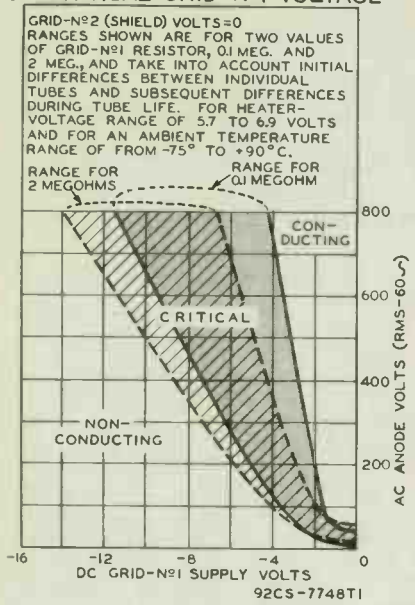
GAS THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID-№1 VOLTAGE



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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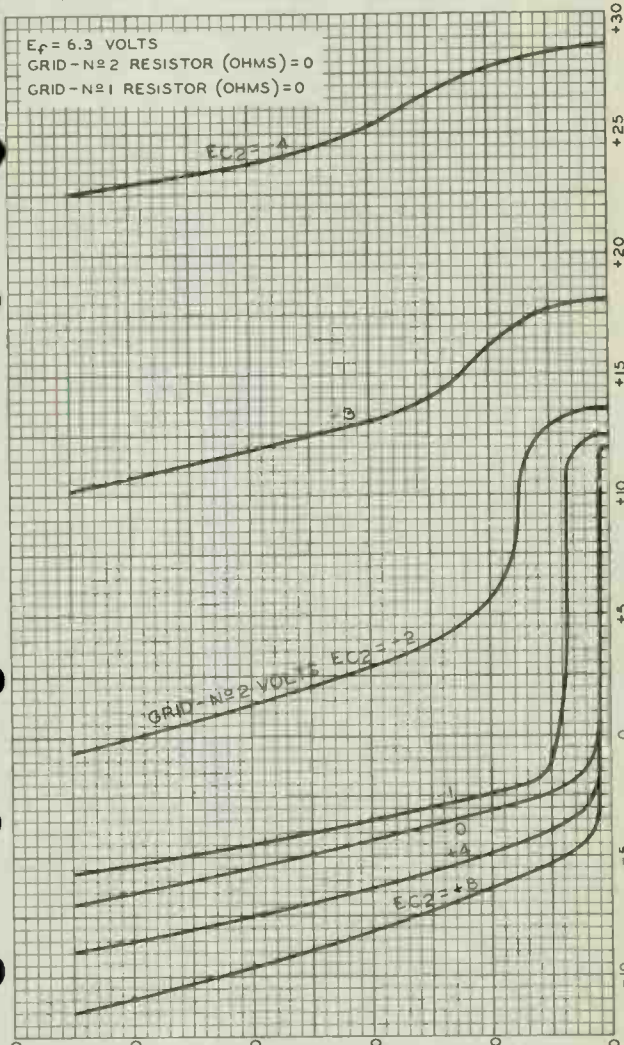
AVERAGE CONTROL CHARACTERISTICS



TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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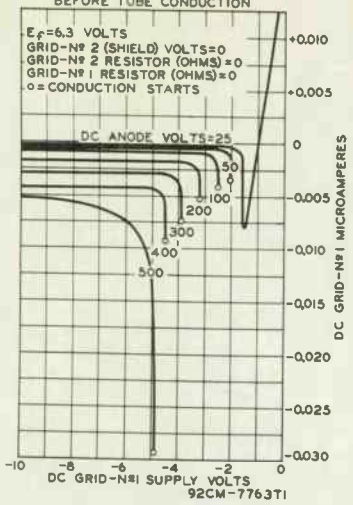
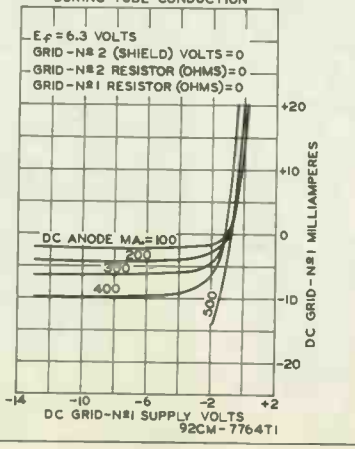
CHARACTERISTIC CURVES

AVERAGE GRID-No1 CHARACTERISTICS
BEFORE TUBE CONDUCTION



AVERAGE GRID-No1 CHARACTERISTICS
DURING TUBE CONDUCTION



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6130/3C45

HYDROGEN THYRATRON

POSITIVE-CONTROL TRIODE TYPE

For Operation at Altitudes up to 50000 Feet

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage	6.3 +5% -10%	ac or dc volts
Current at 6.3 volts:		
Minimum	2.0	amp
Average	2.3	amp
Maximum	2.5	amp
Minimum heating time	2	minutes
Direct Interelectrode Capacitances (Approx.):		
Grid to anode	3.9	μμf
Grid to cathode	8.6	μμf
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
Overall Length	5" ± 3/16"
Seated Length	4-3/8" ± 3/16"
Maximum Diameter	1-9/16"
Bulb	T-12
Cap	Small (JETEC No.C1-1)
Base . . . Medium-Micanol-Shell Small 4-Pin	(JETEC No.A4-9)

BOTTOM VIEW

Pin 1 – Heater
Pin 2 – Cathode
Pin 3 – Grid
Pin 4 – Heater, Cathode
Cap – Anode

Cooling . . . . . Natural

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

□ Defined as the time interval between the point on the rising portion of the grid pulse which is 26% of the peak unloaded pulse amplitude and the point on the anode-current pulse which is 26% of its peak amplitude. The anode-current pulse has a time rise of 0.05 microsecond maximum. The grid pulse has a peak amplitude of 130 volts minimum, has a rise time of 0.5 microsecond maximum, and is supplied by a driver having 1500 ohms maximum internal impedance.

• Continuous Commercial Service.

Corresponds to altitude of about 50000 feet.

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RCA

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HYDROGEN THYRATRON

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
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	−50 to +90	°C

Typical Operation♦ at 2000 pps in Accompanying Circuit:

	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

* 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 75000 volts per second.

▲ Exclusive of spike not having more than 0.05 microsecond duration.

♦ 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.

° Averaged over any cycle.

† Defined as *Peak Forward Anode Volts x Pulse Repetition Rate (pps) x Peak Anode Amperes* (excluding spike).

*: See next page.

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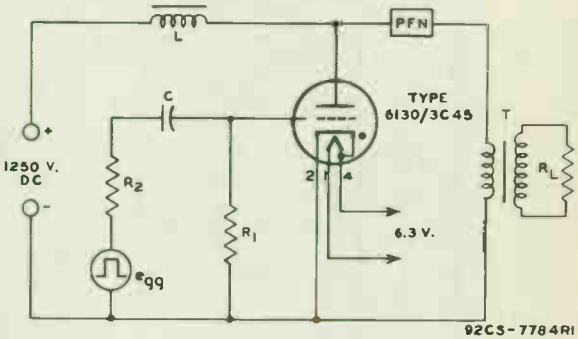
HYDROGEN THYRATRON

• Pulse duration is defined as the time interval between points on the pulse envelope at which instantaneous amplitudes are equal to 70.7% of the maximum amplitude excluding spike.

Typical Pulse-Modulator Circuit Operating at 2000 pps



92CS-7784R1

C: Blocking Capacitor, 0.001 μf

e_{gg}: 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 microsecond

R_1: Grid Resistor, 30000 ohms

R_2: Effective Resistance of pulse generator, 1000 ohms

R_L: Load Resistance. Value reflected into primary of transformer (T) is 35 ohms.

T: Matching Pulse Transformer

OPERATING CONSIDERATIONS

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.

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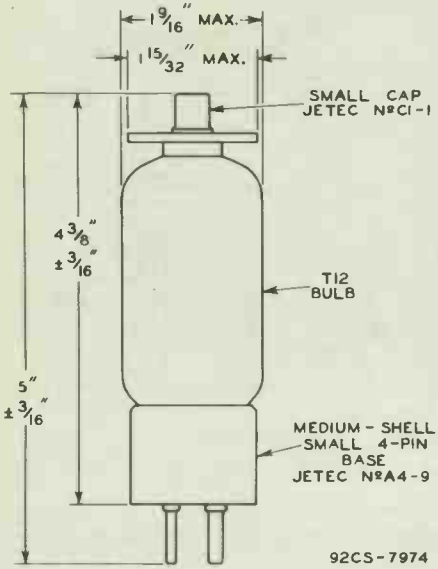
HYDROGEN THYRATRON



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XENON THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

FORCED-AIR COOLED

GENERAL DATA

Electrical:

Filament, Coated:*		
Voltage	2.5 ± 5%	ac volts
Current at 2.5 volts	92	amp
Minimum heating time, prior to tube conduction	60	sec
Direct Interelectrode Capacitances:○		
Grid to anode	44	μμf
Grid to filament	7.5	μμf
Ionization Time (Approx.)	10	μsec
Deionization Time#	1000	μsec
Maximum Critical Grid Current for instantaneous anode volts = 650	50	μa
Peak Tube Voltage Drop	*See Characteristics Range Values*	
Maximum Commutation Factor@	400	va/μsec²
Grid Control Ratio (Approx.): Under conditions: 10000-ohm grid resistor, returns to filament terminal FS, voltage on filament terminal F in phase with anode voltage (with respect to voltage at FS), anode voltage between 100 and 700 volts, and plate load of 2000 ohms	100	

Mechanical:

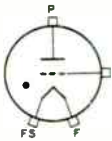
Operating Position	Any
Maximum Overall Length	11.8"
Maximum Radius (Including grid terminal)	2.88"
Maximum Diameter (Excluding grid terminal)	4.62"
Weight (Approx.)	3 lbs
Bulb	T36

Terminal Connections *(See Dimensional Outline)*:

P – Anode

G – Grid

F – Filament



FS – Filament Cathode Shield, Circuit Returns

Air Flow . . . . . 60 cfm

The specified air flow, from a 2- to 3-inch diameter nozzle located about 12 inches from the anode end of the tube and on the tube axis, should be directed at the anode cup and permitted to flow freely around the outside of the anode cup, grid-seal band, and glass bulb. These requirements are for operation at sea level and at an ambient temperature of

*,○,#,@: See next page.

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XENON THYRATRON

30° C. At higher altitudes and ambient temperatures, the air flow must be increased to maintain the respective seal temperatures and the anode temperature within maximum ratings.

Anode Temperature (Measured within 1/2 inch of region where anode terminal blade joins anode surface).	300 max.	°C
Temperature of Anode Seal, Grid Seals, and Filament Seals.	180 max.	°C

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

For supply frequency of 25 to 60 cps

	Continuous Service■	*Intermittent Service*♦	
PEAK ANODE VOLTAGE:			
Forward.	650 max.	650 max.	volts
Inverse.	650 max.	650 max.	volts
GRID VOLTAGE:			
Peak, before tube conduction.	−150 max.	−150 max.	volts
Average, during tube conduction	−10 max.	−10 max.	volts
ANODE CURRENT:			
Peak	160 max.	400 max.	amp
Average.	40 max.●□	7 max.★□	amp
Fault, for duration of 0.1 second maximum .	4000 max.	4000 max.	amp
GRID CURRENT:			
Average positive . . .	2.0 max.	2.0 max.	amp
Peak positive with anode negative . . .	0.1 max.	0.1 max.	amp
AMBIENT-TEMPERATURE RANGE.	−55 to +75	−55 to +75	°C

Typical Operation:

For intermittent ac control of X-ray tube power utilizing inverse-parallel circuit of Fig. 1 with anode-supply frequency of 60 cps

"On" (Conduction) Period	2	sec
"Off" (Non-Conduction) Period.	34	sec
RMS Anode-Supply Voltage	220	volts
Grid-Bias Voltage.	−50	volts
Grid-Circuit Resistance.	0.1	megohm
Grid-Pulse Voltage	60	volts
Anode Current (Per Tube):		
Peak	400	amp
Average▲	127	amp
Load RMS Demand Current.	280	amp

*,○,#,⊕,■,♦,●,□,★,▲: See next page.

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XENON THYRATRON

Maximum Circuit Values:

	Continuous Service	*Intermittent Service*	
Grid-Circuit Resistance. . .	0.1 max.	0.1 max.	megohm

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Throughout Tube Life

	Note	Min.	Max.	
Filament Current	1	87	97	amp
Peak Tube Voltage Drop	1,2	-	40	volts
Peak Critical Anode Voltage.	1,3	-	100	volts

Note 1: With 2.5 volts rms on filament.

Note 2: With peak anode current of 400 amperes provided by a half-cycle pulse from a 60-cps sine wave. Pulse recurs once each second. Tube drop is measured by an oscilloscope connected between anode and the filament terminal FS. The grid is tied to anode through a 10,000-ohm resistor.

Note 3: The voltage at terminal F is in phase with the anode voltage (with respect to voltage at filament terminal FS). Circuit returns are made to terminal FS. Grid resistor = 0 to 100,000 ohms.

* In single-phase applications, to avoid excessive heating of the filament and for maximum tube life, the voltage at filament terminal F should be in phase with the voltage at the anode terminal (with respect to voltage at filament terminal FS). All returns should be made to filament terminal FS in order to reduce the amount of rms current flowing through the filament and filament leads. In polyphase installations, quadrature operation of the filament is recommended to reduce excessive heating of the filament and filament leads by the anode-return current. In quadrature operation, the filament and anode voltages should be 90° out of phase for optimum results. However, in practical applications, nearly full realization of the advantages of this type of excitation is possible with the filament and anode voltages between 60° and 120° out of phase. In polyphase operation where the anode voltage transfers from one phase to another during the current-conduction period, quadrature operation is obtained when the filament voltage passes through zero at the center of the current-conduction period.

○ Without external shield.

* Measured by Capacitor-Discharge Method as described in "Standard on Electron Tubes: Methods of Testing, 1950 (50 IRE 7.S2)" available from The Institute of Radio Engineers, 1 East 79 St., New York 21, N. Y. Also available in "Proceedings of the I.R.E.", Vol.38, No.9, page 1092 (September 1950). Conditions of measurement involve anode-supply voltage (E_{bb}) of 300 volts, grid-supply voltage (E_{cc}) of -150 volts, grid resistor (r_g) of 5000 ohms and anode current (I_b) of 24 amperes.

⊕ Commutation factor is 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.

■ Continuous Service is defined as service where conduction recurs for each cycle of the anode-supply voltage.

◆ Intermittent Service is defined as service where conduction does not take place as often as every cycle of the anode-supply voltage.

● Averaged over any period of 15 seconds maximum.

□ This rating applies when the average or the rms load current is at a maximum with respect to the phase-retard angle. This condition obtains with zero phase-retard angle. As the phase-retard angle is increased, the average or rms load current is reduced but the severity of duty on the 7486 is not reduced.

★, ▲: See next page.

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XENON THYRATRON

The angle of phase retard is the angle by which the grid signal (or the resultant tube conduction) lags the time at which the incoming and outgoing tubes have equal instantaneous values of voltage from the simusoidal supply.

★ Averaged over any period of 36 seconds maximum.

▲ Averaged over the "on" period of 2 seconds.

OPERATING CONSIDERATIONS

The *mounting* may support the 7086 in any position. A suitable mounting arrangement is provided by the use of three insulated 1/4-inch-diameter studs set perpendicularly in a rigid surface at locations which are spaced to correspond with the spacing of the terminal holes as shown on the Dimensional Outline. The studs should extend a minimum distance of 5 inches out from the surface, and should be threaded for a minimum length of 2 inches on their free end. Place a nut followed by a brass or copper washer on each stud so that 1-1/2 inches of the free end extends beyond the washer. Then mount the tube by slipping the holes of the tube's terminals onto the studs. The terminal lugs of the connecting leads to the tube can then be slipped onto their respective studs. Tighten the connection with a second nut on each stud. *In order not to subject the glass-to-metal seals to stress which may damage them, use two wrenches*--one on each side of the tube terminals when tightening a connection.

Filament leads should be made of No.2 stranded copper wire, or equivalent. The tube end of the wire lead should be hard soldered to a 225-ampere (minimum) copper terminal lug. Be sure that this terminal lug is placed in direct contact with the filament terminal before tightening the nut.

The anode lead should be made of No.5 copper wire, or equivalent, and terminate at the tube end in a 150-ampere (minimum) copper terminal lug.

The grid lead should terminate at the tube end in a lug that may be fastened to the grid terminal by a No.6 screw & nut.

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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XENON THYRATRON

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_1 = RMS Load Current
I_p = Anode Current (RMS)
I_{pm} = Peak Anode Current
P_{ac} = Average Power in Load
P_{al} = Line Volt-Amperes
P_{ap} = Trans. Pri. Volt-Amperes
P_{as} = Trans. Sec. Volt-Amperes
P_{dc} = DC Power ($E_{av} \times I_{av}$)
P_p = Peak Load Volt-Amperes

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
Voltage Ratios					
E/E_{av}	–	–	2.22	1.11	1.11
E_{bmi}/E	1.41	1.41	1.41	2.83	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	1.41
Inductive Load■	1.41	1.41	1.41	2.83	1.41
Frequency Ratio					
f_r/f	–	–	1	2	2
Current Ratios					
I_b/I_{av}	–	–	1	0.5	0.5
Resistive Load					
I_p/I_{av}	–	–	1.57	0.785	0.785
I_{pm}/I_{av}	–	–	3.14	1.57	1.57
I_{pm}/I_b	3.14	3.14	3.14	3.14	3.14
I_1/I_b	2.22	2.22k*	–	–	–
Inductive Load■					
I_p/I_{av}	–	–	–	0.707	0.707
I_{pm}/I_{av}	–	–	–	1	1
I_{pm}/I_b	–	–	–	2	2
I_b/I_{av}	–	–	–	0.5	0.5

■, *: See next page.

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RATIO	Fig. 1	Fig. 2	Fig. 3	Fig. 4	Fig. 5
Power Ratios					
$P_{ac}/I_b E_{bmf}$	1.57	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_{a1}/P_{dc}	–	–	2.69	1.23	1.24
Inductive Load■					
P_{as}/P_{dc}	–	–	–	1.57	1.11
P_{ap}/P_{dc}	–	–	–	1.11	1.11
P_{a1}/P_{dc}	–	–	–	1.11	1.11

■ The use of a large filter-input choke is assumed except for the circuit of Figs.1 and 2.

* k = 1/2 number of turns in secondary of transformer T_p divided by the number of turns in the primary of T_p.

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 KW TO FILTER P_{dc}	MAX. AV. AC OUTPUT KVA P_{ac}
Fig. 1 Inverse-Parallel (AC Voltage Control)					
Intermittent Service	460	–	–	–	130▲ / 7♦
Continuous Service	460	–	–	–	40♦
Fig. 2 Full-Wave Reflected Impedance (AC Voltage Control)	460	–	–	–	40♦
Fig. 3 Half-Wave (DC Voltage Control)	460	205	40	8	–
Fig. 4 Full-Wave (DC Voltage Control)					
With Resistive Load	230	205	80	16	–
With Inductive Load	230	205	80	16	–
Fig. 5 Series (DC Voltage Control)	460	410	80	32.5	–

▲ Under conditions with "on" period of 2 seconds and "off" period of 3¾ seconds.

♦ Averaged over any period of 36 seconds maximum.

♦ Averaged over any period of 15 seconds maximum.

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XENON THYRATRON

AC Voltage Control

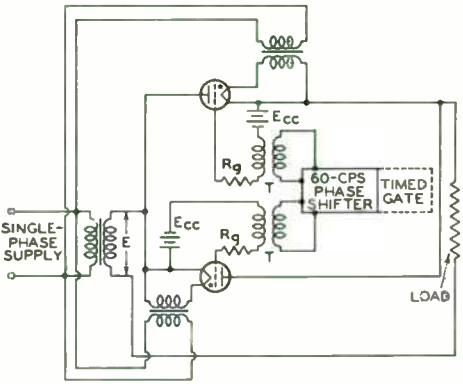

FIG. 1 SINGLE-PHASE INVERSE-PARALLEL

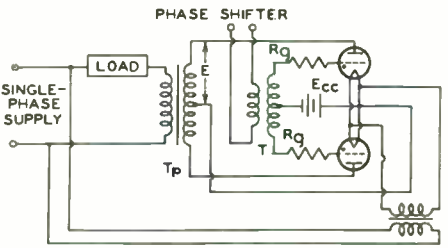

FIG. 2 FULL-WAVE SINGLE-PHASE REFLECTED IMPEDANCE

7086
XENON THYRATRON

DC Voltage Control

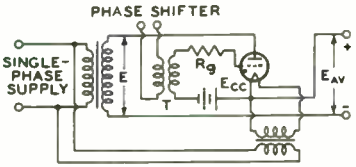

FIG.3 HALF-WAVE SINGLE-PHASE

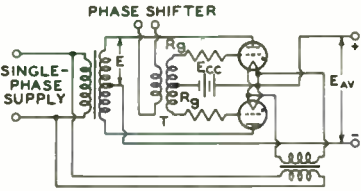

FIG.4 FULL-WAVE SINGLE-PHASE

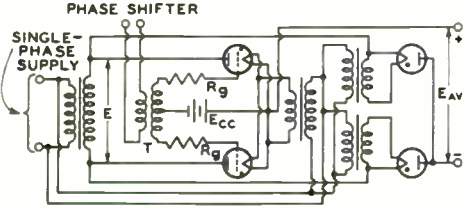

FIG. 5 SERIES SINGLE-PHASE

NOTES

E_{cc} = GRID-BIAS SUPPLY VOLTAGE
R_g = GRID CIRCUIT RESISTANCE
T = PEAKING TRANSFORMER
IN FIG. 5, THE RECTIFIER TUBES MAY BE USED AS DIODES. THE 7086 IS USED AS A DIODE BY CONNECTING THE GRID TO FILAMENT TERMINAL FS.

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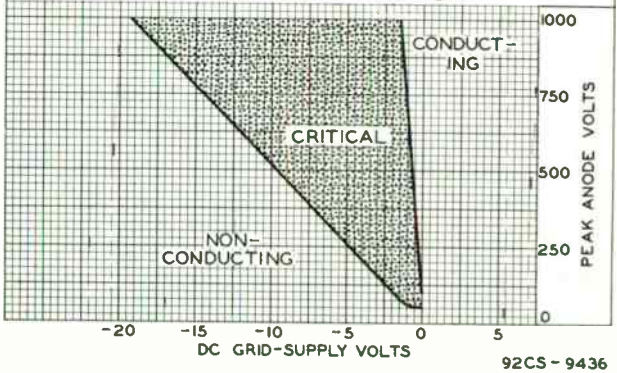
OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

RANGE IS FOR CONDITIONS WHERE:
E_f = 2.5 VOLTS AC ±5%. CIRCUIT RETURNS TO FILAMENT TERMINAL FS. FILAMENT VOLTAGE AT TERMINAL F IN PHASE WITH ANODE VOLTAGE (WITH RESPECT TO VOLTAGE AT FS).
THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES.
GRID RESISTOR = 0 TO 100000 OHMS
AMBIENT-TEMPERATURE RANGE = −55° TO +75° C



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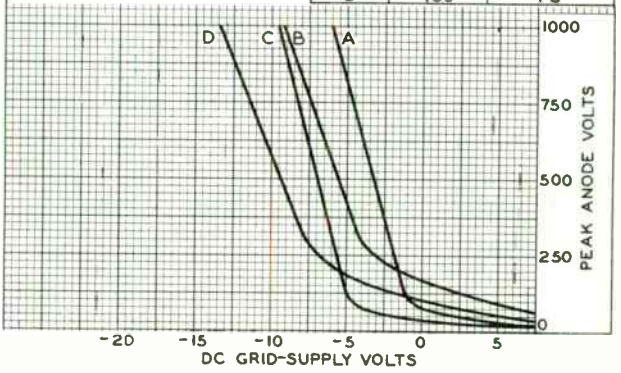
SHIFT OF TYPICAL CONTROL CHARACTERISTICS WITH CHANGE IN FILAMENT PHASING AND CIRCUIT RETURN

E_f = 2.5 VOLTS AC
GRID RESISTOR=10000 OHMS
* BETWEEN FILAMENT VOLTAGE AT TERMINAL F AND ANODE VOLTAGE (WITH RESPECT TO VOLTAGE AT FS).

CURVE	PHASE ANGLE *	CIRCUIT RETURN TO FIL. TERM.
A	0°	FS
B	180°	F
C	0°	F
D	180°	FS



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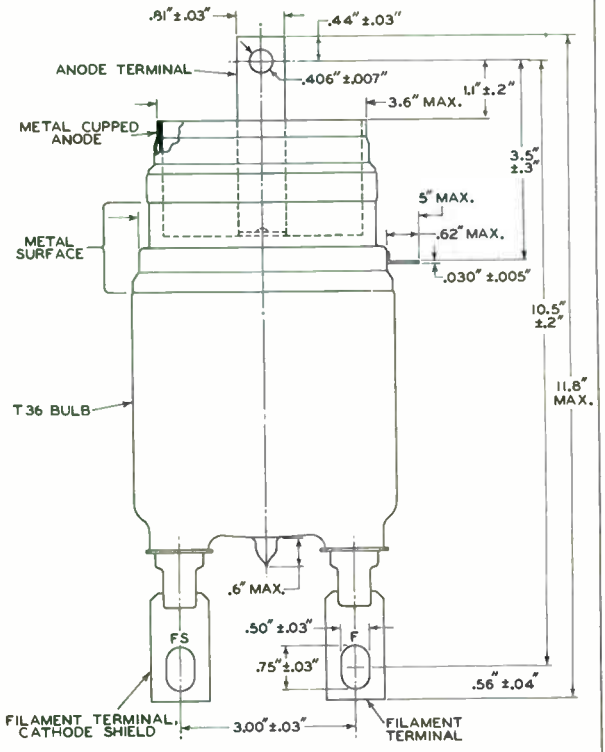
XENON THYRATRON



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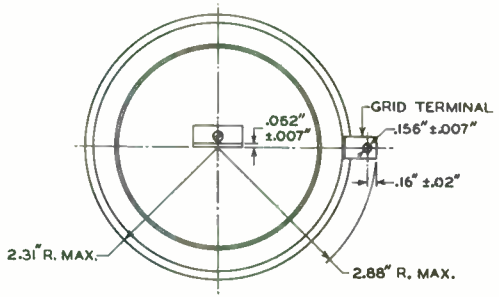
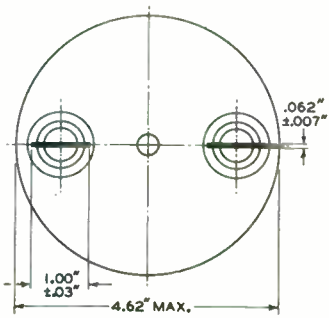
XENON THYRATRON



TOP VIEW



BOTTOM VIEW

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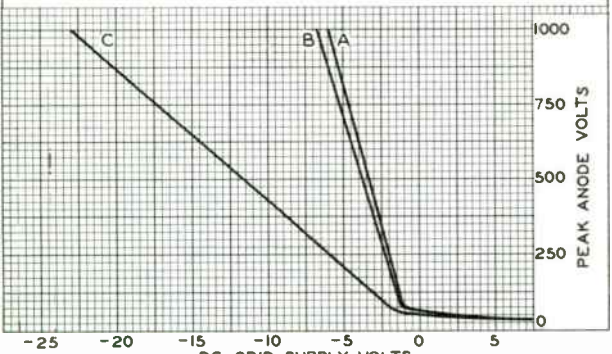
7086

SHIFT OF CONTROL CHARACTERISTICS
WITH CHANGE IN GRID-RESISTOR VALUE

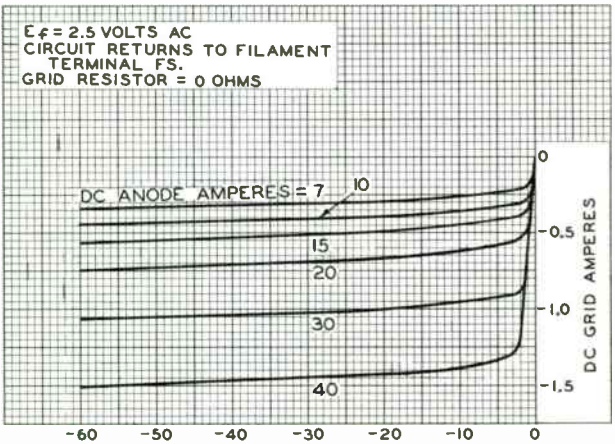
E_f = 2.5 VOLTS AC
* BETWEEN FILAMENT VOLTAGE AT TERMINAL F AND ANODE VOLTAGE (WITH RESPECT TO VOLTAGE AT FS).

CURVE	GRID RESISTOR MEGOHMS	CIRCUIT RETURN TO FIL. TERM.	PHASE ANGLE *
A	0.01	FS	0
B	0.1	FS	0
C	1	FS	0



92CS-9437

TYPICAL GRID CHARACTERISTICS
DURING TUBE CONDUCTION



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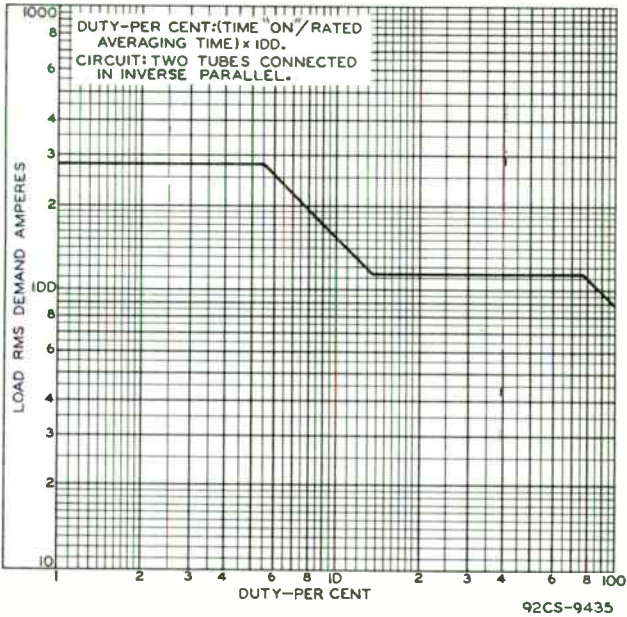
CURRENT DEMAND CHARACTERISTIC
AC VOLTAGE CONTROL SERVICE



92CS-9435

CIK/6014

XENON THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

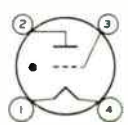
GENERAL DATA

Electrical:

	Min.	Av.	Max.	
Filament, Coated:				
Voltage	2.4	2.5	2.6	ac or dc volts
Current at 2.5 volts	5.5	6.3	7.1	amp
Minimum heating time prior to tube conduction			25	sec
Direct Interelectrode Capacitances (Approx.):				
Grid to anode			1	μμf
Grid to cathode			10	μμf
Maximum Deionization Time			500	μsec
Maximum Critical Grid Current			5	μamp
Anode Voltage Drop:				
Average, at beginning of life			8	volts
Maximum, at end of life			14	volts
Maximum Commutation Factor*, averaged over first 500 volts of inverse anode voltage rise			0.15	$va/\mu s^2$
Grid Control Ratio (Approx.): For conditions: 10000-ohm grid resistor, circuit returns to filament transformer center-tap, dc anode voltage, and dc grid voltage			230	

Mechanical:

Mounting Position	Any
Maximum Overall Length	4-1/4"
Maximum Diameter	1-9/16"
Weight (Approx.)	3 oz
Bulb	T-12
Base	Medium-Metal-Shell Small 4-Pin with Bayonet (JETEC No.A4-89)
Basing Designation for BOTTOM VIEW	4D



Pin 1 – Filament

Pin 2 – Anode

Pin 3 – Grid

Pin 4 – Filament

GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, *Absolute Values:*

PEAK ANODE VOLTAGE:		
Forward	1000 max.	volts
Inverse	1250 max.	volts
GRID VOLTAGE:		
Peak, before tube conduction	-100 max.	volts

* 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.

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CIK/6014

XENON THYRATRON

ANODE CURRENT:			
Peak		8 max.	amp
Average*		1 max.	amp
Overload**, for duration of	0.56 sec.	8 max.	amp
	1 sec.	4.5 max.	amp
	2 sec.	2.25 max.	amp
	3 sec.	1.5 max.	amp
	4 sec.	1.13 max.	amp
Fault, for duration of 0.1 second maximum		77 max.	amp
AMBIENT-TEMPERATURE RANGE		-55 to +75	°C

* Averaged over any period of 4.5 seconds.

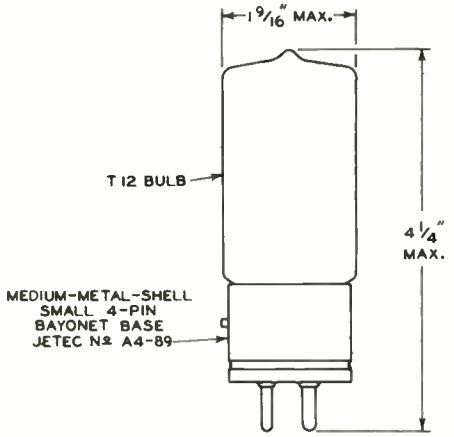
** Averaged for duration of overload occurring no more than once in any period of 4.5 seconds.

OPERATING CONSIDERATIONS

Circuit returns may be made to either side of filament or to transformer center-tap.

The *anode* of the CIK/6014 may show a red color when the tube is operated at full load.

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.

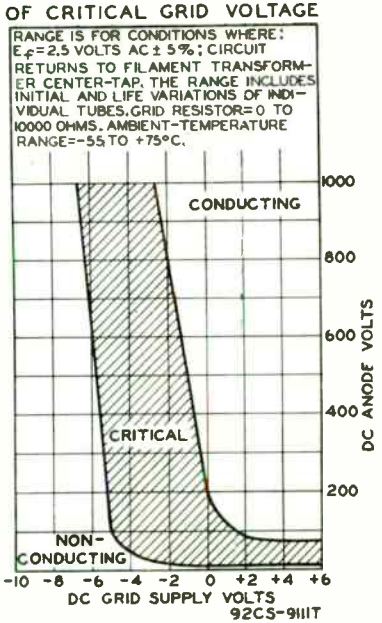


TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CIK/6014

XENON THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

C3J/5632

XENON THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

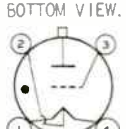
GENERAL DATA

Electrical:

	Min.	Av.	Max.	
Filament, Coated and Mid-tapped:				
Voltage between pins 1 and 4	2.4	2.5	2.6	ac or dc volts
Current at 2.5 volts	7	9	11	amp
Minimum heating time prior to tube conduction			30	sec
Direct Interelectrode Capacitances (Approx.):				
Grid to anode			2	μμf
Grid to cathode			14	μμf
Maximum Deionization Time			1000	μsec
Maximum Critical Grid Current			10	μamp
Anode Voltage Drop:				
Average, at beginning of life			10	volts
Maximum, at end of life			14	volts
Maximum Commutation Factor♦, averaged over first 350 volts of inverse anode voltage rise			0.66	va/μs²
Grid Control Ratio (Approx.):				
For conditions: 10000-ohm grid resistor, circuit returns to filament mid-tap, dc anode voltage, and dc grid voltage			200	

Mechanical:

Mounting Position	Any
Maximum Overall Length	6"
Maximum Diameter	1-9/16"
Weight (Approx.)	3 oz
Cap	Medium (JETEC No. C1-5)
Bulb	T-12
Base	Medium-Metal-Shell Small 4-Pin with Bayonet (JETEC No. A4-89)
Basing Designation for BOTTOM VIEW	4CF



Pin 1 – Filament
Pin 2 – Filament Mid-Tap & Circuit Returns
Pin 3 – Grid
Pin 4 – Filament
Cap – Anode

GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, *Absolute Values:*

PEAK ANODE VOLTAGE:		
Forward	900 max.	volts
Inverse	1250 max.	volts

♦ 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.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

C3J

C3J/5632

XENON THYRATRON

GRID VOLTAGE:			
Peak, before tube conduction. . . .		−100 max.	volts
ANODE CURRENT:			
Peak.		30 max.	amp
Average•.		2.5 max.	amp
Overload:			
Rating I*, for duration of . .	0.37 sec. . .	30 max.	amp
	0.50 sec. . .	22.5 max.	amp
	1 sec. . .	11.25 max.	amp
	2 sec. . .	5.63 max.	amp
	3 sec. . .	3.75 max.	amp
	4 sec. . .	2.82 max.	amp
Rating II**, for duration of . .	3 sec. . .	3.75 max.	amp
	4 sec. . .	3.40 max.	amp
	4.5 sec. . .	3.30 max.	amp
Fault, for duration of 0.1 second maximum		300 max.	amp
AMBIENT-TEMPERATURE RANGE		−55 to +75	°C

• Averaged over any period of 4.5 seconds.

* Averaged over duration of overload occurring no more than once in any period of 4.5 seconds.

** Averaged over duration of overload occurring no more than once in any period of 30 seconds.

OPERATING CONSIDERATIONS

Circuit returns should be connected to filament mid-tap (pin 2).

The *anode* of the C3J/5632 may show a red color when the tube is operated at full load.

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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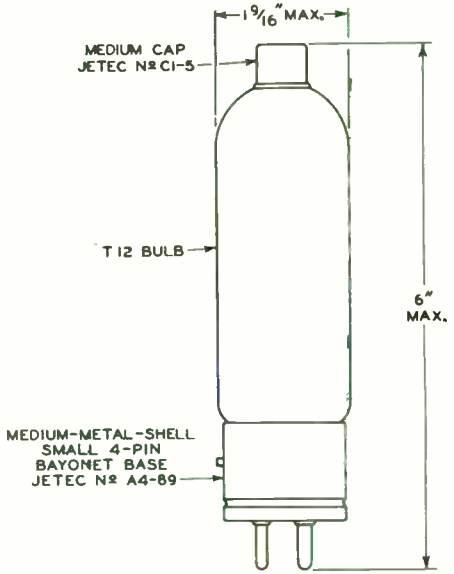
TENTATIVE DATA

C3J/5632

XENON THYRATRON



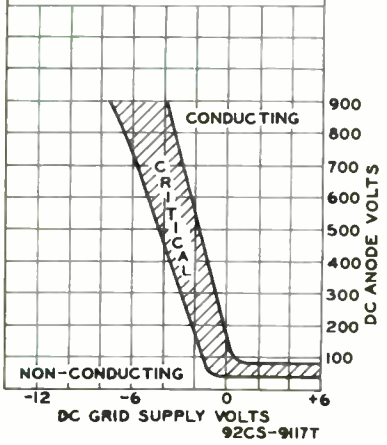
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

C3J/5632

XENON THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

RANGE IS FOR CONDITIONS WHERE: E_f = 2.5 VOLTS ± 5%; CIRCUIT RETURNS AND PIN 2 CONNECTED TO FILAMENT TRANSFORMER CENTER-TAP. THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES. GRID RESISTOR=0 TO 10000 OHMS. AMBIENT-TEMPERATURE RANGE = −55 TO 75°C.



TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

C3J-A/5684

XENON THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

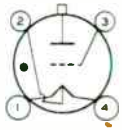
GENERAL DATA

Electrical:

	Min.	Av.	Max.	
Filament, Coated and Mid-tapped:				
Voltage between pins 1 and 4	2.4	2.5	2.6	ac or dc volts
Current at 2.5 volts	7	9	11	amp
Minimum heating time prior to tube conduction			30	sec
Direct Interelectrode Capacitances (Approx.):				
Grid to anode			2	μμf
Grid to cathode			14	μμf
Maximum Deionization Time			1000	μsec
Maximum Critical Grid Current			10	μamp
Anode Voltage Drop:				
Average, at beginning of life			10	volts
Maximum, at end of life			14	volts
Maximum Commutation Factor♦, averaged over first 350 volts of inverse anode voltage rise			0.65	va/μs²
Grid Control Ratio (Approx.):				
For conditions: 10000-ohm grid resistor, circuit returns to filament mid-tap, dc anode voltage, and dc grid voltage			200	

Mechanical:

Mounting Position	Any
Maximum Overall Length	6"
Maximum Diameter	1-9/16"
Weight (Approx.)	3 oz
Cap	Medium (JETEC No.C1-5)
Bulb	T-12
Base	Medium-Metal-Shell Small 4-Pin with Bayonet (JETEC No.A4-89)
Basing Designation for BOTTOM VIEW	4CF



Pin 1 – Filament
Pin 2 – Filament Mid-Tap & Circuit Returns
Pin 3 – Grid
Pin 4 – Filament
Cap – Anode

GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, *Absolute Values:*

PEAK ANODE VOLTAGE:		
Forward	1000 max.	volts
Inverse	1250 max.	volts

♦ 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.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON NEW JERSEY

C3J-A/5684

XENON THYRATRON

GRID VOLTAGE:			
Peak, before tube conduction		−100 max.	volts
ANODE CURRENT:			
Peak		30 max.	amp
Average●		2.5 max.	amp
Overload:			
Rating I*, for duration of	0.37 sec.	30 max.	amp
	0.50 sec.	22.5 max.	amp
	1 sec.	11.25 max.	amp
	2 sec.	5.63 max.	amp
	3 sec.	3.75 max.	amp
	4 sec.	2.82 max.	amp
Rating II**, for duration of	3 sec.	3.75 max.	amp
	4 sec.	3.40 max.	amp
	4.5 sec.	3.30 max.	amp
Fault, for duration of 0.1 second maximum		300 max.	amp
AMBIENT-TEMPERATURE RANGE		−55 to +75	°C

● Averaged over any period of 4.5 seconds.

* Averaged over duration of overload occurring no more than once in any period of 4.5 seconds.

** Averaged over duration of overload occurring no more than once in any period of 30 seconds.

OPERATING CONSIDERATIONS

Circuit returns should be connected to filament mid-tap (pin 2).

The *anode* of the C3J-A/5684 may show a red color when the tube is operated at full load.

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.

TUBE DIVISION
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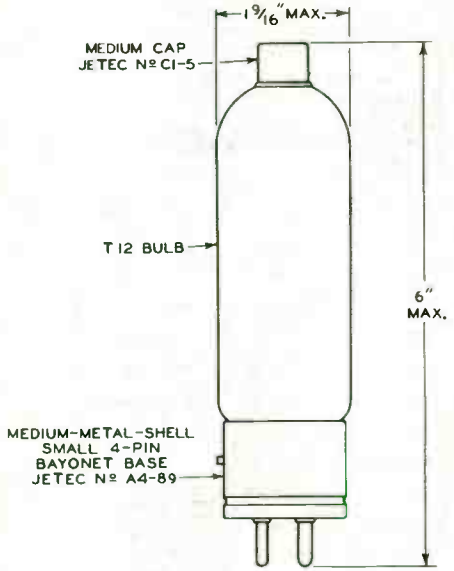
C3J-A/5684

XENON THYRATRON



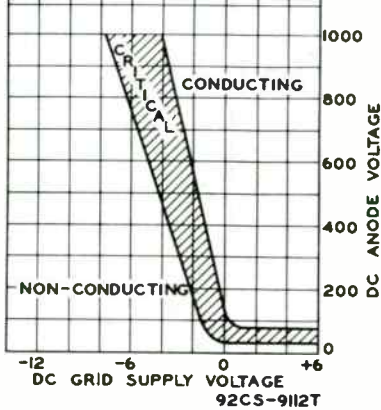
92CS-9109

TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

C3J-A/5684
XENON THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

RANGE IS FOR CONDITIONS WHERE: E_f=2.5 VOLTS± 5%; CIRCUIT RETURNS AND PIN 2 CONNECTED TO FILAMENT TRANSFORMER CENTER-TAP.
THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES.
GRID RESISTOR=0 TO 10000 OHMS.
AMBIENT-TEMPERATURE RANGE=-55 TO 75°C.



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

Xenon Thyratron

NEGATIVE-CONTROL TRIODE TYPE

GENERAL DATA

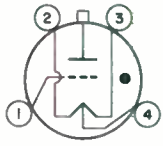
Electrical:

	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		μμf
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/μsec²

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:



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

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.

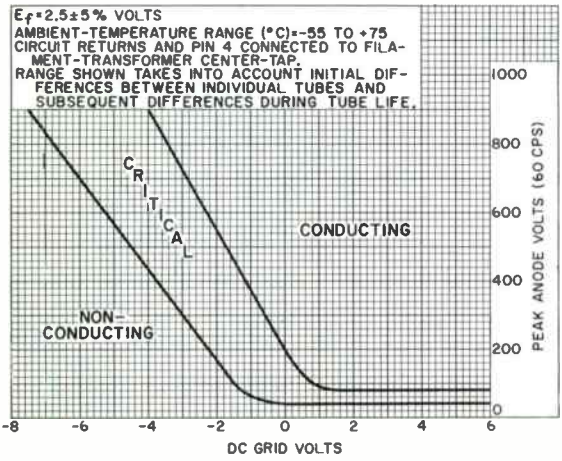
[b] Averaged over any period of 4.5 seconds.

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



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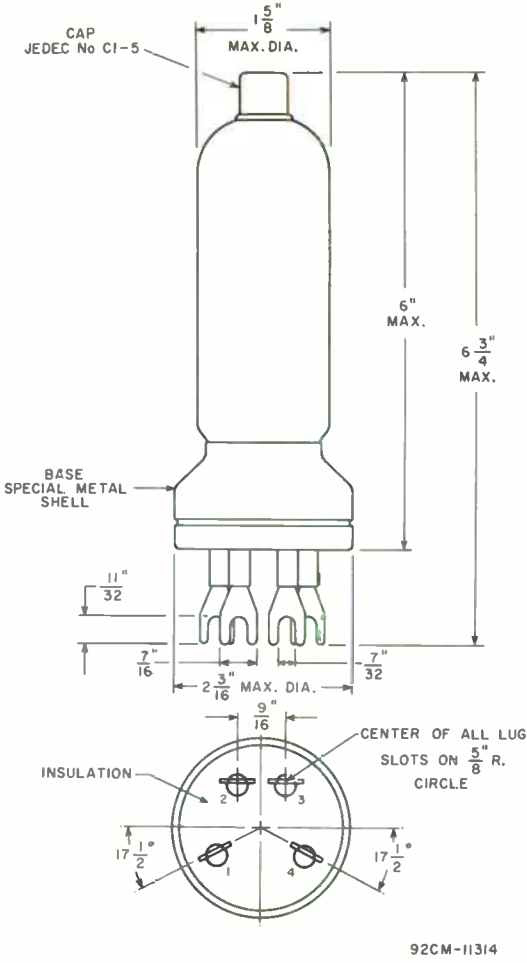


C6J/5C21

XENON THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

GENERAL DATA

Electrical:

	Min.	Av.	Max.	
Filament, Coated:				
Voltage	2.4	2.5	2.6	ac or dc volts
Current at 2.5 volts	19	21	23	amp
Minimum heating time prior to tube conduction			50	sec
Direct Interelectrode Capacitances (Approx.):				
Grid to anode			4	μμf
Grid to cathode			21	μμf
Maximum Deionization Time			1000	μsec
Maximum Critical Grid Current			10	μamp
Anode Voltage Drop:				
Average, at beginning of life			9	volts
Maximum, at end of life			12	volts
Maximum Commutation Factor♦, averaged over first 350 volts of inverse anode voltage rise			0.66	va/μs²
Grid Control Ratio (Approx.):				
For conditions: 10000-ohm grid resistor, circuit returns to filament transformer center-tap, filament pin 2 negative with respect to filament pin 3 when anode is positive, dc anode voltage, and dc grid voltage			210	

Mechanical:

Mounting Position	Vertical, base down
Maximum Overall Length	9-1/2"
Maximum Diameter	2-1/32"
Weight (Approx.)	7 oz
Cap	Medium (JETEC No.C1-5)
Bulb	T-16
Base	Medium-Metal-Shell Super-Jumbo 4-Pin (JETEC No.A4-81)
Basing Designation for BOTTOM VIEW	4BZ

Pin 1 - Grid

Pin 2 - Filament

Pin 3 - Filament

Pin 4 - No Connection

Cap - Anode

GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, *Absolute Values:*

PEAK ANODE VOLTAGE:		
Forward	750 max.	volts
Inverse	1250 max.	volts

♦: See next page.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

C6J

C6J/5C21

XENON THYRATRON

GRID VOLTAGE:			
Peak, before tube conduction		−100 max.	volts
ANODE CURRENT:			
Peak		77 max.	amp
Average•		6.4 max.	amp
Overload:			
Rating I*, for duration of	0.5 sec.	77 max.	amp
	1 sec.	38.5 max.	amp
	2 sec.	19.2 max.	amp
	3 sec.	12.8 max.	amp
	4 sec.	9.6 max.	amp
	5 sec.	7.7 max.	amp
Rating II**, for duration of	3 sec.	12.8 max.	amp
	4 sec.	11.2 max.	amp
	5 sec.	10.3 max.	amp
	6 sec.	9.6 max.	amp
Fault, for duration of 0.1 second maximum		770 max.	amp
AMBIENT-TEMPERATURE RANGE		−55 to +75	°C

♦ 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.

• Averaged over any period of 6 seconds.

* Averaged over duration of overload occurring no more than once in any period of 6 seconds.

** Averaged over duration of overload occurring no more than once in any period of 30 seconds.

OPERATING CONSIDERATIONS

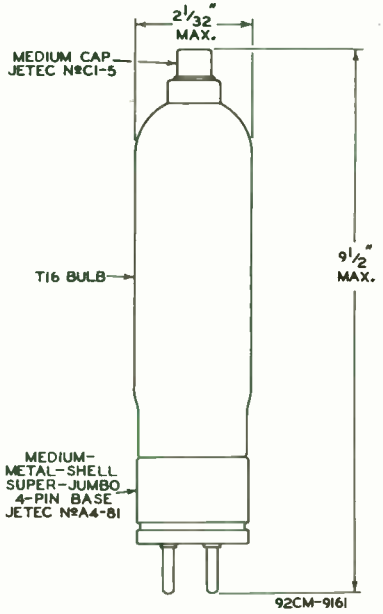
The *anode* of the C6J/5C21 will show a red color when the tube is operated at full load.

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.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

C6J/5C21

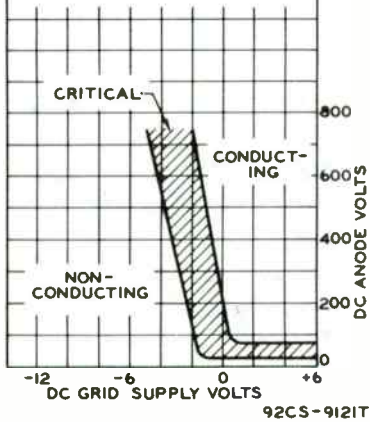
XENON THYRATRON



C6J/5C21
XENON THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

RANGE IS FOR CONDITIONS WHERE: E_f = 2.5 VOLTS ± 5%; CIRCUIT RETURNS TO CENTER-TAP OF FILAMENT TRANSFORMER. FILAMENT VOLTAGE AT PIN 2 IS (-) WHEN ANODE VOLTAGE IS (+). THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES. GRID RESISTOR = 0 TO 10000 OHMS. AMBIENT TEMPERATURE = -55 TO +75°C.



C6J-A/5685

XENON THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

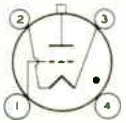
GENERAL DATA

Electrical:

	Min.	Av.	Max.	
Filament, Coated:				
Voltage	2.4	2.5	2.6	ac or dc volts
Current at 2.5 volts	19	21	23	amp
Minimum heating time prior to tube conduction			60	sec
Direct Interelectrode Capacitances (Approx.):				
Grid to anode			4	μμf
Grid to cathode			21	μμf
Maximum Deionization Time			1000	μsec
Maximum Critical Grid Current			10	μamp
Anode Voltage Drop:				
Average, at beginning of life			9	volts
Maximum, at end of life			12	volts
Maximum Commutation Factor♦, averaged over first 350 volts of inverse anode voltage rise			0.66	$va/\mu s^2$
Grid Control Ratio (Approx.): For concitions: 10000-ohm grid resistor, circuit returns to filament transformer center-tap, filament pin 2 negative with respect to filament pin 3 when anode is positive, dc anode voltage, and dc grid voltage			210	

Mechanical:

Mounting Position	Vertical, base down
Maximum Overall Length	9-1/2"
Maximum Diameter	2-1/32"
Weight (Approx.)	7 oz
Cap	Medium (JETEC No.C1-5)
Bulb	T-16
Base	Medium-Metal-Shell Super-Jumbo 4-Pin (JETEC No.A4-81)
Basing Designation for BOTTOM VIEW	4BZ



Pin 1 - Grid

Pin 2 - Filament

Pin 3 - Filament

Pin 4 - No Connection

Cap - Anode

GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, *Absolute Values:*

PEAK ANODE VOLTAGE:	
Forward	1000 max. volts
Inverse	1250 max. volts

♦: See next page.

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

C6J-A/5685

XENON THYRATRON

GRID VOLTAGE:			
Peak, before tube conduction		−100 max.	volts
ANODE CURRENT:			
Peak		77 max.	amp
Average•		6.4 max.	amp
Overload:			
Rating I*, for duration of	0.5 sec	77 max.	amp
	1 sec	38.5 max.	amp
	2 sec	19.2 max.	amp
	3 sec	12.8 max.	amp
	4 sec	9.6 max.	amp
	5 sec	7.7 max.	amp
Rating II**, for duration of	3 sec	12.8 max.	amp
	4 sec	11.2 max.	amp
	5 sec	10.3 max.	amp
	6 sec	9.6 max.	amp
Fault, for duration of 0.1 second maximum		770 max.	amp
AMBIENT-TEMPERATURE RANGE		−55 to +75	°C

♦ 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.

• Averaged over any period of 6 seconds.

* Averaged over duration of overload occurring no more than once in any period of 6 seconds.

** Averaged over duration of overload occurring no more than once in any period of 30 seconds.

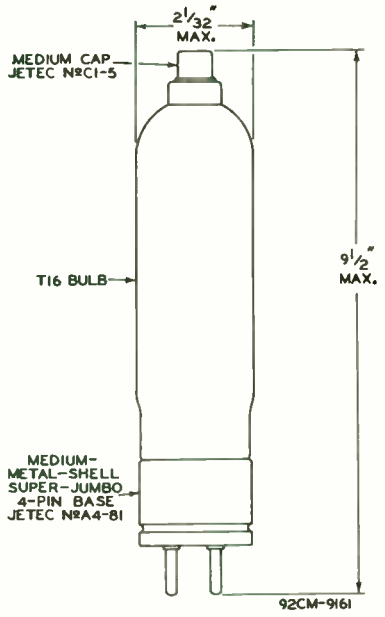
OPERATING CONSIDERATIONS

The *anode* of the C6J-A/5685 will show a red color when the tube is operated at full load.

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.

C6J-A/5685

XENON THYRATRON



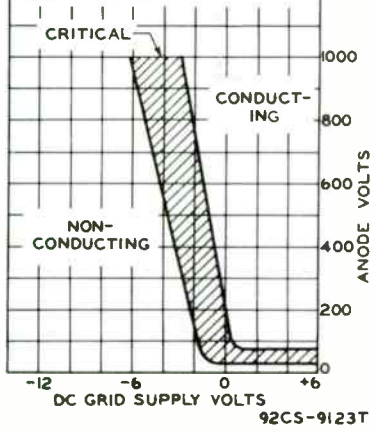
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

C6J-A/5685

XENON THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

RANGE IS FOR CONDITIONS WHERE: Ef = 2.5 VOLTS ± 5%; CIRCUIT RETURNS TO CENTER-TAP OF FILAMENT TRANSFORMER. FILAMENT VOLTAGE AT PIN 2 IS (-) WHEN ANODE VOLTAGE IS (+). THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES. GRID RESISTOR = 0 TO 10000 OHMS. AMBIENT TEMPERATURE = -55 TO +75°C.



92CS-9123T

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

C16J/5665

XENON THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

GENERAL DATA

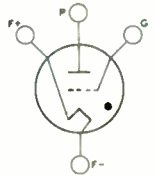
Electrical:

	Min.	Av.	Max.	
Filament, Coated:				
Voltage	2.4	2.5	2.6	ac or dc volts
Current at 2.5 volts	28	31	34	amp
Minimum heating time prior to tube conduction			60	sec
Direct Interelectrode Capacitances (Approx.):				
Grid to anode			8	μμf
Grid to cathode			29	μμf
Maximum Deionization Time			1000	μsec
Maximum Critical Grid Current			10	μamp
Anode Voltage Drop:				
Average, at beginning of life			11	volts
Maximum, at end of life			14	volts
Maximum Commutation Factor♦, averaged over first 330 volts of inverse anode voltage rise			0.66	$va/\mu s^2$
Grid Control Ratio (Approx.): For conditions: 10000-ohm grid resistor, circuit returns to filament transformer center-tap, filament lead F- negative with respect to filament lead F+ during conduction period, dc anode voltage and dc grid voltage			270	

Mechanical:

Mounting Position	Vertical, base down
Tube and Base Bracket Dimensions	*See Dimensional Outline*
Weight (Approx.)	14 oz
Bulb	T-20
Terminal Connections	*See Dimensional Outline*

BOTTOM VIEW



F- - Filament Lead

F+ - Filament Lead

G - Grid Lead

P - Anode Lead (On end opposite bracket)

GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, *Absolute Values:*

PEAK ANODE VOLTAGE:			
Forward	1000 max.	1000 max.	volts
Inverse	1250 max.	1250 max.	volts

♦ 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.

TENTATIVE DATA

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

C16J/5665

XENON THYRATRON

GRID VOLTAGE:			
Peak, before tube conduction	−100 max.	−100 max.	volts
ANODE CURRENT:			
Peak	160 max.	100 max.	amp
Average•	16 max.	18 max.	amp
Overload:			
Rating I*, for duration of. . 1 sec.	72 max.	81 max.	amp
2 sec.	36 max.	40.5 max.	amp
3 sec.	24 max.	27 max.	amp
3.5 sec.	21 max.	22.8 max.	amp
4 sec.	18 max.	20.3 max.	amp
Rating II**, for duration of. . 3 sec.	24 max.	–	amp
3.5 sec.	23 max.	22.8 max.	amp
4 sec.	22 max.	22.5 max.	amp
4.5 sec.	21.3 max.	22 max.	amp
Fault, for duration of 0.1 second maximum	1000 max.	1000 max.	amp
AMBIENT-TEMPERATURE RANGE	−55 to +75	−55 to +75	°C

• Averaged over any period of 4.5 seconds.

* Averaged over duration of overload occurring no more than once in any period of 4.5 seconds.

** Averaged over duration of overload occurring no more than once in any period of 30 seconds.

OPERATING CONSIDERATIONS

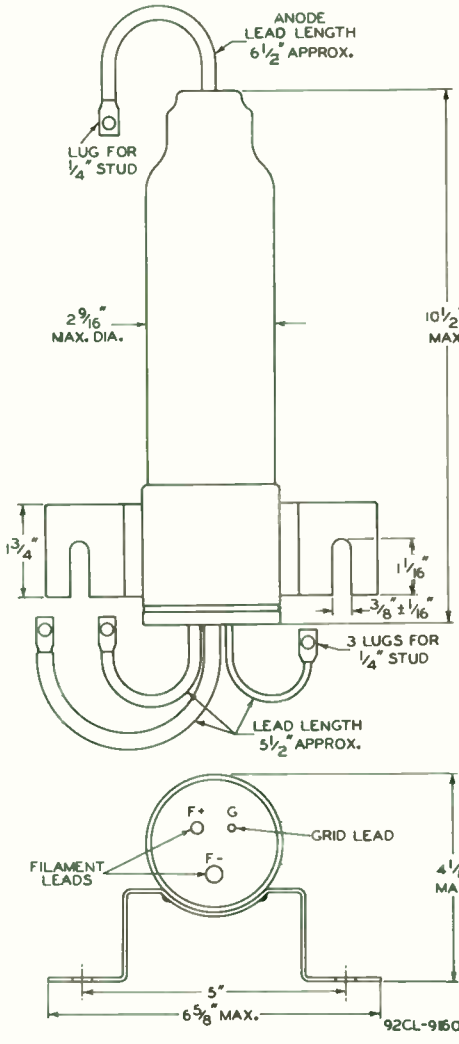
The *anode* of the C16J/5665 will show a red color when the tube is operated at full load.

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.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

C16J/5665

XENON THYRATRON



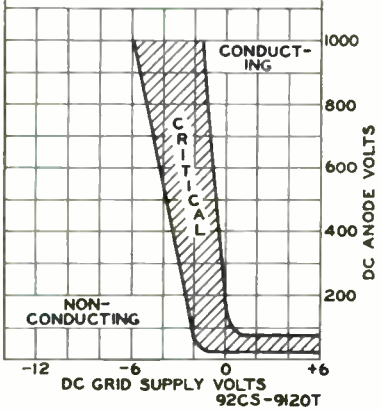
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

C16J/5665

XENON THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

RANGE IS FOR CONDITIONS WHERE: E_f = 2.5 VOLTS ± 5%; CIRCUIT RETURNS TO FILAMENT TRANSFORMER CENTER-TAP; FILAMENT LEAD F− NEGATIVE WITH RESPECT TO FILAMENT LEAD F+ DURING CONDUCTION PERIOD. THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES. GRID RESISTOR = 0 TO 10000 OHMS. AMBIENT TEMPERATURE RANGE −55 TO +75°C.



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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.

The following tables contain defining data for the various photocells currently available from RCA. Additional technical data for types 6694A, 6957, 7163, 7412, 7467, and 7536 are given on the individual data sheets in this section.

PHOTOCONDUCTIVE CELLS - Cadmium-Sulfide Types

RCA Type	Spectral Response	MAXIMUM RATINGS				MAX. DIMENSIONS		CHARACTERISTICS AT 25° C				
		Voltage Between Terminals DC or Peak AC	Power Dissipation	Photocurrent	Ambient Temp. Range	Length	Diameter	Voltage Between Terminals	Illumination	Photocurrent ma		Max. Decay Current
		volts	watt	ma	°C	in.	in.	volts	foot-candles	Min.	Max.	μa
4402	S-15	200	0.05	5	-75 to +60	0.580[a]	0.30	12 (dc)	10	1.6	-	12
4403	S-15	250	0.3	50	-75 to +60	0.9	1.26	50 (ac)	1	7	16	78
4404	S-15	600	0.3	50	-75 to +60	0.9	1.26	50 (ac)	1	2.5	5	40
4408	S-15	250	0.5	50	-75 to +60	1.25[a]	1.185	50 (ac)	1	1	3	40
4410	S-15	250	0.5	50	-75 to +60	1.25[a]	1.185	50 (ac)	1	2.5	5	40
4413	S-15	110	0.05	5	+60	0.587[a]	0.300	12 (dc)	10	1	2.75	12
4423	S-15	250	0.2	20	-75 to +60	0.550[a]	0.500	12 (dc)	10	2	8	10
4424	S-15	110	0.2	50	-75 to +60	0.670[b]	0.665	12 (dc)	1	3.6	14.5	80
4425	S-15	110	0.2	50	-75 to +60	0.550[a]	0.500	12 (dc)	1	3	9	35
4442	S-15	600	0.3	50	-75 to +60	0.9	1.26	50 (ac)	1	2.5	5	40
4447	S-15	600	0.3	50	-75 to +60	0.9	1.26	50 (ac)	1	3	5	40
4448	S-15	600	0.3	50	-75 to +60	0.9	1.26	50 (ac)	1	1.5	4	40
4450	S-15	600	0.3	50	-75 to +60	0.9	1.26	50 (ac)	3.5	2	3.5	40
4451	S-15	600	0.3	50	-75 to +60	0.9	1.26	50 (ac)	35	2	3.5	40
4453	S-15	600	0.3	50	-75 to +60	0.9	1.26	50 (ac)	1	3	7	40
6694A[c]	S-12	150	0.03	-	0 to +70	0.500	0.22x 0.375[d]	90 (dc)	30	0.057	0.65	0.1
6957[e]	S-15	600	0.5	50	-75 to +60	2-7/32	1-9/32	50 (dc)	1	2	8	40
7163	S-15	600	0.3	50	-75 to +60	0.9	1.26	50 (ac)	1	1	3	40
7412	S-15	200	0.05	1	+60	1.35[a]	0.30	12 (dc)	1	0.065	0.275	1
7536[f]	S-15	200	0.05	1	+60	1.35[a]	0.30	12 (dc)	1	0.065	0.275	1

[a] Excluding flexible leads.
[b] Excluding pin length.
[c] Single crystal.
[d] Cell face is rectangular.
[e] For renewal use.
[f] Side-on version of 7412.

RCA PHOTOCELL DATA TABLES

PHOTOJUNCTION CELLS

RCA Type	Spectral Response	MAXIMUM RATINGS			
		Voltage Between Terminals dc volts	Power Dissipation watt	Photocurrent ma	Ambient Temp. Range °C
4420	S-14	50	0.03	-	-40 to +50
7467	S-14	50	0.03	-	-40 to +50

PHOTOVOLTAIC CELLS

RCA Type	Spectral Response	CHARACTERISTICS AT 28° ± 3° C		
		Minimum Current ma	Minimum Power Output mw	Minimum Efficiency per cent
4800	g	89[h]	40[h]	10.5[h]
4801	g	40[h]	18[h]	10.0[h]

[g] Wavelength of max. response 8800 ± 500 angstroms. Approx. spectral range 4750 to 10750 angstroms.

RCA PHOTOCELL DATA

RCA PHOTOCELL DATA

Germanium P-N Alloy Types

MAX. DIMENSIONS		CHARACTERISTICS AT 25° C			RCA Type
Length in.	Diameter in.	Voltage Between Terminals dc volts	Illum. Sensitivity μa/fc	Max. Dark Current μa	
1.10[a]	0.350	45	0.7	35	4420
0.875[a]	0.35	45	0.7	35	7467

[a] Excluding flexible leads.

Silicon N on P Types

MAX. DIMENSIONS		SENSITIVE AREA (Av.)			RCA Type
Length in.	Width in.	Length in.	Width in.	Area sq. in.	
0.791	0.791	0.742	0.782	0.58	4800
0.396	0.791	0.351	0.782	0.274	4801

[h] With incident radiant power of 100 mw/cm^2 and load resistor adjusted to obtain 0.45 volt.

RCA Photocell Replacement Directory

Type to be Replaced	Replace with Similar RCA Type[a]	Type to be Replaced	Replace with Similar RCA Type[a]
8100	4423	CL607	4402
8142	4425	D-1767	4448
8143	4423	K20	6957
8346	4425	NSL-5	7163
8347	4423	NSL-6	4404
8935	4410	NSL-7	4403
CdS-9	7163	NSL-45	7163
CdS-9F	4404	NSL-46	4404
CL402	7412	NSL-47	4453
CL402S	7536	ORP-11	4425
CL407	7412	ORP-30	6957
CL407S	7536	ORP-60	7412
CL505	4423	ORP-61	7536
CL505L	4425	PB201	7412
CL602	4402	PB204	4425
CL605	4402	PB205	4423
CL605L	4402	PD401	7412

[a] RCA types shown in this column are not directly interchangeable with the types to be replaced because of differences in mechanical and/or electrical characteristics, physical structure, or types of tests to which they are subjected. For more information as to degree of interchangeability, refer to RCA PHOTOCELL DATA TABLES sheet.

DEFINITIONS
OF PHOTOSENSITIVE DEVICE TERMS

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

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.

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

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

PHOTOTUBE CLASSIFICATION CHART

When choosing tube types, the equipment designer should refer to the RCA PREFERRED TYPES LIST and its companion list – TYPES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN – both of which appear in the General Section.

Response	S-1	S-3	S-4	S-5	S-8	S-9	S-10	S-11
SINGLE-UNIT PHOTOTUBES								
Vacuum Types	917 919 922□ 925 6570‡	926□	1P39 929 934 5653	935		1P42●		
Gas Types	1P40 1P41● 868 918 921□ 923 924● 927 928▪ 930 6405/ 1640‡	1P29	1P37 5581 5582□ 5583					
TWIN PHOTOTUBES								
Vacuum Types			5652					
Gas Types	920		5584					
MULTIPLIER PHOTOTUBES								
Vacuum Types			1P21▲ 931-A▲ 6323§▲ 6328§▲ 6472§▲	1P28▲	1P22▲		6217●■	5819●■ 6199●■ 6342●■ 6372■ 6655●■ 6810●■

PHOTOCONDUCTIVE CELLS
See Semiconductor Device Section

□ Cartridge type.
‡ Low-microphonic type.
● Head-on type.
▪ Non-directional type.
§ For headlight-control service.
▲ 9-stage type.
■ 10-stage type.
● 14-stage type.

DEFINITIONS
OF PHOTOTUBE TERMS

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

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

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.

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

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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)

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.

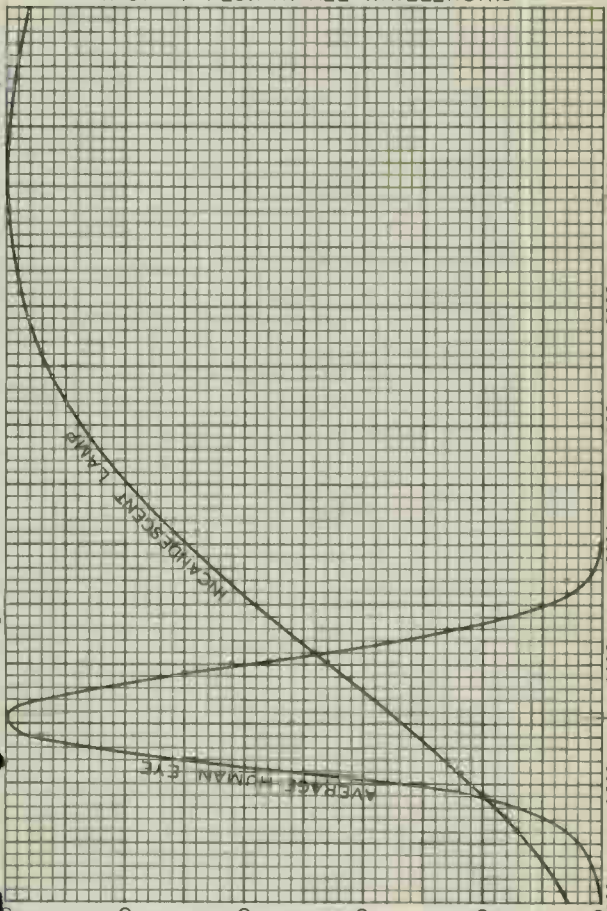
   b. **Vacuum Types:** The light source consists of a tungsten lamp operating at a filament color temperature of 2870°K. A steady light input of 0.1 lumen is used, unless otherwise specified, together with a dc anode-supply voltage of 250 volts and a 1-megohm load resistor.

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.

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



RELATIVE ENERGY DISTRIBUTION OF LAMP-ARBITRARY UNITS

RELATIVE SENSITIVITY OF EYE -ARBITRARY UNITS

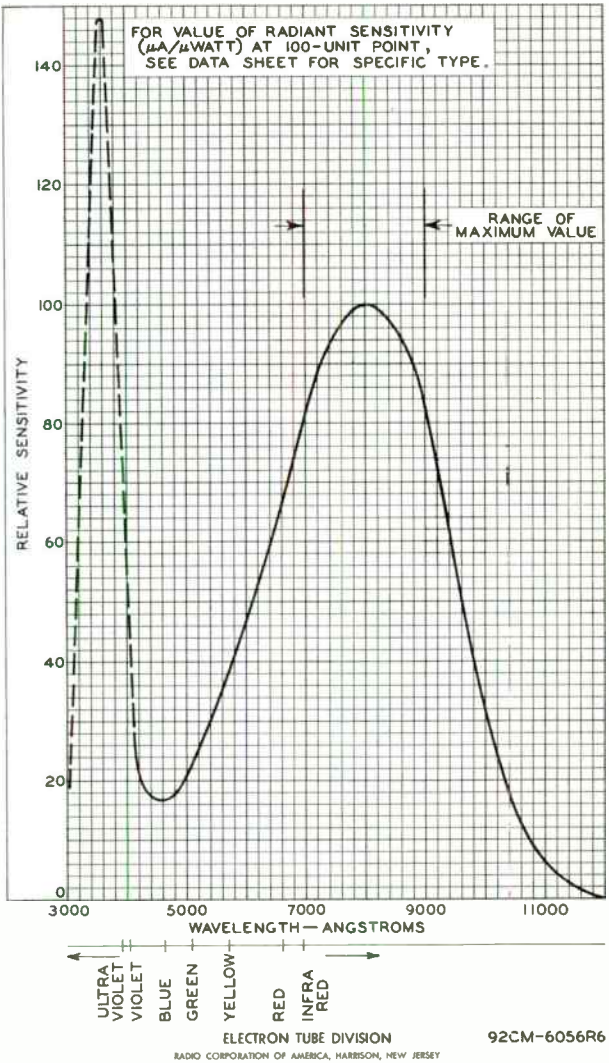
OCT. 20, 1947

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6435RI

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-1 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



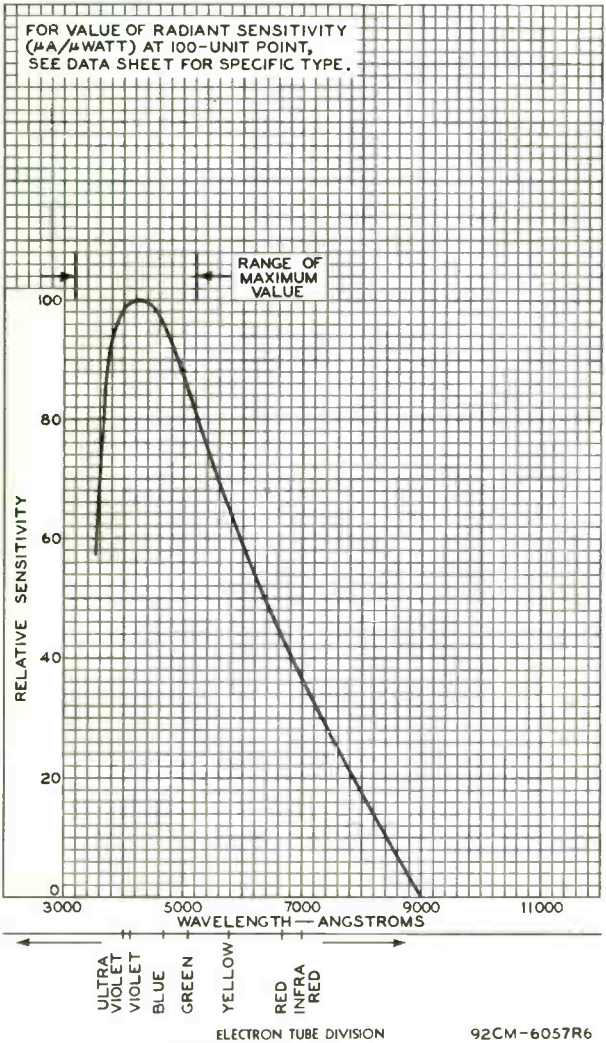
ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6056R6

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-3 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



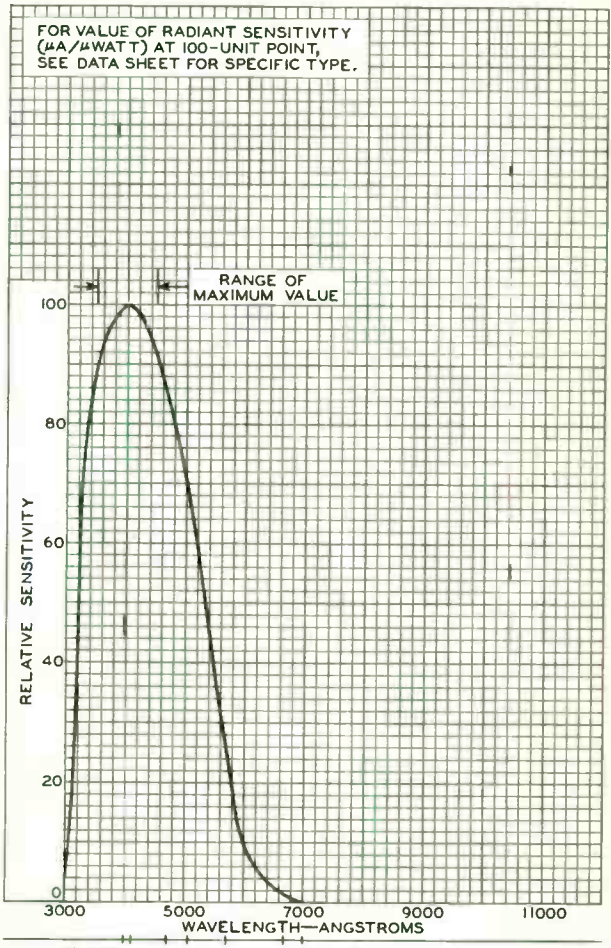
ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6057R6

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-4 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS

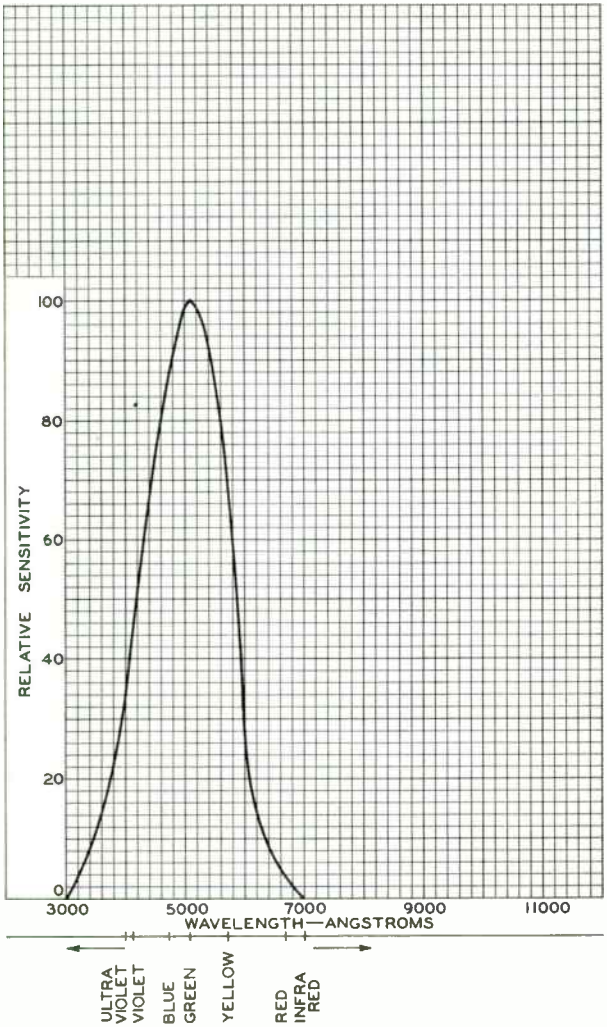


ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6152R9

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-4 RESPONSE

RADIANT FLUX FROM TUNGSTEN SOURCE AT 2870° K



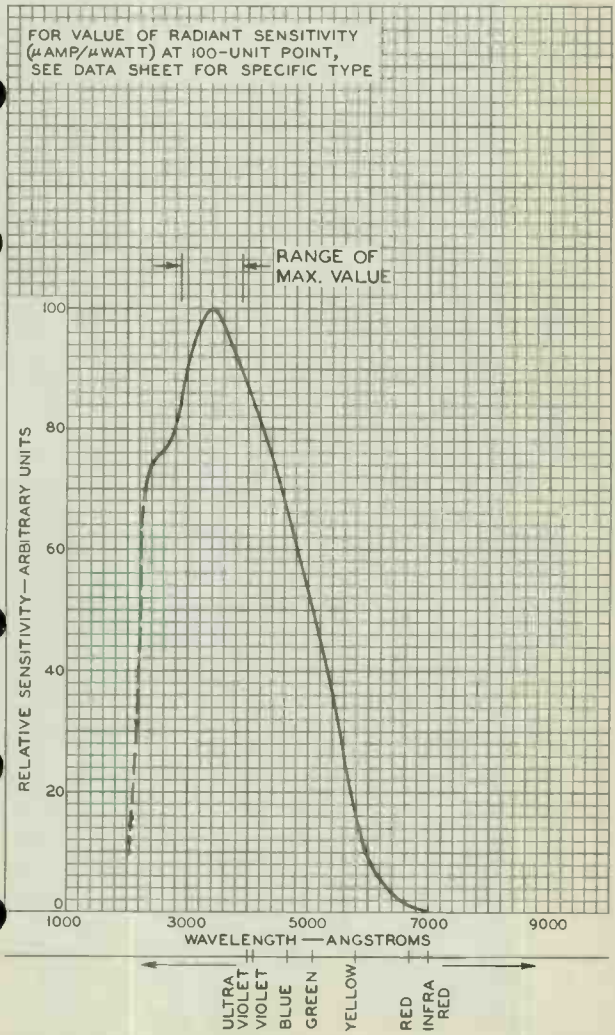
ELECTRON TUBE DIVISION

92CM-6652R3

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

SPECTRAL SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-5 RESPONSE

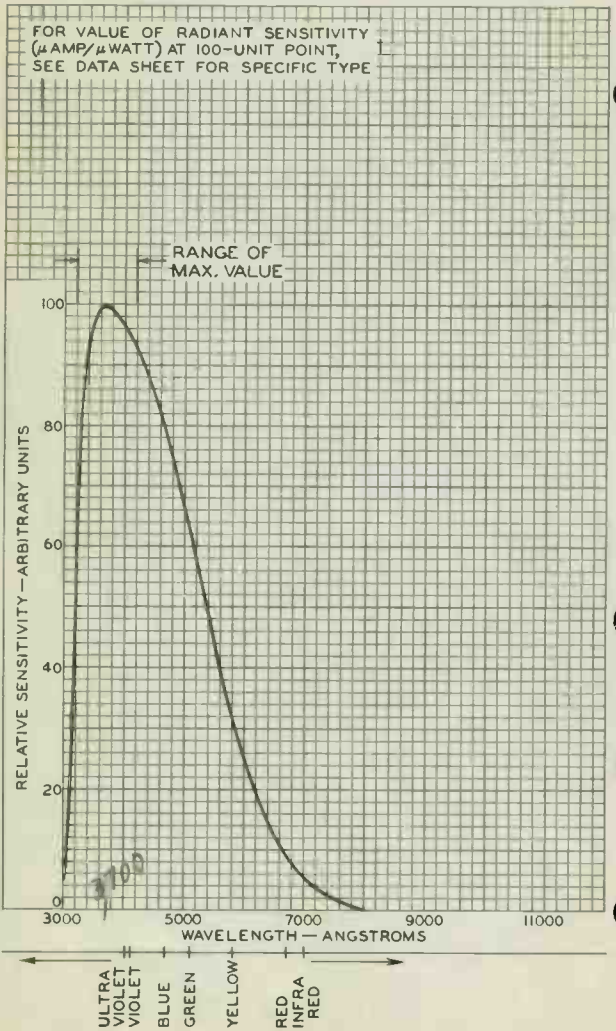
FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



RCA

SPECTRAL SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-8 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS

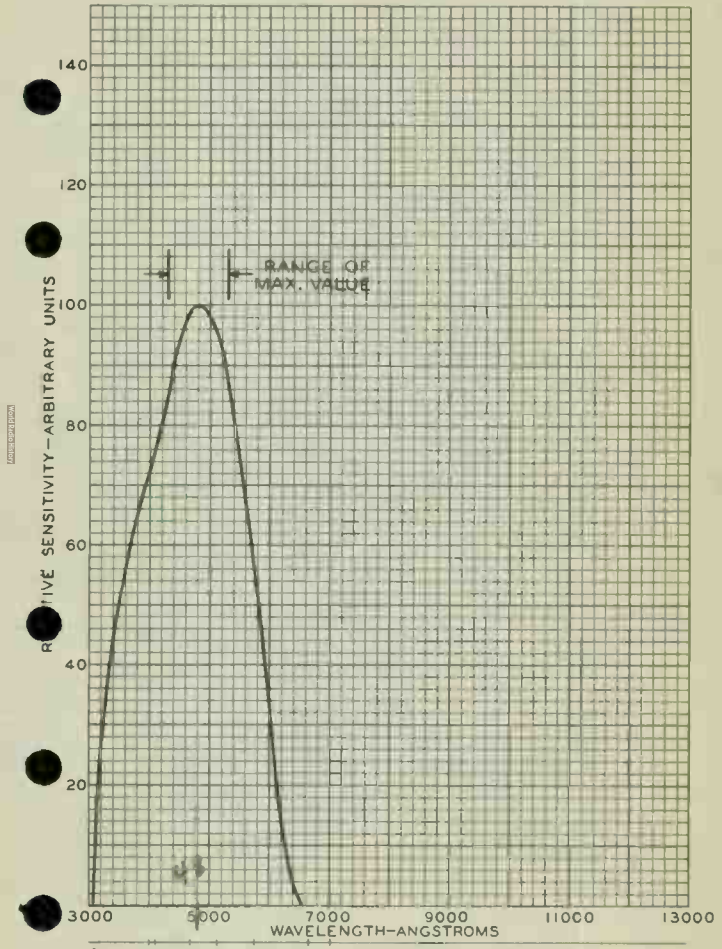


TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6592R2

SPECTRAL SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-9 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



MAY 5, 1949

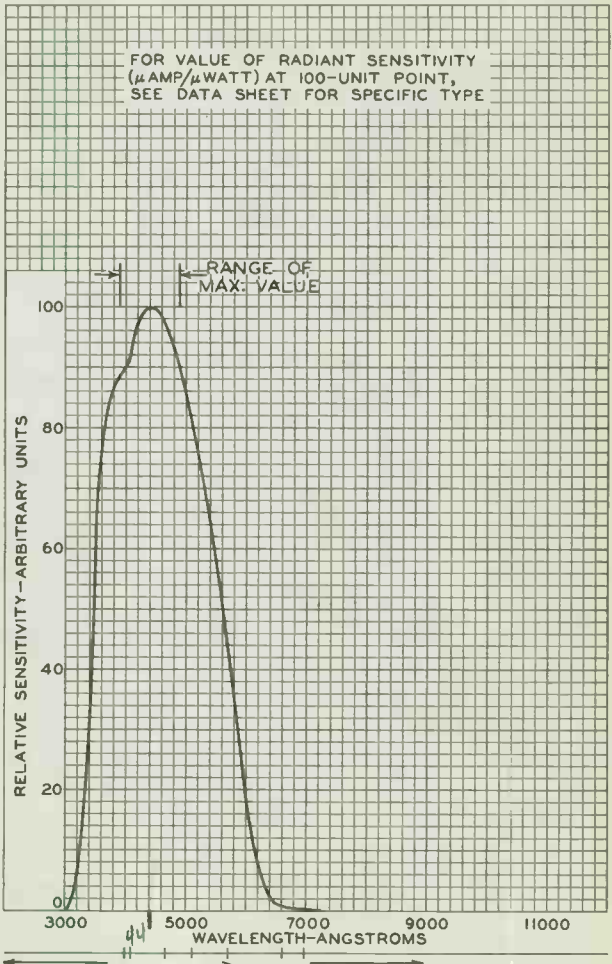
TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-7274

SPECTRAL SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-11 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



JULY 1, 1955

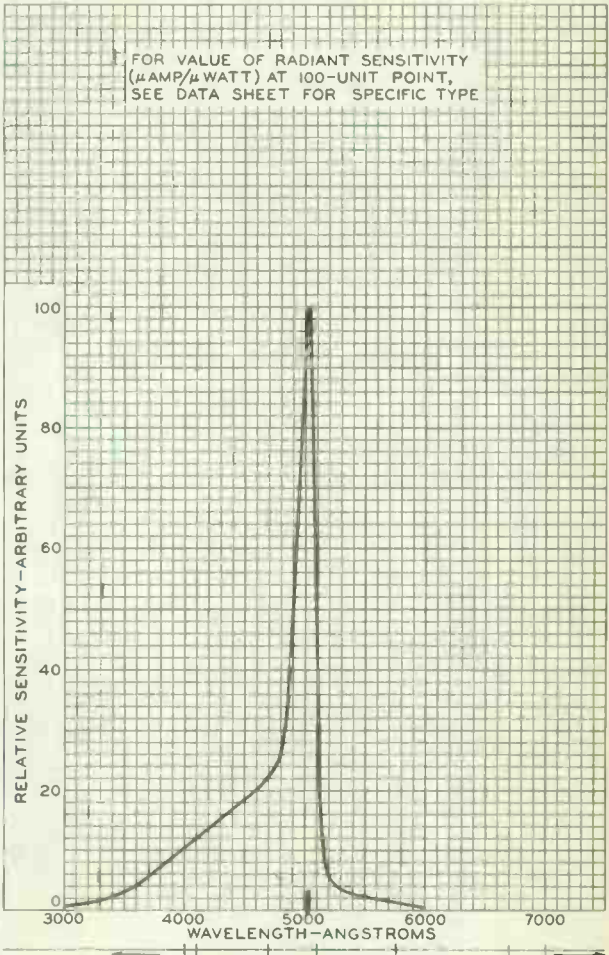
TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8601RI

SPECTRAL SENSITIVITY CHARACTERISTIC OF PHOTOCONDUCTIVE CELL HAVING S-12 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



MAR. 31, 1955

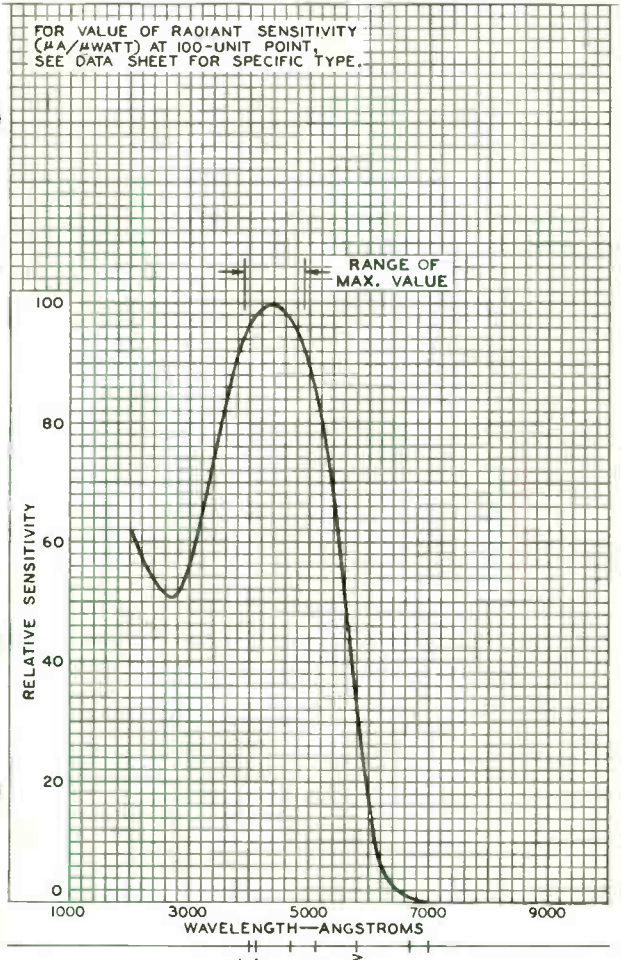
TUBE DIVISION

92CM-8569

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE SPECTRAL SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-13 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS

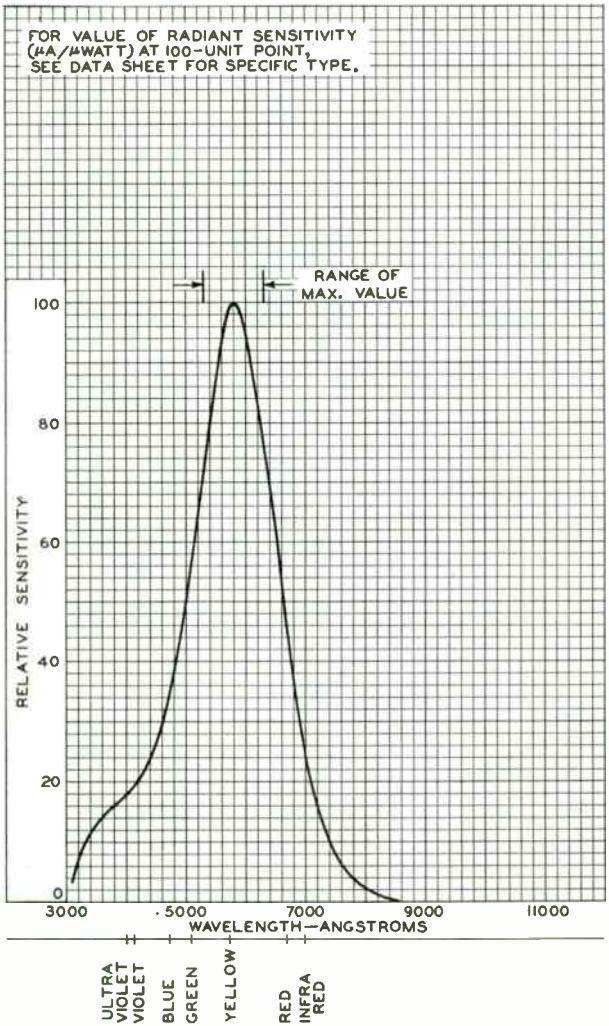


ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9037

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

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS

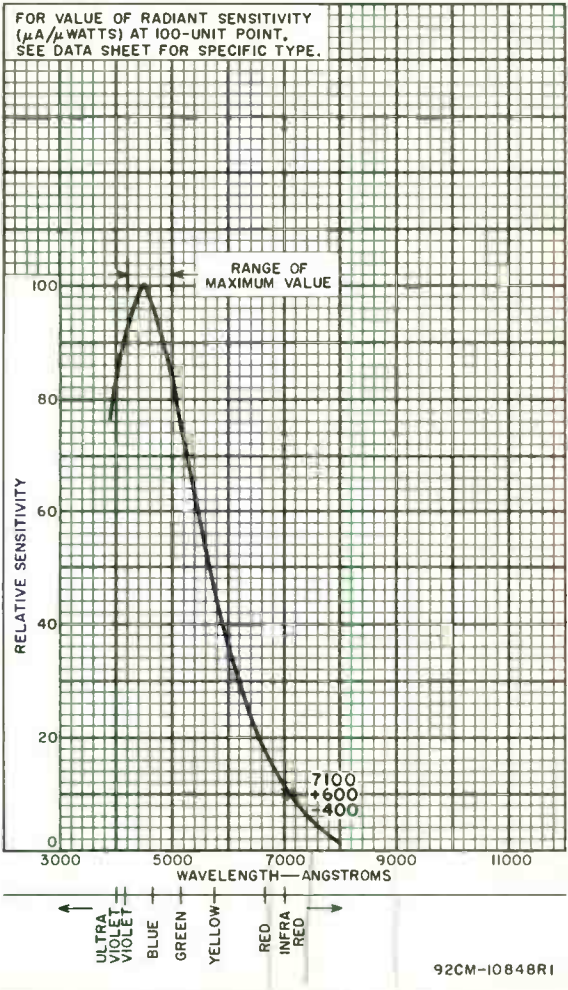


ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9206

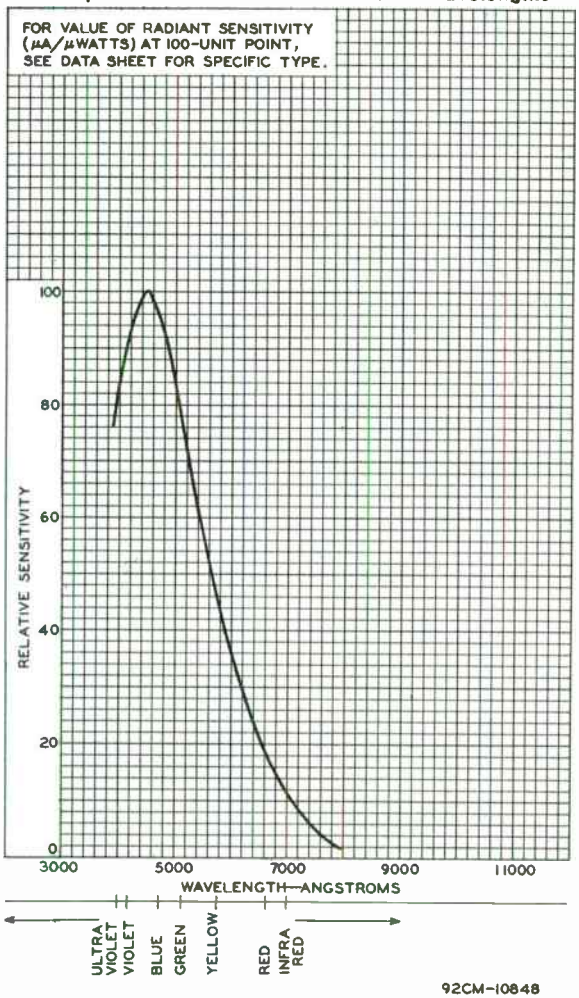
SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-18 RESPONSE

For Equal Values of Radiant Power at All Wavelengths



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

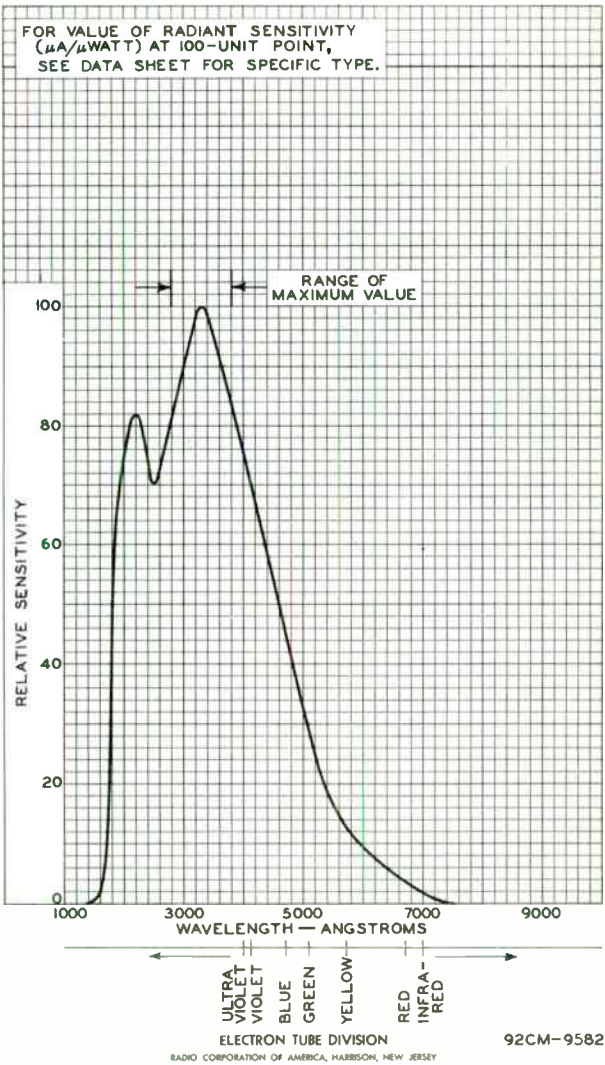
For Equal Values of Radiant Flux at All Wavelengths



92CM-10848

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

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS

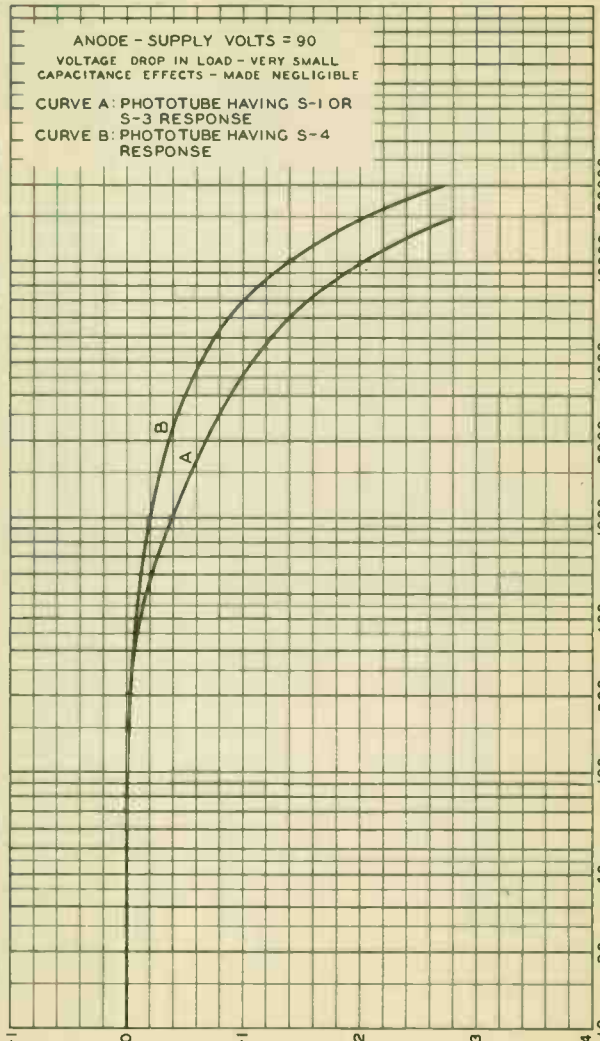


ELECTRON TUBE DIVISION

92CM-9582

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

FREQUENCY-RESPONSE CHARACTERISTICS OF GAS PHOTOTUBES



APRIL 30, 1947 TUBE DEPARTMENT 92CM-6864

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

IP21

MULTIPLIER PHOTOTUBE

9-STAGE TYPE WITH S-4 RESPONSE

For applications involving extremely low light levels♦

DATA

General:

Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 angstroms
Cathode:	
Minimum projected length*	15/16"
Minimum projected width*	5/16"
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 Catnode Area	1-15/16" ± 3/32"
Maximum Diameter	1-5/16"
Mounting Position	Any
Weight (Approx.)	1.6 oz
Bulb	T-9
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 – Cathode

Maximum Ratings, *Absolute Values:*

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	1250 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.9 AND ANODE (DC or Peak AC)	250 max.	volts
AVERAGE ANODE CURRENT•	0.1 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

Characteristics Range Values for Equipment Design:

Under conditions with 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

With E = 1000 volts (except as noted)

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4000 angstroms	–	80800	–	μamp/μwatt

♦ For less critical applications, the 931-A is recommended.

*, •: See next page.

← Indicates a change.

RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

RCA

IP21

MULTIPLIER PHOTOTUBE

	Min.	Median	Max.	
Cathode radiant, at 4000 angstroms. . .	–	0.04	–	μamp/μwatt
Luminous:♦				
At 0 cps.	40	80	800	amp/lumen
At 100 Mc	–	76	–	amp/lumen
Cathode luminous▲ . .	–	40	–	μamp/lumen
Current Amplification .	–	2×10^6	–	
Equivalent Anode-Dark-Current Input*■ . . .	–	–	5×10^{-10}	lumen
Equivalent Noise Input★.	–	5×10^{-13}	–	lumen

With E = 750 volts (except as noted)

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4000 angstroms	–	12000	–	μamp/μwatt
Cathode radiant, at 4000 angstroms. . .	–	0.04	–	μamp/μwatt
Luminous♦				
At 0 cps.	–	12	–	amp/lumen
Cathode luminous▲ . .	–	40	–	μamp/lumen
Current Amplification .	–	300000	–	

* 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.

* 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 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.

OPERATING CONSIDERATIONS

The *operating stability* of the IP21 is dependent on the magnitude of the anode current and its duration. When the IP21 is operated at high 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 IP21 usually recovers a substantial percentage of such loss in sensitivity.

→ Indicates a change.

IP21

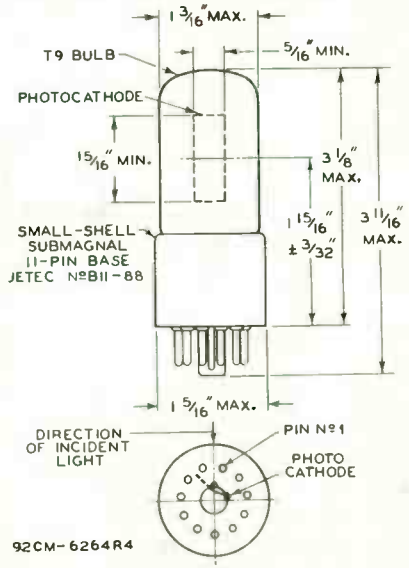
MULTIPLIER PHOTOTUBE

The use of an average anode current well below the maximum rated value of 0.1 milliampere is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 10 microamperes, and the tube should be given a warm-up period of about 1/2 hour under load conditions.

Electrostatic and/or *magnetic shielding* of the IP21 may be necessary.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-4 Response
is shown at the front of this Section

Curves showing
EFFECT OF MAGNETIC FIELD ON ANODE CURRENT,
VARIATION IN SENSITIVITY OF PHOTOCATHODE ALONG ITS LENGTH,
and
VARIATION IN SENSITIVITY OF PHOTOCATHODE ACROSS
ITS PROJECTED WIDTH IN PLANE OF GRILL
for Type IP21 are the same as those shown for Type 931-A

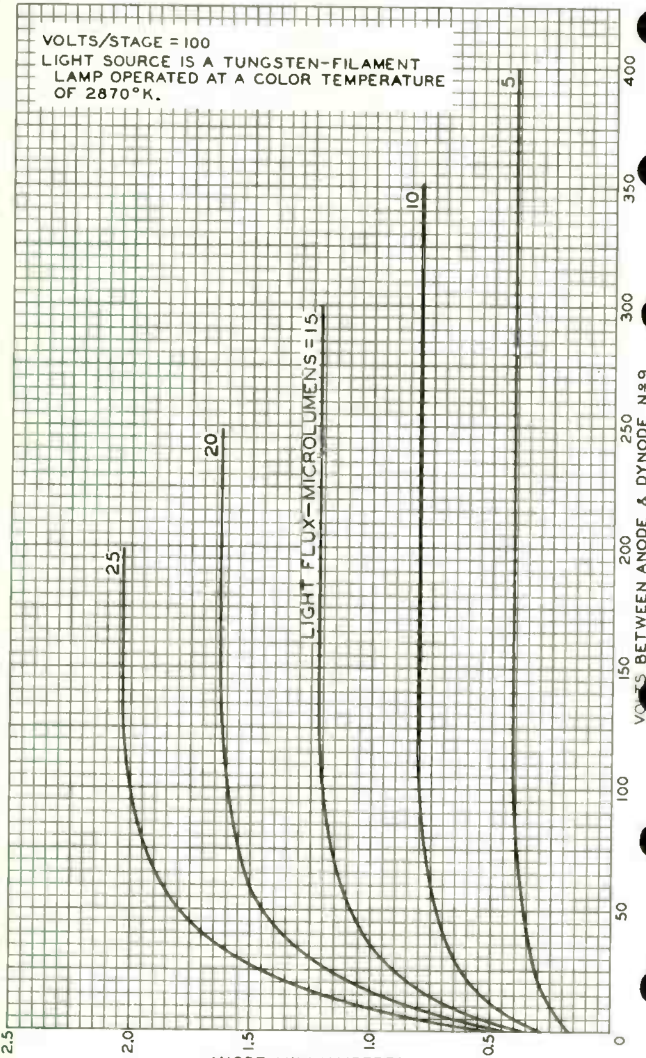


℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

1P21

1P21

AVERAGE ANODE CHARACTERISTICS



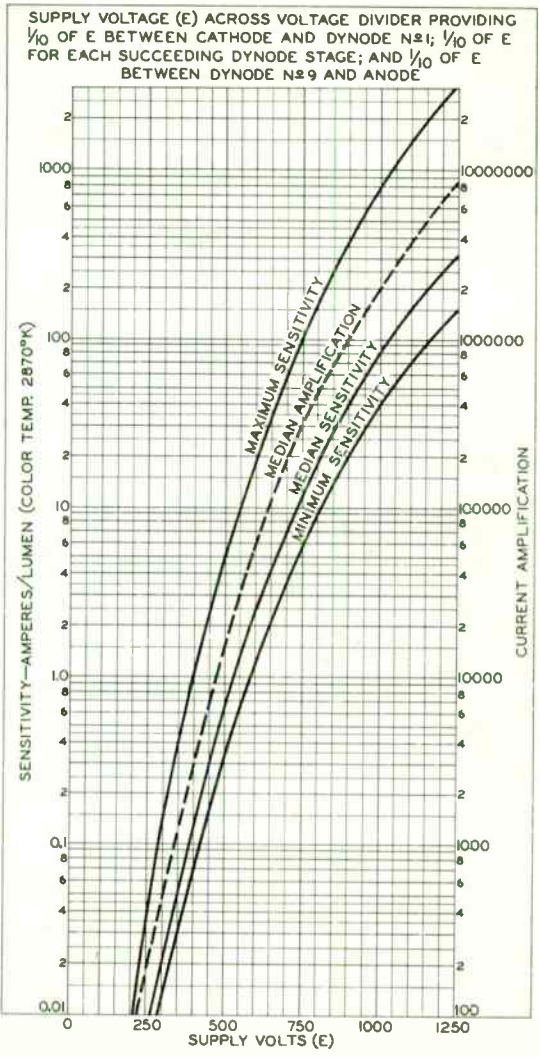
92CM-6456R4

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

IP21

AVERAGE CHARACTERISTICS



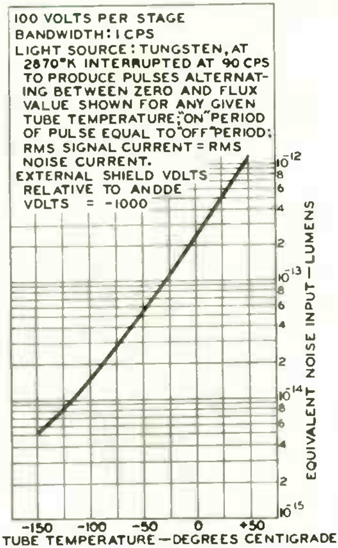
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CL-6454R3

RCA

1P21

EQUIVALENT-NOISE-INPUT CHARACTERISTIC



92CS-7018T1

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

IP22

MULTIPLIER PHOTOTUBE

9-STAGE TYPE WITH S-8 RESPONSE

DATA

General:

Spectral Response	S-8
Wavelength of Maximum Response	4200 ± 500 angstroms ←
Cathode:	
Minimum Projected Length*	15/16"
Minimum Projected Width*	5/16"
Direct Interelectrode Capacitances:	
Anode to Dynode No. 9	4 μμf
Anode to All Other Electrodes	6.5 μμf
Maximum Overall Length	3-11/16"
Maximum Seated Length	3-1/8"
Seated Length to Center of Cathode	1-15/16" ± 3/32"
Maximum Diameter	1-5/16"
Bulb	T-9
Mounting Position	Any
Base	Small-Shell Submagnal 11-Pin, 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

DIRECTION OF LIGHT

Pin 7- Dynode No.7
Pin 8- Dynode No.8
Pin 9- Dynode No.9
Pin 10- Anode
Pin 11- Cathode

Maximum Ratings, *Absolute Values:*

ANODE-SUPPLY VOLTAGE (DC or Peak AC)[D]	1250 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.9 and ANODE (DC or peak AC)	250 max.	volts
PEAK ANODE CURRENT	10 max.	ma ←
AVERAGE ANODE CURRENT[O]	1 max.	ma ←
AMBIENT TEMPERATURE	50 max.	°C

Characteristics: ←

With 100 volts per dynode stage and 100 volts between dynode No.9 and anode[⊕]

	Min.	Av.	Max.	
Anode Dark Current[#•]	–	–	0.25	μamp
Sensitivity:				
At 4200 Angstroms	–	370	–	μamp/μwatt
Luminous[▲]	0.115	0.6	50	amp/lumen
Current Amplification[■]	–	200000	–	
Luminous Detectivity[★]	1×10^{-10}	–	–	lumen

[⊕] The use of about 50 volts between dynode No.9 and anode will give improved operating stability without sacrifice in sensitivity as explained in note under Type 931-A.

[•] On plane perpendicular to indicated direction of incident light.

[D] Referred to cathode.

[O], [#], [●], [▲], [■], [★]: See next page.] ← Indicates a change.

1P22
MULTIPLIER PHOTOTUBE

→ **Characteristics:**

With 75 volts per dynode stage
and 50 volts between dynode No.9 and anode

Sensitivity:	Av.	
At 4200 Angstroms.	55	μamp/μwatt
Luminous▲	0.09	amp/lumen
Current Amplification■	30000	

° Averaged over any interval of 30 seconds maximum.

ß Dark current due to thermionic emission and ion feedback may be reduced by the use of refrigerants.

● For maximum signal-to-noise ratio, operation below 1000 volts is recommended.

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

■ Ratio of anode sensitivity to cathode sensitivity.

Ж Defined as the value where the rms output current is equal to the rms noise current determined under the following conditions: 100 volts per stage, 25°C tube temperature, bandwidth of 1 cycle per second, tungsten light source at 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.

OUTLINE DIMENSIONS for Type 1P22
are the same as those for Type 931-A

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-8 Response
is shown at the front of this Section

→ Indicates a change.

IP22

RCA

IP22

AVERAGE ANODE CHARACTERISTICS

VOLTS/STAGE = 100

VOLTS BETWEEN ANODE & DYNODE N° 9

0 50 100 150 200 250 300 350 400

ANODE MILLIAMPERES

0.25 0.5 0.75 1.0 1.25

MAR. 12, 1948

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

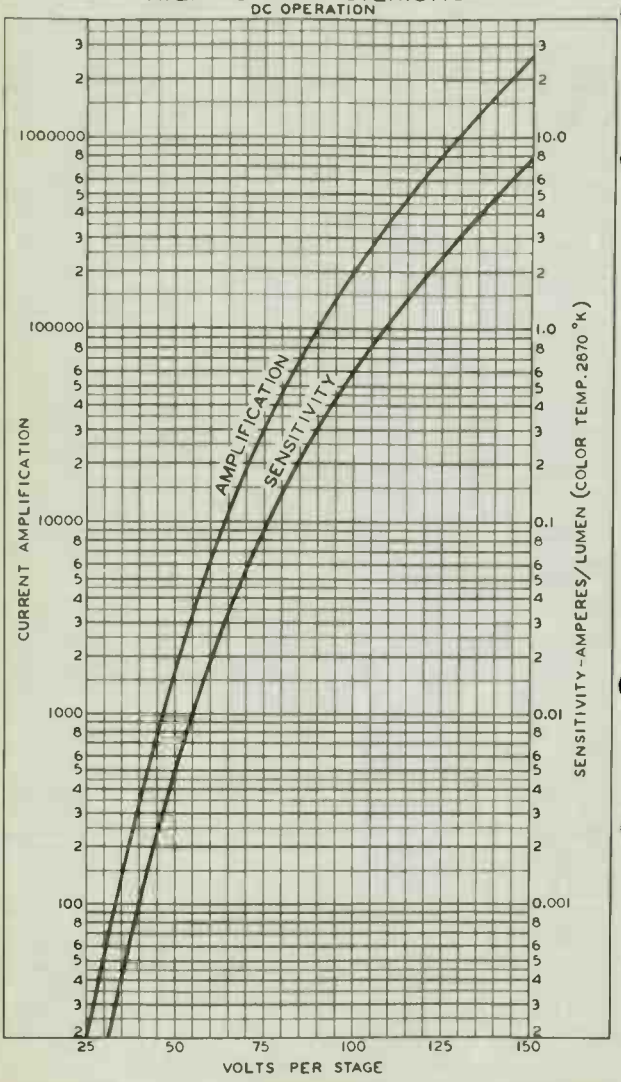
92CM-6585R1

IP22

RCA

IP22

AVERAGE CHARACTERISTIC
DC OPERATION



JUNE 15, 1945

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6586

RCA

IP28

MULTIPLIER PHOTOTUBE

9-STAGE TYPE WITH S-5 RESPONSE

DATA

General:

Spectral Response	S-5
Wavelength of Maximum Response	3400 ± 500 angstroms
Cathode:	
Minimum projected length*	15/16"
Minimum projected width*	5/16"
Direct Interelectrode Capacitances (Approx.):	
Anode to dynode No.9	4.4 μμf
Anode to all other dynodes	6 μμf
Maximum Overall Length	3-11/16"
Maximum Seated Length	3-1/8"
Length from Base Seat to Center of Useful Cathode Area	1-5/16" ± 3/32"
Maximum Diameter	1-5/16"
Mounting Position	Any
Weight (Approx.)	1.2 oz
Bulb	T-9
Base	Small-Shell Diheptal 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 – Cathode

Maximum Ratings, *Absolute Values:*

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	1250 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.1 AND ANODE (DC or Peak AC)	250 max.	volts
AVERAGE ANODE CURRENT•	0.5 max.	ma
AMBIENT TEMPERATURE	70 max.	°C

Characteristics Range Values for Equipment Design:

Under conditions with 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

With E = 1000 volts (except as noted)

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 3400 Angstroms	–	61000	–	amp/μwatt

* On plane perpendicular to the indicated direction of incident radiation.
• Averaged over any interval of 30 seconds maximum.

← Indicates a change.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

IP28

IP28

MULTIPLIER PHOTOTUBE

	Min.	Median	Max.	
Cathode radiant, at 3400 angstroms . .	–	0.050	–	μamp/μwatt
Luminous:●				
At 0 cps	10	50	300	amp/lumen
At 100 Mc	–	47.5	–	amp/lumen
Cathode luminous▲. .	–	40	–	μamp/lumen
Current Amplification.	–	1,250,000	–	
Equivalent Anode-Dark-Current Input●■ . .	–	–	1.25×10^{-9}	lumen
Equivalent Noise Input:				
Luminous★.	–	7.5×10^{-13}	–	lumen
Ultraviolet†	–	8×10^{-16}	–	watt

With E = 750 volts (except as noted)

	Min.	Median	Max.	
Sensitivity:				
Radiant at 3400 angstroms.	–	7900	–	μamp/μwatt
Cathode radiant, at 3400 angstroms . .	–	0.050	–	μamp/μwatt
Luminous:●				
At 0 cps	–	6.4	–	amp/lumen
Cathode luminous▲. .	–	40	–	μamp/lumen
Current Amplification.	–	160000	–	

● 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.

● 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 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, 25°C tube temperature, ac-amplifier band-width 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 a monochromatic source having radiation at 2537 angstroms.

Curves showing
VARIATION IN SENSITIVITY OF PHOTOCATHODE for Type 1P28
are the same as those shown for Type 931-A

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-5 Response
is shown at the front of this Section

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

IP28

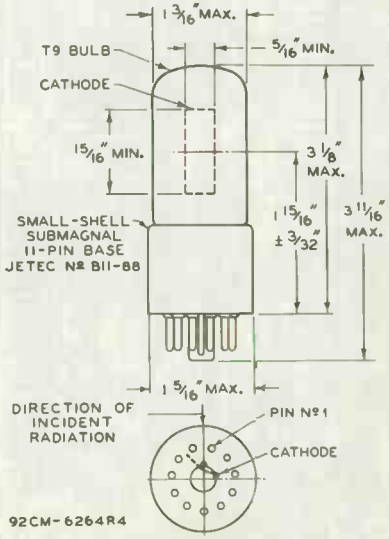
MULTIPLIER PHOTOTUBE

OPERATING CONSIDERATIONS

The *operating stability* of the IP28 is dependent on the magnitude of the anode current and its duration. When the IP28 is operated at high 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 IP28 usually recovers a substantial percentage of such loss in sensitivity.

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. When maximum stability is required, the anode current should not exceed 10 microamperes, and the tube should be given a warm-up period of about 1/2 hour under load conditions.

Electrostatic and/or *magnetic shielding* of the IP28 may be necessary.



BOTTOM VIEW

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

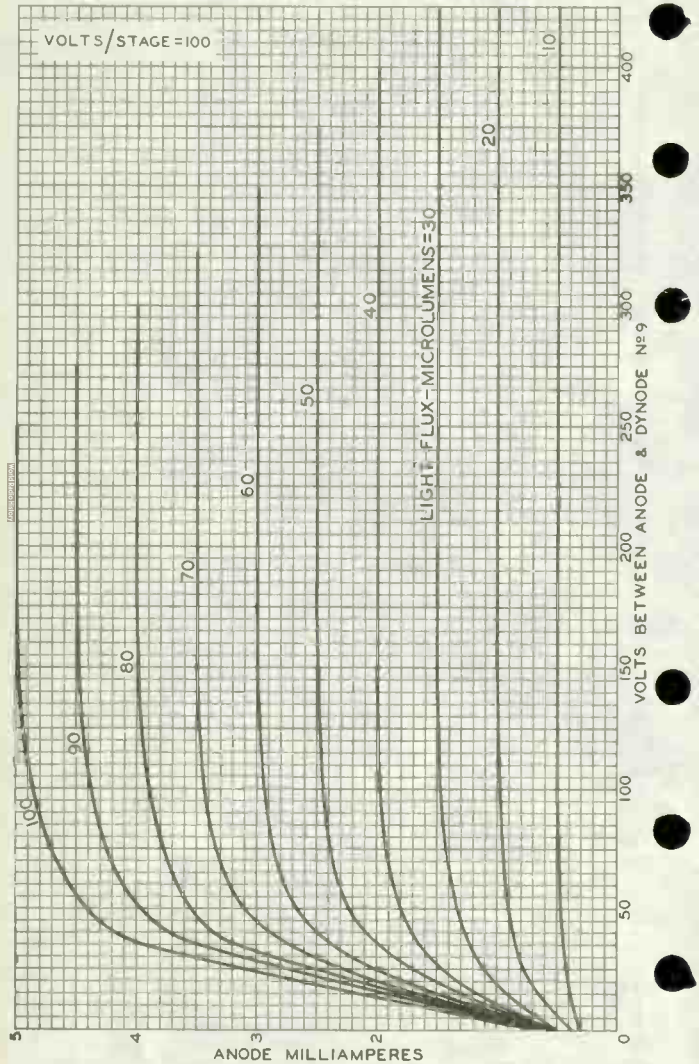
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

IP28

RCA

IP28

AVERAGE ANODE CHARACTERISTICS



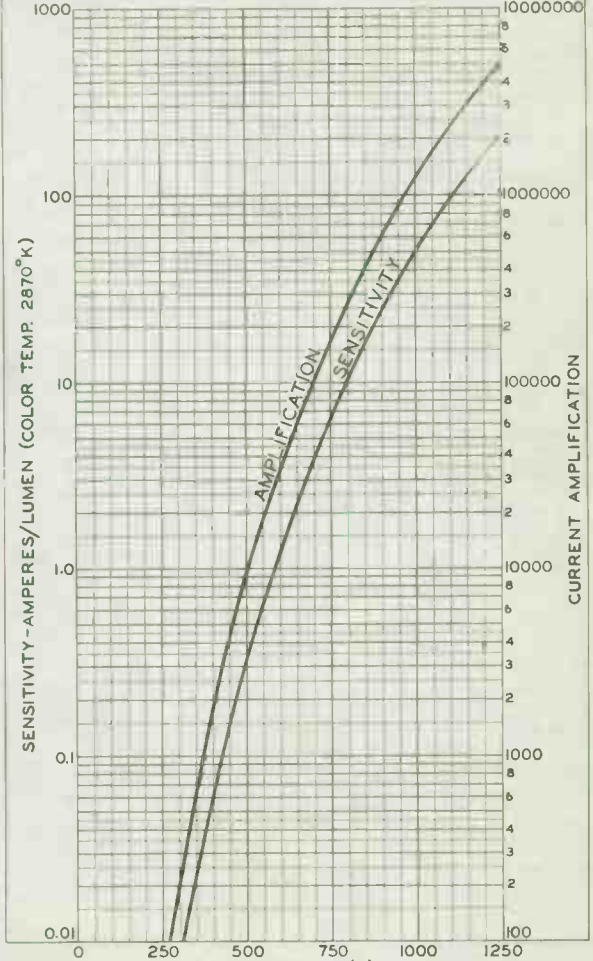
MAY 6, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6632R3

AVERAGE CHARACTERISTICS

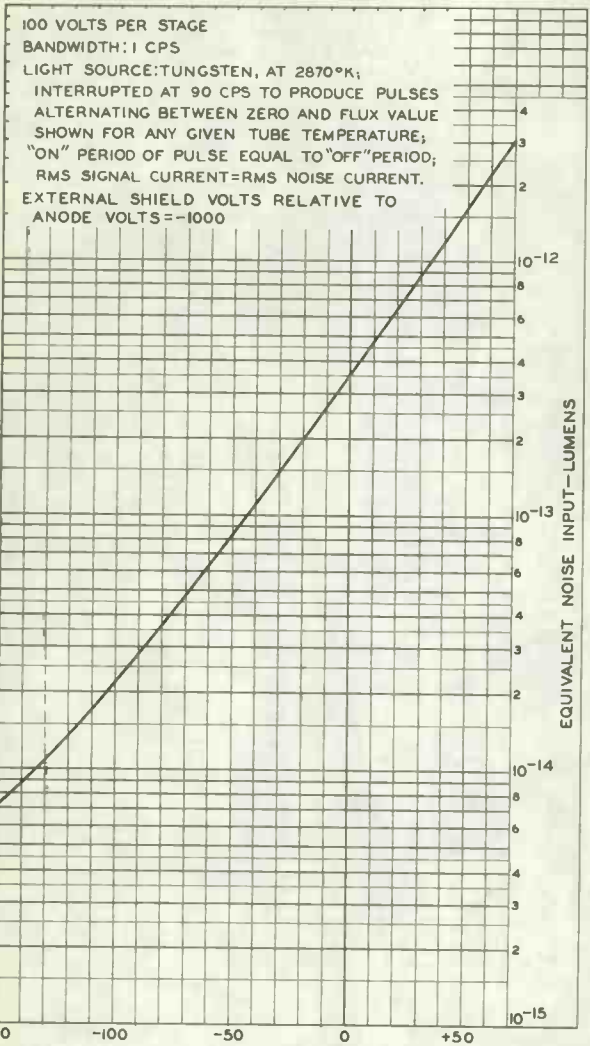
SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER PROVIDING 1/10 OF E BETWEEN CATHODE AND DYNODE No1; 1/10 OF E FOR EACH SUCCEEDING DYNODE STAGE; AND 1/10 OF E BETWEEN DYNODE No 9 AND ANODE



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

IP28

EQUIVALENT-NOISE-INPUT CHARACTERISTIC



MAY 7, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7503RI

Gas Phototube

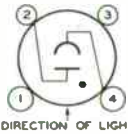
SIDE-ON TYPE HAVING S-3 RESPONSE

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.

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-3 RESPONSE

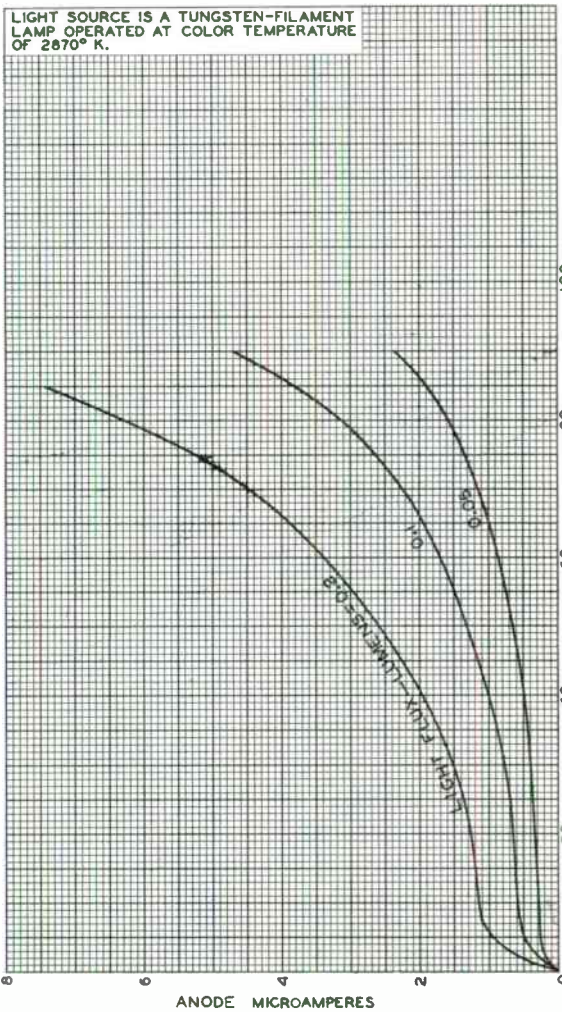
and

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

AVERAGE ANODE CHARACTERISTICS



92CM-6472R2

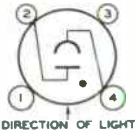
Gas Phototube

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.

1P37

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.

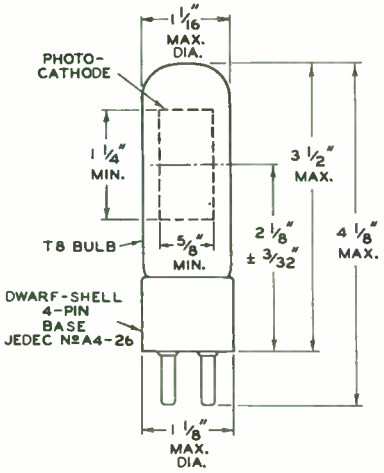
SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-4 RESPONSE

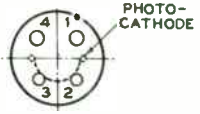
and

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





92CM-470R5

IP39
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.

IP40
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.

IP41

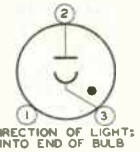
GAS PHOTOTUBE

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

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

IP41

GAS PHOTOTUBE

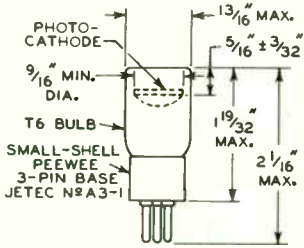
Minimum Circuit Values:

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



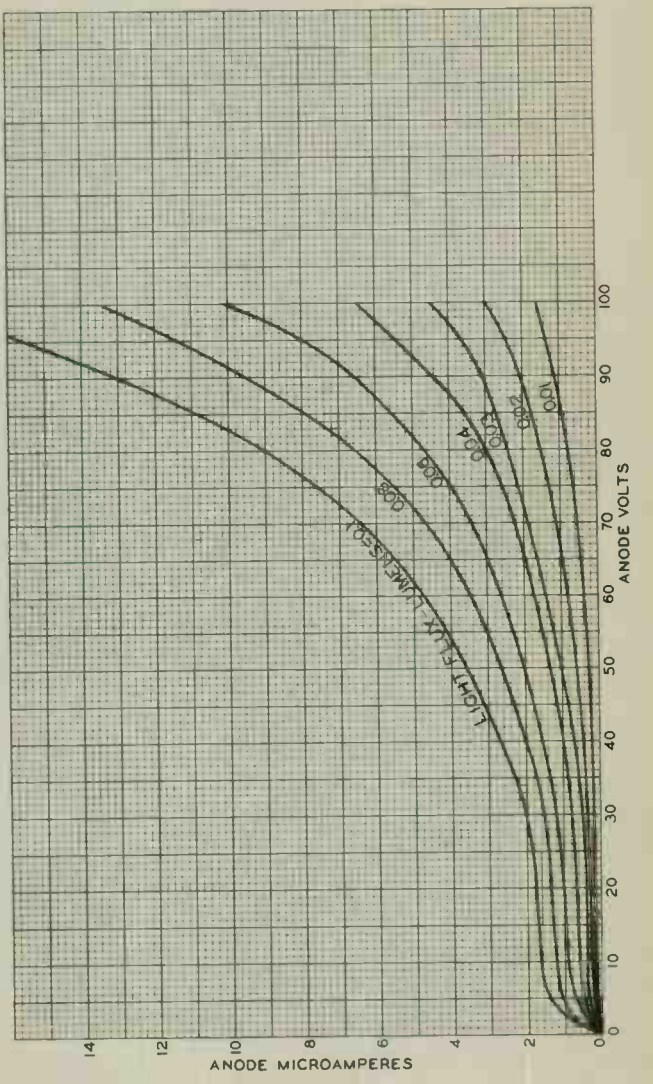
92CS-6676R2

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

1P41

AVERAGE ANODE CHARACTERISTICS



DEC. 13, 1946

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-5217R3

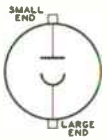
Vacuum Phototube

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.

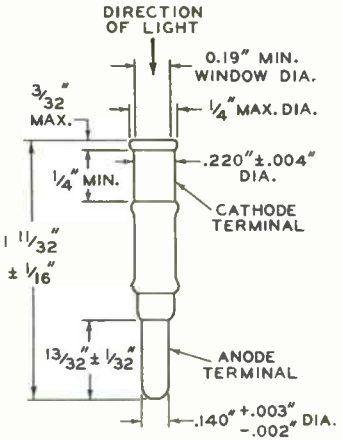
→ indicates a change.

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

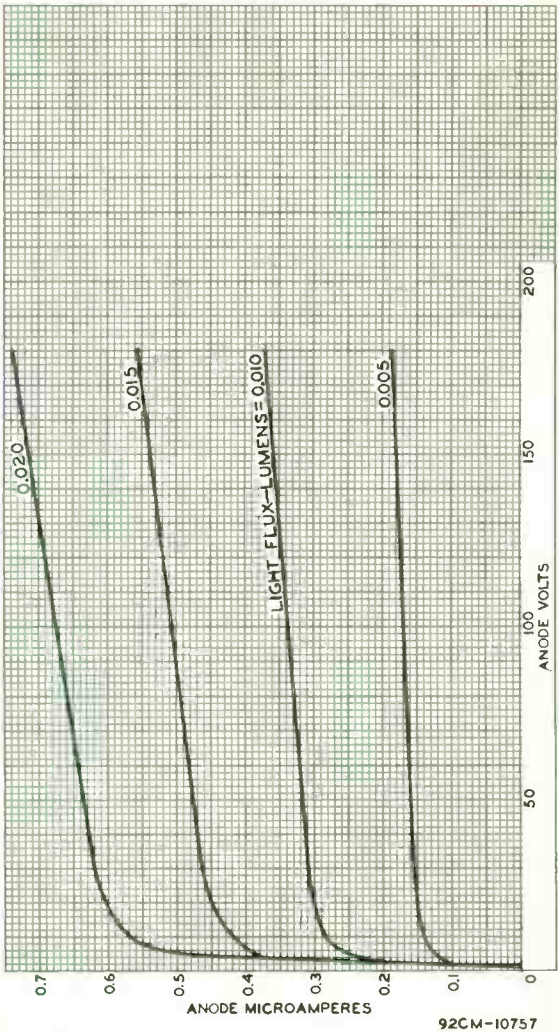


NOTE: WHEN TUBE IS ROTATED ABOUT THE LONGITUDINAL AXIS OF ITS CATHODE TERMINAL, NO PART OF THE ANODE TERMINAL WILL FALL OUTSIDE OF A 0.241"-DIAMETER CIRCLE CONCENTRIC WITH THE LONGITUDINAL AXIS OF THE CATHODE TERMINAL.

92CS-6791R2

→ Indicates a change.

AVERAGE ANODE CHARACTERISTICS



92CM-10757

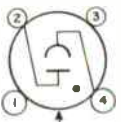
Gas Phototube

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
Pin 3 – No Connection
Pin 4 – Photocathode

Maximum Ratings, *Absolute-Maximum Values:* ◄

	Rating 1	*Rating 11*	
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.

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

917

VACUUM PHOTOTUBE

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

For light-measuring and relay applications

DATA

General:

Spectral Response	S-1
Wavelength of Maximum Response	8000 ± 1000 angstroms
Cathode:	
Shape	Semicylindrical
Minimum projected length*	1-9/16"
Minimum projected width*	5/8"
Direct Interelectrode Capacitance	2.2 μμf
Maximum Overall Length	4-7/16"
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.)	1.1 oz ←
Bulb	T-8
Cap	Small (JETEC No. C1-1) ←
Base	Dwarf-Shell Small 4-Pin (JETEC No. A4-26) ←
Basing Designation for BOTTOM VIEW	1A ←

Pin 1 – No Connection
Pin 2 – No Connection

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

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°	10 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▲	12	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.

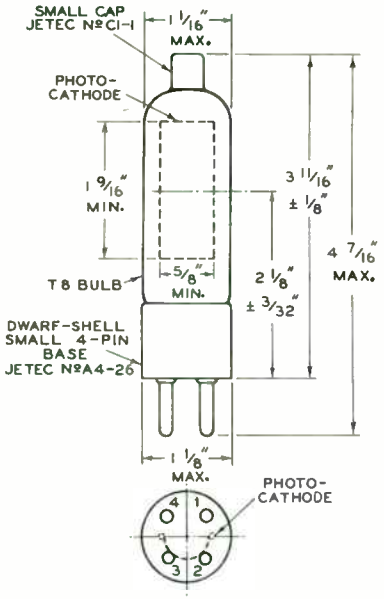
SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-1 Response
is shown at front of this Section

← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

917

VACUUM PHOTOTUBE



CE-4359R6

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

917

AVERAGE ANODE CHARACTERISTICS

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-4360R2

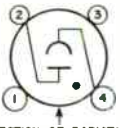
Gas Phototube

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
Pin 3 – No Connection
Pin 4 – Photocathode

DIRECTION OF RADIATION

Maximum Ratings, *Absolute-Maximum Values:* ←

	Rating 1	*Rating 11*	
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.

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

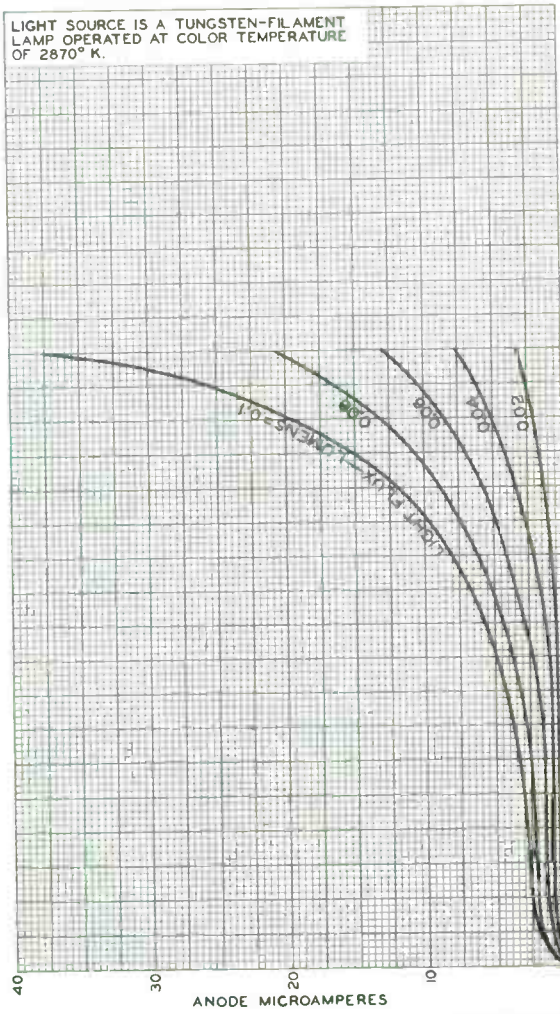
and

FREQUENCY-RESPONSE CHARACTERISTICS OF GAS PHOTOTUBES

are shown at the front of this section

DIMENSIONAL OUTLINE
shown under Type IP37 also applies to the 918

AVERAGE ANODE CHARACTERISTICS



919

VACUUM PHOTOTUBE

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

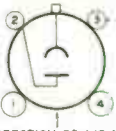
For light-measuring and relay applications

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

920

GAS PHOTOTUBE

TWIN TYPE WITH S-1 RESPONSE

DATA

General:

Spectral Response	S-1
Wavelength of Maximum Response	8000 ± 1000 Angstroms
Cathodes (Each):	
Shape	Quarter-Cylindrical
Minimum Projected Length*	1-3/16"
Minimum Projected Width*	1/4"
Direct Interelectrode Capacitances:	
Cathode to Anode♦	1.6 μμf
Cathode to Cathode□	1.8 μμf
Anode to Anode●	0.44 μμf
Maximum Overall Length	4"
Maximum Seated Length	3-3/8"
Seated Length to Center of Cathode	2-1/8" ± 3/32"
Maximum Diameter	1-3/16"
Bulb	T-9
Mounting Position	Any
Base	Small-Shell Small 4-Pin

BOTTOM VIEW

Pin 1 – Cathode, Unit No.2
Pin 2 – Anode, Unit No.2
Pin 3 – Anode, Unit No.1
Pin 4 – Cathode, Unit No.1

DIRECTION OF LIGHT

Maximum Ratings, *Absolute Values* (Each Unit):

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	90 max.	volts
PEAK CATHODE CURRENT	6 max.	μamp
PEAK CATHODE-CURRENT DENSITY	50 max.	μamp/sq. in.
AVERAGE CATHODE CURRENT○	2 max.	μamp
AMBIENT TEMPERATURE	100 max.	°C

Characteristics:

	Min.	Av.	Max.	
Dark Current at 90 Volts	–	–	0.1	μamp
Sensitivity:				
At 8000 Angstroms	–	0.010	–	μamp/μwatt
Luminous.▲				
At 0 Cycles	50	100	175	μamp/lumen
At 500 Cycles	–	85	–	μamp/lumen
At 1000 Cycles	–	74	–	μamp/lumen
Gas Amplification Factor	–	–	9	

* On plane perpendicular to indicated direction of incident light.

♦ Each unit, with other unit grounded.

□ Anodes grounded.

● Cathodes grounded.

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

▲ Measured with .04 lumen.

← Indicates a change.

920
GAS PHOTOTUBE

Minimum Circuit Values:

DC Load Resistance:

With anode-supply voltage of 70 volts or less:

→ For dc currents	above 2 μamp	0.1	megohm
	below 2 μamp	No Minimum	

With anode-supply voltage of 90 volts:

→ For dc currents	above 1 μamp	2.5	megohms
	below 1 μamp	0.1	megohm

OUTLINE DIMENSIONS for Type 920
are the same as those for Type 5584

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

→ Indicates a change.

920

RCA
920

AVERAGE ANODE CHARACTERISTICS

ANODE VOLTS
0 20 40 60 80 100

ANODE MICROAMPERES
0 1.0 2.0 3.0 4.0 5.0

-3.0
-2.5
-2.0
-1.5
-1.0
-0.5
0

LIGHT FLUX-LUMENS/SQ. FT.

SEPT. 19, 1947

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-4618R3

921

GAS PHOTOTUBE

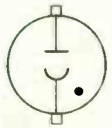
CARTRIDGE TYPE WITH S-1 RESPONSE

For relay applications

DATA

General:

Spectral Response	S-1
Wavelength of Maximum Response	8000 ± 1000 angstroms
Cathode:	
Shape	Semicylindrical
Minimum projected length*	7/8"
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 ←



DIRECTION OF LIGHT: INTO CONCAVE SIDE OF CATHODE

Maximum Ratings, *Absolute Values:*

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	90 max.	volts
AVERAGE CATHODE-CURRENT DENSITY°	30 max.	μamp/sq. in. ←
AVERAGE CATHODE CURRENT°	3 max.	μamp
AMBIENT TEMPERATURE	100 max.	°C

Characteristics, *At 90 Volts on Anode:*

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 8000 angstroms	–	0.012	–	μamp/μwatt ←
Luminous:▲				
At 0 cps	75	135	205	μamp/lumen
At 5000 cps	–	119	–	μamp/lumen
At 10000 cps	–	108	–	μamp/lumen
Gas Amplification Factor	–	–	10	
Anode Dark Current at 25°C	–	–	0.01	μamp ←

* On plane perpendicular to indicated direction of incident light.

°,▲: See next page.

← Indicates a change.

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921

GAS PHOTOTUBE

Minimum Circuit Values:

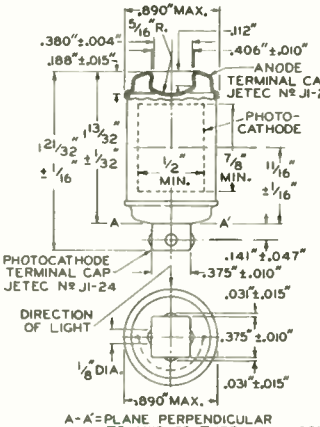
With anode-supply voltage of	*70 or less*	*90*	*volts*
DC Load Resistance:			
For dc currents above 3 μamp	0.1 min.	–	megohm
For dc currents below 3 μamp	0 min.	–	megohm
For dc currents above 2 μamp	–	2.5 min.	megohms
For dc currents below 2 μamp	–	0.1 min.	megohm

○ Averaged over any interval of 30 seconds maximum. This value may be doubled when anode-supply voltage is limited to 70 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-1 Response
and
FREQUENCY-RESPONSE CHARACTERISTICS
of Gas Phototubes
are shown at the front of this Section

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



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RCA

922

VACUUM PHOTOTUBE

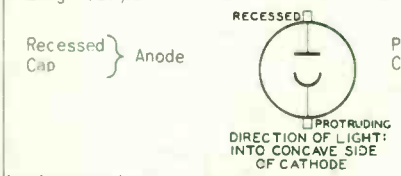
CARTRIDGE TYPE WITH S-1 RESPONSE

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 μμf
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 ←



Maximum Ratings, *Absolute Values:*

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	500 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[o]	30 max.	μamp/sq. in. ←
AVERAGE CATHODE CURRENT[o]	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.

[o] 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.

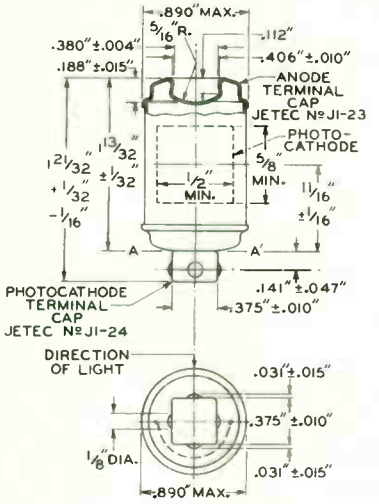
TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

922

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

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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

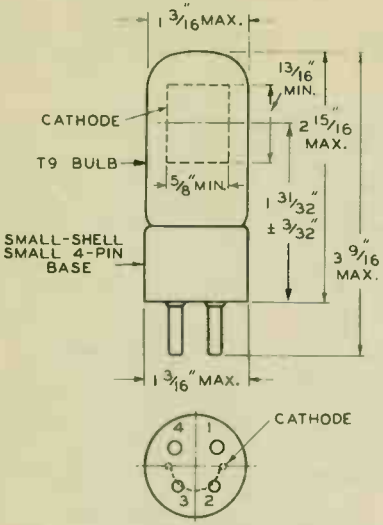
Maximum Ratings, Characteristics, and Curves for the 923 are the same as those shown for Type 930

* On plane perpendicular to indicated direction of incident light.

← Indicates a change.

923

923
GAS PHOTOTUBE



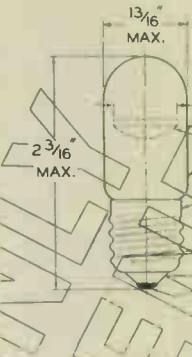
BOTTOM VIEW

92CM-4788R3

924
GAS PHOTOTUBE
END TYPE
RED—INFRARED SENSITIVE

The 924 is the same electrically as the 1P41 with the exception of its interelectrode capacitance. Mechanically, the 924 and 1P41 differ as to base, base connections, and overall length.

Direct Interelectrode Capacitance	2.7 $\mu\mu$f
Overall Length	2-1/16" ± 1/8"
Base	Intermediate Screw



Vacuum Phototube

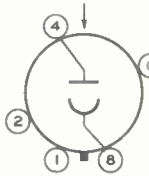
SIDE-ON TYPE HAVING S-1 RESPONSE

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 μμf
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

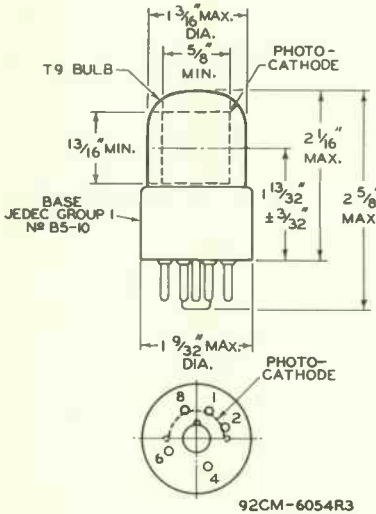
← Indicates a change.

[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



925
VACUUM PHOTOTUBE

SHORT TYPE WITH S- 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	1.6 μμf
Maximum Overall Length	2-5/8"
Maximum Seated Length	2-1/16"
Seated Length to Center of Cathode	1-9/32" ± 3/32"
Maximum Diameter	1-9/32"
Bulb	T-9
Mounting Position	Any
Base	Intermediate-Shell Octal 5-Pin
Basing Designation for BOTTOM VIEW	3J

Pin 1 – No Connection
Pin 2 – No Connection
Pin 4 – Anode
Pin 6 – No Connection
Pin 8 – Cathode

Maximum Ratings, *Absolute Values*:

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	250 max.	volts
PEAK CATHODE CURRENT	15 max.	μamp
PEAK CATHODE-CURRENT DENSITY	100 max.	μamp/sq. in.
AVERAGE CATHODE CURRENT°	5 max.	μamp
AMBIENT TEMPERATURE	100 max.	°C

Characteristics:

	Min.	Av.	Max.	
Dark Current at 250 Volts	–	–	0.0125	μamp
Sensitivity:				
At 8000 Angstroms	–	0.0015	–	μamp/μwatt
Luminous	10	20	40	μamp/lumen

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

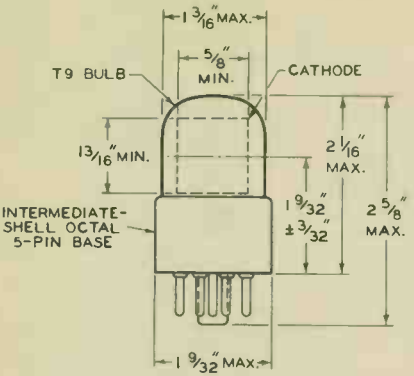
SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-1 Response
is shown at the beginning of this Section

→ Indicates a change.

RCA

925

VACUUM PHOTOTUBE



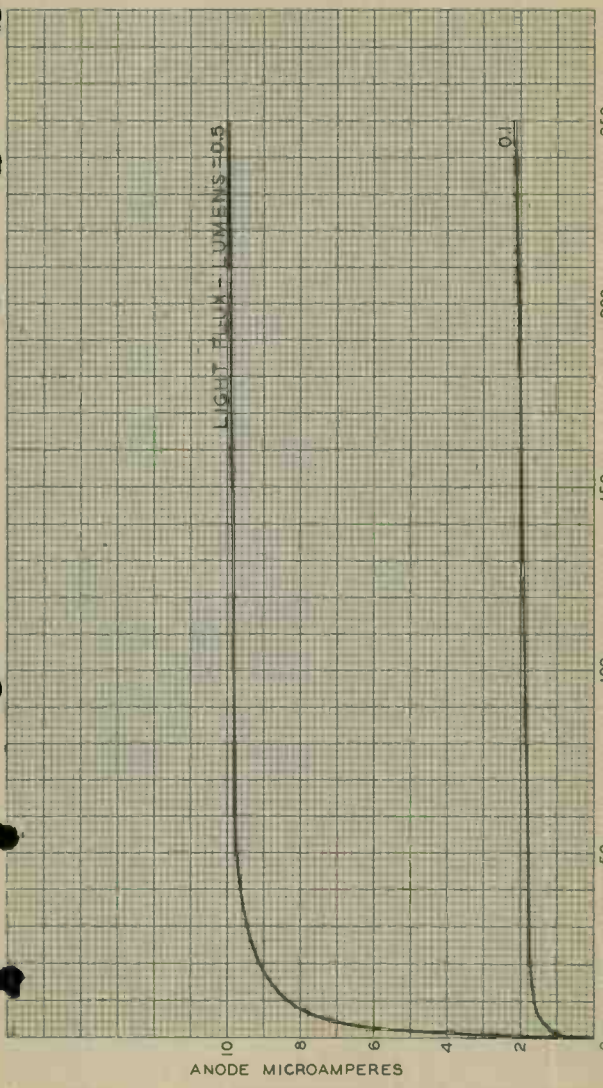
BOTTOM VIEW

92CM-6054R2

RCA

925

AVERAGE ANODE CHARACTERISTICS



JULY 31, 1947

TUBE DEPARTMENT

92CM-6208R1

926

VACUUM PHOTOTUBE

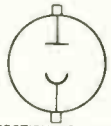
CARTRIDGE TYPE WITH S-3 RESPONSE

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 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 ←



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.

RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

926

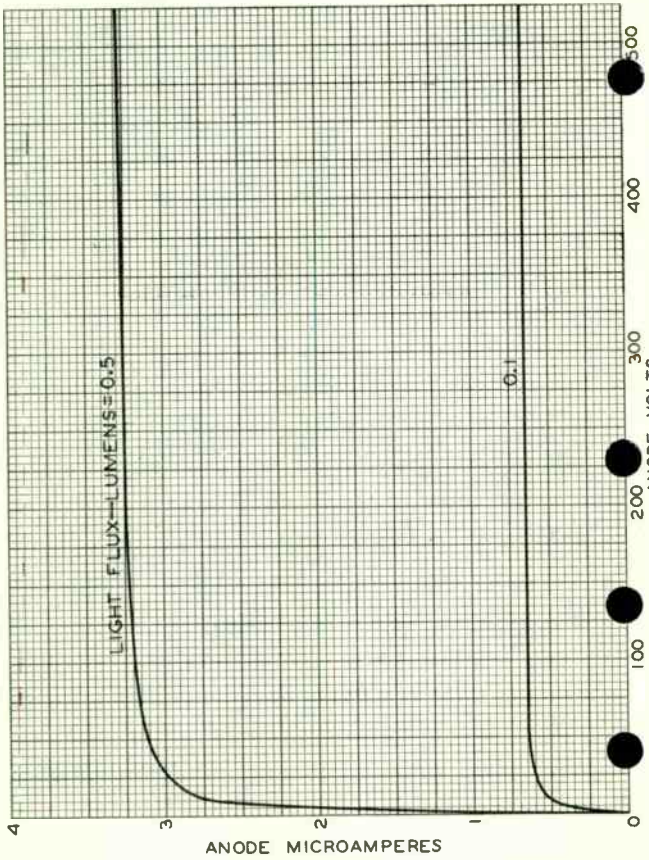
926

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



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92CM—6209RI

927
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*	11/16"
Minimum Projected Width*	7/16"
Direct Interelectrode Capacitance	2 μμf
Maximum Overall Length	2-13/32" ←
Maximum Seated Length	1-15/32" ←
Seated Length to Center of Cathode	1-1/4" ± 3/32"
Maximum Diameter	0.669" ←
Bulb	T-5-1/4 ←
Mounting Position	Any
Base	Small-Shell Peewee 3-Pin
Basing Designation for BOTTOM VIEW	2F

Pin 1 – No Connection
Pin 2 – Anode
Pin 3 – Cathode

Maximum Ratings, *Absolute Values*:

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	90 max.	volts
PEAK CATHODE CURRENT	6 max.	μamp
PEAK CATHODE-CURRENT DENSITY	100 max.	μamp/sq. in.
AVERAGE CATHODE CURRENT°	2 max.	μamp
AMBIENT TEMPERATURE	100 max.	°C

Characteristics:

	Min.	At.	Max.	
DC Dark Current■	–	–	0.1	μamp
Sensitivity:				
At 8000 angstroms	–	0.0125	–	μamp/μwatt
Luminous:				
At 0 cps	75	125	185	μamp/lumen
At 5000 cps	–	110	–	μamp/lumen
At 10000 cps	–	100	–	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.

■ At 25°C and 90 volts.

← Indicates a change.

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GAS PHOTOTUBE

Minimum Circuit Values:

DC Load Resistance:

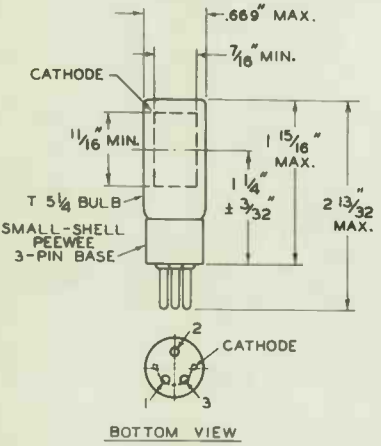
With anode-supply voltage of 70 volts or less:

For dc currents	above 2 μamp . . .	0.1 . . .	megohm
	below 2 μamp . . .	No Minimum	

With anode-supply voltage of 90 volts:

For dc currents	above 1.0 μamp . .	2.5 . . .	megohms
	below 1.0 μamp . .	0.1 . . .	megohm

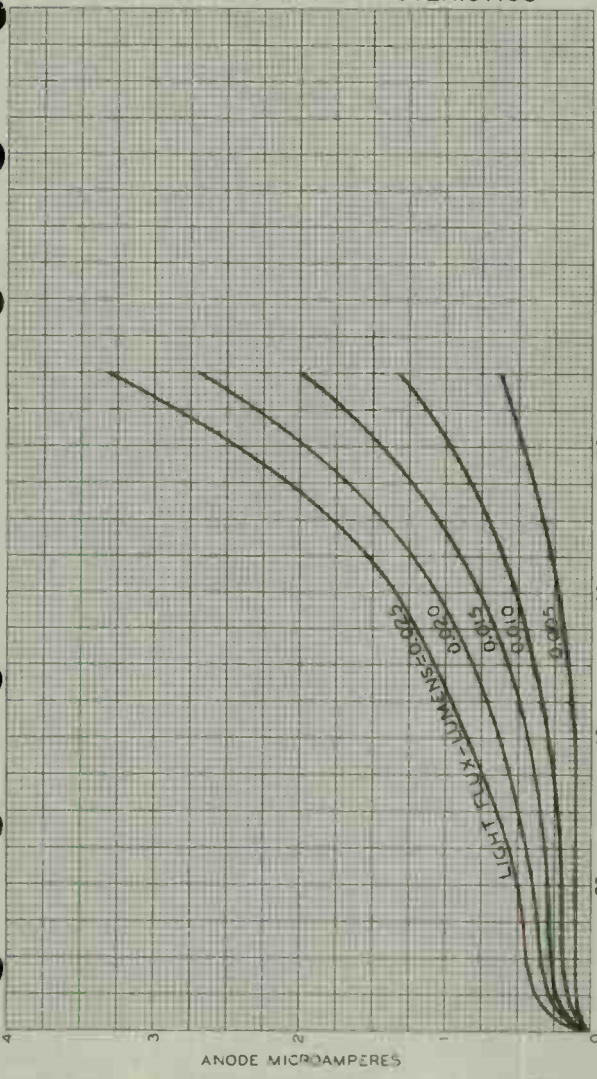
SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-1 Response
and
FREQUENCY-RESPONSE CHARACTERISTICS
of Gas Phototubes
are shown at the front of this Section



92CM-6053R4

→Indicates a change.

AVERAGE ANODE CHARACTERISTICS



APRIL 5, 1950 TUBE DEPARTMENT 92CM-6258R2

Gas Phototube

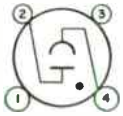
NON-DIRECTIONAL TYPE HAVING S-1 RESPONSE

DATA

General:

Spectral Response	S-1
Wavelength of Maximum Response	8000 ± 1000 angstroms
Cathode:	
Shape	Cylindrical Mesh
Minimum length	13/16"
Minimum diameter	5/8"
Direct Interelectrode Capacitance (Approx.)	3 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"
Operating Position	Any
Weight (Approx.)	1 oz ←
Bulb	T9
Socket	Amphenol No.77-MIP-4-T, or equivalent ←
Base	Small-Shell Small 4-Pin (JEDEC No.A4-5) ←
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)	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	–	0.0061	–	amp/watt
Luminous:[c]				
At 0 cps	40	65	100	μa/lumen
At 5000 cps	–	56	–	μa/lumen
At 10000 cps	–	50	–	μa/lumen
Gas Amplification Factor[d]	–	–	10	
Anode Dark Current at 25° C.	–	–	0.1	μa

← Indicates a change.

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.	–	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.

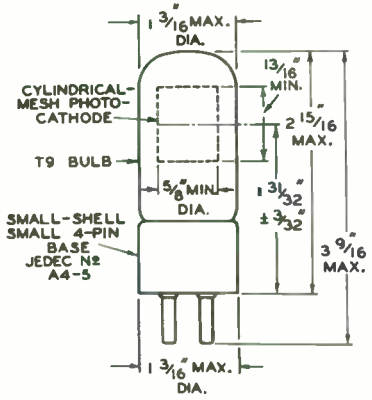
[d] The ratio of luminous sensitivity at an anode supply voltage of 90 volts to luminous sensitivity at an anode supply voltage of 25 volts. In each case, sensitivity is obtained under conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K, the light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

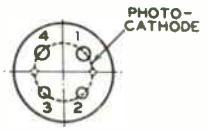
SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-1 RESPONSE

and

FREQUENCY-RESPONSE CHARACTERISTICS OF GAS PHOTOTUBES

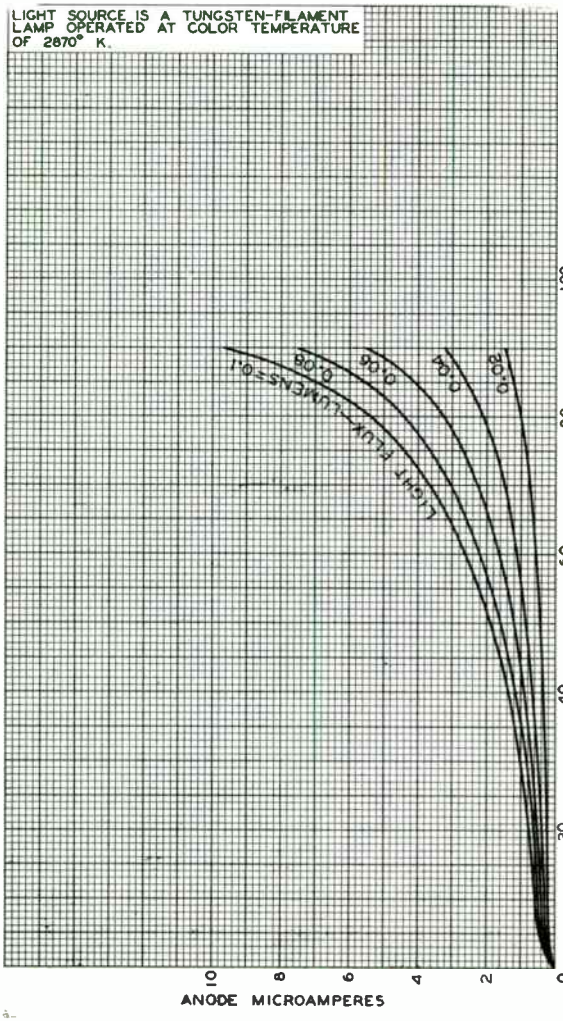
are shown at the front of this section





92CM-6111R3

AVERAGE ANODE CHARACTERISTICS



92CM-6117RI

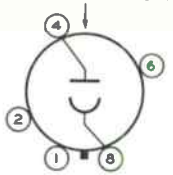
Vacuum Phototube

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.

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

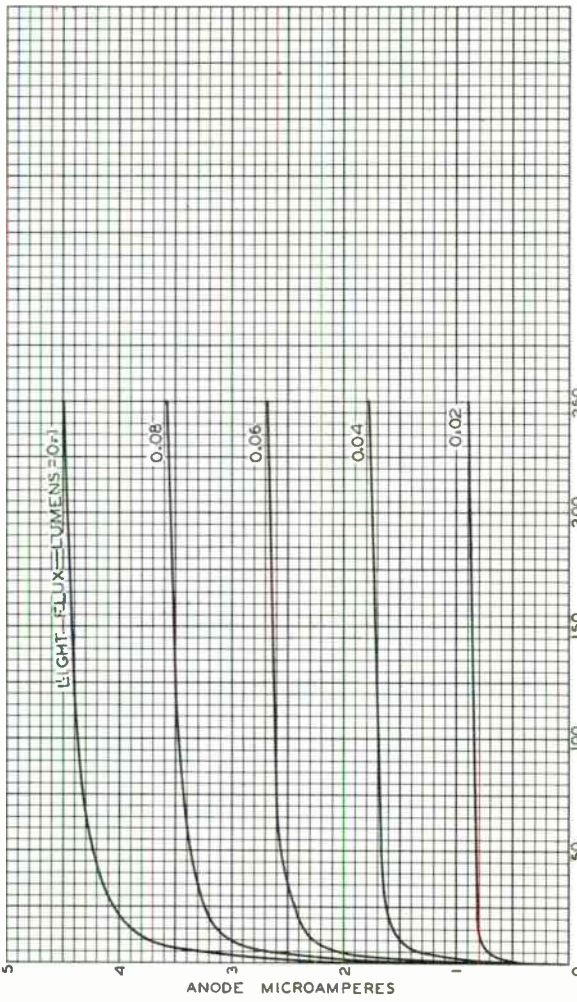
[b] Averaged over any interval of 30 seconds maximum.

[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

AVERAGE ANODE CHARACTERISTICS



92CM-6151RI

929

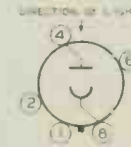
VACUUM PHOTOTUBE

WITH S-4 RESPONSE

DATA

General:

Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 Angstroms
Cathode:	
Shape	Semi-Cylindrical
Minimum Projected Length*	13/16"
Minimum Projected Width*	5/8"
Direct Interelectrode Capacitance	2.5 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"
Bulb	T-4
Mounting Position	Any
Base	Intermediate-Shell Octal 5-Pin
Basing Designation for BOTTOM VIEW	31



Pin 1—No Connection
Pin 2—No Connection
Pin 3—Cathode
Pin 4—Anode
Pin 5—No Connection

Maximum Ratings, *Absolute Values*:

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	250 max. volts
PEAK CATHODE CURRENT	20 max. μamp
PEAK CATHODE CURRENT DENSITY	100 max. μamp/sq. in.
AVERAGE CATHODE CURRENT°	5 max. μamp
AMBIENT TEMPERATURE	75 max. °C

Characteristics:

	Min.	Av.	Max.	
Dark Current at 250 volts	–	–	0.0125	μamp
Sensitivity:				
At 4000 Angstroms	–	0.042	–	μamp/μwatt
Luminous	25	45	70	μamp/lumen

* On plane perpendicular to indicated direction of incident light.

° Averaged over any interval of 30 seconds maximum.

OUTLINE DIMENSIONS for Type 929
are the same as those for Type 55HT

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-4 Response
is shown at the beginning of this Section

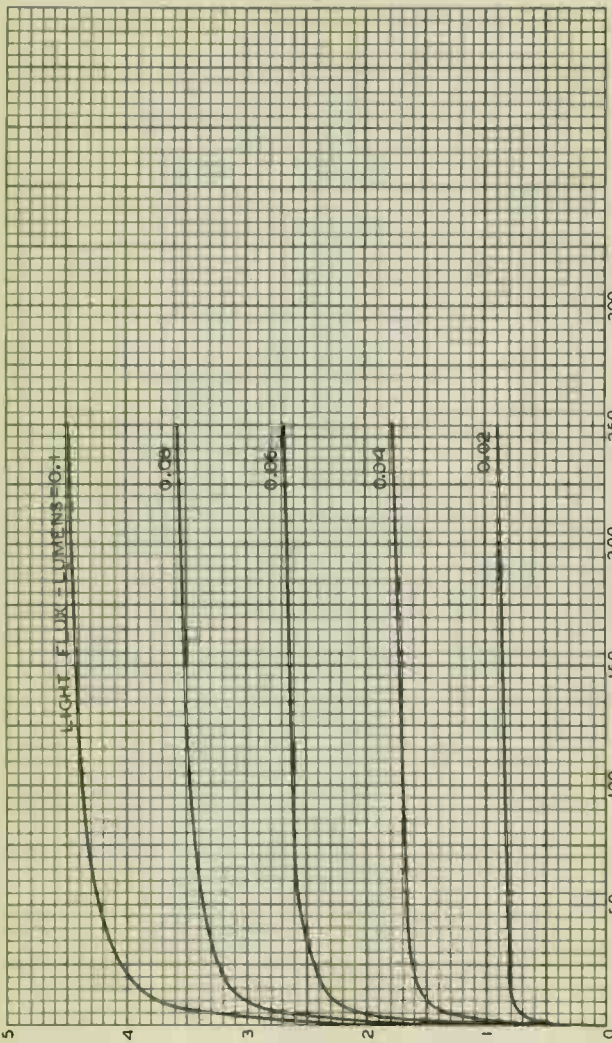
◄ Indicates a change.

929

RCA

929

AVERAGE ANODE CHARACTERISTICS



AUG. 4, 1947

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-6151RI

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.

	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-I RESPONSE

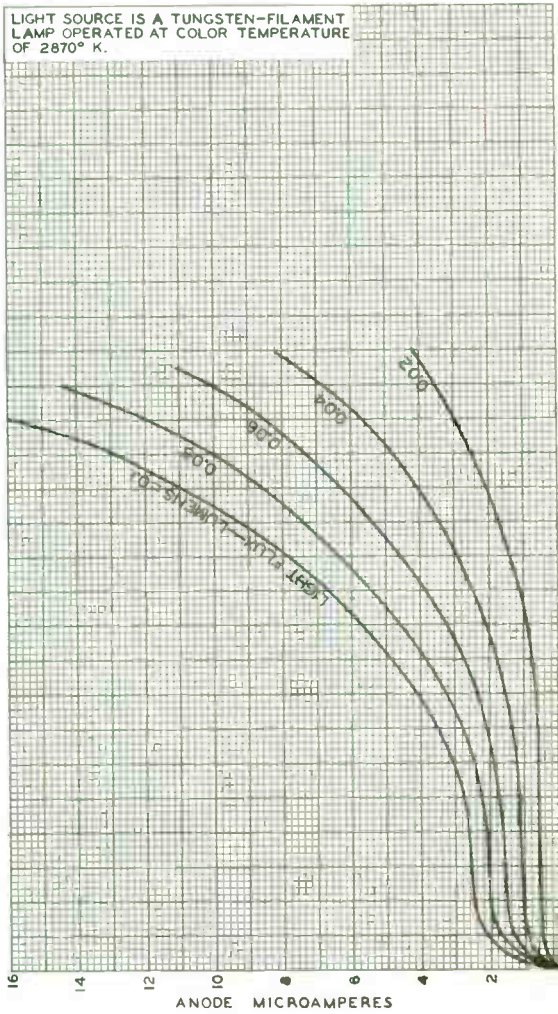
and

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

AVERAGE ANODE CHARACTERISTICS



92CM-4806R2

931-A
MULTIPLIER PHOTOTUBE

9-STAGE TYPE WITH S-4 RESPONSE

DATA

General:

Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 angstroms
Cathode:	
Minimum projected length*	15/16"
Minimum projected width*	5/16"
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"
Maximum Diameter	1-5/16"
Mounting Position	Any
Weight (Approx.)	1.6 oz
Bulb	T-9
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

DIRECTION OF LIGHT

Pin 7 – Dynode No.7
Pin 8 – Dynode No.8
Pin 9 – Dynode No.9
Pin 10 – Anode
Pin 11 – Cathode

Maximum Ratings, *Absolute Values:*

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	1250 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.9 AND ANODE (DC or Peak AC)	250 max.	volts
AVERAGE ANODE CURRENT•	1 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

Characteristic Range Values for Equipment Design:

Under conditions with 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

With E = 1000 volts (except as noted)

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4000 angstroms	–	24000	–	μamp/μwatt

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

← Indicates a change.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

931-A

MULTIPLIER PHOTOTUBE

	Min.	Median	Max.	
Cathode radiant, at 4000 angstroms. . .	–	0.03	–	μamp/μwatt
Luminous:♦				
At 0 cps.	4.5	24	300	amp/lumen
At 100 Mc	–	23	–	amp/lumen
Cathode luminous▲ . .	–	30	–	μamp/lumen
Current Amplification .	–	800,000	–	
Equivalent Anode-Dark-Current Input●■ . . .	–	–	2.5×10^{-9}	lumen
Equivalent Noise Input▲.	–	9.5×10^{-13}	–	lumen

With E = 750 volts (except as noted)

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4000 angstroms	–	3300	–	μamp/μwatt
Cathode radiant, at 4000 angstroms. . . .	–	0.03	–	μamp/μwatt
Luminous:♦				
At 0 cps.	–	3.3	–	amp/lumen
Cathode luminous▲ . .	–	30	–	μamp/lumen
Current Amplification .	–	110,000	–	

♦ 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.

● 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 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.

OPERATING CONSIDERATIONS

The *operating stability* of the 931-A is dependent on the magnitude of the anode current and its duration. When the 931-A is operated at high 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 931-A usually recovers a substantial percentage of such loss in sensitivity.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

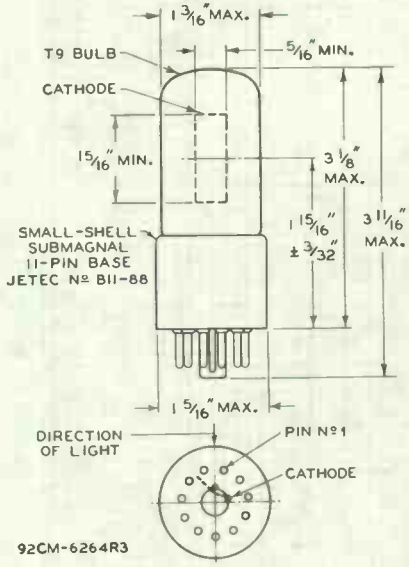
931-A

MULTIPLIER PHOTOTUBE

The use of an average anode current well below the maximum rated value of 1.0 milliampere is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 10 microamperes, and the tube should be given a warm-up period of about 1/2 hour under load conditions.

Electrostatic and/or *magnetic shielding* of the 931-A may be necessary.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-4 Response
is shown at the front of this Section



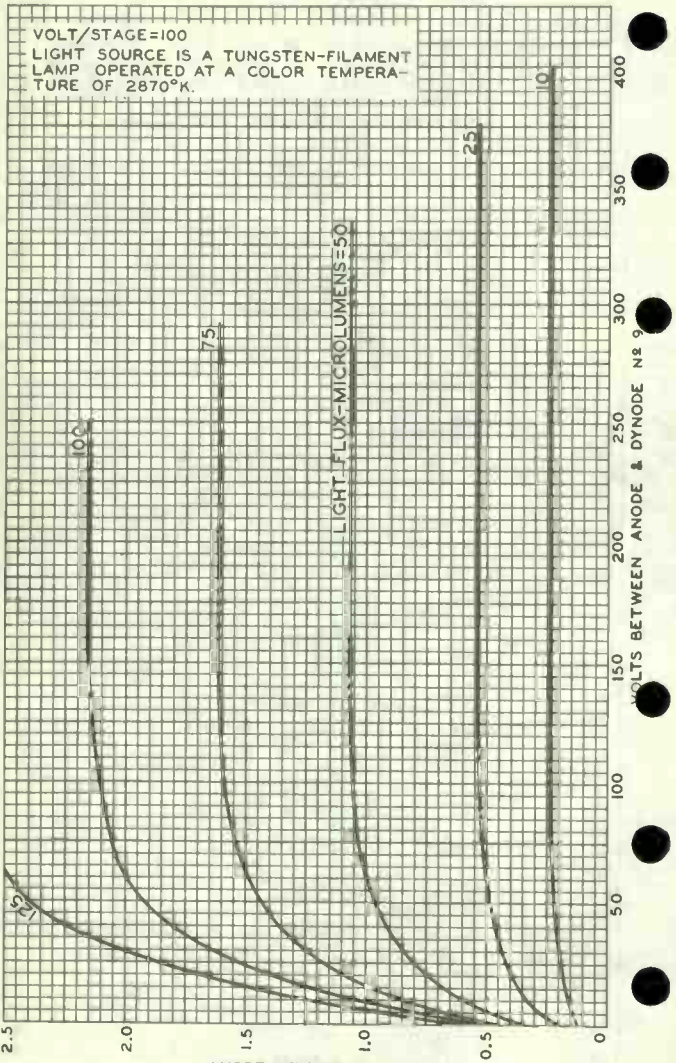
BOTTOM VIEW

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

931-A

931-A

AVERAGE ANODE CHARACTERISTICS



JULY 8, 1955

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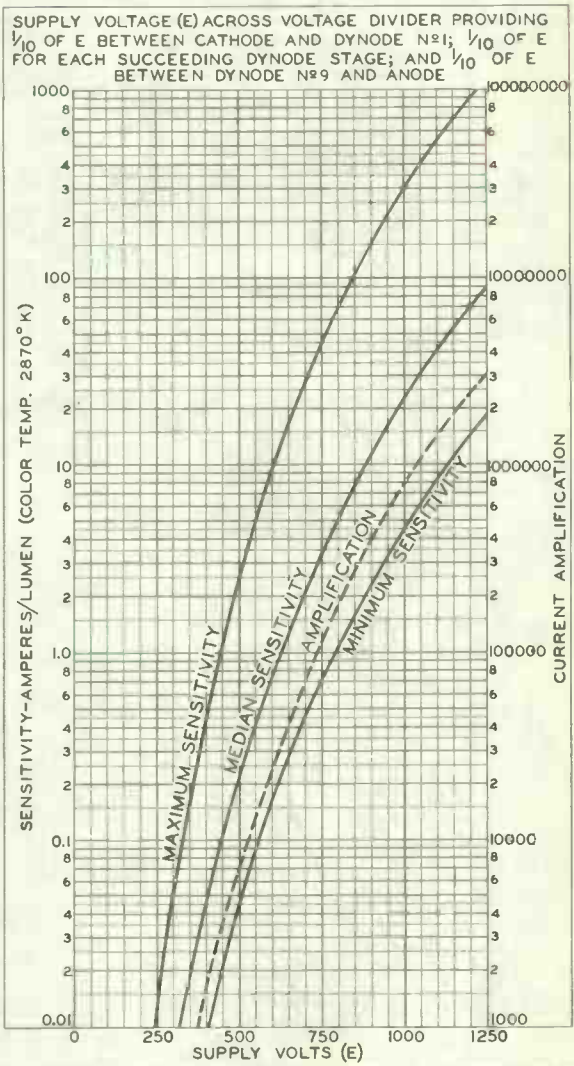
92CM-6268R5

931-A
AVERAGE CHARACTERISTICS



JULY 8, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

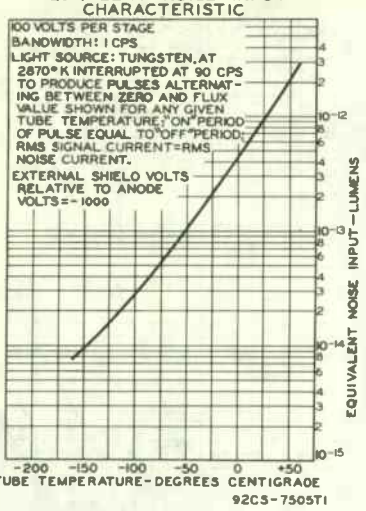
92CL-6459R3

RCA

931-A

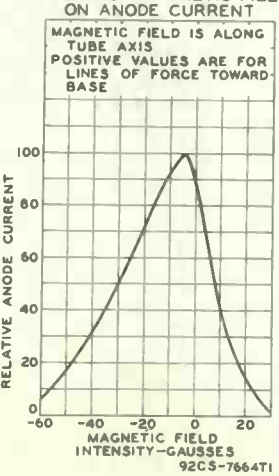
CHARACTERISTIC CURVES

EQUIVALENT-NOISE-INPUT CHARACTERISTIC



92CS-7505TI

EFFECT OF MAGNETIC FIELD ON ANODE CURRENT



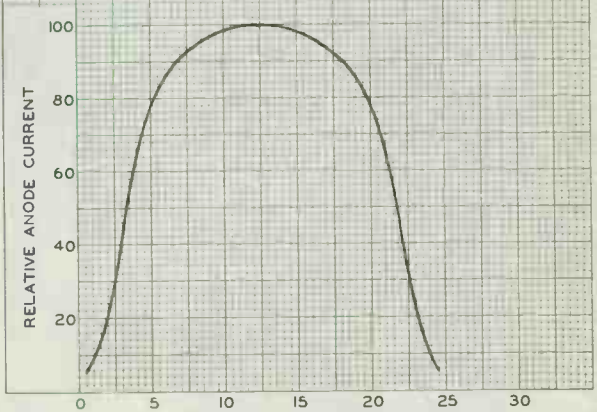
92CS-7664TI

RCA

931-A

VARIATION IN SENSITIVITY OF PHOTOCATHODE ALONG ITS LENGTH

SPOT SIZE: 1 MM APPROX.
VARIATIONS CAUSED BY INTERCEPTION OF LIGHT BY GRILL AS WELL AS SURFACE IRREGULARITIES HAVE BEEN IGNORED



MAR. 18, 1954 TUBE DIVISION 92CM-7663R1

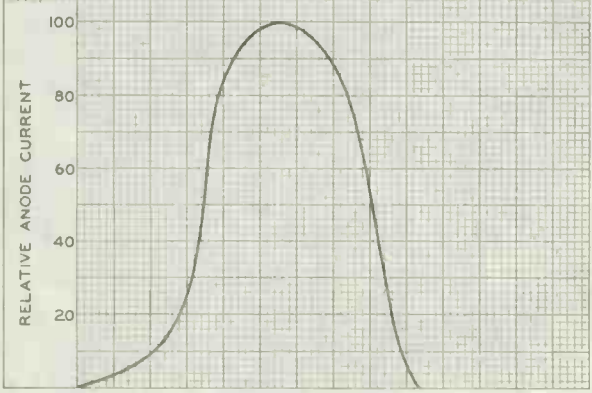
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

RCA

931-A

VARIATION IN SENSITIVITY OF PHOTOCATHODE ACROSS ITS PROJECTED WIDTH IN PLANE OF GRILL

SPOT SIZE 1 MM APPROX.
GRILL TOWARD OBSERVER, BASE DOWN
CATHODE WIDTH PROJECTED NORMAL TO PLANE OF GRILL
VARIATIONS CAUSED BY INTERCEPTION OF LIGHT BY GRILL AS WELL AS SURFACE IRREGULARITIES HAVE BEEN IGNORED



MAR. 18, 1954 TUBE DIVISION 92CM-7667RI

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

934
VACUUM PHOTOTUBE
WITH S-4 RESPONSE

DATA

General:

Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 angstroms
Cathode:	
Shape	Semi-Cylindrical
Minimum Projected Length*	11/16"
Minimum Projected Width*	7/16"
Direct Interelectrode Capacitance	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" ←
Bulb	T-5-1/4 ←
Mounting Position	Any
Base	Small-Shell Peewee 3-Pin
Basing Designation for BOTTOM VIEW	$2F_1$

Pin 1 - No Connection
Pin 2 - Anode
Pin 3 - Cathode

Maximum Ratings, *Absolute Values*:

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	250 max.	volts
PEAK CATHODE CURRENT	12 max.	μamp
PEAK CATHODE-CURRENT DENSITY	100 max.	μamp/sq.in.
AVERAGE CATHODE CURRENT●	4 max.	μamp
AMBIENT TEMPERATURE	75 max.	°C

Characteristics:

	Min.	Av.	Max.	
DC Dark Current□	–	–	0.005	μamp
Sensitivity:				
At 4000 angstroms	–	0.028	–	μamp/μwatt
Luminous	15	30	70	μamp/lumen

* On plane perpendicular to indicated direction of incident light.
● Averaged over any interval of 30 seconds maximum.
□ At 25°C and 250 volts.

OUTLINE DIMENSIONS for Type 934 are the same as those for Type 927

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-4 Response is shown at the front of this Section

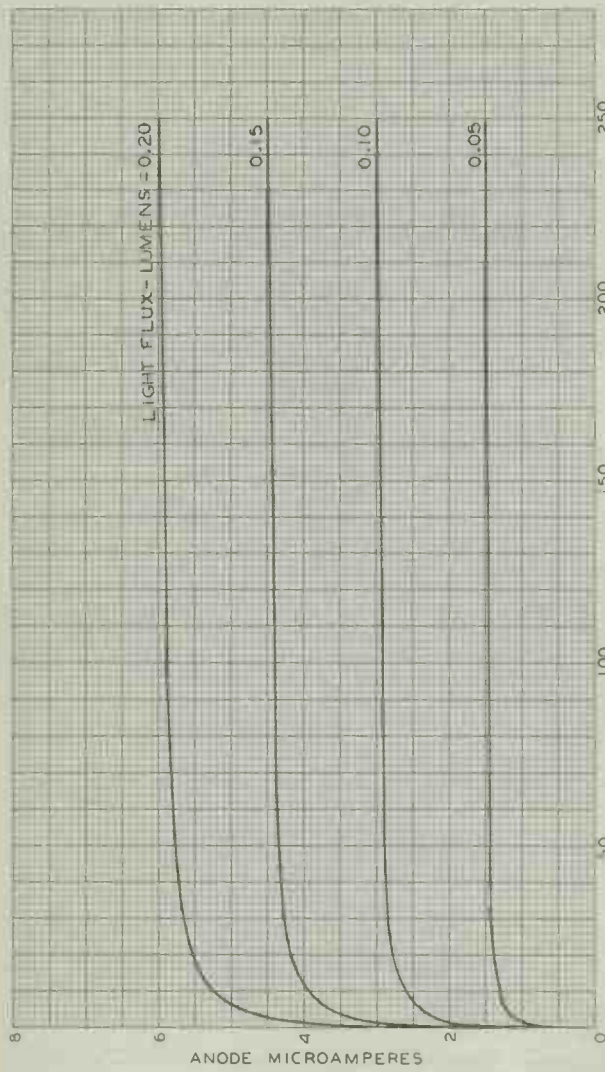
← Indicates a change.

934

RCA

934

AVERAGE ANODE CHARACTERISTICS



OCT. 16, 1944 TUBE DEPARTMENT 92CM-6479

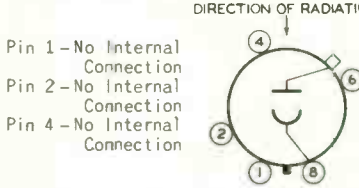
Vacuum Phototube

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



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

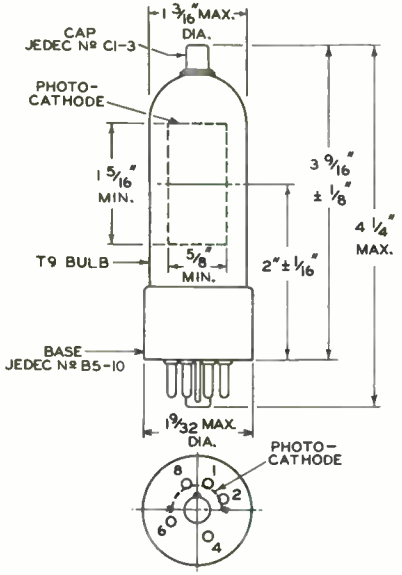
← Indicates a change.

[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



935

VACUUM PHOTOTUBE

WITH S-5 RESPONSE

DATA

General:

Spectral Response	S-5
Wavelength of Maximum Response	3400 ± 500 Angstroms
Cathode:	
Shape	Semi-Cylindrical
Minimum Projected Length*	1-5/16"
Minimum Projected Width*	5/8"
Direct Interelectrode Capacitance	0.6 μμf
Overall Length	4-1/8" ± 1/8"
Seated Length	3-9/16" ± 1/8"
Seated Length to Center of Cathode	2" ± 1/16"
Maximum Diameter	1-9/32"
Bulb	T-9
Mounting Position	Any
Cap	Skirted Miniature
Base	Intermediate-Shell Octal 5-Pin

BOTTOM VIEW

Pin 1 – No Connection
Pin 2 – No Connection
Pin 4 – No Connection
Pin 6 – No Connection
Pin 8 – Cathode
Cap – Anode

Maximum Ratings, *Absolute Values*:

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	250 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	75 max.	°C

Characteristics:

	Min.	Av.	Max.	
Dark Current at 250 Volts	–	–	0.0005	μamp
Sensitivity:				
At 3400 Angstroms	–	0.032	–	μamp/μwatt ←
Luminous▲	18	35	70	μamp/lumen ←

* On plane perpendicular to indicated direction of incident radiation.

° Averaged over any interval of 30 seconds maximum.

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

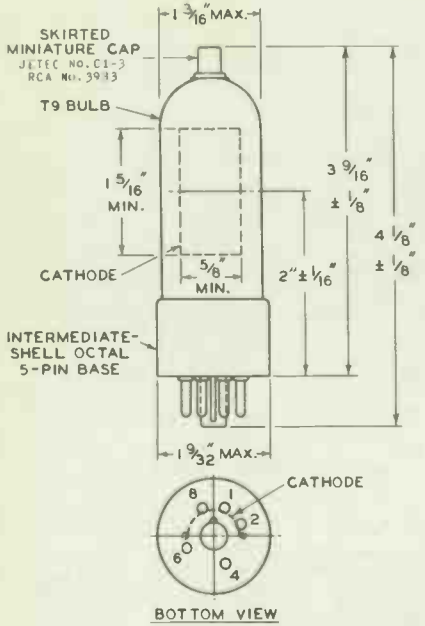
SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-5 Response
is shown at the beginning of this Section

← Indicates a change.

RCA

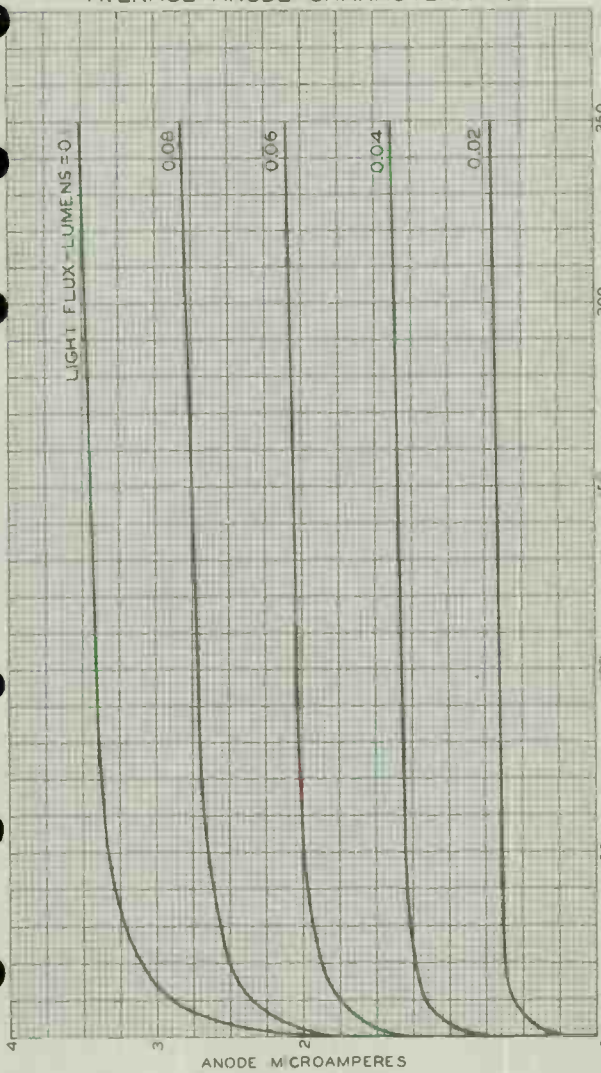
935

VACUUM PHOTOTUBE



92CM-6411R4

AVERAGE ANODE CHARACTERISTICS



2048A

Vidicon

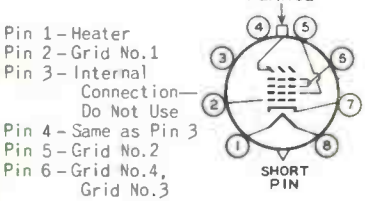
LOW-POWER (0.6-WATT) HEATER 600-TO-900-LINE RESOLUTION

For Use Under Severe Shock and Vibration, High Humidity, and at Altitudes up to 50,000 Feet

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:[a]		
Target to all other electrodes	3	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	5.154" ± 0.06"	
Greatest Diameter (Excluding target-flange contact)	1.125" ± 0.010"	
Weight (Approx.)	2 oz	
Operating Position	Any	
Bulb	T8	
Socket	Cinch No.54A18088[b], or equivalent	
Base	Small-Button Ditetrar 8-Pin (JEDEC No.E8-11)	
Basing Designation for BOTTOM VIEW	8HM	



DIRECTION OF LIGHT:
INTO FACE END OF TUBE

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
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[c]	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[d]) Voltage	250[e] to 300	volts
Grid-No.2 (Accelerator) Voltage	300	volts
Grid-No.1 Voltage for picture cutoff[f]	-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.)[g]	300:1	
Lag (Per cent of initial value of signal-output current 1/20 second after illumination is removed) for initial signal-output current of 0.2 μa, dark current of 0.02 μa:		
Typical	15	%
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	gauss
Field Strength of Adjustable Alignment Coil[h]	0 to 4	gauss

Maximum-sensitivity operation—0.1 footcandle on faceplate

Faceplate Illumination (Highlight)	0.1	fc
Target Voltage[j,k]	35 to 70	volts
Dark Current[m]	0.2	μa
Signal-Output Current:[n]		
Typical	0.14	μa

Intermediate-sensitivity operation—0.5 footcandle on faceplate

Faceplate Illumination (Highlight)	0.5	fc
Target Voltage[j,k]	30 to 60	volts
Dark Current[m]	0.1	μa
Signal-Output Current:[n]		
Typical	0.27	μa

Average-sensitivity operation—1 footcandle on faceplate

Faceplate Illumination (Highlight)	1	fc
Target Voltage[j,k]	20 to 40	volts
Dark Current[m]	0.02	μa
Signal-Output Current:[n]		
Typical	0.2	μa
Minimum	0.15	μa

[a] This capacitance, which effectively is the output impedance of the 2048A, 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.

[b] Cinch Manufacturing Corporation, 1026 South Homan Avenue, Chicago 24, Illinois.

[c] Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

[d] Beam focus is obtained by combined effect of grid-No.3 voltage which should be adjustable over indicated range, and a focusing coil having and average field strength of 40 gausses.

[e] 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.

[f] With no blanking voltage on grid No.1.

[g] 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.

[h] 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.

[j] Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

[k] The target voltage for each 2048A must be adjusted to that value which gives the desired operating dark current.

[m] 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.

[n] 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 2048A's will maintain resolution as determined with a RETMA Resolution Chart, or equivalent.

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[p] are vibrated on apparatus providing dynamic conditions similar to those described in MIL-E-5272B[r], paragraph 4.7.1.

Resonance. Tubes and associated components[p] are vibrated (per the method of MIL-E-5272B[r], 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[p] are vibrated (per the method of MIL-E-5272B[r], paragraph 4.7.1.2 pertaining

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[p] are subjected (per the method of MIL-E-5400[s], 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[p] are subjected in these tests (per MIL-E-5400[s], 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 2048A. The 2048A and associated components[p] are subjected (per the method of MIL-E-5400[s], paragraph 3.2.20.28) to relative humidities up to and including 95 per cent at temperatures up to and including +50° C.

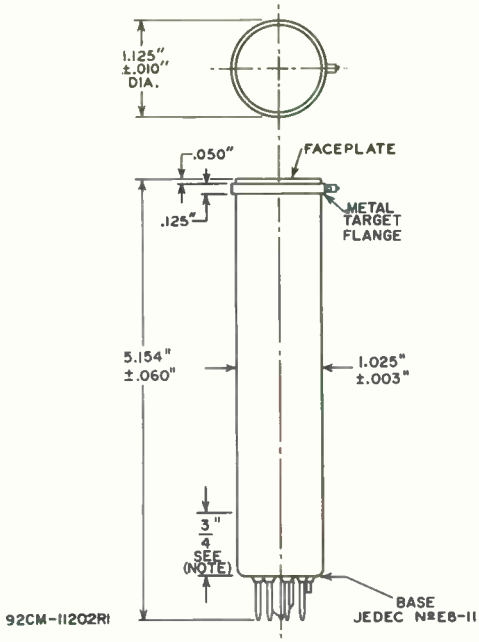
[p] Tube socket such as Cinch No.54A18088 and RCA Assembly No.8447880, or equivalent, which consists of the deflecting coils, focusing coil, alignment coil, shield, and target connector. This assembly is available from RCA Defense Electronic Products, Equipment Maintenance and Support, Building 7-5, Camden, New Jersey.

[r] 5 June 1957, Procedure I of Military Specifications.

[s] 1 January 1956.

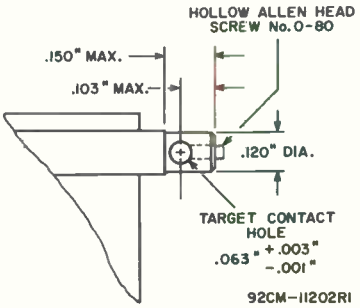
OPERATING CONSIDERATIONS

Support for the 2048A 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 8447880, or equivalent. Orientation of the 2048A 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.

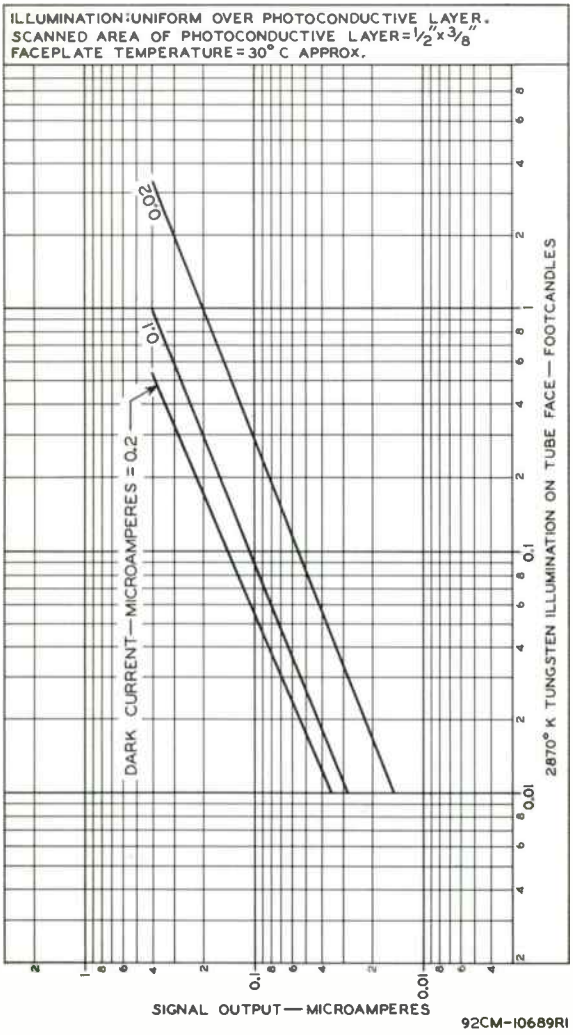


NOTE: WITHIN THIS DISTANCE, DIAMETER OF BULB IS 1.025" + 0.010" - 0.030".

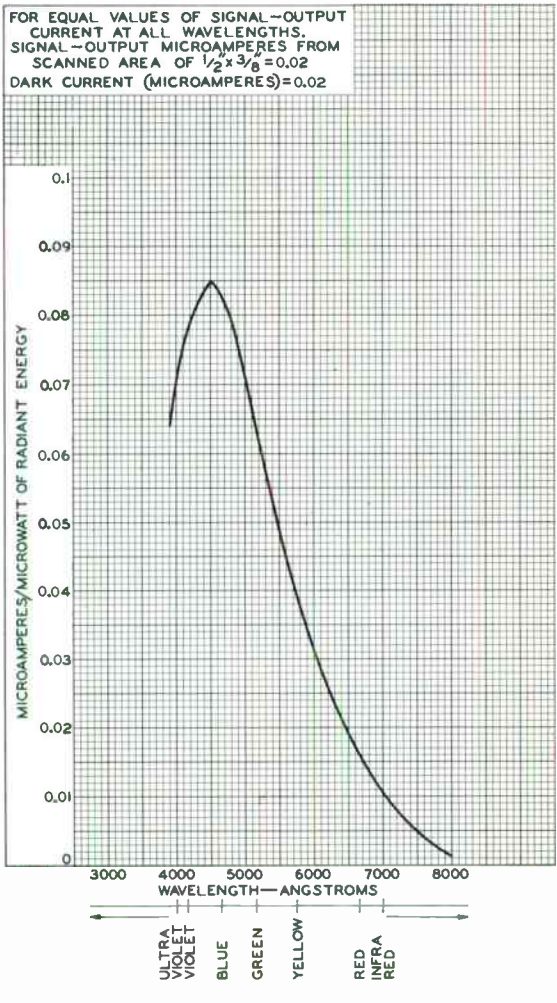
DETAIL OF TARGET-FLANGE CONTACT



TYPICAL LIGHT-TRANSFER CHARACTERISTICS



TYPICAL SPECTRAL-SENSITIVITY CHARACTERISTIC



92CM-10698RI

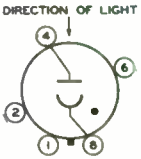
Gas Phototube

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

	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.

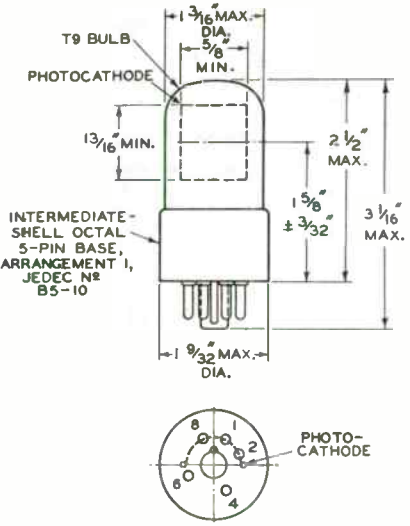
[d] The ratio of luminous sensitivity at an anode supply voltage of 90 volts to luminous sensitivity at an anode supply voltage of 25 volts, in each case, sensitivity is obtained under conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K, the light 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

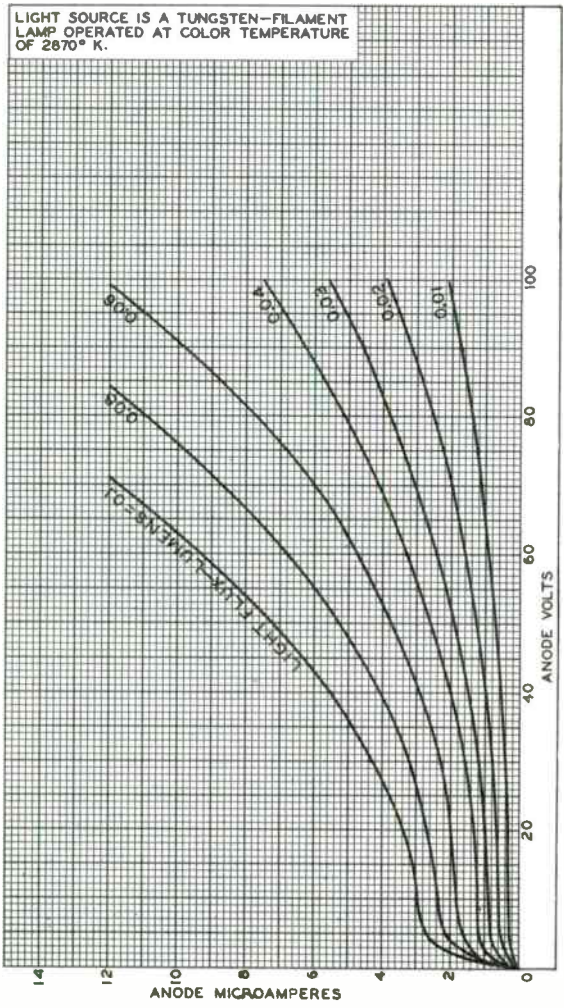
FREQUENCY-RESPONSE CHARACTERISTICS OF GAS PHOTOTUBES

are shown at the front of this section



92CM-6137R3

AVERAGE ANODE CHARACTERISTICS



92CM-6822RI

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 ←

Maximum Ratings, *Absolute Values:*

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	100 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[O]	20 max.	μamp/sq. in. ←
AVERAGE CATHODE CURRENT[O]	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.

O, ▲: See next page. ← Indicates a change.

TUBE DIVISION
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GAS PHOTOTUBE

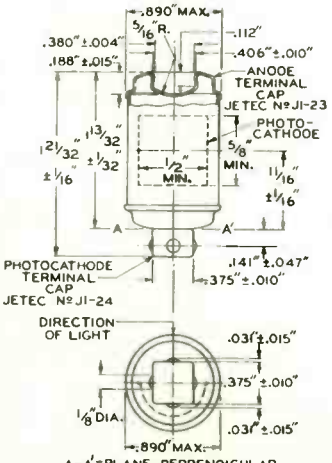
Minimum Circuit Values:

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 0.055 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



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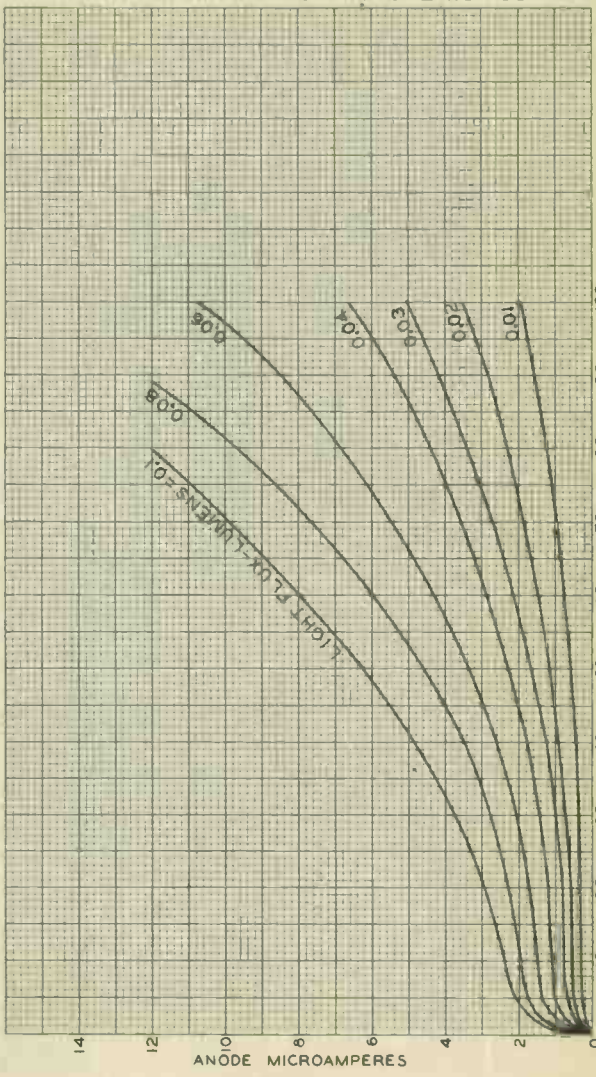
AVERAGE ANODE CHARACTERISTICS



DEC. 27, 1946

TUBE DEPARTMENT

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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]	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 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 cos	75	135	205	μa/lumen
At 5000 cps	–	124	–	μa/lumen
At 10000 cps	–	108	–	μa/lumen

← Indicates a change.

	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] Avereged 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.

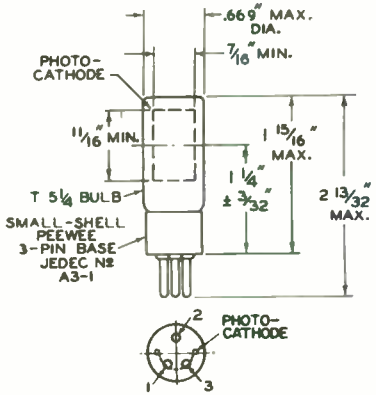
SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-4 RESPONSE

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



92CM-6053R5

5584
GAS PHOTOTUBE

BLUE SENSITIVE, TWIN TYPE

DATA

General:

Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 Angstroms
Cathode (Each):	
Shape	Quarter-Cylindrical
Minimum Projected Length*	1-3/16"
Minimum Projected Width*	1/4"
Direct Interelectrode Capacitances:	
Cathode to Anode ♦	1.6 μμf
Cathode to Cathode ■	1.8 μμf
Anode to Anode ●	0.44 μμf
Maximum Overall Length	4"
Maximum Seated Length	3-3/8"
Seated Length to Center of Cathode	2-1/8" ± 3/32"
Maximum Diameter	1-3/16"
Bulb	T-9
Mounting Position	Any
Base	Small-Shell Small 4-Pin
Basing Designation for BOTTOM VIEW	4BG

Pin 1 – Cathode, Unit No.2
Pin 2 – Anode, Unit No.2

DIRECTION OF LIGHT

Pin 3 – Anode, Unit No.1
Pin 4 – Cathode, Unit No.1

Maximum Ratings, *Absolute Values* **(Each Unit):**

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	100 max.	volts
PEAK CATHODE CURRENT	10 max.	μamp
PEAK CATHODE-CURRENT DENSITY	50 max.	μamp/sq.in.
AVERAGE CATHODE CURRENT°	2 max.	μamp
AMBIENT TEMPERATURE	75 max.	°C

Characteristics (Each Unit):

	Min.	Av.	Max.	
Dark Current at 90 Volts	–	–	0.050	μamp
Sensitivity:				
At 4000 Angstroms	–	0.11	–	μamp/μwatt
Luminous:				
At 0 Cycles	80	120	175	μamp/lumen
At 5000 Cycles	–	110	–	μamp/lumen
At 10000 Cycles	–	96	–	μamp/lumen
Gas Amplification Factor	–	–	5.5	

Minimum Circuit Values (Each Unit):

DC Load Resistance:
With anode-supply voltage of 80 volts or less

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

*, ♦, ■, ●, °: See next page.

5584
GAS PHOTOTUBE

With anode-supply voltage of 100 volts

For dc currents { above 1 μamp . . . 2.5 . . . . . megohms
below 1 μamp . . . 0.1 . . . . . megohm

* On plane perpendicular to indicated direction of incident light.

♦ Each unit, with other unit grounded.

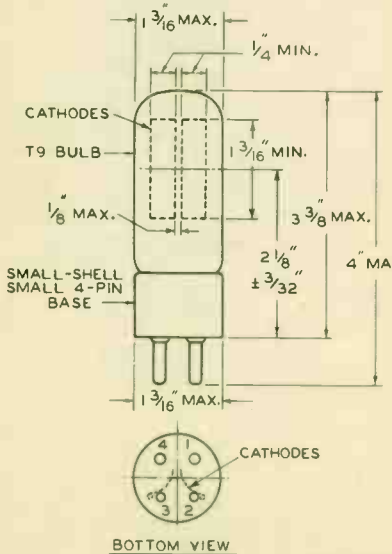
■ Anodes grounded.

● Cathodes grounded.

c Averaged over any interval of 30 seconds maximum. Average current may be doubled when anode-supply voltage is limited to 80 volts.

SPECTRAL-SENSITIVITY CHARACTERISTIC
and
FREQUENCY-RESPONSE CHARACTERISTIC
of Gas Phototube having S-4 Response
are shown at beginning of this Section

AVERAGE ANODE CHARACTERISTICS
of Type 5584 are the same
as those shown under Type 5582



92CM-4561R3

5652
VACUUM PHOTOTUBE

COMPOSITE ANODE-CATHODE TYPE WITH S-4 RESPONSE

DATA

General:

Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 Angstroms
Cathode:	
Shape	Flat
Minimum Projected Length*	1/4"
Minimum Projected Width*	19/32"
Direct Interelectrode Capacitance (C_1)▲	1 μμf
Balancing Capacitance (C_2)□	1 μμf
Capacitance Difference Between C_1 and C_2	Not more than 0.3 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"
Bulb	T-9
Mounting Position	Any
Base	Intermediate-Shell Octal 5-Pin, Non-hygroscopic
Basing Designation for BOTTOM VIEW	2AB

Pin 1: No Connection
Pin 2: Balancing Capacitance
Pin 4: Cathode or Anode

Pin 6: No Connection
Pin 8: Anode or Cathode

Maximum Ratings, *Absolute Values*:

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	250 max.	volts
PEAK CATHODE CURRENT (For either electrode)	12 max.	μamp
PEAK CATHODE-CURRENT DENSITY	100 max.	μamp/sq. in.
AVERAGE CATHODE CURRENT (For either electrode)○	4 max.	μamp
AMBIENT TEMPERATURE	75 max.	°C

Characteristics:

	Min.	Av.	Max.	
Dark Current at 250 Volts	–	–	0.01	μamp
Sensitivity:				
At 4000 Angstroms	–	0.042	–	μamp/μwatt
Luminous	30	45	70	μamp/lumen

* On plane perpendicular to indicated direction of incident light.
▲ Measured between base pins 4 and 8.
□ Measured between base pins 2 and 4.
○ Averaged over any interval of 30 seconds maximum.

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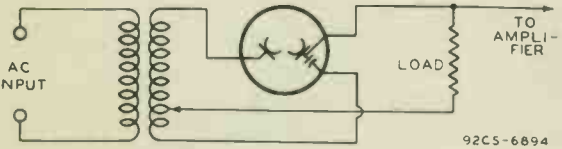
5652
VACUUM PHOTOTUBE

SPECTRAL SENSITIVITY CHARACTERISTIC
of Phototube having S-4 Response
is shown at the beginning of this Section

The curve shown under Type 929
is also applicable to the 5652

TYPICAL CIRCUIT



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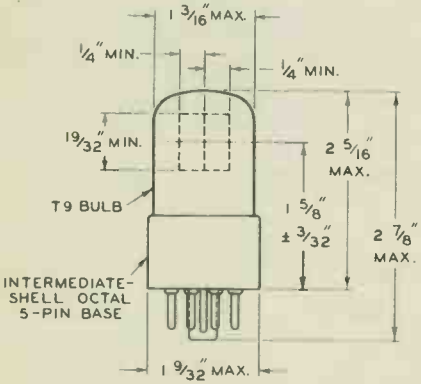

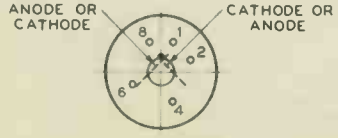

BOTTOM VIEW

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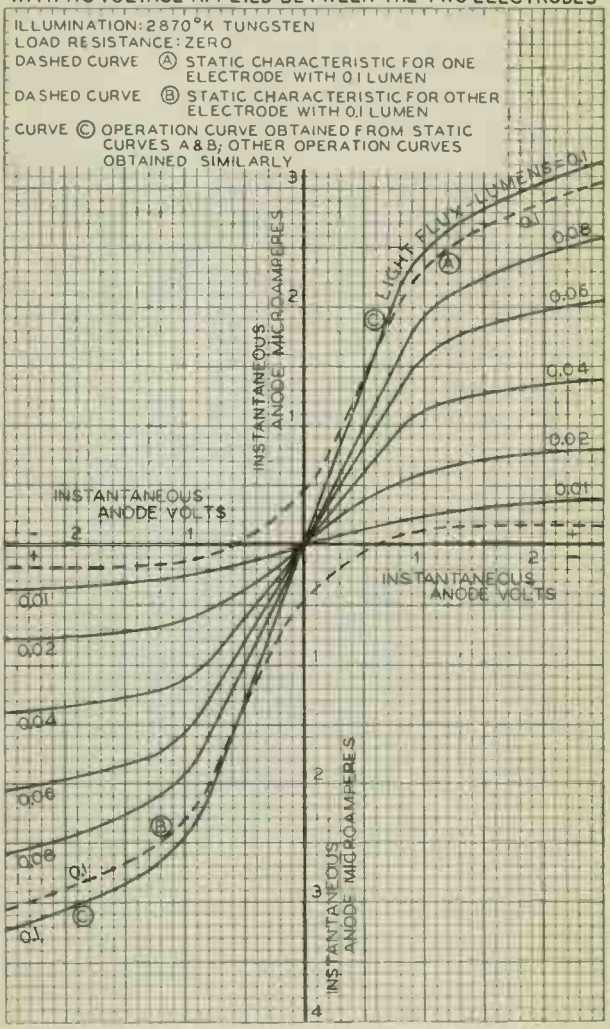
AVERAGE OPERATION CHARACTERISTICS

WITH AC VOLTAGE APPLIED BETWEEN THE TWO ELECTRODES



5653

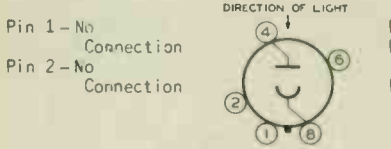
VACUUM PHOTOTUBE

WITH S-4 RESPONSE

DATA

General:

Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 Angstroms
Cathode:	
Shape	Semi-Cylindrical
Minimum Projected Length*	13/16"
Minimum Projected Width*	5/8"
Direct Interelectrode Capacitance	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"
Bulb	T-9
Mounting Position	Any
Base	Intermediate-Shell Octal 5-Pin
Basing Designation for BOTTOM VIEW	3J



Maximum Ratings, *Absolute Values*:

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	250 max.	volts
PEAK CATHODE CURRENT	20 max.	μamp
PEAK CATHODE-CURRENT DENSITY	100 max.	μamp/sq. in.
AVERAGE CATHODE CURRENT°	5 max.	μamp
AMBIENT TEMPERATURE	75 max.	°C

Characteristics:

	Min.	Av.	Max.	
Dark Current at 250 Volts	–	–	0.25	μamp
Sensitivity:				
At 4000 Angstroms	–	0.042	–	μamp/μwatt
Luminous	20	45	100	μamp/lumen

* on plane perpendicular to indicated direction of incident light.

° Averaged over any interval of 30 seconds maximum.

OUTLINE DIMENSIONS for Type 5653 are the same as those for Type 5581

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-4 Response is shown at beginning of this Section

AVERAGE ANODE CHARACTERISTICS of Type 5653 are the same as those shown under Type 929

5819

MULTIPLIER PHOTOTUBE

10-STAGE, HEAD-ON TYPE WITH
1-11/16" SEMITRANSPARENT CATHODE AND S-11 RESPONSE

DATA

General:

Spectral Response	S-11	←
Wavelength of Maximum Response	4400 ± 500	angstroms ←
Cathode, Semitransparent:		
Shape	Circular	
Window:		
Area	2.2	sq. in. ←
Minimum diameter	1-11/16	in. ←
Index of refraction	1.51	
Direct Interelectrode Capacitances (Approx.):		
Anode to dynode No.10	4.2	μμf
Anode to all other electrodes	6.5	μμf
Maximum Overall Length	5-13/16"	←
Seated Length	4-7/8" ± 3/16"	
Maximum Diameter	2-15/16"	←
Mounting Position	Any	
Weight (Approx.)	5 oz	←
Bulb	T-16	
Base	Medium-Shell Diheptal 14-Pin (JETEC 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

DIRECTION OF LIGHT INTO END OF BULB

Pin 10 – Dynode No.10
Pin 11 – Anode
Pin 12 – No Connection
Pin 13 – Internal Connection–Do Not Use
Pin 14 – Cathode

Maximum Ratings, *Absolute Values:*

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	1250 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE (DC or Peak AC)	250 max.	volts ←
DYNODE-No.1 SUPPLY VOLTAGE (DC or Peak AC)	300 max.	volts
AVERAGE ANODE CURRENT*	0.75 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

* Averaged over any interval of 30 seconds maximum.

← Indicates a change.

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5819

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 = 1000 volts (except as noted)

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms.	–	20000	–	μamp/μwatt
Cathode radiant, at 4400 angstroms . . .	–	0.040	–	μamp/μwatt
Luminous:♦				
At 0 cps.	10	25	300	amp/lumen
With dynode No. 10 as output electrode†	–	15	–	amp/lumen
Cathode luminous:				
With tungsten light source▲	40	50	–	μamp/lumen
With blue light source⊕♦.	0.04	–	–	μamp
Current Amplification . . .	–	500000	–	
Equivalent Anode-Dark-Current Input⊕■	–	8.5×10^{-10}	2×10^{-9}	lumen
Equivalent Noise Input★ . .	–	7×10^{-12}	–	lumen
Dark Current to Any Electrode Except Anode (At 25°C)	–	–	0.75	μamp

With E = 750 volts (except as noted)

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms.	–	2000	–	μamp/μwatt
Cathode radiant, at 4400 angstroms . . .	–	0.040	–	μamp/μwatt
Luminous:♦				
At 0 cps.	–	2.5	–	amp/lumen
With dynode No. 10 as output electrode†	–	1.5	–	amp/lumen
Cathode luminous:				
With tungsten light source▲	40	50	–	μamp/lumen
With blue light source⊕♦.	0.04	–	–	μamp
Current Amplification . . .	–	50000	–	

♦,†,▲,⊕,♦,●,■,★: See next page.

→ indicates a change.

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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 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.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: 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 150 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 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, 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.

OPERATING CONSIDERATIONS

The *operating stability* of the 5819 is dependent on the magnitude of the anode current and its duration. When the 5819 is operated at high 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 5819 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum rated value of 0.75 milliampere is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 100 microamperes.

Electrostatic and/or *magnetic* shielding of the 5819 may be necessary.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-11 Response
is shown at the front of this Section

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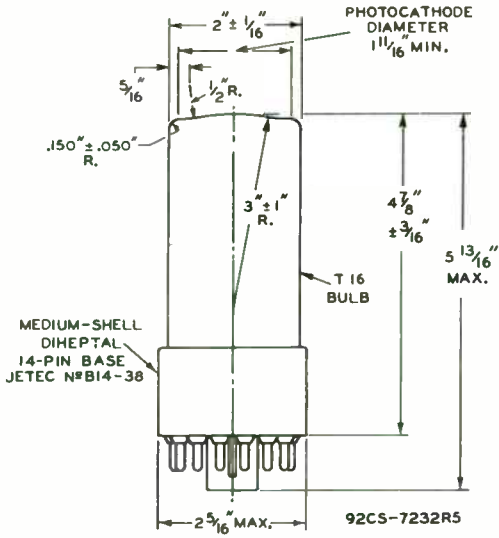
MULTIPLIER PHOTOTUBE



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

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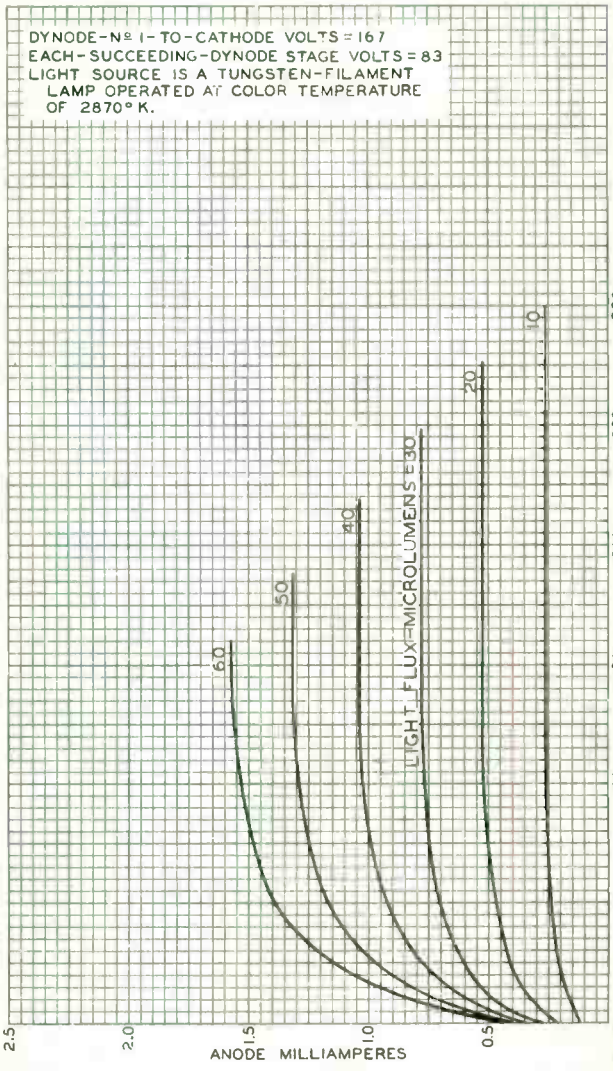
5819

AVERAGE ANODE CHARACTERISTICS



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5819

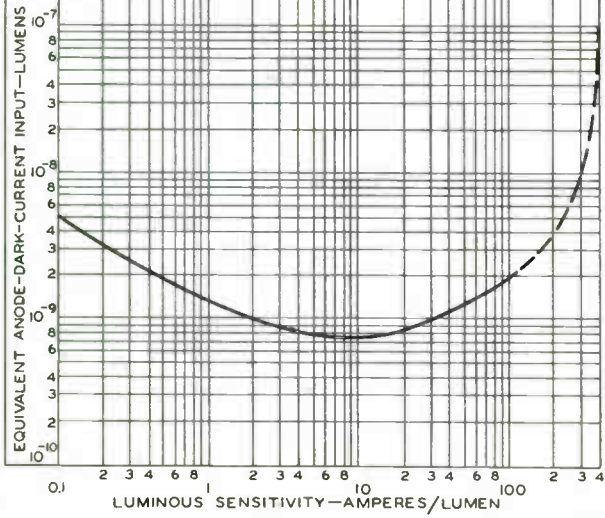
TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

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



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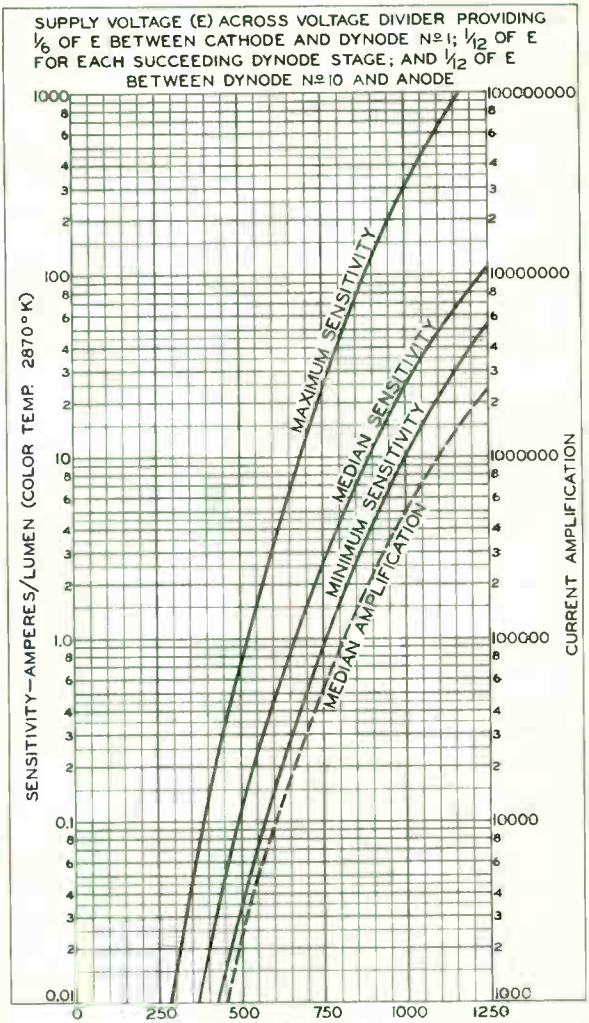
CHARACTERISTICS



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92CL-7258R4

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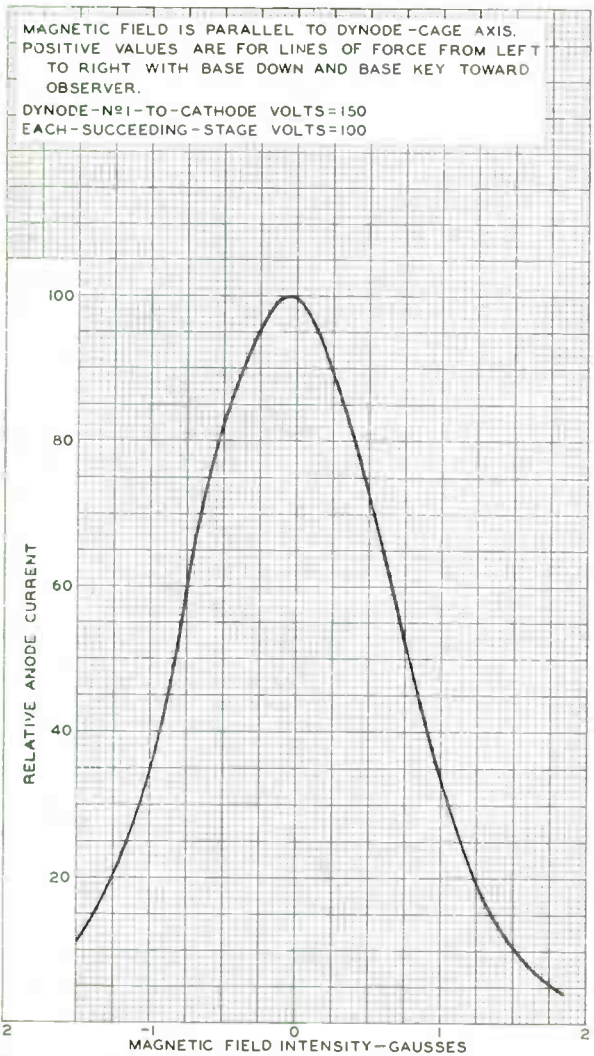
5819

EFFECT OF MAGNETIC FIELD ON ANODE CURRENT



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7839

5820

IMAGE ORTHICON

For outdoor and studio pickup

MAGNETIC FOCUS MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:
- Voltage . . . . . 6.3 ± 10% . . . . ac or dc volts
- Current . . . . . 0.6 . . . . . amp

Direct Interelectrode Capacitance:
- Anode to all other electrodes . . . . . 12 μμf

Photocathode, Semitransparent:
- Response . . . . . *See accompanying Spectral-Sensitivity-Characteristics curves*

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 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

■ See basing diagram on next page. ← Indicates a change.

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

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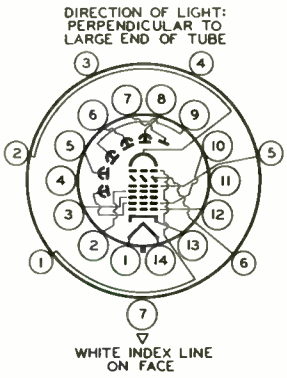
IMAGE ORTHICON

End Base. . . . Small-Shell Diheptal 14-Pin (JETEC 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 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

*: See next page.

5820

IMAGE ORTHICON

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
Anode Current (DC)	30	μa
Signal-Output Current (Peak to peak)	3 to 24	μa
Target-Temperature Range	35 to 45	°C
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current (Approx.)	35	
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil▲	75	gauss
Field Strength of Alignment Coil (Approx.)	0 to 3	gauss

* 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.

OPERATING CONSIDERATIONS

The *operating position* of the 5820 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.

When the equipment-design or operating conditions are such that the maximum temperature rating or maximum temperature difference as given under ***Maximum and Minimum 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

←Indicates a change.

5820

IMAGE ORTHICON

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 5820 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.

→ *Resolution* in excess of 500 lines at the center of the picture can be produced by the 5820. The Square-Wave Response Characteristics curves show the center square-wave amplitude response versus television line number for the 5820 when it is operated with the highlights at the knee of the light-transfer characteristic and at one lens stop above the knee and at a temperature of 35° C. The values of response plotted on the curves are those obtained after optimum adjustments are made.

To utilize the resolution capability of the 5820 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.

For very high illumination or for individual tubes with exceptionally high photocathode sensitivity, it may not be possible to stop the lens down far enough to reduce the high-light illumination on the photocathode to a value near the knee of the transfer characteristic. When such a condition is encountered, the use of a Wratten neutral filter selected to give the required reduction in illumination is recommended. Ordinarily, two filters--one having 10% transmission and the other 20%--will give sufficient choice. Such filters with lens-adapter rings can be obtained at a photographic-supply store.

→ Indicates a change.

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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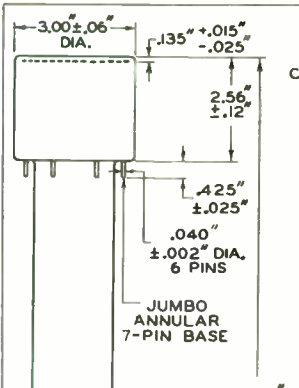
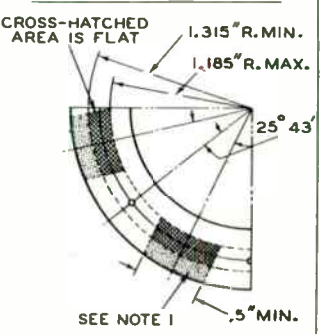
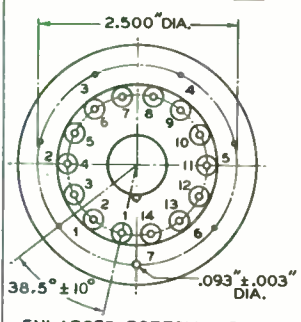
IMAGE ORTHICON



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.



ENLARGED BOTTOM VIEW

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

ELECTRON TUBE DIVISION
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RCA

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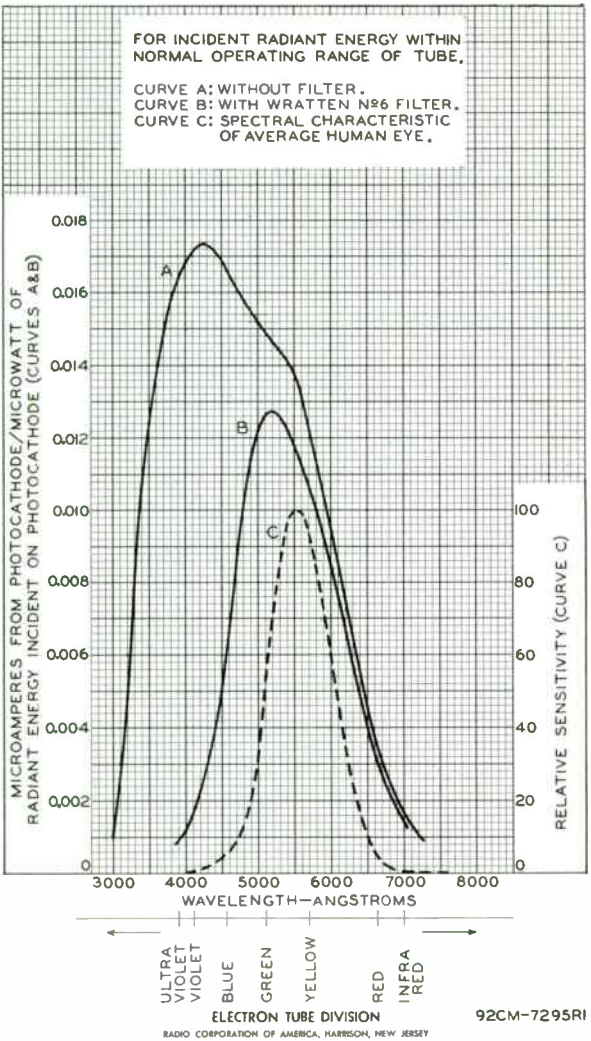
SPECTRAL-SENSITIVITY CHARACTERISTICS



ELECTRON TUBE DIVISION

92CM-7295RI

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

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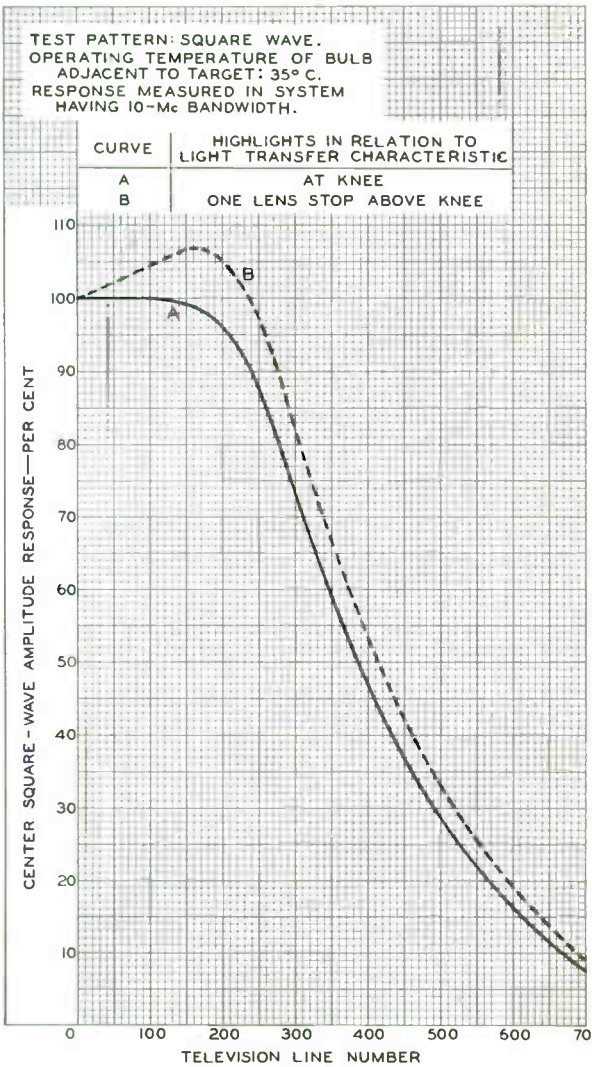
SQUARE-WAVE RESPONSE CHARACTERISTICS



5820

RCA

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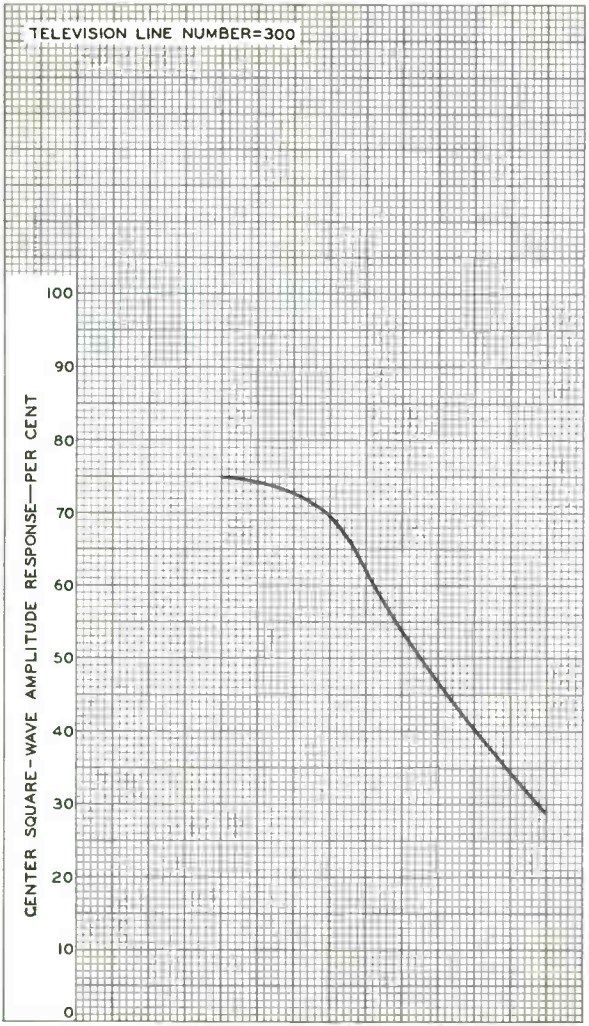
TEMPERATURE EFFECT ON SQUARE-WAVE RESPONSE



ELECTRON TUBE DIVISION 92CM-8272R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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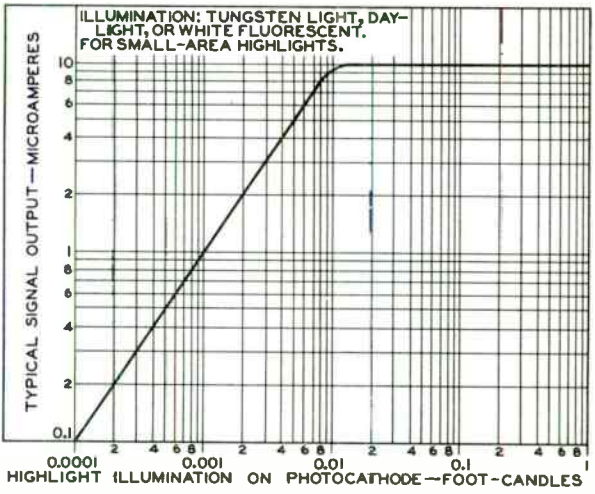
BASIC LIGHT-TRANSFER CHARACTERISTIC



6032

IMAGE-CONVERTER TUBE

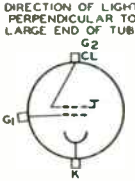
For use, in combination with suitable optical systems, in viewing a scene with infrared radiation

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

Termina' Connections *(See Dimensional Outline)*:



CL – Collector

G_2 – Grid No.2

G_1 – Grid No.1

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.

RCA

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 3/8" 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.

6032

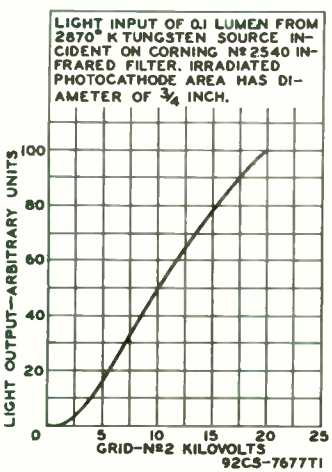
IMAGE-CONVERTER TUBE

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

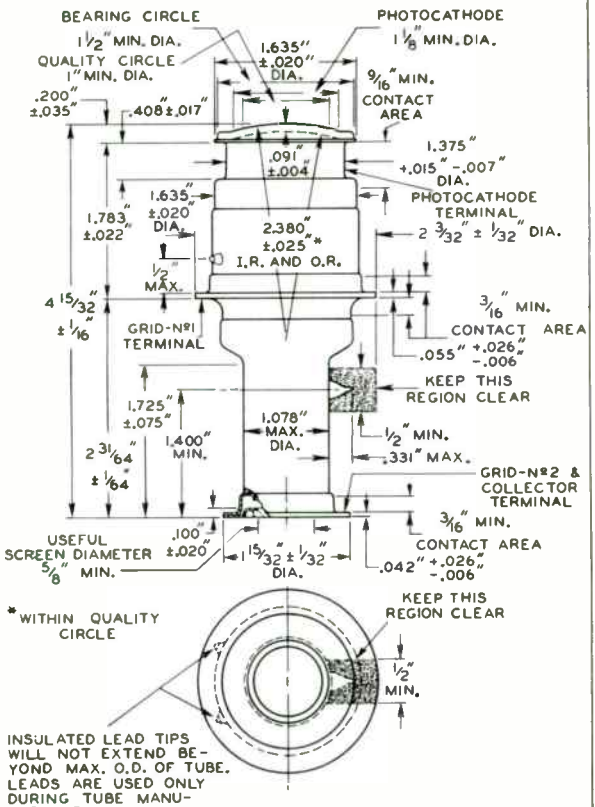
AVERAGE CHARACTERISTIC



RCA

6032

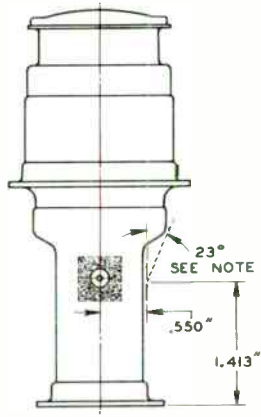
IMAGE-CONVERTER TUBE

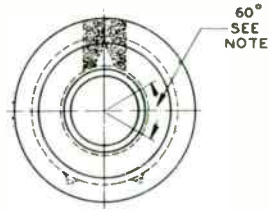


ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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

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

6032

RCA

6032

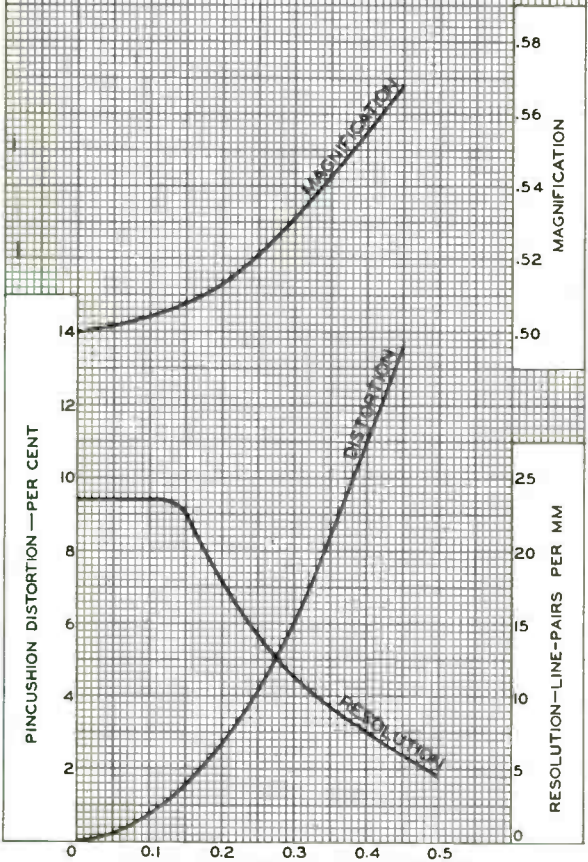
AVERAGE CHARACTERISTICS

PINCUSHION DISTORTION (PER CENT) $= \left(\frac{M_X}{M_C} - 1\right) \times 100$

WHERE

M_X = MAGNIFICATION AT DISTANCE "x" FROM CENTER OF PHOTOCATHODE

M_C = MAGNIFICATION AT CENTER OF PHOTOCATHODE



ELECTRON TUBE DIVISION

92CM-8624

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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.

6198-A

VIDICON

600-LINE RESOLUTION

For use in industrial applications

The 6198-A is an improved version of the 6198 and is unilaterally interchangeable with it.

DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3 ± 10%	ac or dc volts
Current	0.6	amp
Direct Interelectrode Capacitance:#		
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 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	6-1/4" ± 1/4"
Greatest Diameter	1.125" ± 0.010"
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	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 - Signal Electrode
Short Index Pin - Same as Pin 3

Maximum Ratings, *Absolute Values:*

SIGNAL-ELECTRODE VOLTAGE	100 max.	volts
GRID-No.4 & GRID-No.3 VOLTAGE	350 max.	volts
GRID-No.2 VOLTAGE	350 max.	volts

This capacitance, which effectively is the output impedance of the 6198-A, is increased by about 3 μμf 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.

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

TENTATIVE DATA

RCA

6198-A

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
FACEPLATE:		
Illumination (Highlight)	1000 max.	ft-c
Temperature.	60 max.	°C

Typical Operation and Characteristics:

For scanned area of 1/2" x 3/8"

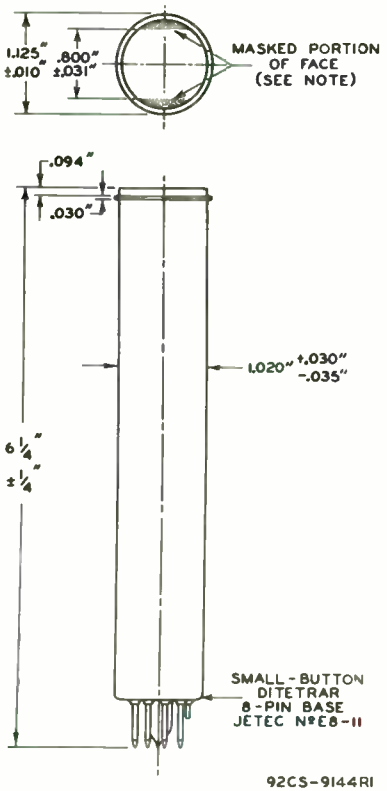
Faceplate Illumination (Highlight) .	10 to 20	ft-c
Signal-Electrode Voltage	10 to 70	volts
Grid-No.4 (Decelerator) & Grid-No.3 (Beam Focus) Voltage	250●● to 300	volts
Grid-No.2 (Accelerator) Voltage. . .	300	volts
Grid-No.1 Voltage for picture cutoff♦.	-45 to -100	volts
Highlight Signal-Output Current. . .	0.1 to 0.2	μa
Maximum Dark Current	0.02	μa
Uniform 2870° K Tungsten Illumination on Tube Face to Produce Signal-Output Current of 0.1 to 0.2 μa	3 to 10	ft-c
Average "Gamma" of Transfer Characteristic for Signal-Output Current between 0.02 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 Device.	40	gausses
Field Strength of Adjustable Alignment Coil	0 to 4	gausses

●● Definition, focus uniformity, and picture quality decrease with decreasing grid-No.3 and grid-No.4 voltage. In general, grid No.3 and grid No.4 should not be operated below 250 volts.

♦ With no blanking voltage on grid No.1.

* Measured with a high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc and determined primarily by the signal-output level of the vidicon and the noise generated in the input amplifier. 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.

6198-A
VIDICON



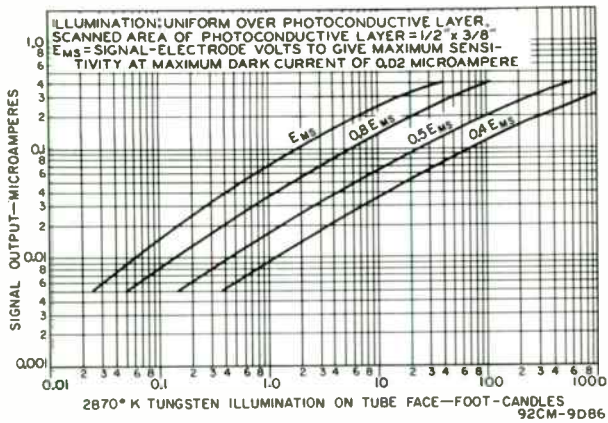
NOTE: STRAIGHT SIDES OF MASKED PORTIONS ARE PARALLEL TO THE PLANE PASSING THROUGH TUBE AXIS AND SHORT INDEX PIN.

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

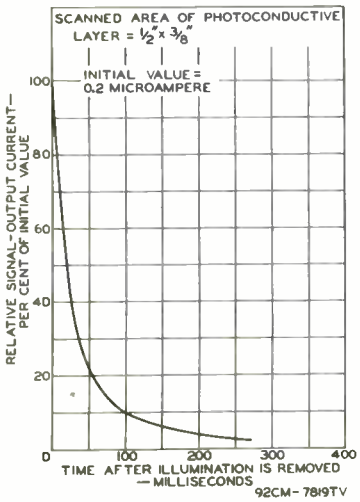
RCA

6198-A
VIDICON

TYPICAL LIGHT-TRANSFER CHARACTERISTICS



PERSISTENCE CHARACTERISTIC



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

RCA

6198-A

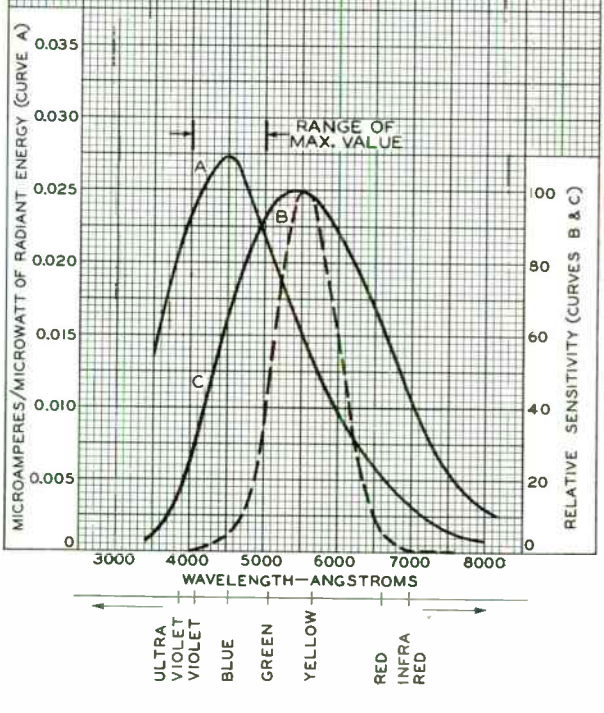
SPECTRAL SENSITIVITY CHARACTERISTICS

CURVE A: FOR EQUAL VALUES OF SIGNAL—OUTPUT CURRENT AT ALL WAVELENGTHS.

SIGNAL—OUTPUT MICROAMPERES FROM SCANNED AREA OF $\frac{1}{2}$" x $\frac{3}{8}$" = 0.02

CURVE B: SPECTRAL CHARACTERISTIC OF AVERAGE HUMAN EYE.

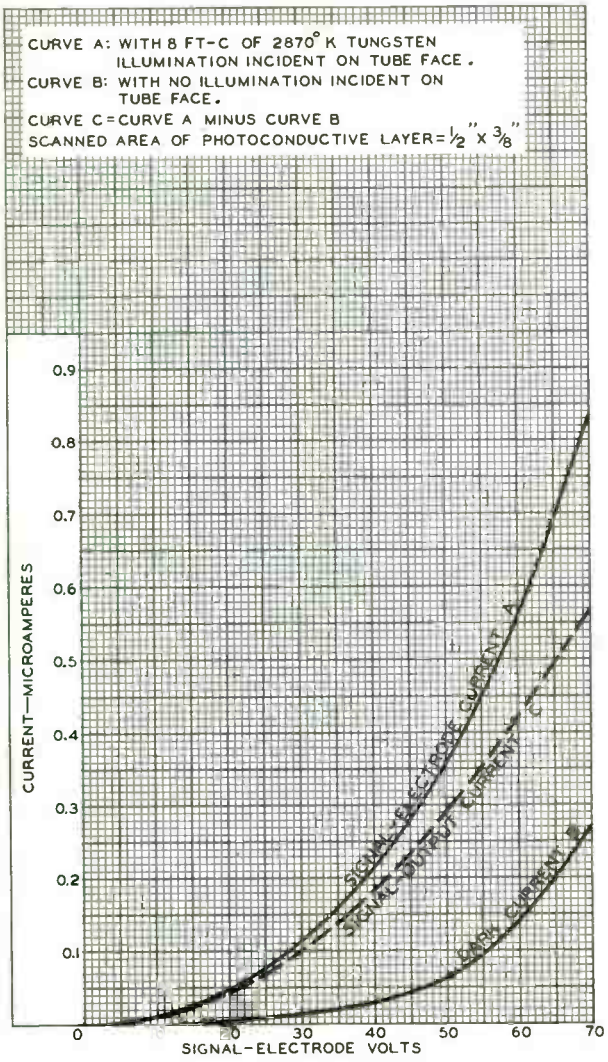
CURVE C: FOR EQUAL VALUES OF SIGNAL-OUTPUT CURRENT WITH RADIANT FLUX FROM TUNGSTEN SOURCE AT 2870° K.



RCA

6198-A

TYPICAL CHARACTERISTICS



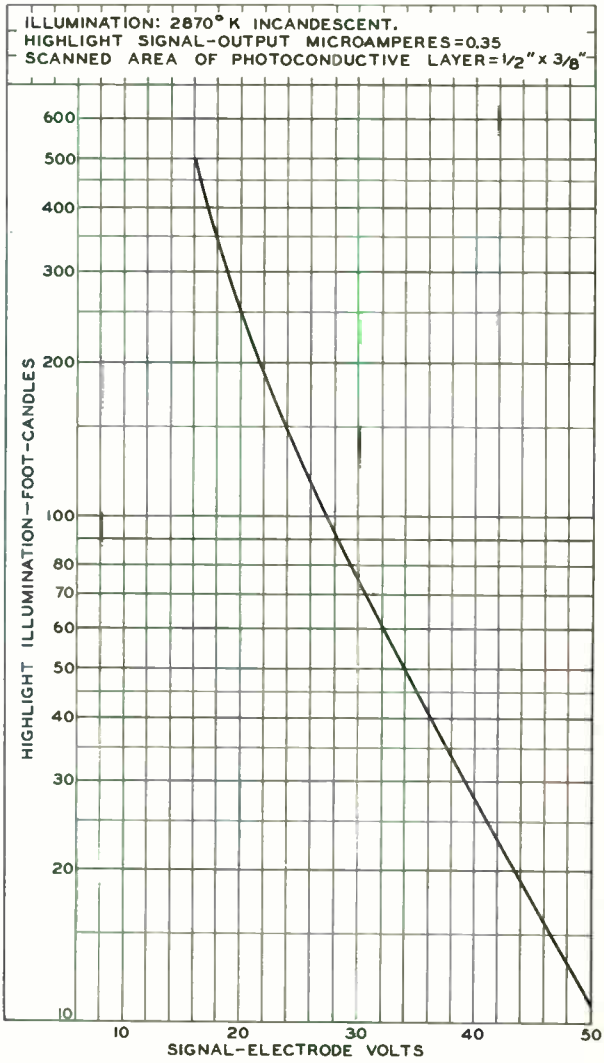
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7818

RCA

6198-A

TYPICAL CHARACTERISTIC



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

92CM-8118

OBSOLETE

6198

6198
VIDICON

600-LINE RESOLUTION

For use in industrial applications

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 . . . . . 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 (Signal Electrode)
Short Index Pin – Same as Pin 3

Maximum Ratings, *Absolute Values:*

TARGET (SIGNAL-ELECTRODE) VOLTAGE.	100 max.	volts ←
GRID-No.4 & GRID-No.3 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
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	10 max.	volts

▲ See next page.

← Indicates a change.

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

6198

VIDICON

FACEPLATE:

→ Illumination	1000 max.	ft-c
Temperature	60 max.	°C

→ Typical Operation and Characteristics:

For scanned area of 1/2" x 3/8"

Faceplate Illumination (Highlight)	10 to 20	ft-c
Target (Signal-Electrode) Voltage	10 to 70	volts
Grid-No.4 (Decelerator) & Grid-No.3 (Beam-Focus) Voltage	250●● to 300	volts
Grid-No.2 (Accelerator) Voltage	300	volts
Grid-No.1 Voltage for picture cutoff♦	-45 to -100	volts
Highlight Signal-Output Current#	0.1 to 0.2	μa
Maximum Dark Current	0.02	μa
Uniform 2870° K Tungsten Illumination on Tube Face to Produce Signal-Output Current of 0.1 to 0.2 μa	3 to 10	ft-c
Average "Gamma" of Transfer Characteristic for Signal-Output Current between 0.02 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 Device	40	gauss
Field Strength of Adjustable Alignment Coil	0 to 4	gauss

\# Defined as the component of the target current after the dark-current component has been subtracted.

●● Definition, focus uniformity, and picture quality decrease with decreasing grid-No.3 and grid-No.4 voltage. In general, grid No.3 and grid No.4 should not be operated below 250 volts.

♦ With no blanking voltage on grid No.1.

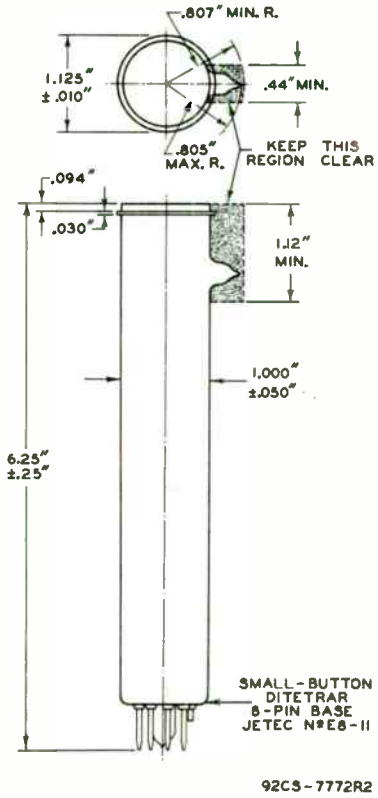
* Measured with a high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc.

▲ This capacitance, which effectively is the output impedance of the 6198, 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.

→ Indicates a change.

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

6198
VIDICON



ELECTRON TUBE DIVISION
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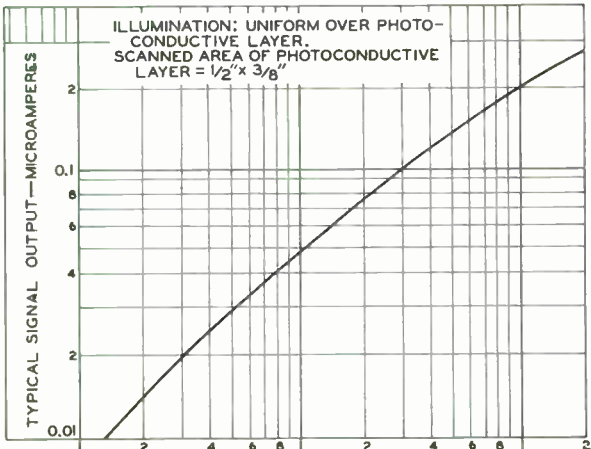
6198

RCA

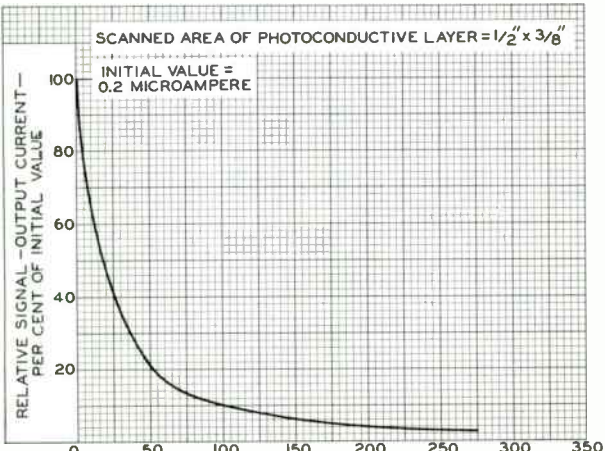
6198

TYPICAL SIGNAL OUTPUT



92CS-7820RI

PERSISTENCE CHARACTERISTIC



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

92CS-7819RI

Obsolete

RCA

6198

6198

SPECTRAL-SENSITIVITY CHARACTERISTICS

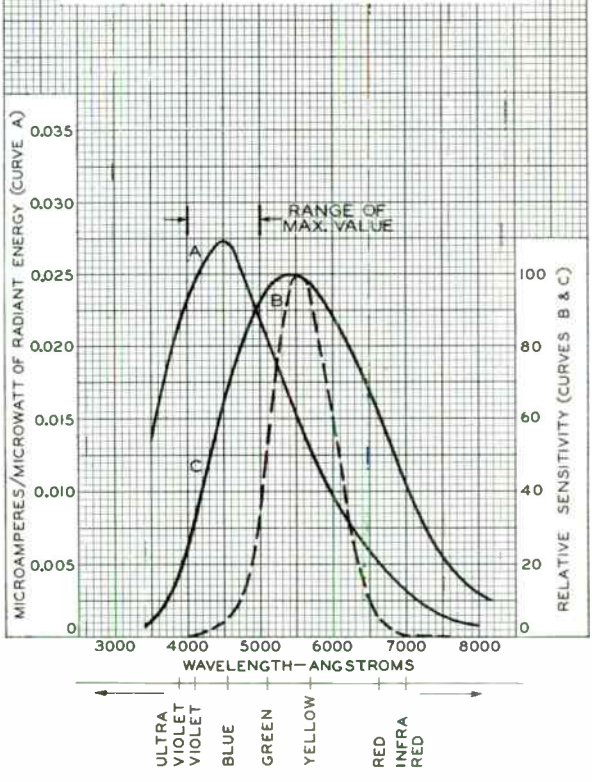
CURVE A: FOR EQUAL VALUES OF SIGNAL-OUTPUT CURRENT AT ALL WAVELENGTHS.

SIGNAL-OUTPUT MICROAMPERES FROM SCANNED AREA OF $\frac{1}{2}$" × $\frac{3}{8}$" = 0.02

DARK CURRENT (MICROAMPERES) = 0.02

CURVE B: SPECTRAL CHARACTERISTIC OF AVERAGE HUMAN EYE.

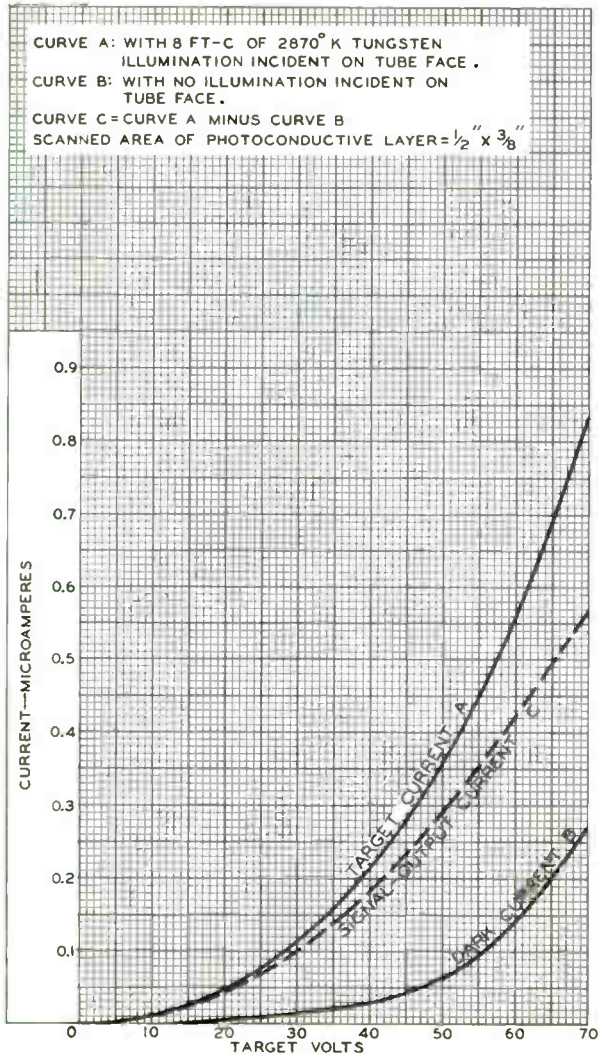
CURVE C: FOR EQUAL VALUES OF SIGNAL-OUTPUT CURRENT WITH RADIANT FLUX FROM TUNGSTEN SOURCE AT 2870° K.



RCA

6198

TYPICAL CHARACTERISTICS



6199

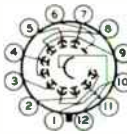
MULTIPLIER PHOTOTUBE

10-STAGE, HEAD-ON TYPE WITH
1.24" SEMITRANSPARENT CATHODE AND S-11 RESPONSE

DATA

General:

Spectral Response	S-11	
Wavelength of Maximum Response	4400 ± 500 angstroms	
Cathode, Semitransparent:		
Shape	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	4-9/16"	
Seated Length	3-7/8" ± 3/16"	
Maximum Diameter	1-9/16"	
Mounting Position	Any	
Weight (Approx.)	2 oz	
Bulb	T-12	
Base	Small-Shell Duodecal 12-Pin (JETEC No.B12-43), Non-hygroscopic	
Basing Designation for BOTTOM VIEW	12AE	



DIRECTION OF LIGHT: INTO END OF BULB

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

Maximum Ratings, *Absolute Values:*

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	1250 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE (DC or Peak AC)	250 max.	volts
DYNODE-No.1 SUPPLY VOLTAGE (DC or Peak AC)	300 max.	volts
AVERAGE ANODE CURRENT*	0.75 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

* Averaged over any interval of 30 seconds maximum.

← Indicates a change.

TUBE DIVISION
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RCA

6199

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 = 1000 volts (except as noted)

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms. . .	–	21600	–	μamp/μwatt
Cathode radiant, at 4400 angstroms. . .	–	0.036	–	μamp/μwatt
Luminous:♦				
At 0 cps.	10	27	300	amp/lumen
With dynode No.10 as output electrode†.	–	16	–	amp/lumen
Cathode luminous:				
With tungsten light source▲ . .	30	45	–	μamp/lumen
With blue light source●♦.	0.028	–	–	μamp
Current Amplification .	–	600000	–	
Equivalent Anode-Dark-Current Input■ . . .	–	8×10^{-10}	2.5×10^{-9}	lumen
Equivalent Noise Input★	–	4×10^{-12}	–	lumen
Dark Current to Any Electrode Except Anode (At 25°C) . . .	–	–	0.75	μamp

With E = 750 volts (except as noted)

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms. . .	–	2160	–	μamp/μwatt
Cathode radiant, at 4400 angstroms. . .	–	0.036	–	μamp/μwatt
Luminous:♦				
At 0 cps.	–	2.7	–	amp/lumen
With dynode No.10 as output electrode†. . . .	–	1.6	–	amp/lumen
Cathode luminous:				
With tungsten light source▲ . .	30	45	–	μamp/lumen
With blue light source●♦.	0.04	–	–	μamp
Current Amplification .	–	60000	–	

♦,†,▲,●,♦,●,■,★: See next page.

→ Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6199

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 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.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: 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 150 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 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, 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.

OPERATING CONSIDERATIONS

The *operating stability* of the 6199 is dependent on the magnitude of the anode current and its duration. When the 6199 is operated at high 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 6199 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum rated value of 0.75 milliampere is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 100 microamperes.

Electrostatic and/or *magnetic shielding* of the 6199 may be necessary.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-11 Response
is shown at the front of this Section

← Indicates a change.

TUBE DIVISION
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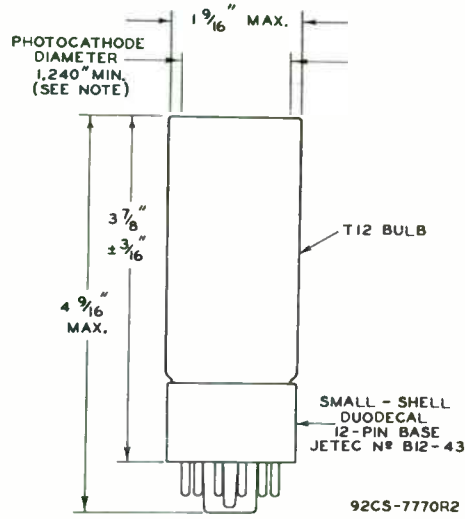
RCA

6199

MULTIPLIER PHOTOTUBE



NOTE: DEVIATION FROM FLATNESS WITHIN THE 1.240"-DIAMETER AREA WILL NOT EXCEED 0.010" FROM PEAK TO VALLEY.

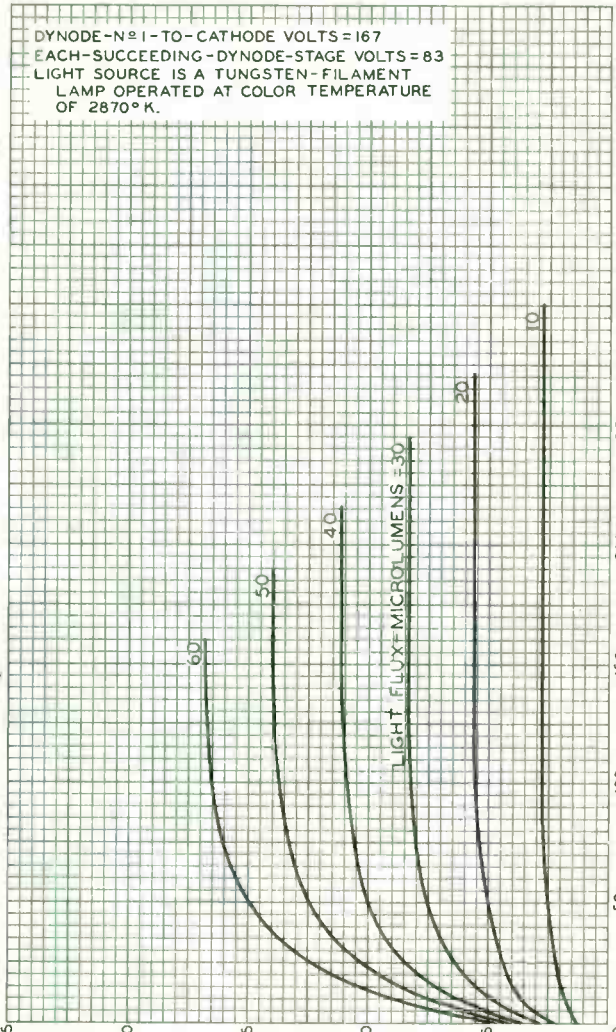
℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

RCA

6199

AVERAGE ANODE CHARACTERISTICS



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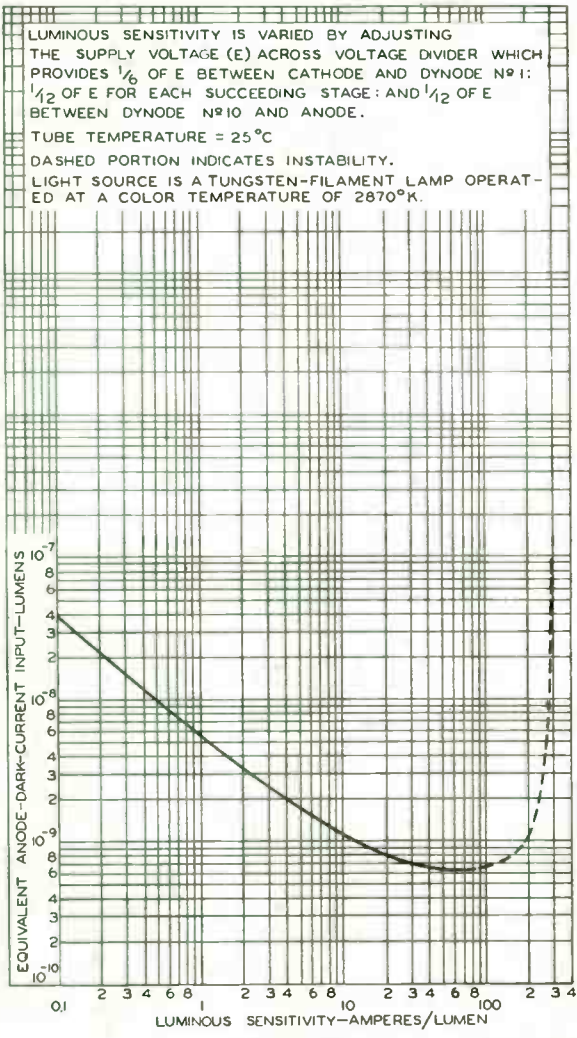
92CM-7255R4

RCA

6199

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



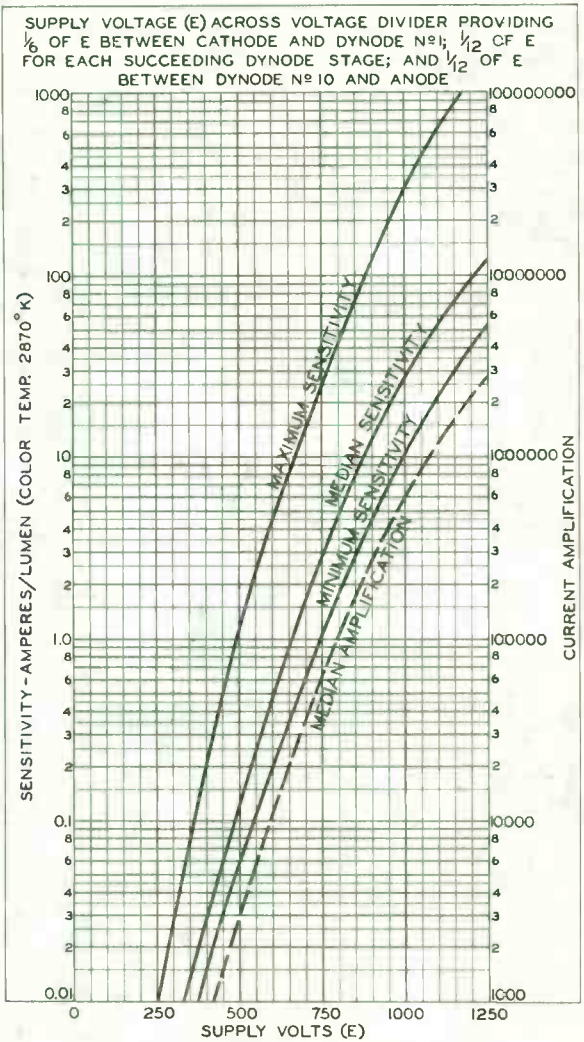
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7814R2

RCA

6199

CHARACTERISTICS



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CL-7812RI

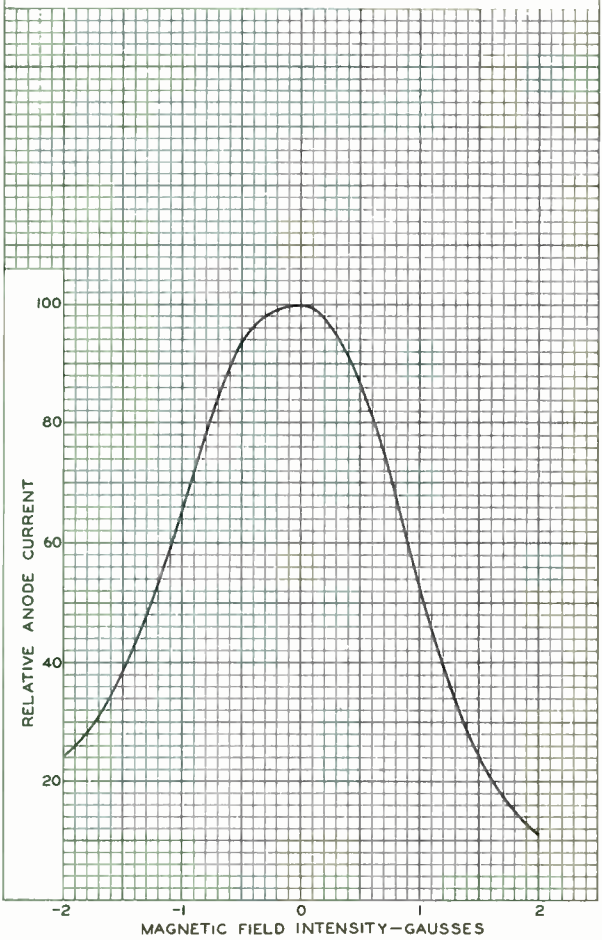
6199

RCA

6199

EFFECT OF MAGNETIC FIELD ON ANODE CURRENT

MAGNETIC FIELD IS PARALLEL TO DYNODE-CAGE AXIS
POSITIVE VALUES ARE FOR LINES OF FORCE FROM LEFT TO RIGHT WITH BASE DOWN AND BASE KEY TOWARD OBSERVER
VOLTS PER STAGE = 100



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7813

RCA

6323

MULTIPLIER PHOTOTUBE

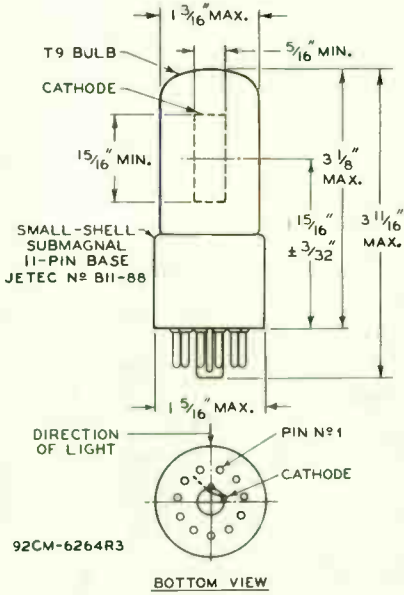
9-STAGE TYPE WITH S-4 RESPONSE

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	5	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	



BOTTOM VIEW

℄ 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

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
Pin 7 – Cathode
Pin 8 – Heater
Flange – Target (Signal Electrode)
Short Index Pin – Internal Connection—Do Not Use

DIRECTION OF LIGHT: INTO FACE END OF TUBE

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

6326

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	gauss
Field Strength of Adjustable Alignment Coil□	0 to 4	gauss

♦,▲,**,†,*,⊕,●,#,○,□: See next page. → Indicates a change.

6326
VIDICON

♦ 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.

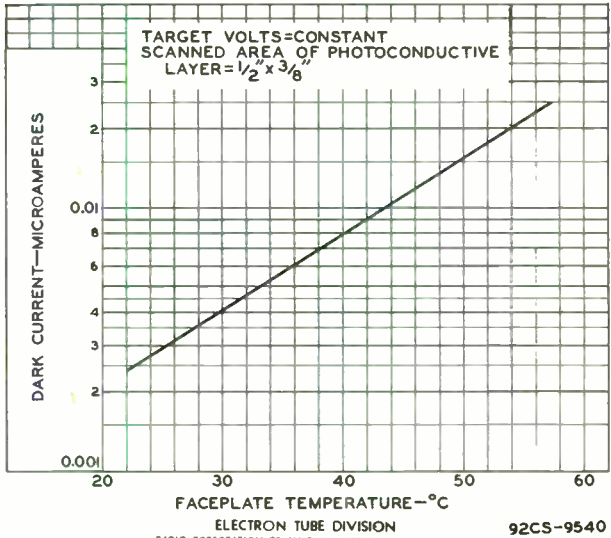
Defined as the component of the target (signal-electrode) current after the dark-current component has been subtracted.

○ 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



92CS-9540

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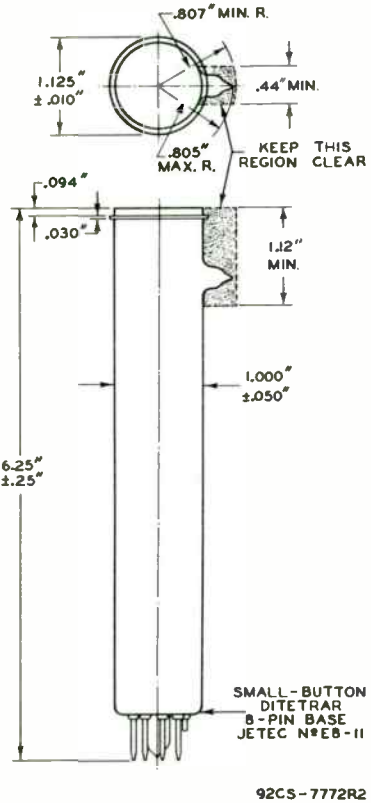
6326
VIDICON



ELECTRON TUBE DIVISION
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6326
SPECTRAL-SENSITIVITY CHARACTERISTICS

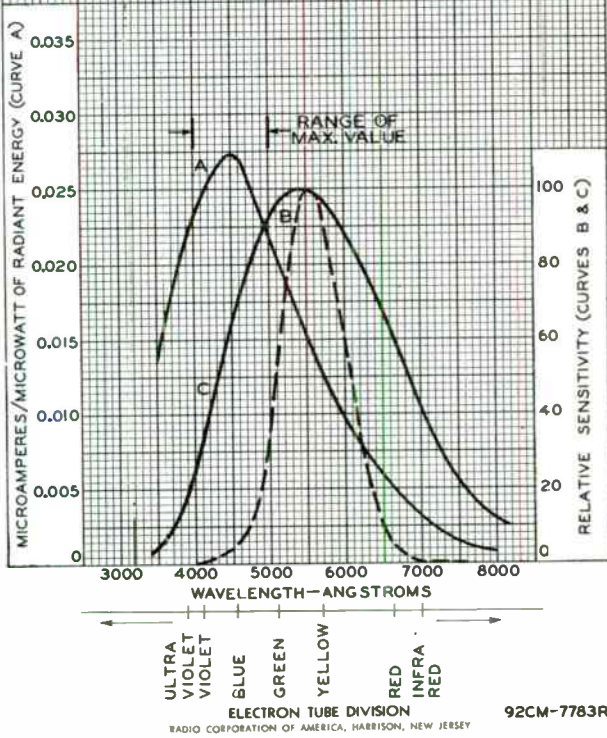
CURVE A: FOR EQUAL VALUES OF SIGNAL—OUTPUT CURRENT AT ALL WAVELENGTHS.

SIGNAL—OUTPUT MICROAMPERES FROM SCANNED AREA OF $\frac{1}{2}$" x $\frac{3}{8}$" = 0.02

DARK CURRENT (MICROAMPERES) = 0.02

CURVE B: SPECTRAL CHARACTERISTIC OF AVERAGE HUMAN EYE.

CURVE C: FOR EQUAL VALUES OF SIGNAL-OUTPUT CURRENT WITH RADIANT FLUX FROM TUNGSTEN SOURCE AT 2870° K.



92CM-7783R2

ELECTRON TUBE DIVISION

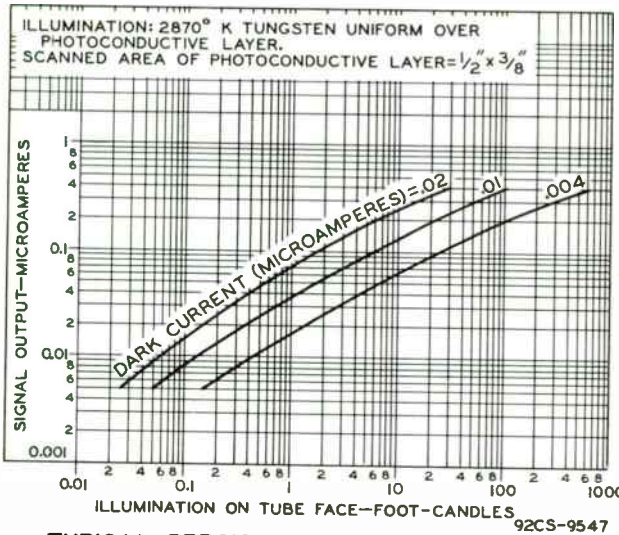
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6326

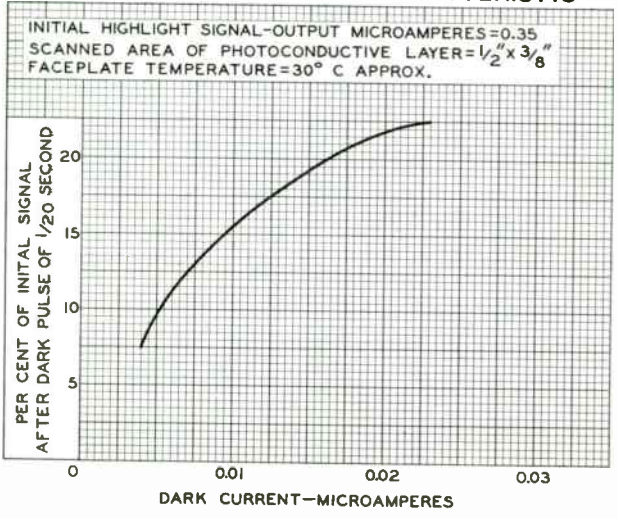
RCA

6326

TYPICAL LIGHT-TRANSFER CHARACTERISTICS



TYPICAL PERSISTENCE CHARACTERISTIC



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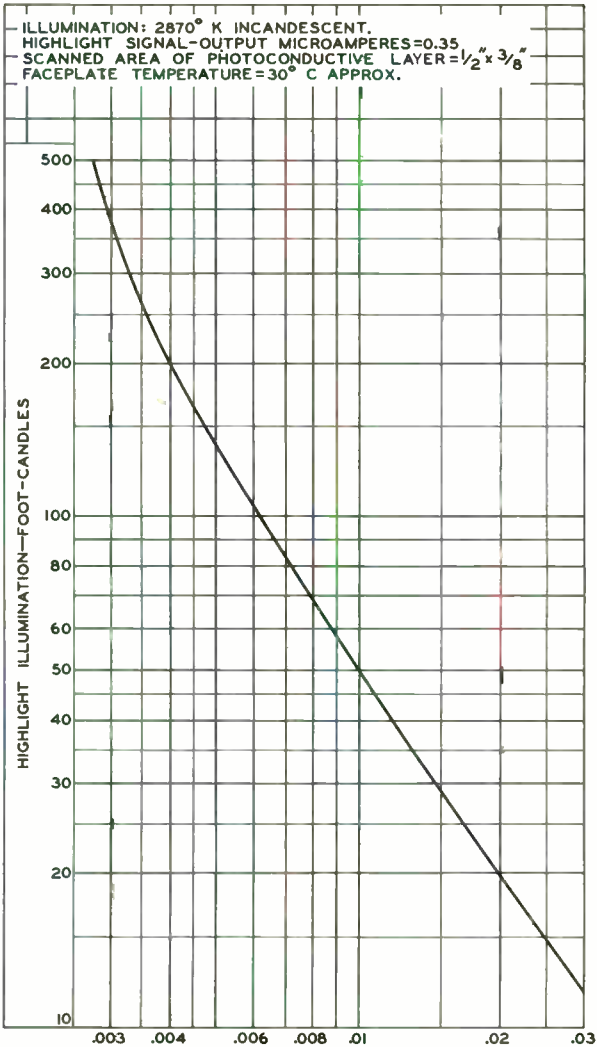
92CS-9550

RCA

6326

TYPICAL CHARACTERISTIC



ELECTRON TUBE DIVISION

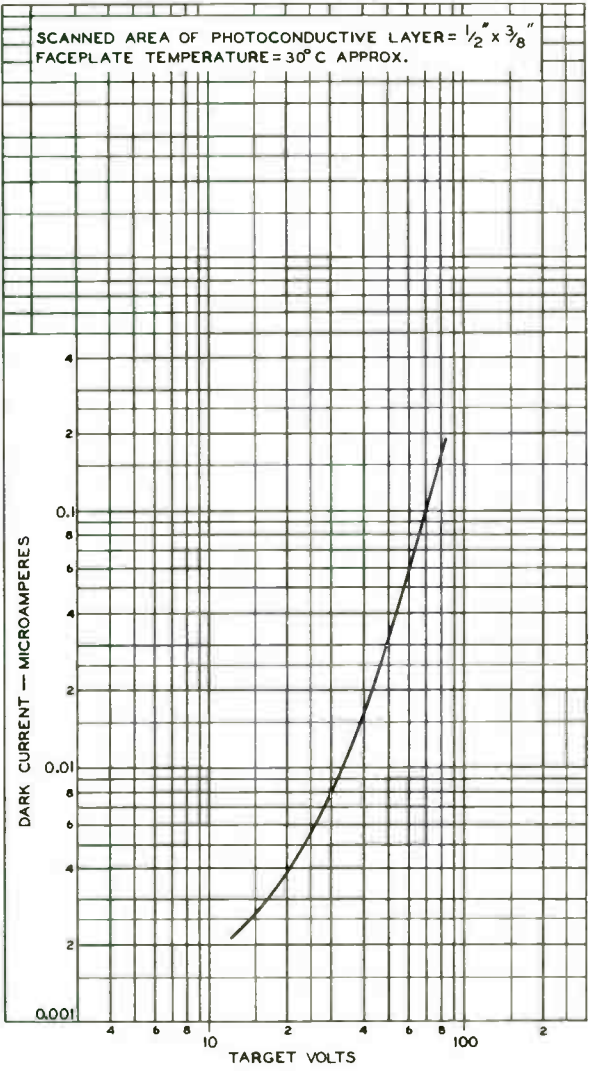
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9545

6326

6326

TYPICAL DARK-CURRENT CHARACTERISTIC



92CM-9541

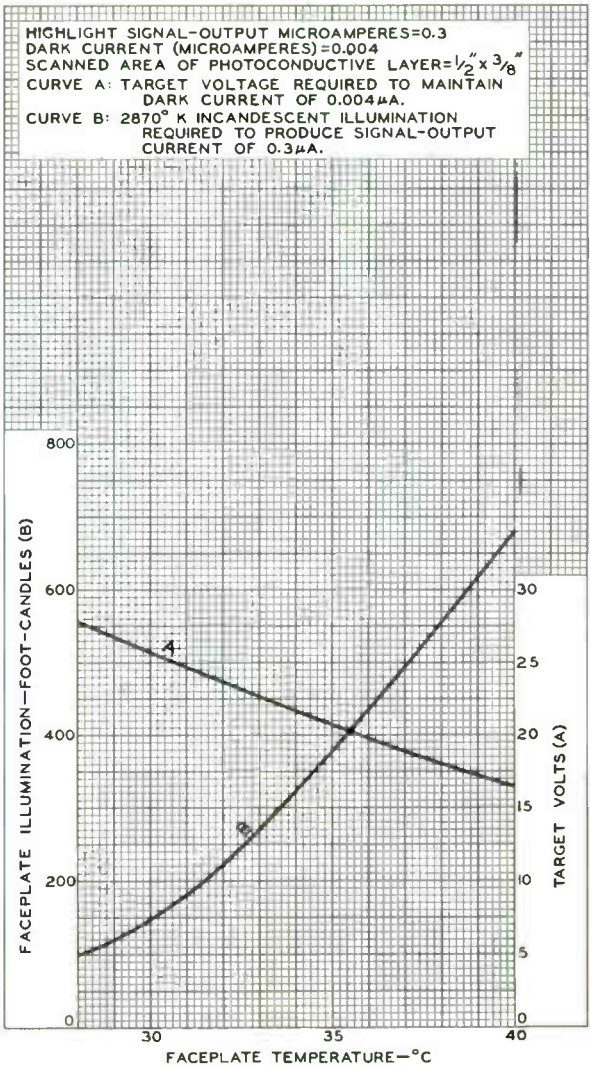
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6326

TYPICAL CHARACTERISTICS

HIGHLIGHT SIGNAL-OUTPUT MICROAMPERES=0.3
DARK CURRENT (MICROAMPERES)=0.004
SCANNED AREA OF PHOTOCONDUCTIVE LAYER=$\frac{1}{2}$" x $\frac{3}{8}$"
CURVE A: TARGET VOLTAGE REQUIRED TO MAINTAIN DARK CURRENT OF 0.004μA.
CURVE B: 2870° K INCANDESCENT ILLUMINATION REQUIRED TO PRODUCE SIGNAL-OUTPUT CURRENT OF 0.3μA.



6326-A
VIDICON

600-LINE RESOLUTION
For live pickup
with color or black-and-white TV cameras

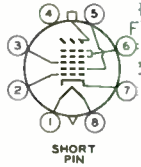
The 6326-A is an improved version of the 6326 and is unilaterally interchangeable with it.

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 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	6.25" ± 0.25"
Greatest Diameter	1.125" ± 0.010"
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
Pin 7 - Cathode
Pin 8 - Heater
Flange - Target (Signal Electrode)
Short Index Pin—Internal Connection—Do Not Use



DIRECTION OF LIGHT:
INTO FACE END OF TUBE

♦: See next page.

← Indicates a change.

RCA

6326-A
VIDICON

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
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	0.12 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:		
Constant highlight, for pickup from live scenes	2 to 5	ft-c
Average highlight▲, for pickup from film	50 to 300	ft-c
Maximum Target (Signal-Electrode) Voltage required to produce dark current of 0.1 μa in any tube**	100	volts
Target (Signal-Electrode) Voltage:†		
For pickup from live scenes	60 to 80	volts
For pickup from film	20 to 40	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 live scenes	0.1	μa
For pickup from film	0.004	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

♦,▲,■,†,*,●,●,#,○: See next page. → Indicates a change.

RADIO CORPORATION of AMERICA, HARRISON, NEW JERSEY

6326-A
VIDICON

Field Strength at Center of Focusing Coil (Approx.)	40	gauss
Field Strength of Adjustable Alignment Coil□	0 to 4	gauss

♦ This capacitance, which effectively is the output impedance of the 6326-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.

▲ Averaged over the time of one TV frame.

** The target (signal-electrode) voltage for each 6326-A 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.

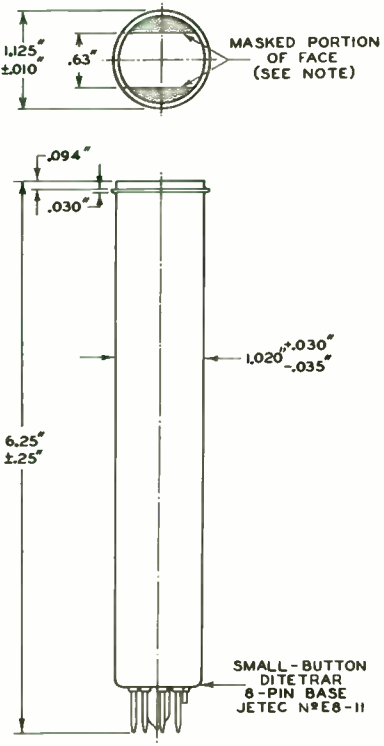
● With no blanking voltage on grid No.1.

Defines 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.

6326-A
VIDICON



NOTE: STRAIGHT SIDES OF MASKED PORTIONS ARE PARALLEL TO THE PLANE PASSING THROUGH TUBE AXIS AND SHORT INDEX PIN.

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

RCA

6326-A

SPECTRAL-SENSITIVITY CHARACTERISTICS

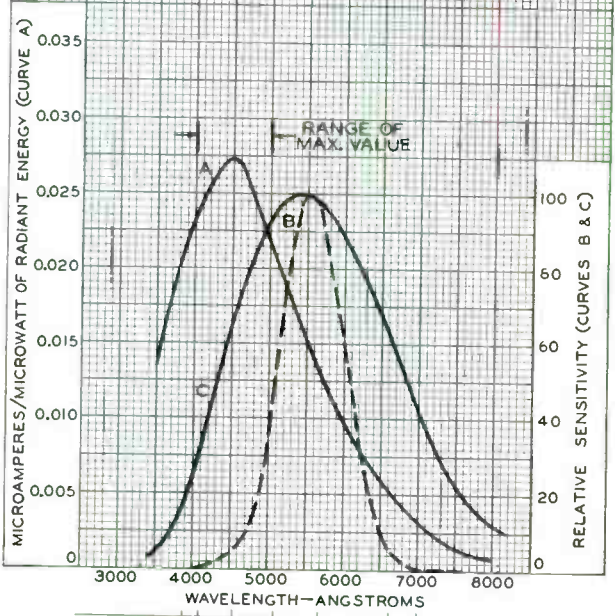
CURVE A: FOR EQUAL VALUES OF SIGNAL-OUTPUT CURRENT AT ALL WAVELENGTHS.

SIGNAL-OUTPUT MICROAMPERES FROM SCANNED AREA OF $\frac{1}{2}$" x $\frac{3}{8}$" = 0.02

DARK CURRENT (MICROAMPERES) = 0.02

CURVE B: SPECTRAL CHARACTERISTIC OF AVERAGE HUMAN EYE.

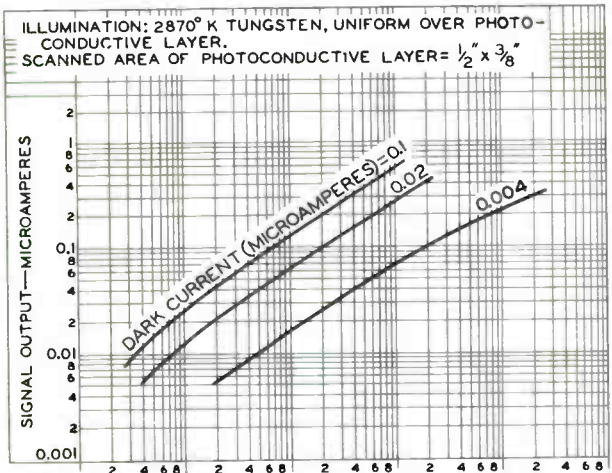
CURVE C: FOR EQUAL VALUES OF SIGNAL-OUTPUT CURRENT WITH RADIANT FLUX FROM TUNGSTEN SOURCE AT 2870° K.



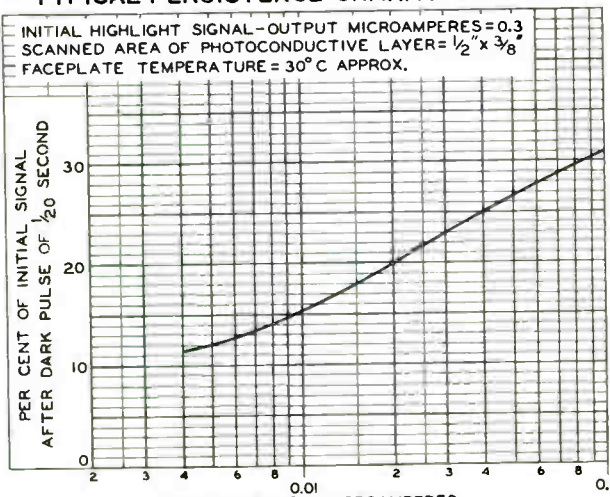
RCA

6326-A

TYPICAL LIGHT-TRANSFER CHARACTERISTICS



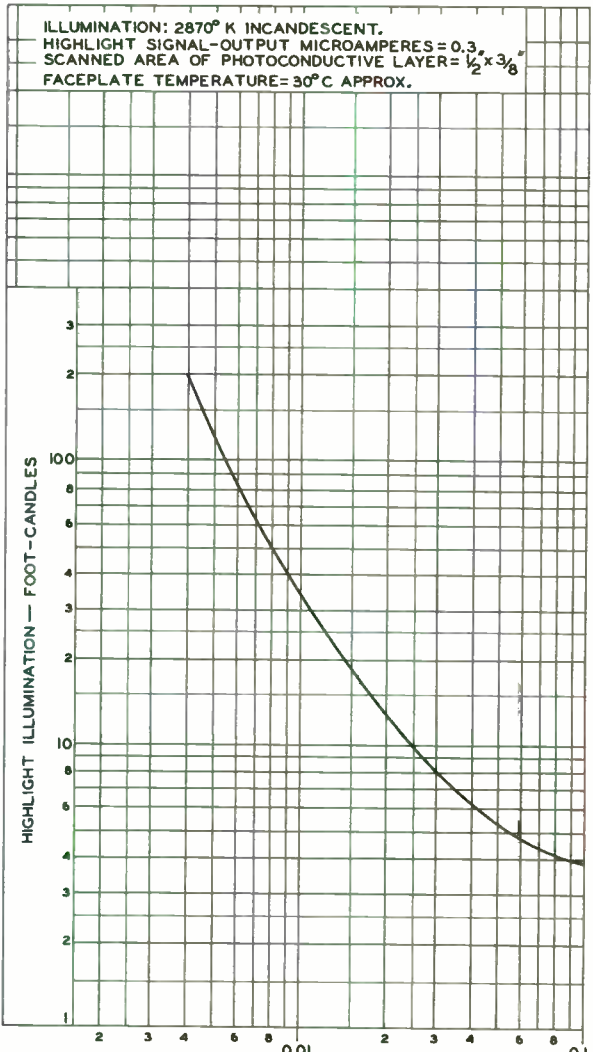
TYPICAL PERSISTENCE CHARACTERISTIC



RCA

6326-A

TYPICAL CHARACTERISTIC



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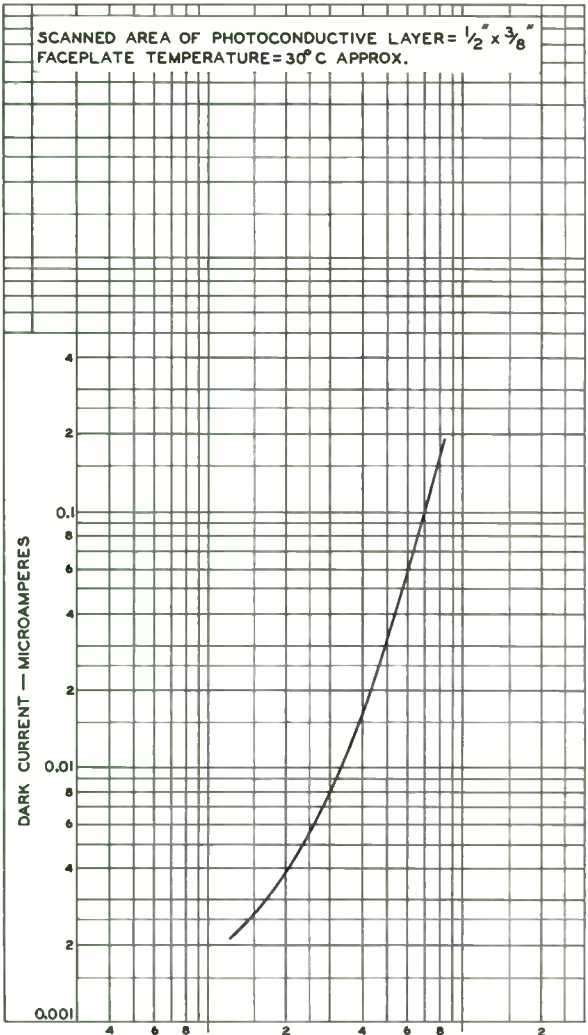
92CM-9544

6326-A

6326-A

TYPICAL DARK-CURRENT CHARACTERISTIC



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

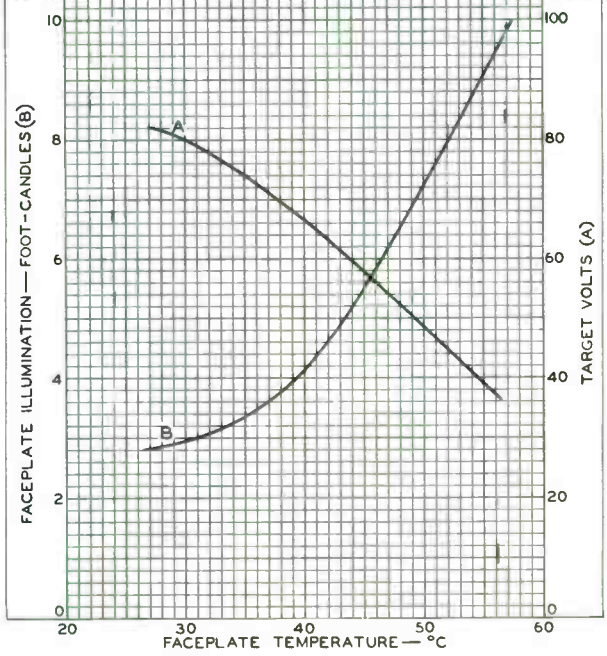
92CM-9541

RCA

6326-A

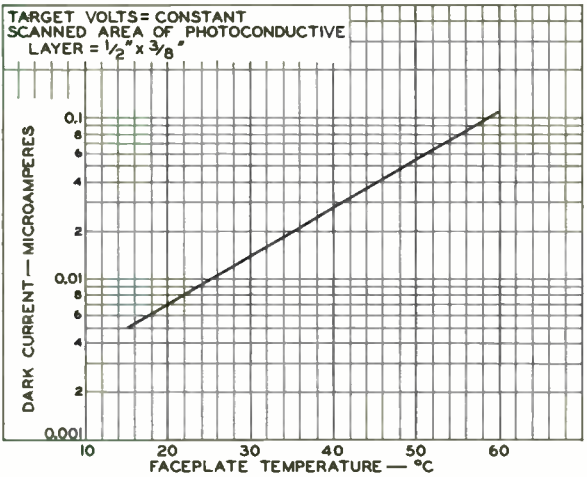
TYPICAL CHARACTERISTICS

HIGHLIGHT SIGNAL-OUTPUT MICROAMPERES = 0.3
DARK CURRENT (MICROAMPERES) = 0.1
SCANNED AREA OF PHOTOCONDUCTIVE LAYER = $\frac{1}{2}$" x $\frac{3}{8}$"
CURVE A: TARGET VOLTAGE REQUIRED TO MAINTAIN DARK CURRENT OF 0.1 μA.
CURVE B: 2870° K INCANDESCENT ILLUMINATION REQUIRED TO PRODUCE SIGNAL-OUTPUT CURRENT OF 0.3 μA.



6326-A

TYPICAL CHARACTERISTIC



92CS-9539

6328

MULTIPLIER PHOTOTUBE

9-STAGE TYPE WITH S-4 RESPONSE

For ac automobile-headlight-control service

DATA

General:

Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 angstroms
Cathode:	
Minimum projected length*	0.93"
Minimum projected width*	0.31"
Direct Interelectrode Capacitances:	
Anode to dynode No.9	4.2 μμf
Anode to all other electrodes	5.5 μμf
Maximum Overall Length	3.12"
Maximum Seated Length.*	2.69"
Length from Base Seat to Center of Useful Cathode Area	1.56" ± 0.09"
Maximum Diameter	1.31"
Operating Position	Any
Weight (Approx.)	1.6 oz ←
Bulb	T9
Base	Small-Shell Neosubmagnal 11-Pin (JETEC No.B11-104), 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 – Photo-cathode

Maximum Ratings, *Absolute Values:*

ANODE-SUPPLY VOLTAGE (Peak AC or DC)	1250 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.9 AND ANODE (Peak AC or DC)	250 max.	volts
AVERAGE ANODE CURRENT[O]	0.1 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

Characteristics Range Values for Equipment Design: ←

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 dc

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4000 angstroms	–	35000	–	μa/μW

*,O: See next page. ← Indicates a change.

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

6328

MULTIPLIER PHOTOTUBE

	Min.	Median	Max.	
Luminous:▲				
At 0 cps	–	35	–	amp/lumen
At 100 Mc	–	33	–	amp/lumen
Dark Current, Any Electrode Except Anode at 25° C	–	–	0.75	μa

With E = adjustable ac voltage

	Min.	Median	Max.	
Anode-to-Cathode Voltage (RMS)#	525	750	990	volts
Anode Dark Current at 25° C♦	–	–	0.1	μa

* On plane perpendicular to the indicated direction of incident light.

○ Averaged over any interval of 30 seconds maximum.

▲ For conditions where light source is a tungsten-filament lamp operated at a color temperature of 2870° K; a light input of 10 microlumens is used; and the load resistor has a value of 0.01 megohm.

\# For conditions where the light flux from a tungsten-filament lamp operated at a color temperature of 2870° K is transmitted through a filter (Corning No.2418 having an effective transmission of luminous flux of 5%) onto the photocathode. The value of light flux incident on the filter is 10 microlumens and the load resistor is 0.01 megohm. Supply voltage (E) is adjusted to give an anode current of 8 microamperes.

♦ For conditions same as (#) except no radiant flux on photocathode.

OPERATING CONSIDERATIONS

The *operating stability* of the 6328 is dependent on the magnitude of the anode current and its duration. When the 6328 is operated at high 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 6328 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum-rated value of 0.1 milliampere is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 10 microamperes.

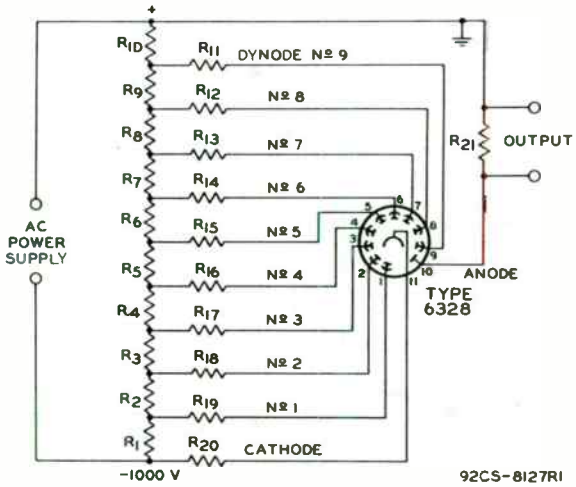
A recommended design of voltage-divider network for use with the 6328 to provide stable operation and long tube life is shown in the accompanying circuit. This design provides linear operation within the range normally required for headlight control. At higher light levels, the network design limits the tube output to a safe value. The indicated design values provide headlight-control operation for an anode current in the range between 5 and 10 microamperes.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-4 Response is shown at the front of this Section

6328

MULTIPLIER PHOTOTUBE

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

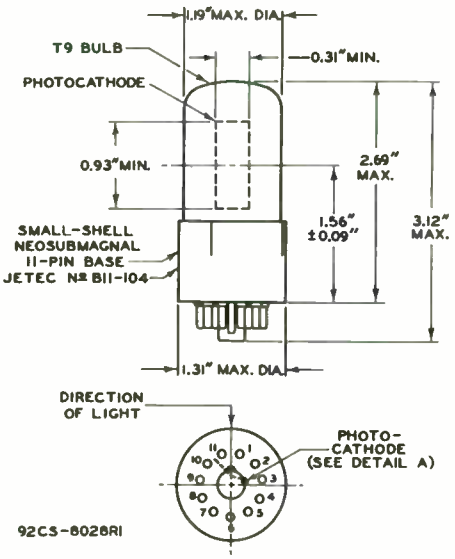
R13 R14 R15 R16
R17 R18 R19 R20: 8.2 megohms, 1/2 watt

R21: 820,000 ohms, 1/2 watt

6328

6328

MULTIPLIER PHOTOTUBE



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

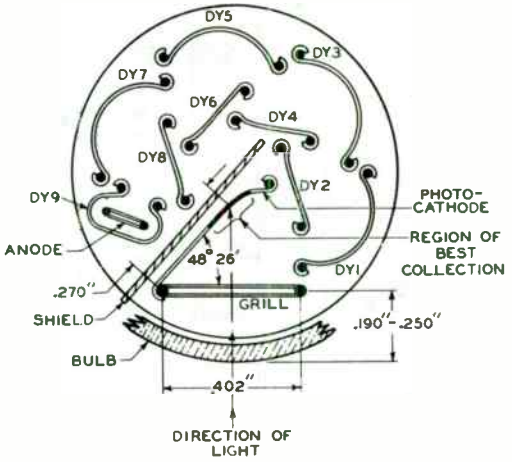
NOTE: THE MAXIMUM ANGULAR VARIATION BETWEEN THE PLANE THROUGH PINS 1 AND 11 AND THE PLANE OF THE GRILL WILL NOT EXCEED 6°.

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

6328

MULTIPLIER PHOTOTUBE

DETAIL A



92CS-8674RI

ELECTRON TUBE DIVISION
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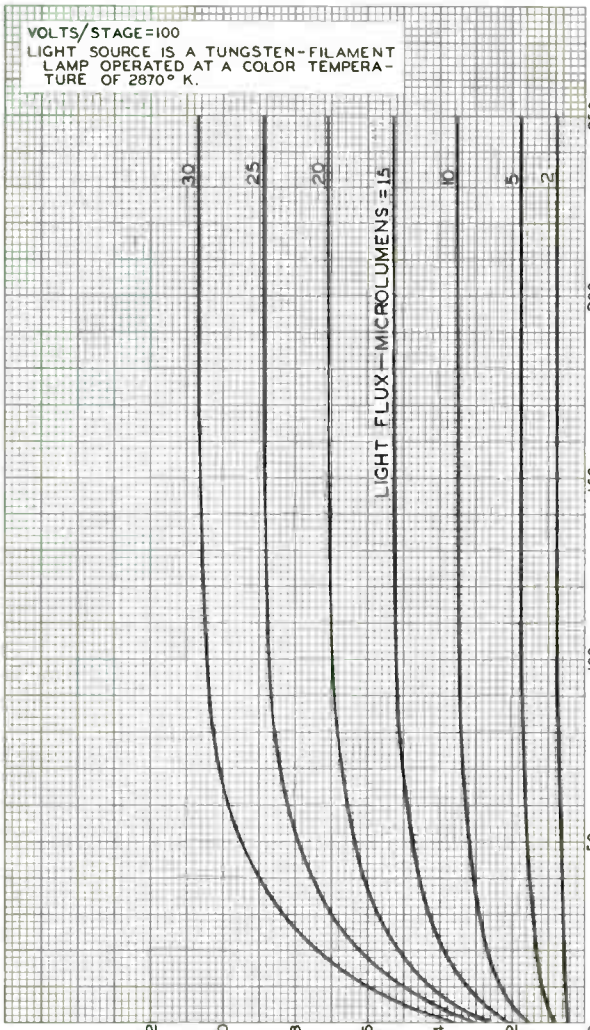
6328

RCA

6328

AVERAGE ANODE CHARACTERISTICS



ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8029R2

RCA

6328

VARIATION IN SENSITIVITY OF PHOTOCATHODE ALONG ITS LENGTH

SPOT SIZE: 1 MM APPROX.
VARIATIONS CAUSED BY INTERCEPTION OF LIGHT BY GRILL AS WELL AS SURFACE IRREGULARITIES HAVE BEEN IGNORED.

ELECTRON TUBE DIVISION 92CM-7663R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

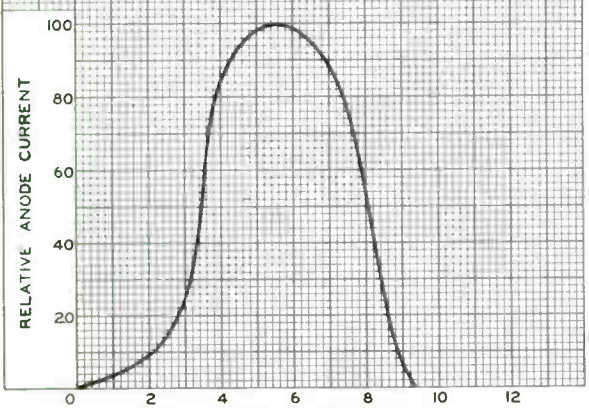
6328

RCA

6328

VARIATION IN SENSITIVITY OF PHOTOCATHODE ACROSS ITS PROJECTED WIDTH IN PLANE OF GRILL

SPOT SIZE: 1 MM APPROX.
GRILL TOWARD OBSERVER, BASE DOWN.
CATHODE WIDTH PROJECTED NORMAL TO PLANE OF GRILL.
VARIATIONS CAUSED BY INTERCEPTION OF LIGHT BY GRILL AS WELL AS SURFACE IRREGULARITIES HAVE BEEN IGNORED.



ELECTRON TUBE DIVISION

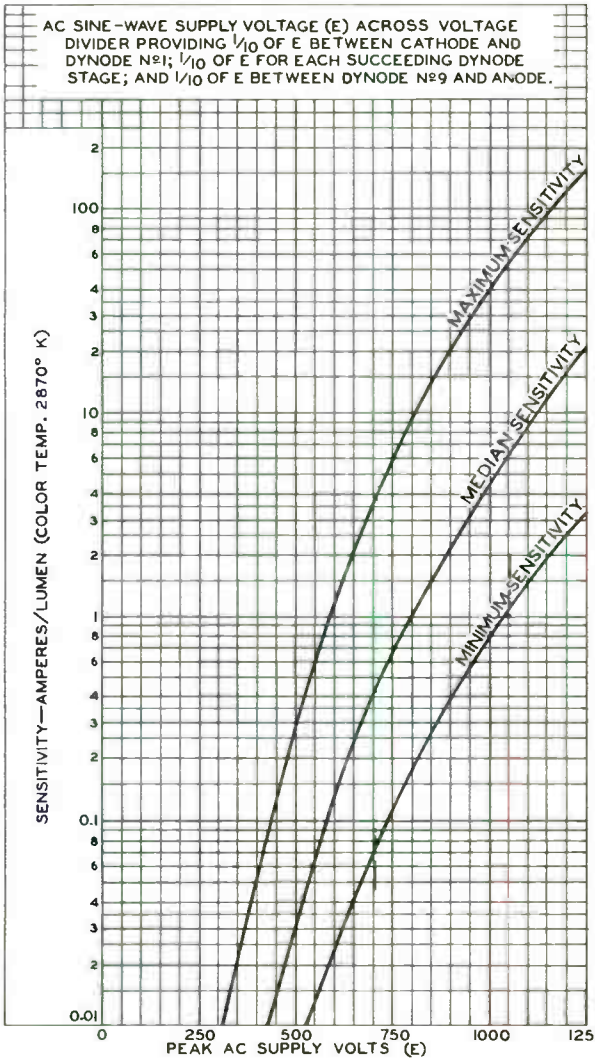
92CM-7667RI

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6328

LUMINOUS-SENSITIVITY RANGE



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

92CM-9571

RCA

6342

MULTIPLIER PHOTOTUBE

10-STAGE, HEAD-ON TYPE WITH
1-11/16" SEMITRANSPARENT CATHODE AND S-11 RESPONSE
SHORT TIME-RESOLUTION CAPABILITY

DATA

General:

Spectral Response	S-11	
Wavelength of Maximum Response	4400 ± 500 angstroms	
Cathode, Semitransparent:		
Shape	Circular	
Window:		
Area	2.2	sq. in.
Minimum diameter	1-11/16	in.
Index of refraction	1.51	
Direct Interelectrode Capacitances (Approx.):		
Anode to dynode No.10	4.4	μμf
Anode to all other electrodes	7	μμf
Maximum Overall Length	5-13/16"	
Seated Length	4-7/8" ± 3/16"	
Maximum Diameter	2-1/4"	
Mounting Position	Any	
Weight (Approx.)	5.2 oz	
Bulb	T-16	
Base .....Medium-Shell Diheptal 14-Pin (JETEC No.B14-38), Non-hygroscopic		

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 – Internal Connection–Do Not Use
Pin 13 – Focusing Electrode
Pin 14 – Cathode

DIRECTION OF LIGHT 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
DYNODE-No.1 SUPPLY VOLTAGE (DC or Peak AC)	400 max.	volts
FOCUSING-ELECTRODE VOLTAGE (DC or Peak AC)	400 max.	volts
AVERAGE ANODE CURRENT●	2 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

● Averaged over any interval of 30 seconds maximum.

← Indicates a change.

6342

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) and Focusing Electrode connected to Dynode No.1 at socket*

	Min.	Median	Max.	
Sensitivity:				
→ Radiant, at 4400 angstroms	–	6000	–	μamp/μwatt
→ Cathode radiant, at 4400 angstroms	–	0.048	–	μamp/μwatt
Luminous:♦				
At 0 cps	3	7.5	100	amp/lumen
Cathode luminous:				
With tungsten light source▲	40	60	–	μamp/lumen
With blue light source●◆	0.04	–	–	μamp
Current Amplification	–	125000	–	
Equivalent Anode-Dark-Current Input●■	–	2×10^{-10}	2×10^{-9}	lumen
Equivalent Noise Input▲	–	7×10^{-12}	–	lumen

With E = 1500 volts (except as noted) and Focusing Electrode connected to Dynode No.1 at socket*

	Min.	Median	Max.	
Sensitivity:				
→ Radiant, at 4400 angstroms	–	28000	–	μamp/μwatt
→ Cathode radiant, at 4400 angstroms	–	0.048	–	μamp/μwatt
Luminous:♦				
At 0 cps	–	35	–	amp/lumen
Cathode luminous:				
With tungsten light source▲	40	60	–	μamp/lumen
With blue light source●◆	0.04	–	–	μamp
Current Amplification	–	600000	–	

* In general, the focusing electrode is connected to dynode No.1 at the socket and operated at the same fixed potential as dynode No.1. However, in applications critical as to magnitude, uniformity, or speed of the response, the focusing electrode may be connected to the adjustable arm of a potentiometer between cathode and dynode No.1 in the voltage divider, and operated at an optimum potential within a range of 10 to 60 per cent of the dynode-No.1 potential.

♦ 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.

▲, ●, ◆, ■, ★: See next page. → Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6342

MULTIPLIER PHOTOTUBE

▲ For conditions the same as shown under (♦) except that 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 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 1250 volts is recommended.

★ Under the following conditions: Supply voltage (E) is 1250 volts, 25°C tube temperature, 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.

OPERATING CONSIDERATIONS

The *operating stability* of the 6342 is dependent on the magnitude of the anode current and its duration. When the 6342 is operated at high 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 6342 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 anode current should not exceed 250 microamperes.

Electrostatic and/or *magnetic shielding* of the 6342 may be necessary.

The *material* of which the dynodes of the 6342 are made has stable, high-current carrying capabilities and permits the use of a tube manufacturing process which minimizes regenerative effects such as afterpulses. The relative freedom of the 6342 from afterpulses and its small spread in electron transit time make it particularly useful for fast coincidence scintillation counting.

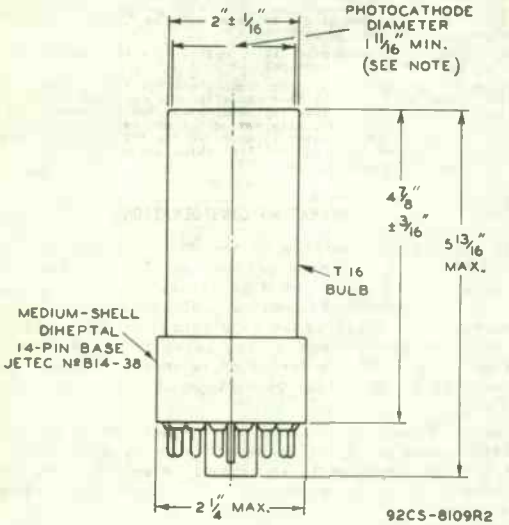
Because the 6342 offers the advantage of small spread in electron transit time, it has a fast pulse rise time. For an input pulse having a rise time of 1 millimicrosecond or less, the rise time of the pulse at the anode is about

6342

MULTIPLIER PHOTOTUBE

5 millimicroseconds as measured between its 10- and 90-per cent magnitude points when the supply voltage is 1500 volts and the focusing electrode is connected to dynode No. 1.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-11 Response is shown at the front of this Section



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

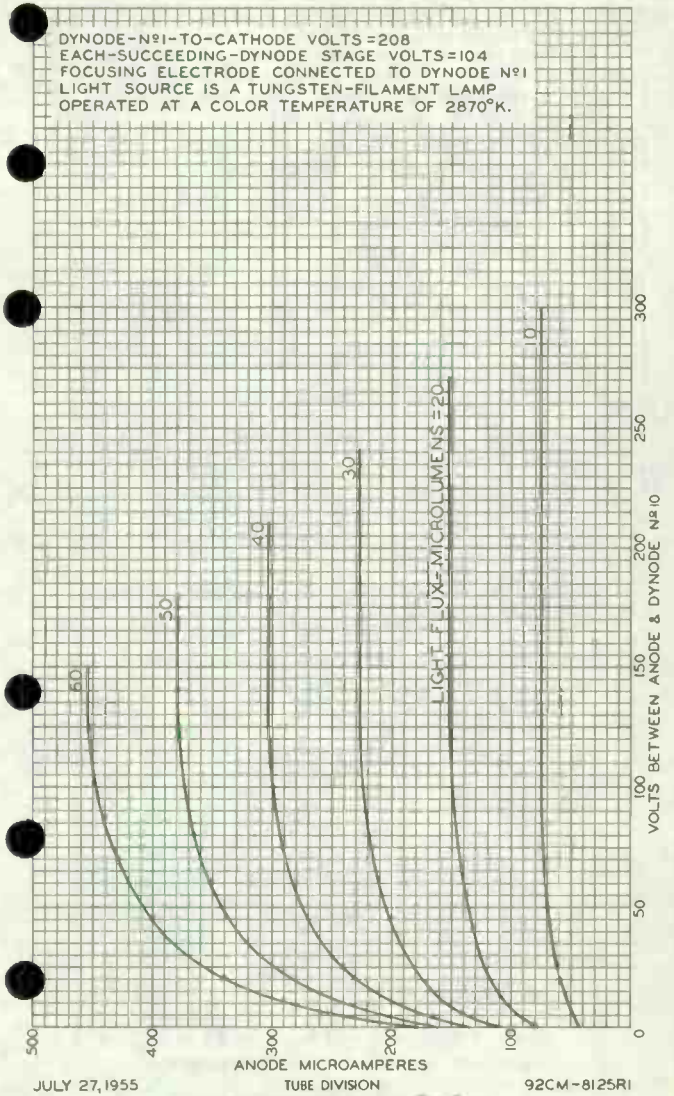
NOTE: WITHIN MINIMUM DIAMETER, DEVIATION FROM FLATNESS WILL NOT EXCEED 0.010" FROM PEAK TO VALLEY.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6342

AVERAGE ANODE CHARACTERISTICS



JULY 27, 1955

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8125RI

RCA

6342

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

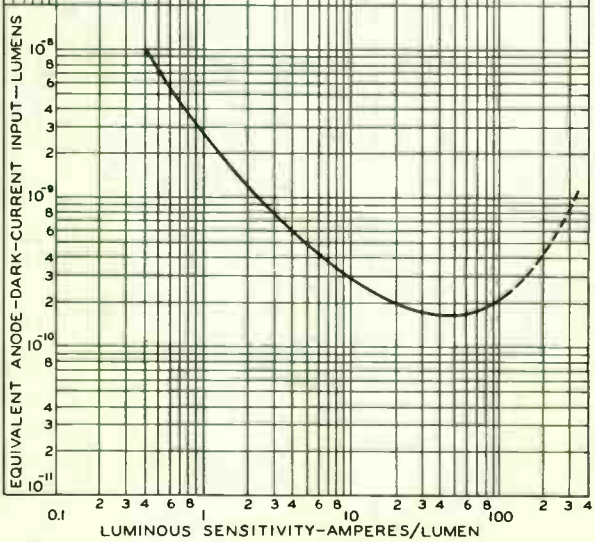
LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES 1/6 OF E BETWEEN CATHODE AND DYNODE Nº1; 1/12 OF E FOR EACH SUCCEEDING STAGE; AND 1/12 OF E BETWEEN DYNODE Nº10 AND ANODE.

FOCUSING ELECTRODE IS CONNECTED TO DYNODE Nº1.

DASHED PORTION INDICATES INSTABILITY.

LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870°K.

TUBE TEMPERATURE=25°C

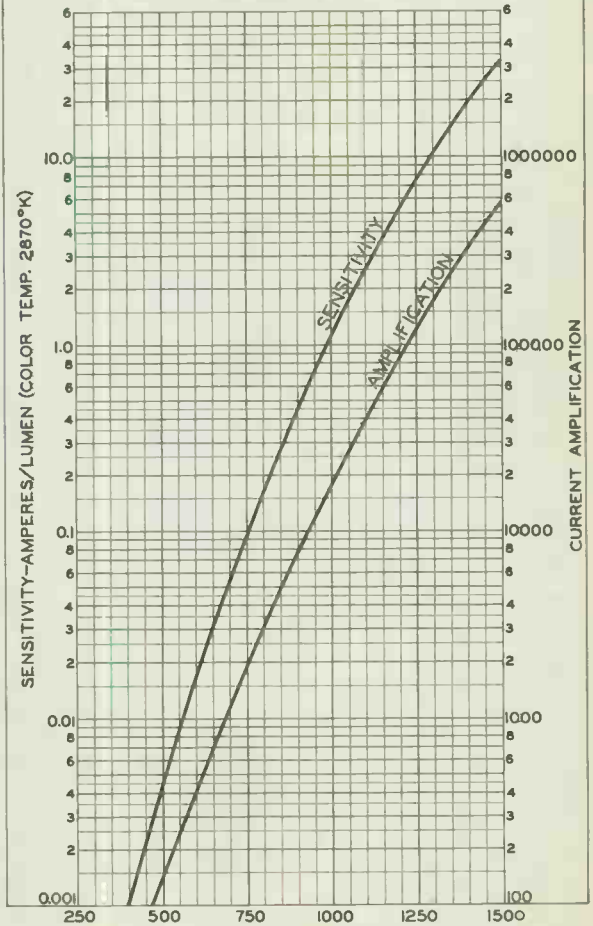


RCA

6342

AVERAGE CHARACTERISTICS

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



OCT. 15, 1953

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CL-8123

6372

MULTIPLIER PHOTOTUBE

10-STAGE TYPE WITH
4-1/8" x 3" SEMITRANSPARENT CATHODE AND S-11 RESPONSE

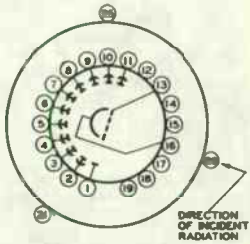
DATA

General:

Spectral Response	S-11	←
Wavelength of Maximum Response	4400 ± 500 angstroms	←
Cathode, Semitransparent:		
Shape	Semicylindrical	
Window:		
Minimum length	4-1/8	in.
Minimum width (Along circumference of bulb)	3	in.
Minimum area	12-3/8	sq. in.
Index of refraction	1.48	
Direct Interelectrode Capacitances (Approx.):		
Anode to dynode No.10	5	μμf
Anode to all other electrodes	6.5	μμf
Maximum Overall Length	7-3/4"	
Maximum Seated Length	7-1/4"	
Length from Base Seat to Center of Useful Cathode Area	3-5/8" ± 1/8"	
Maximum Diameter	2-9/16"	
Mounting Position	Any	
Weight (Approx.)	9 oz	
Bulb	T-20	
Base	Small-Button Twentyninar 22-Pin (JETEC No.E22-16)	

BOTTOM VIEW

Pin 1 – Anode
Pin 2 – Dynode No.10
Pin 3 – Dynode No.9
Pin 4 – Dynode No.8
Pin 5 – Dynode No.7
Pin 6 – Dynode No.6
Pin 7 – Dynode No.5
Pin 8 – Dynode No.4
Pin 9 – Dynode No.3
Pin 10 – Dynode No.2
Pin 11 – Dynode No.1
Pin 12 – Internal Connection-Do Not Use
Pin 13 – Focusing Electrode
Pin 14 – Same as Pin 12
Pin 15 – Same as Pin 12
Pin 16 – Cathode
Pin 17 – Same as Pin 12
Pin 18 – Same as Pin 12
Pin 19 – Same as Pin 12
Pin 21 – Same as Pin 12
Pin 25 – Same as Pin 12
Pin 28 – Same as Pin 12



PINS 1-18 ON 1 1/8" DIA. PIN CIRCLE
PINS 21,25,28 ON 7/8" DIA. PIN CIRCLE
PIN CIRCLES ARE CONCENTRIC

← Indicate a change.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6372

6372

MULTIPLIER PHOTOTUBE

Maximum Ratings, *Absolute Values*:

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	1200 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE (DC or Peak AC)	180 max.	volts
DYNODE-No.1 SUPPLY VOLTAGE (DC or Peak AC)	300 max.	volts
FOCUSING-ELECTRODE VOLTAGE (DC or Peak AC)	300 max.	volts
AVERAGE ANODE CURRENT●	0.75 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

Characteristics Range Values for Equipment Design:

Under conditions with supply voltage (E) across a voltage divider providing 1/12 of E between cathode and focusing electrode; 1/12 of E between focusing electrode 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.	Median	Max	
Sensitivity:				
→ Radiant, at 4400 angstroms. .	–	16000	–	μamp/μwatt
→ Cathode radiant, at 4400 angstroms	–	0.026	–	μamp/μwatt
Luminous:♦				
At 0 cps.	5	20	–	amp/lumen
At 100 Mc	–	19	–	amp/lumen
Cathode luminous:				
With tungsten light source▲	20	33	–	μamp/lumen
With blue light source†♦	0.026	–	–	μamp
Current Amplification	–	600000	–	
Equivalent Anode-Dark-Current Input●	–	5×10^{-9}	1×10^{-8}	lumen
Equivalent Noise Input●■	–	1×10^{-10}	–	lumen

● Averaged over any interval of 30 seconds maximum.

♦ For conditions when 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 150 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 150 volts are applied between cathode and all other electrodes connected together as anode.

♦,●,▪,■: See next page.

→ Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6372

MULTIPLIER PHOTOTUBE

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 20 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) is 1000 volts, 25°C tube temperature, 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.

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

OPERATING CONSIDERATIONS

The *operating stability* of the 6372 is dependent on the magnitude of the anode current and its duration. When the 6372 is operated at high 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 6372 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum rated value of 0.75 milliampere is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 100 microamperes.

Electrostatic and/or *magnetic shielding* of the 6372 may be necessary.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-11 Response
is shown at the front of this Section

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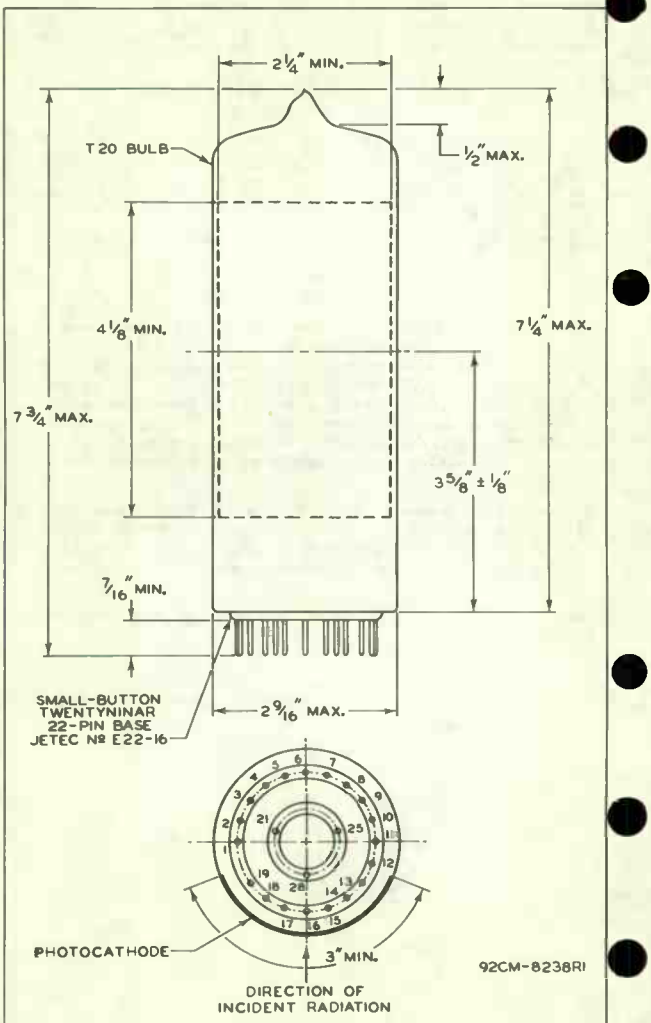
6372

MULTIPLIER PHOTOTUBE



SEPT. 1, 1955

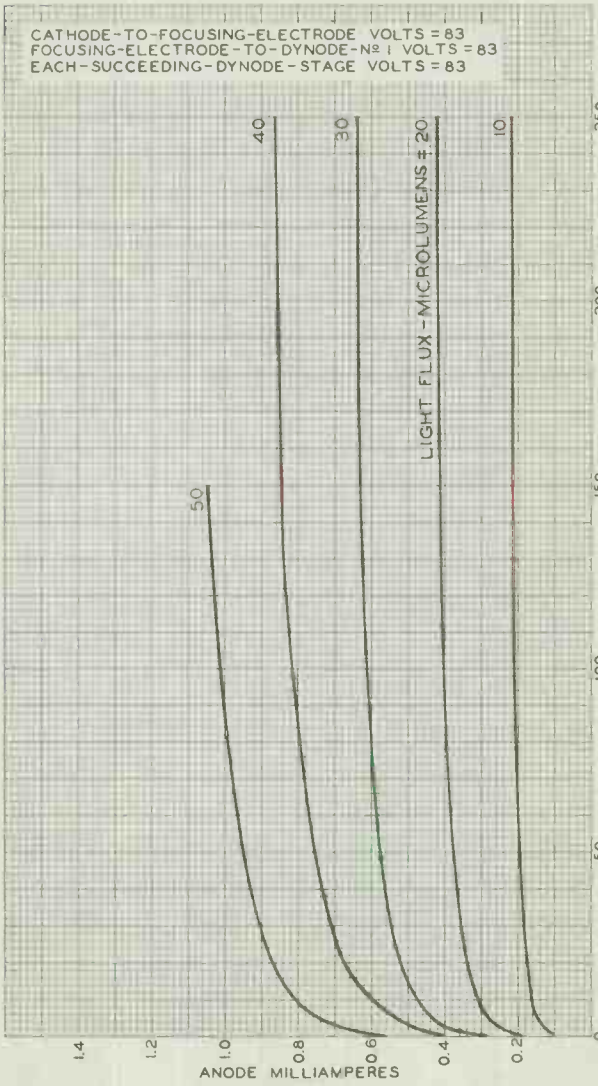
CE-8238R1

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6372

AVERAGE ANODE CHARACTERISTICS



FEB. 26, 1954

TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

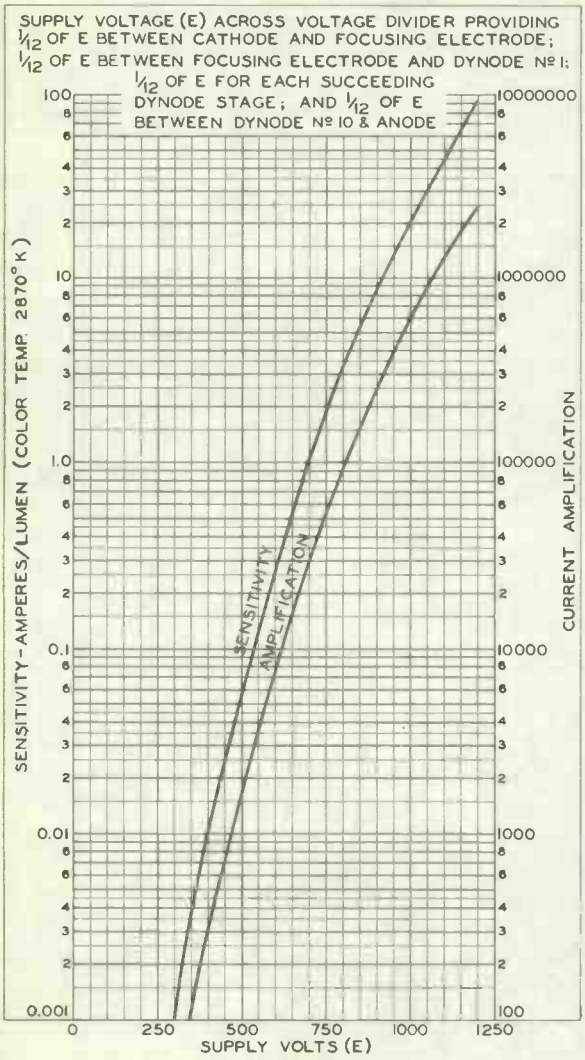
92CM-8258

6372

RCA

6372

AVERAGE CHARACTERISTICS



FEB. 26, 1954

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CL-8257

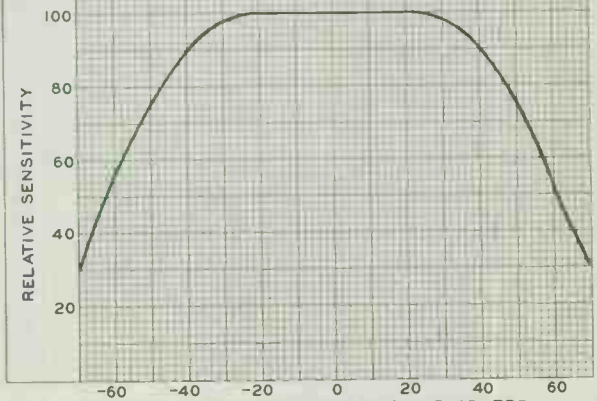
RCA

6372

VARIATION IN SENSITIVITY

LIGHT SPOT ½ INCH DIA. APPROX. POSITIONED MIDWAY ALONG LENGTH OF PHOTOCATHODE

VARIATIONS CAUSED BY INTERCEPTION OF LIGHT BY GRILL HAVE BEEN IGNORED



APRIL 9, 1954

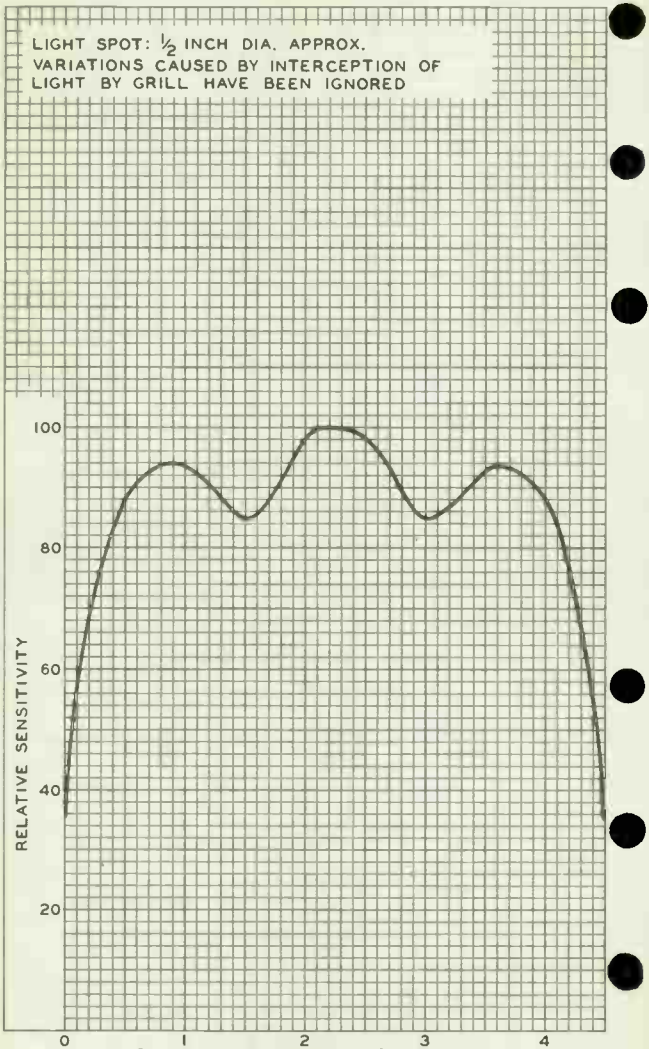
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8304

RCA

6372

VARIATION IN SENSITIVITY



APRIL 9,1954

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8306

6405/1640

GAS 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
Pin 3 – No Connection
Pin 4 – Cathode

DIRECTION OF LIGHT

Maximum Ratings, *Absolute Values:*

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

Characteristics at 90 Volts on Anode:

	Min.	*Av.*	*Max.*	
Sensitivity: Radiant at 8000 angstroms	–	0.0135	–	μamp/μwatt

* On plane perpendicular to indicated direction of incident light.

° Averaged over any interval of 30 seconds maximum.

RCA

6405

GAS PHOTOTUBE

	Min.	Av.	Max.	
Sensitivity:				
Luminous:▲				
At 0 cps	80	135	200	μamp/lumen
At 5000 cps	–	116	–	μamp/lumen
At 10000 cps	–	100	–	μamp/lumen
Sensitivity Difference Between Highest Value and Lowest Value Along Cathode Length♦	–	–	25	μamp/lumen
Gas Amplification Factor	–	–	9	
Anode Dark Current:				
At 25°C	–	–	0.1	μamp
Minimum Circuit Values:				
With anode-supply voltage of		*70 or less*	*90*	*volts*
DC Load Resistance:				
For dc currents above 5 μamp	0.1 min.		–	megohm
For dc currents below 5 μamp	0 min.		–	megohm
For dc currents above 3 μamp	–		2.5 min.	megohms
For dc currents below 3 μamp	–		0.1 min.	megohm

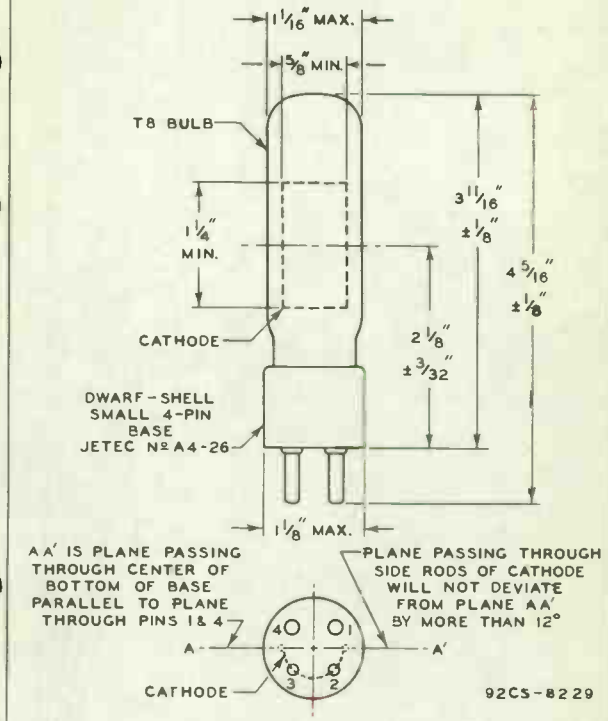
▲ For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A dc anode supply of 90 volts and a 1-megohm load resistor are used. For the 0-cycle measurements, a light input of 0.1 lumen is used. For the 5000 and 10000-cycle measurements, the light input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

♦ Measured under the same conditions as indicated under (▲) with light input of 0.1 lumen and a light spot 1/2 inch in diameter.

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

6405

GAS PHOTOTUBE

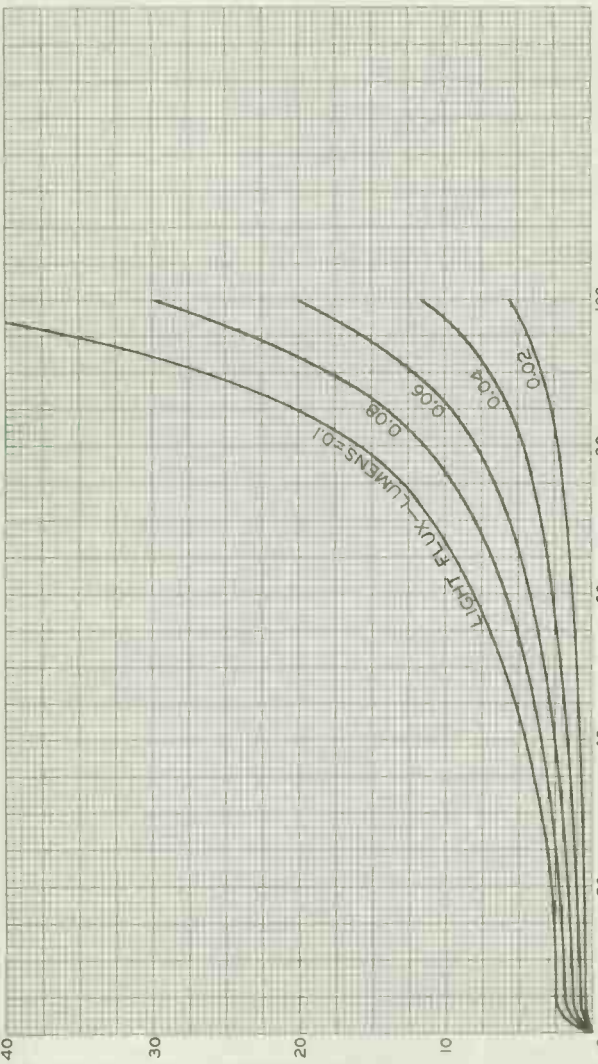


6405

RCA

6405

AVERAGE ANODE CHARACTERISTICS



JAN. 22, 1954

TUBE DIVISION

92CM-8227

6472
MULTIPLIER PHOTOTUBE

9-STAGE TYPE WITH S-4 RESPONSE

For Headlight-Control Service

DATA

General:

Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 angstroms
Cathode:	
Minimum projected length*	15/16"
Minimum projected width*	5-16"
Direct Interelectrode Capacitances:	
Anode to dynode No.9	4.2 μμf
Anode to all other electrodes	5.5 μμf
Maximum Overall Length (Excluding leads)	2-3/4"
Maximum Envelope Length (Excluding tip)	2-1/4"
Length from Envelope Seal to Center of Useful Cathode Area	1-1/4" ± 3/32"
Maximum Diameter	1-3/16"
Bulb	T-9
Mounting Position	Any
Weight (Approx.)	2 oz
Terminals, Flexible Lead	*See Dimensional Outline*

BOTTOM VIEW

Lead 1 – Cathode
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

DIRECTION OF LIGHT

Maximum Ratings, *Absolute Values:*

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	1250 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.9 AND ANODE (DC or Peak AC)	250 max.	volts
AVERAGE ANODE CURRENT°	0.1 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

* On plane perpendicular to the indicated direction of light (*See Dimensional Outline*).

° Averaged over any interval of 30 seconds maximum.

6472

6472

MULTIPLIER PHOTOTUBE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Under conditions with 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

With E = 1000 volts

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4000 angstroms	–	32500	–	μamp/μwatt
Luminous:▲				
At 0 cps	5	35	250	amp/lumen
At 100 Mc.	–	33	–	amp/lumen
Electrode Dark Current (At 25°C):				
Anode	–	–	0.25♦	μamp
Any other electrode	–	–	0.75	μamp

▲ 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.

♦ With Sine-wave, 60-cycle supply voltage adjusted to give sensitivity of 7.5 amperes per lumen.

OPERATING CONSIDERATIONS

The *operating stability* of the 6472 is dependent on the magnitude of the anode current and its duration. When the 6472 is operated at high 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 6472 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum rated value of 0.1 milliampere is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 10 microamperes.

A recommended design of voltage-divider network for use with the 6472 to provide stable operation and long tube life is shown in the accompanying circuit. This design provides linear operation within the range normally required for dimming. At higher light levels, the network design limits the tube output to a safe value. The indicated design values provide dimming operation for an anode current in the range between 5 and 10 microamperes on basis of dc operation. When operation at other current values is desired, the values of the resistors can be changed proportionately.

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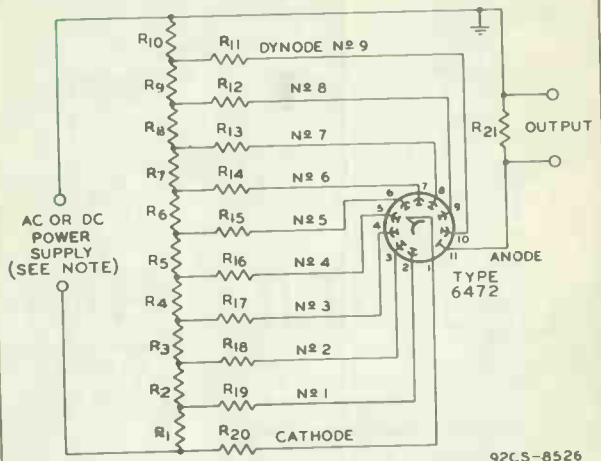
MULTIPLIER PHOTOTUBE

RECOMMENDED VOLTAGE-DIVIDER NETWORK FOR USE WITH TYPE 6472 IN HEADLIGHT-DIMMING SERVICE



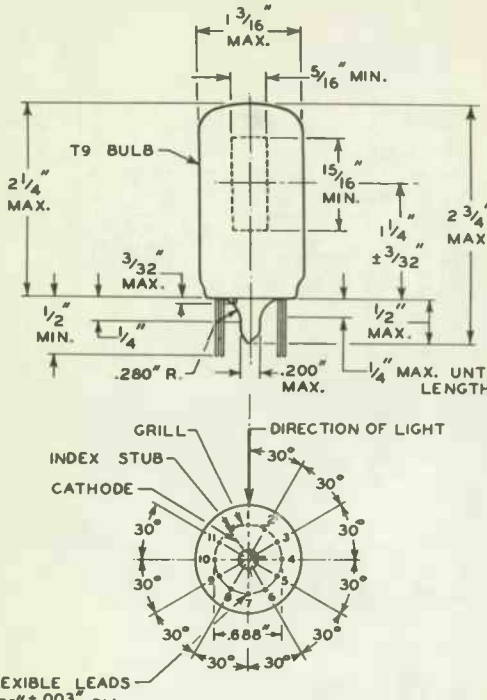
R1 R2 R3 R4 R5
R6 R7 R8 R9 R10: 1 megohm, 1/2 watt
R11: 2 megohms, 1/2 watt
R12: 5.1 megohms, 1/2 watt
R13 R14 R15 R16
R17 R18 R19 R20: 8.2 megohms, 1/2 watt
R21: 820,000 ohms, 1/2 watt

NOTE: Adjustable between approximately 500 and 1000 volts dc or peak ac.

6472

6472

MULTIPLIER PHOTOTUBE



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

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AVERAGE ANODE CHARACTERISTICS

JAN. 29, 1955

TUBE DIVISION

RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM – 8029RI

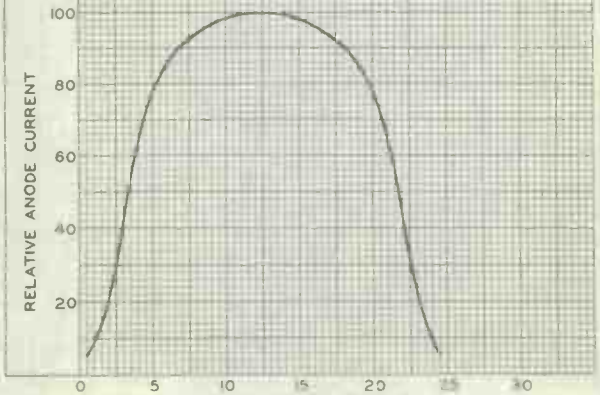
6472

RCA

6472

VARIATION IN SENSITIVITY OF PHOTOCATHODE ALONG ITS LENGTH

SPOT SIZE: 1 MM APPROX.
VARIATIONS CAUSED BY INTERCEPTION OF LIGHT BY GRILL AS WELL AS SURFACE IRREGULARITIES HAVE BEEN IGNORED



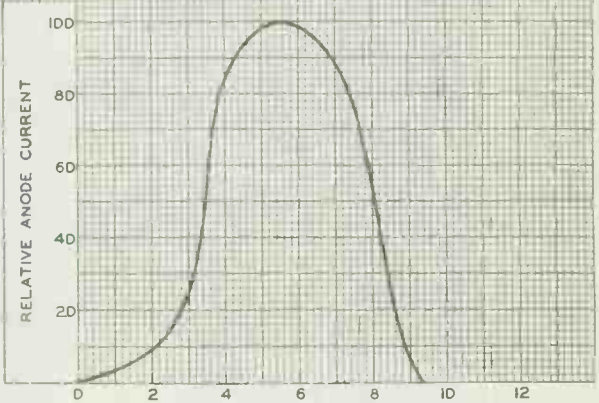
FEB. 11, 1955 TUBE DIVISION 32CM-8535

RCA

6472

VARIATION IN SENSITIVITY OF PHOTOCATHODE ACROSS ITS PROJECTED WIDTH IN PLANE OF GRILL

SPOT SIZE 1 MM APPROX.
GRILL TOWARD OBSERVER, LEADS DOWN
CATHODE WIDTH PROJECTED NORMAL TO PLANE OF GRILL
VARIATIONS CAUSED BY INTERCEPTION OF LIGHT BY GRILL AS WELL AS SURFACE IRREGULARITIES HAVE BEEN IGNORED



FEB. 11, 1955

TUBE DIVISION

RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-8536

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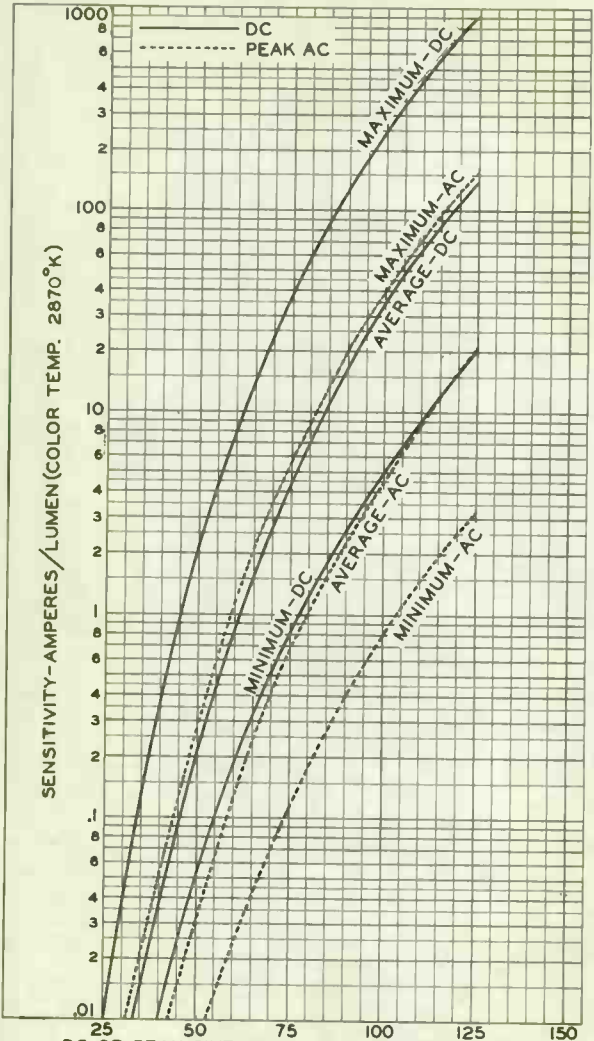
RANGE OF LUMINOUS SENSITIVITY



JAN. 29, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CL-8027RI

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
Pin 3 – No Connection
Pin 4 – Cathode

DIRECTION OF LIGHT

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.

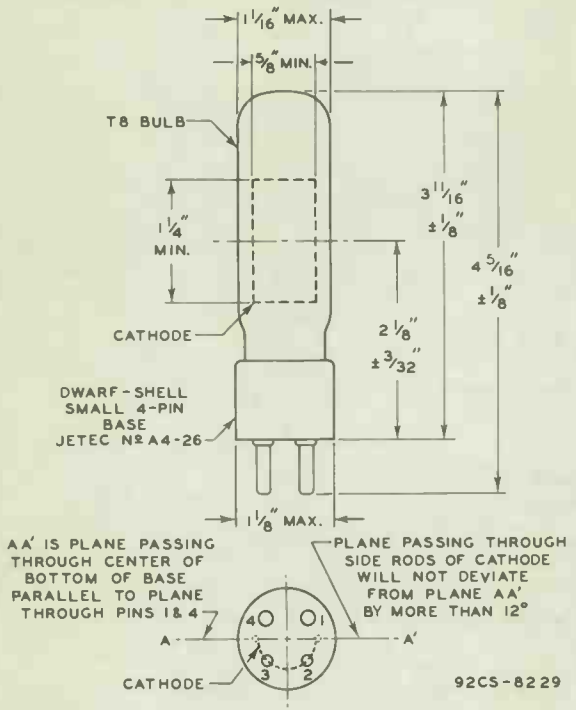
\# For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A dc anode supply of 250 volts, a 1-megohm load resistor, and a light input of 0.1 lumen are used.

▲ Measured under the same conditions as indicated under (#) with light input of 0.1 lumen and a light spot 1/2 inch in diameter.

6570

VACUUM PHOTOTUBE

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



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AVERAGE ANODE CHARACTERISTICS

DEC. 3, 1954

TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-8491

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6571

COMPUTER STORAGE TUBE

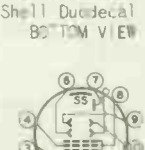
SINGLE-BEAM, PRIMARY-CURRENT-MODULATION TYPE
REDISTRIBUTION WRITING CAPACITANCE-DISCHARGE READING

DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.6	amp
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to all other electrodes	6.5	μμf
Grid No.1 to deflecting electrode DJ_1	0.2	μμf
Grid No.1 to deflecting electrode DJ_2	0.2	μμf
Grid No.1 to deflecting electrode DJ_3	0.2	μμf
Grid No.1 to deflecting electrode DJ_4	0.2	μμf
Cathode to all other electrodes	5	μμf
DJ_1 to DJ_2	2.8	μμf
DJ_3 to DJ_4	2.6	μμf
DJ_1 to all other electrodes	9	μμf
DJ_2 to all other electrodes	9	μμf
DJ_3 to all other electrodes	8	μμf
DJ_4 to all other electrodes	7	μμf
Focusing Method	Electrostatic	
Deflection Method	Electrostatic	
Deflecting-electrode arrangement	*See Dimensional Outline*	
Storage Surface	On inner surface of faceplate	
Signal-Output Electrode	Metal plate or 50-line (minimum) mesh covering external surface of faceplate and capacitively coupled to the storage surface. (This electrode is not supplied with the tube).	
Overall Length	11-1/2" ± 1/4"	
Greatest Diameter of Bulb	3" ± 1/16"	
Weight (Approx.)	9 oz	
Mounting Position	Center of tube face must be at same elevation as or at higher elevation than tube base.	
Cap	Recessed Small Cavity (JETEC No.J1-21)	
Base	Small-Shell Duodecal 10-Pin (JETEC No.B10-75)	

BOTTOM VIEW



Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Cathode
Pin 4 – Grid No.3
Pin 6 – Deflecting Electrode DJ_4
Pin 7 – Deflecting Electrode DJ_3
Pin 8 – Ultor (Grids No.2 & No.4)
Pin 9 – Deflecting Electrode DJ_2
Pin10 – Deflecting Electrode DJ_1
Pin12 – Heater
Cap – Collector
SS – Storage Surface▲

▲ The Signal-Output Electrode is capacitively coupled to the Storage Surface.

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COMPUTER STORAGE TUBE

Maximum Ratings, *Design-Center Values*:

COLLECTOR VOLTAGE:		
Difference between collector voltage and ultor voltage	150 max.	volts
ULTOR• VOLTAGE	2500 max.	volts
GRID-No.3 VOLTAGE	1000 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	200 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFLECTING ELECTRODE	500 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	125 max.	volts

Equipment Design Ranges:

For any ultor voltage (E_{c_4}) between 1000 and 2500 volts

Collector Voltage	95% to 105% of E_{c_4}	volts
Grid-No.3 Voltage	20% to 28% of E_{c_4}	volts
Max. Grid-No.1 Voltage for Beam-Current Cutoff	2.4% of E_{c_4}	volts
Max. Grid-No.3 Current Range	-15 to +10	μamp
Deflection Factors:		
DJ_1 & DJ_2	39 to 53	v dc/in./kv of E_{c_4}
DJ_3 & DJ_4	35.5 to 48.5	v dc/in./kv of E_{c_4}
Focused-Beam Position	##	

Examples of Use of Design Ranges:

For ultor voltage of	*1000*	*2500*	*volts*
Collector Voltage	950 to 1050	2375 to 2625	volts
Grid-No.3 Voltage	200 to 280	500 to 700	volts
Max. Grid-No.1 Voltage for Beam-Current Cutoff	-24	-60	volts
Deflection Factors:			
DJ_1 & DJ_2	39 to 53	97.5 to 133	volts dc/in.
DJ_3 & DJ_4	35.5 to 48.5	89 to 122	volts dc/in.

• The "ultor" in a storage tube is the electrode to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection. In the 6571, the ultor function is performed by grid No.4. Since grid No.4 and grid No.2 are connected together within the 6571, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.

The center of the undeflected focused beam will fall within a circle having a 7.5-mm radius concentric with the center of the tube face.

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COMPUTER STORAGE TUBE

Storage Characteristics for Ultor Voltage of 2500 Volts:

Storage-Surface Boundary (In terms of deflection voltage):		
In the $DJ_1 - DJ_2$ direction from position of undeflected focused beam . .	±109	volts
In the $DJ_3 - DJ_4$ direction from position of undeflected focused beam . .	±100	volts
Blemish Factor*, for storage surface within indicated boundary.	0.5 max.	
Spill (Determined for Double-Dot Pattern):**		
Under conditions involving 255 references to "spill" element and 1 reference to "test" element		
Separation Between Storage Elements, in either the $DJ_1 - DJ_2$ or $DJ_3 - DJ_4$ direction in terms of deflection voltage:		
At center of storage surface . . .	8 max.	volts
At midpoint on each side of storage-surface boundary	10 max.	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting-Electrode Circuit■	1.0 max.	megohm

* Blemish factor is defined as the factor by which the normal positive signal is reduced by the blemish.

** Spill is indicative of the amount of binary information that can be stored by the tube. The storage capability is determined by the separation between two storage elements at which the signal from one element is changed by no more than a specified amount after repeated references to the other element. For the 6571, the separation is measured, in terms of deflection voltage, when the amplitude of the negative signal of the "test" element has decreased to 50% of its maximum negative amplitude. The maximum negative amplitude is determined by separating the two elements far enough to eliminate the effects of secondary electron redistribution from the "spill" element.

■ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

OPERATING CONSIDERATIONS

Shielding. In typical computer applications, the 6571 is mounted in a compartment having effective magnetic and electrostatic shielding. It is recommended that the bulb be provided with a tight-fitting electrostatic shield extending from the base to the collector coating. *(See Dimensional Outline).* This external shield supplements the shielding action of the collector in preventing cross-coupling between the electron gun and the external signal electrode.

A *signal-output electrode* shaped to conform with the external contour of the faceplate and placed in contact with the entire area of the faceplate is required. The signal-output electrode is connected to a low-noise video

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6571

COMPUTER STORAGE TUBE

amplifier having sufficient gain to amplify signals from a fraction of a millivolt to the desired level.

The *amount of information that can be stored by the 6571* is dependent on the manner in which it is operated, and is affected by the stability of the deflecting system, freedom from noise in the associated output circuit, the number of regenerations compared with the number of addresses, and the effectiveness of the electrostatic and magnetic shielding.

In general, the number of storage elements is proportional to the operating ultor voltage. For the greatest number of storage elements, the 6571 should be operated at the rated maximum ultor voltage and so that the peak grid-No.1 drive is less than that required for the maximum positive amplitude but high enough to provide a satisfactory output signal.

It is recommended that the beam current be limited to the minimum value which provides satisfactory signal amplitude.

The *storage characteristics* in the tabulated data and curve are based on the use of a double-dot pattern. In this method of storage, the positive signal is produced by adjusting the beam current and the distance between two dot storage elements so that the optimum positive signal is produced when the "test" element is addressed. Other methods of storage such as superimposed focused and defocused spots or dots and dashes may be used equally well with the 6571.

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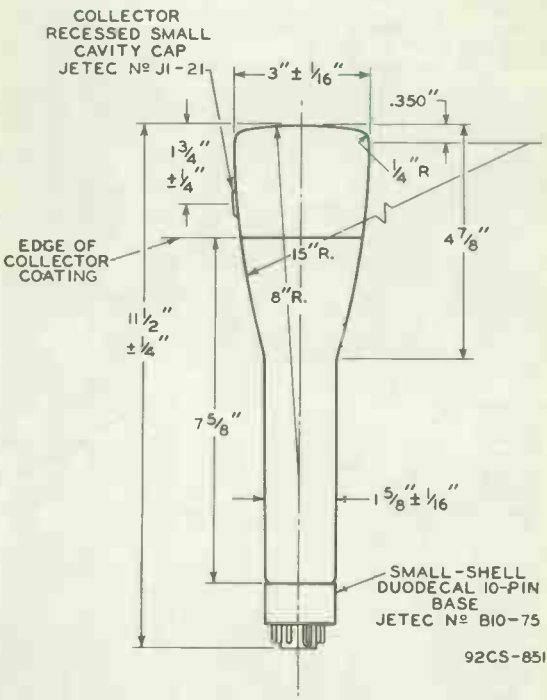
COMPUTER STORAGE TUBE



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

DJ_1 AND DJ_2 ARE NEARER THE STORAGE SURFACE: DJ_3 AND DJ_4 ARE NEARER THE BASE. WITH DJ_1 POSITIVE WITH RESPECT TO DJ_2, THE BEAM WILL BE DEFLECTED TOWARD PIN 2; LIKEWISE, WITH DJ_3 POSITIVE WITH RESPECT TO DJ_4, THE BEAM WILL BE DEFLECTED TOWARD VACANT PIN POSITION 11.

THE PLANE THROUGH TUBE AXIS AND EACH OF THE FOLLOWING ITEMS MAY VARY FROM THE DEFLECTION PATH PRODUCED BY DJ_1 AND DJ_2 BY THE FOLLOWING ANGULAR TOLERANCES (MEASURED ABOUT THE TUBE AXIS): PIN 2, 10°; SIDE TERMINAL (ON SAME SIDE AS PIN 8), 10°. ANGLE BETWEEN DJ_1-DJ_2 DEFLECTION PATH AND DJ_3-DJ_4 DEFLECTION PATH IS 90° ± 3°.

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AVERAGE CHARACTERISTIC

MULTIPLIER PHOTOTUBE

10-STAGE, HEAD-ON TYPE WITH
1-11/16" SEMITRANSPARENT CATHODE AND S-11 RESPONSE

DATA

General:

Spectral Response	S-11
Wavelength of Maximum Response	4400 ± 500 angstroms
Cathode, Semitransparent:	
Shape	Circular
Window:	
Area	2.2 sq. in.
Minimum diameter	1-11/16 in.
Index of refraction	1.51
Direct Interelectrode Capacitances (Approx.):	
Anode to dynode No.10	4.4 μμf
Anode to all other electrodes	7 μμf
Maximum Overall Length	5-13/16"
Seated Length	4-7/8" ± 3/16"
Maximum Diameter	2-5/16" ←
Mounting Position	Any
Weight (Approx.)	5.2 oz ←
Bulb	T-16
Base . . . . Medium-Shell Diheptal 14-Pin (JETEC No.B14-38), Non-hygroscopic	
Basing Designation for BOTTOM VIEW	14AA ←

DIRECTION OF LIGHT: INTO END OF BULB

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 – Cathode

Maximum Ratings, *Absolute Values*:

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	1250 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE (DC or Peak AC)	250 max.	volts ←
DYNODE-No.1 SUPPLY VOLTAGE (DC or Peak AC)	300 max.	volts
FOCUSING-ELECTRODE VOLTAGE (DC or Peak AC)	300 max.	volts
AVERAGE ANODE CURRENT*	0.75 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

*Averaged over any interval of 30 seconds maximum.

← Indicates a change.

RCA

6655

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 = 1000 volts (except as noted) and Focusing Electrode" connected to Dynode No. 1 at socket

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms . .	–	20000	–	μamp/μwatt
Cathode radiant, at 4400 angstroms . .	–	0.040	–	μamp/μwatt
Luminous:♦				
At 0 cps	10	25	–	amp/lumen
→ With dynode No. 10 as output electrode**.	–	15	–	amp/lumen
Cathode luminous:				
With tungsten light source▲. .	40	50	–	μamp/lumen
With blue light source◉♦	0.04	–	–	μamp
Current Amplification.	–	500000	–	
Equivalent Anode-Dark-Current Input■. . .	–	8.5×10^{-10}	2×10^{-9}	lumen
→ Equivalent Noise Input★	–	7×10^{-12}	–	lumen
Dark Current to Any Electrode Except Anode (At 25°C). . .	–	–	0.75	μamp

With E = 750 volts (except as noted) and Focusing Electrode" connected to Dynode No. 1 at socket

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms . .	–	2000	–	μamp/μwatt
Cathode radiant, at 4400 angstroms . .	–	0.040	–	μamp/μwatt
Luminous:♦				
At 0 cps	–	2.5	–	amp/lumen
Cathode luminous:				
With tungsten light source▲. .	40	50	–	μamp/lumen
With blue light source◉♦	0.04	–	–	μamp
Current Amplification.	–	50000	–	

♦ 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.

*, **, ▲, ◉, ♦, ●, ■, ★: See next page. → Indicates a change.

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MULTIPLIER PHOTOTUBE

* In general, the focusing electrode is connected to dynode No. 1 at the socket and operated at the same fixed potential as dynode No. 1. However, in applications critical as to magnitude, uniformity, or speed of the response, the focusing electrode may be connected to the adjustable arm of a potentiometer between cathode and dynode No. 1 in the voltage divider, and operated at an optimum potential within a range of 10 to 60 per cent of the dynode-No. 1 potential.

** 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 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 2.01 megohm, and 200 volts are applied between cathode and all other electroces 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 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, 25°C tube temperature, 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. ←

OPERATING CONSIDERATIONS

The *operating stability* of the 6655 is dependent on the magnitude of the anode current and its duration. When the 6655 is operated at high 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 6655 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum rated value of 0.75 milliampere is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 100 microamperes.

Electrostatic and/or *magnetic shielding* of the 6655 may be necessary.

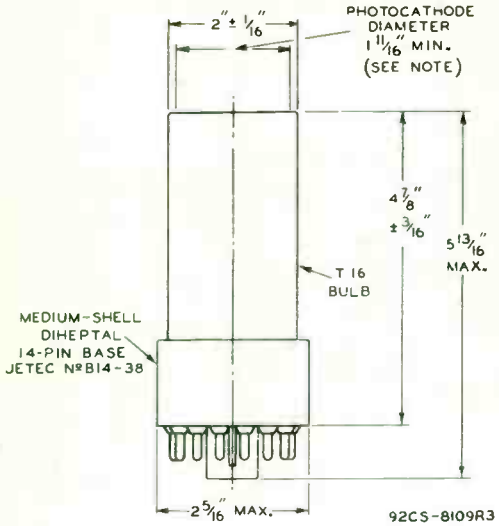
SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-11 Response is shown at the front of this Section

← Indicates a change.

RCA

6655

MULTIPLIER PHOTOTUBE



℄ 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 MINIMUM DIAMETER, DEVIATION FROM FLATNESS WILL NOT EXCEED 0.01D" FROM PEAK TO VALLEY.

TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

RCA

6655

AVERAGE ANODE CHARACTERISTICS

APRIL 20, 1955 TUBE DIVISION 92CM-8603

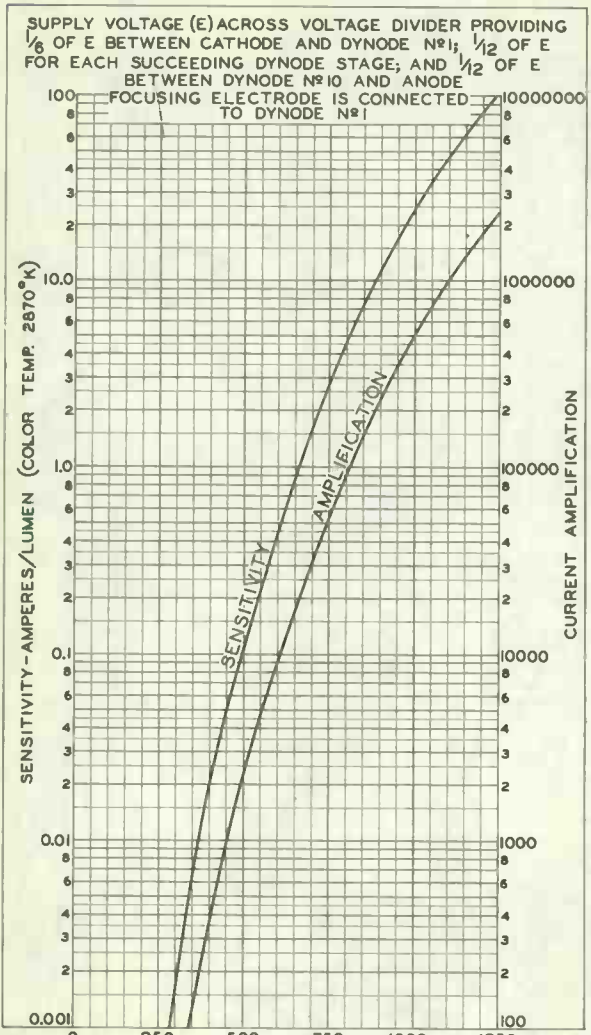
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

6655

RCA

6655

AVERAGE CHARACTERISTICS



MAY 27, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CL-8638

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

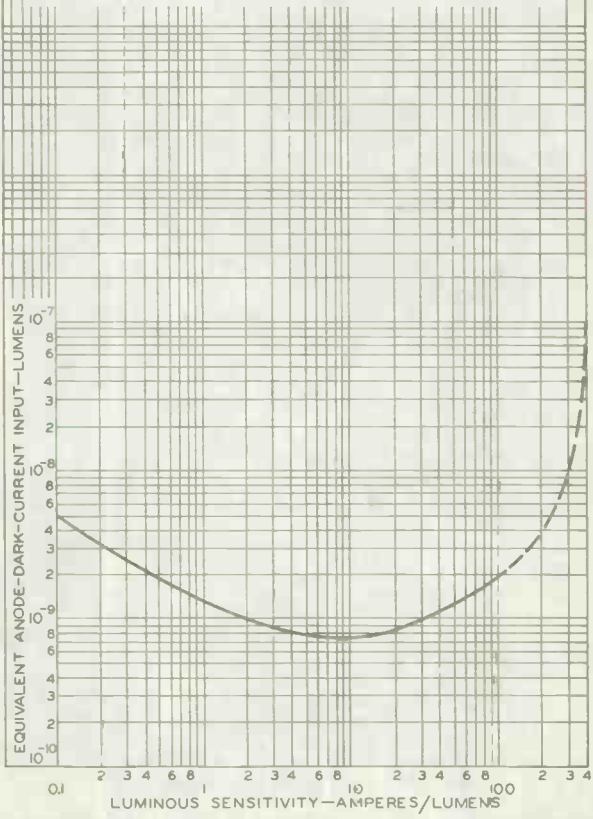
LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES 1/8 OF E BETWEEN CATHODE AND DYNODE Nº 1; 1/12 OF E FOR EACH SUCCEEDING STAGE AND 1/12 OF E BETWEEN DYNODE Nº 10 AND ANODE.

FOCUSING ELECTRODE IS CONNECTED TO DYNODE Nº 1.

DASHED PORTION INDICATES INSTABILITY.

LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870°K.

TUBE TEMPERATURE=25°C



MAY 27, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON NEW JERSEY

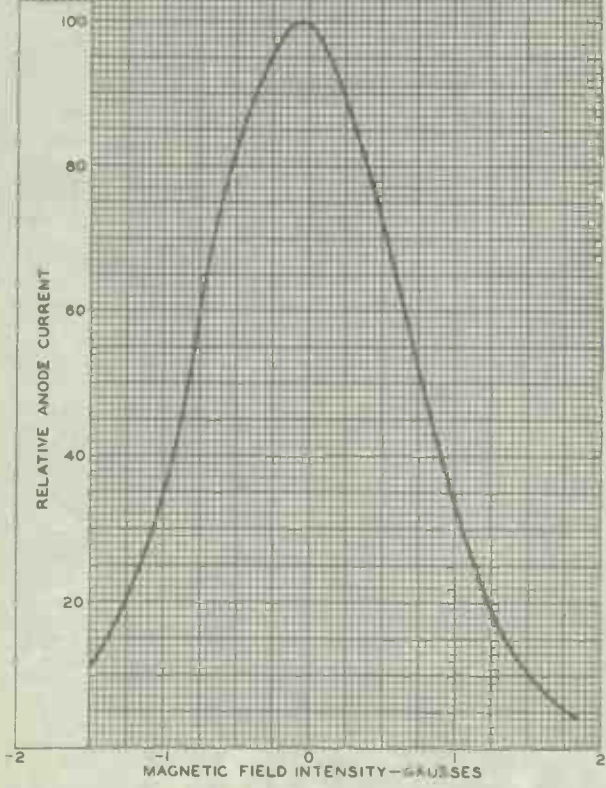
92CM-8636

RCA

6655

EFFECT OF MAGNETIC FIELD ON ANODE CURRENT

MAGNETIC FIELD IS PARALLEL TO DYNODE-CAGE AXIS.
POSITIVE VALUES ARE FOR LINES OF FORCE FROM LEFT TO RIGHT WITH BASE DOWN AND BASE KEY TOWARD OBSERVER.
DYNODE-NO.1-TO-CATHODE VOLTS=150
EACH-SUCCEEDING-STAGE VOLTS=100
FOCUSING ELECTRODE IS CONNECTED TO DYNODE NO.1



MAY 7, 1955 TUBE DIVISION 92CM-8136R1

RADIO CORPORATION OF AMERICA, HARRISON, N.J.

6694-A

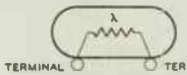
PHOTOCONDUCTIVE CELL

CADMIUM-SULFIDE TYPE

DATA

General:

Spectral Response	S-12
Wavelength of Maximum Response	5000 ± 500 angstroms
Sensitive Area:	
Shape	Rectangular
Dimensions (Minimum)	0.020" x 0.018"
Direct Interelectrode Capacitance	0.6 μμf
Maximum Overall Length	0.500"
Maximum Seated Length	0.300"
Width	0.350" ± 0.025"
Depth	0.200" ± 0.020"
Mounting Position	Any
Weight (Approx.)	0.02 oz
Base	Small-Rectangle Linotetrar 2-Pin (JETEC No.E2-33)
Socket	Cinch Part No.46AZ20248, or equivalent



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	150 max.	volts
POWER DISSIPATION	30 max.	mw
AMBIENT-TEMPERATURE RANGE	0 to +70	°C

Characteristics:

Under conditions with polarizing voltage of 90 volts and at ambient temperature of 25°C

	Min.	Median	Max.	
Sensitivity:				
Radiant♦, at 5000 angstroms	–	415	–	μamp/μwatt
Luminous*, at 0 cps	–	1	–	amp/lumen
Luminous intensity▲, at 0 cps	1.9	4	–	μamp/ft-c
Dynamic				*See Curves*
Dark Current	–	–	0.1	μamp
Dark Noise	Essentially lower than that of associated circuit			
Photocurrent:				
Rise				*See Curves*
Decay				*See Curves*

♦ For conditions where the incident power is 0.2 μwatt.

* For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A light flux of about 100 microlumens is used.

▲: See next page.

TENTATIVE DATA

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6694-A
PHOTOCONDUCTIVE CELL

▲ For light conditions the same as shown under (*) except that an incident light intensity of 30 foot-candles is used.

DEFINITIONS

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

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

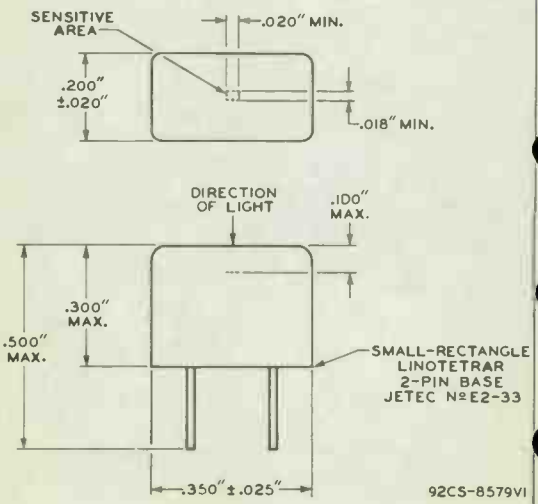
Luminous Intensity Sensitivity. The quotient of output current by the incident luminous intensity, at constant electrode voltages.

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

OPERATING CONSIDERATIONS

The *polarizing voltage* for the 6694-A may be applied without regard to polarity. To obtain the full sensitivity of the cell, it is essential that its entire photosensitive area be illuminated. Otherwise, a blocking action produced by the unilluminated area of the cell will occur and cause unsatisfactory operation.

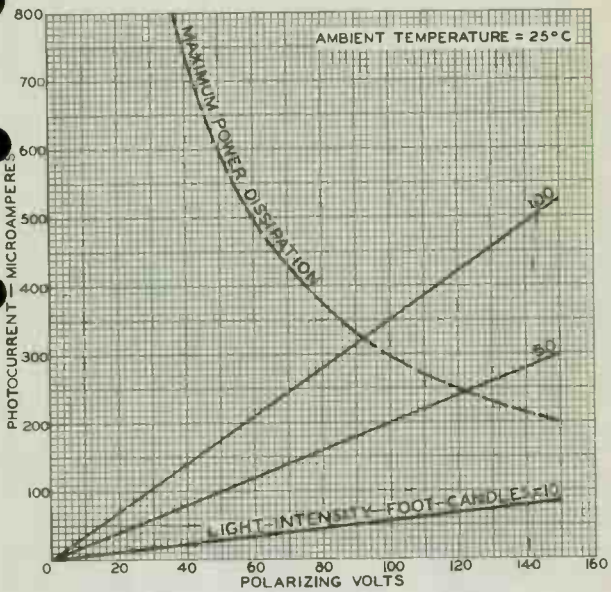
SPECTRAL-SENSITIVITY CHARACTERISTIC
of Photoconductive Cell having S-12 Response
is shown at the front of this Section



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

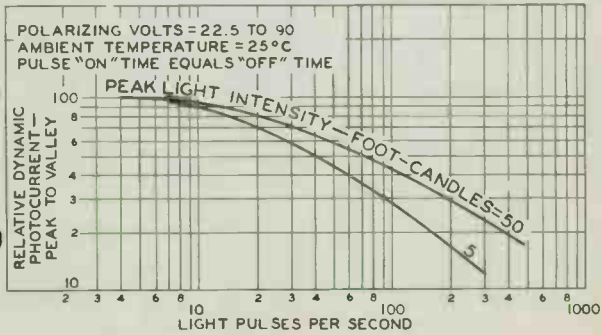
6694-A

AVERAGE CHARACTERISTICS



92CM-8583VI

DYNAMIC SENSITIVITY CHARACTERISTICS



92CM-8872V

TUBE DIVISION
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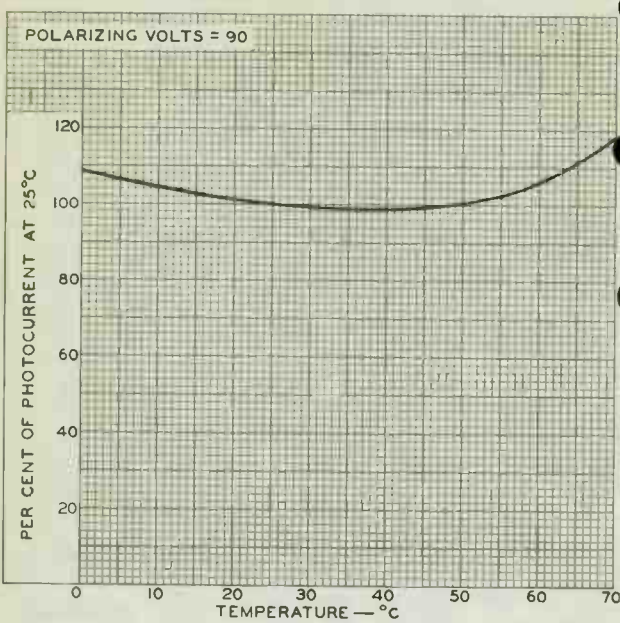
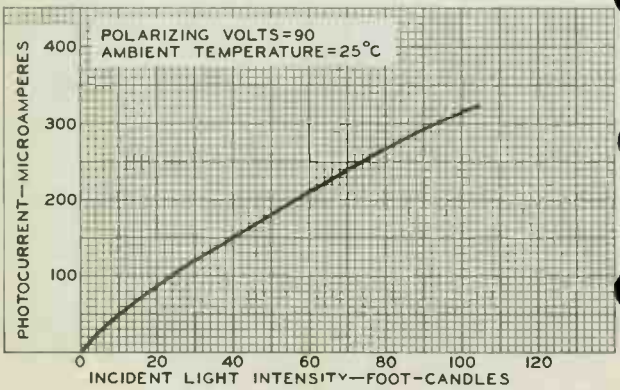
RCA

6694-A

TYPICAL CHARACTERISTICS



92CM-8585RI



92CM-8584RI

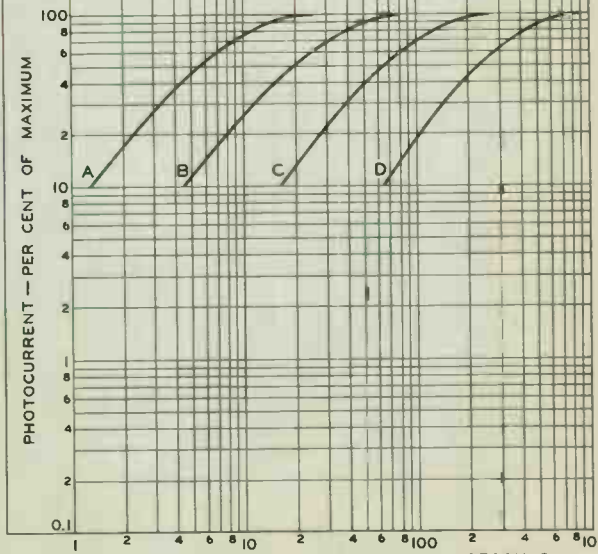
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6694-A

TYPICAL RISE CHARACTERISTICS

POLARIZING VOLTS=90
AMBIENT TEMPERATURE=25°C

CURVE	LIGHT INTENSITY FOOT-CANDLES
A	100
B	10
C	1
D	0.1



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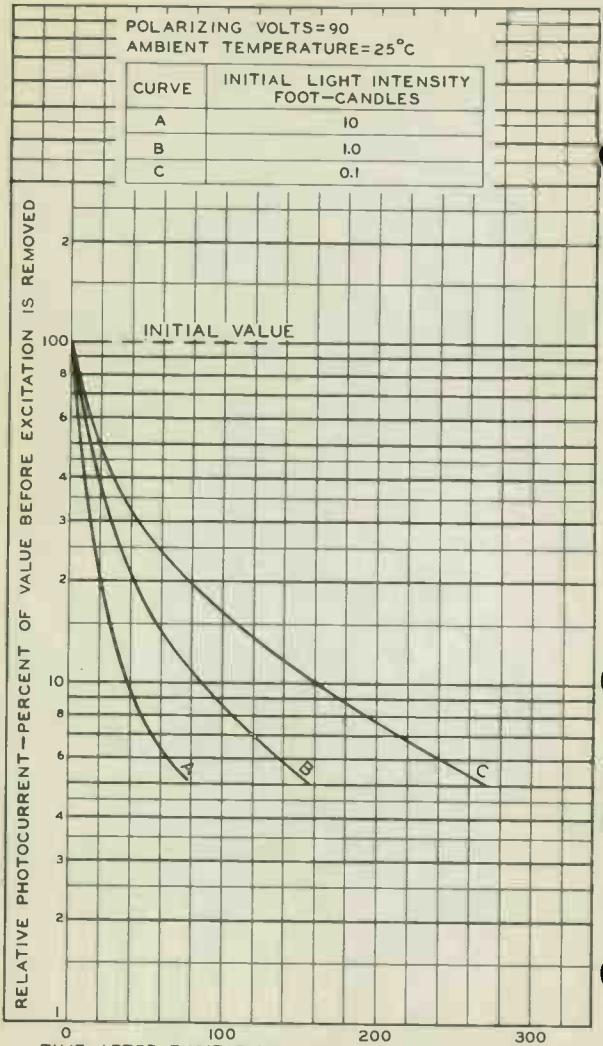
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8873

RCA

6694-A

TYPICAL DECAY CHARACTERISTICS



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-8593RI

6810

MULTIPLIER PHOTOTUBE

14-STAGE, HEAD-ON TYPE WITH
1-11/16" SEMITRANSPARENT CATHODE AND S-11 RESPONSE
SHORT TIME-RESOLUTION CAPABILITY

DATA

General:

Spectral Response	S-11	
Wavelength of Maximum Response	4400 ± 500	Angstroms
Cathode, Semitransparent:		
Shape	Circular	
Window:		
Area	2.2	sq. in.
Minimum diameter	1-11/16	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	7-1/2"	
Seated Length	6-11/16" ± 3/16"	
Maximum Diameter	2-3/8"	
Mounting Position	Any	
Weight (Approx.)	8 oz	
Bulb	T-16	
Base	Small-Shell Bidecal 20-Pin (JETEC No.E20-102), Non-hygroscopic	
Basing Designation for BOTTOM VIEW	20B	

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

Maximum Ratings, *Absolute Values:*

ANODE-SUPPLY VOLTAGE (DC)	2300 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.14 AND ANODE (DC)	400 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

* Averaged over any interval of 30 seconds maximum.

RCA

6810

MULTIPLIER PHOTOTUBE

Characteristics Range Values for Equipment Design:

Under conditions with supply voltage (E) across a voltage divider providing electrode voltages shown in Table 1

With E = 2000 volts (except as noted) and Accelerating-Electrode Voltage adjusted to give maximum gain

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms	–	0.6	–	amp/μwatt
Cathode radiant, at 4400 angstroms	–	0.048	–	μamp/μwatt
Luminous:♦				
At 0 cps	120	750	4500	amp/lumen
With dynode No.14 as output electrode†	–	525	–	amp/lumen
Cathode luminous:				
With tungsten light source▲	40	60	–	μamp/lumen
With blue light source⊕◆	0.04	–	–	μamp
Current Amplification	–	12.5×10^6	–	
Equivalent Anode-Dark-Current Input■	–	5×10^{-10}	2×10^{-9}	lumen
Equivalent Noise Input★	–	8×10^{-12}	–	lumen
Dark Current to Any Electrode Except Anode (At 25°C)	–	–	0.75	μamp

With E = 2300 volts (except as noted) and Accelerating-Electrode Voltage adjusted to give maximum gain

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms	–	3.2	–	amp/μwatt
Cathode radiant, at 4400 angstroms	–	0.048	–	μamp/μwatt
Luminous:♦				
At 0 cps	660	4000	28000	amp/lumen
With dynode No.14 as output electrode†	–	2800	–	amp/lumen
Cathode luminous:				
With tungsten light source▲	40	60	–	μamp/lumen
With blue light source⊕◆	0.04	–	–	μamp
Current Amplification	–	6×10^6	–	

♦,†,▲,⊕,◆,⊕,■,★: See next page.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6810

MULTIPLIER PHOTOTUBE

TABLE I

VOLTAGE TO BE PROVIDED BY DIVIDER

Between	5.4% of Supply Voltage (E) multiplied by
Cathode and Focusing Electrode	1
Focusing Electrode and Dynode No.1	1
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

● For conditions where 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. The value of sensitivity at dynode No.14 is approximately 70% of that when the anode is the output electrode. Specifically, the sensitivity measured at dynode No. 14 is equal to $(1-1/g)$ times the sensitivity measured at the anode, where "g" is the gain of the dynode-No.14 stage.

▲ For conditions the same as shown under (●) except that 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 2000 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 2000 volts is recommended.

▲ Under the following conditions: Supply voltage (E) is 2000 volts, 25°C tube temperature, external shield potential of −2000 volts, a-c 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.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6810

MULTIPLIER PHOTOTUBE

OPERATING CONSIDERATIONS

The *operating stability* of the 6810 is dependent on the magnitude of the anode current and its duration. When the 6810 is operated at high 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 6810 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 anode current should not exceed 250 microamperes.

Electrostatic and/or *magnetic shielding* of the 6810 may be necessary.

The *material* of which the dynodes of the 6810 are made has stable, high-current carrying capabilities and permits the use of a tube manufacturing process which minimizes regenerative effects such as afterpulses. The relative freedom of the 6810 from afterpulses and its small spread in electron transit time make it particularly useful for fast coincidence scintillation counting.

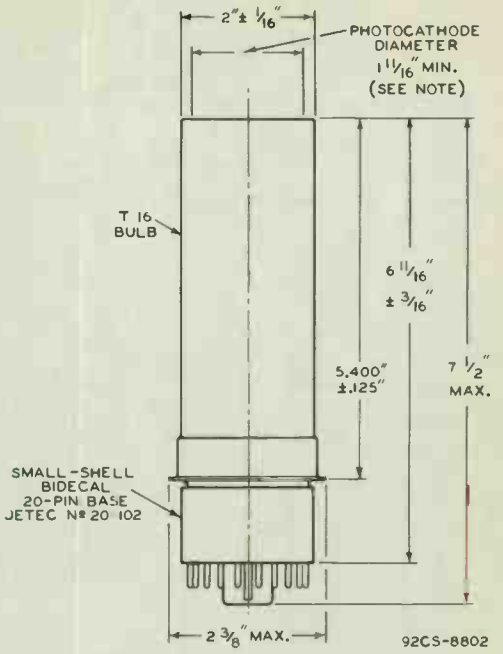
Because the 6810 offers the advantage of small spread in electron transit time, it has a fast pulse rise time. As a result, the 6810 has very short time-resolution capability, i.e., in the order of 1 or 2 millimicroseconds. For an input pulse having a duration of 1 millimicrosecond or less, the time spread of the pulse at the anode is about 9 millimicroseconds measured at 50 per cent of the maximum pulse height, when the supply voltage is 2000 volts and the focusing electrode is connected to dynode No. 1.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-11 Response
is shown at the front of this Section

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6810

MULTIPLIER PHOTOTUBE



℄ 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 MINIMUM DIAMETER, DEVIATION FROM FLATNESS WILL NOT EXCEED 0.010" FROM PEAK TO VALLEY.

6810

RCA

6810

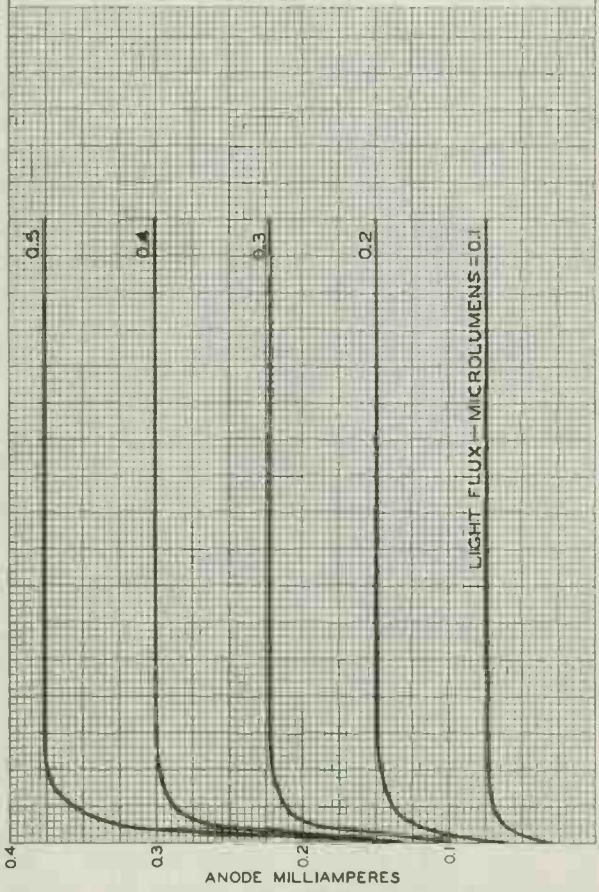
AVERAGE ANODE CHARACTERISTICS

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 MAX. GAIN

LIGHT SOURCE IS TUNGSTEN FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870°K.



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8846

RCA

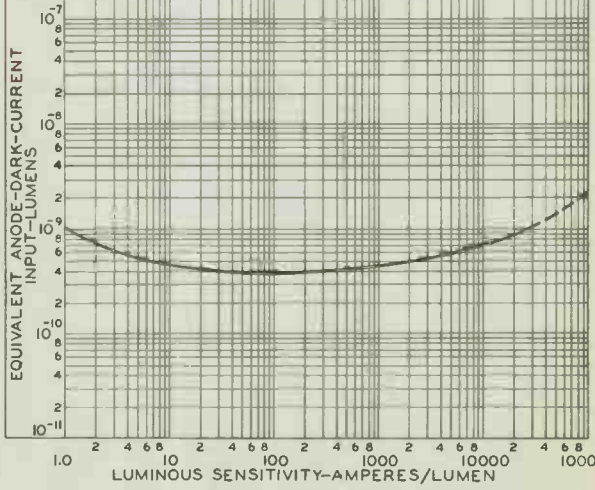
6810

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 & 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}	1.50
DY_{13} & DY_{14}	1.75
DY_{14} & ANODE	2.
ANODE & CATHODE	18.5

GRID-№2 VOLTS ADJUSTED TO GIVE MAX. GAIN.
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870°K.
TUBE TEMPERATURE=25°C
DASHED PORTION INDICATES INSTABILITY.



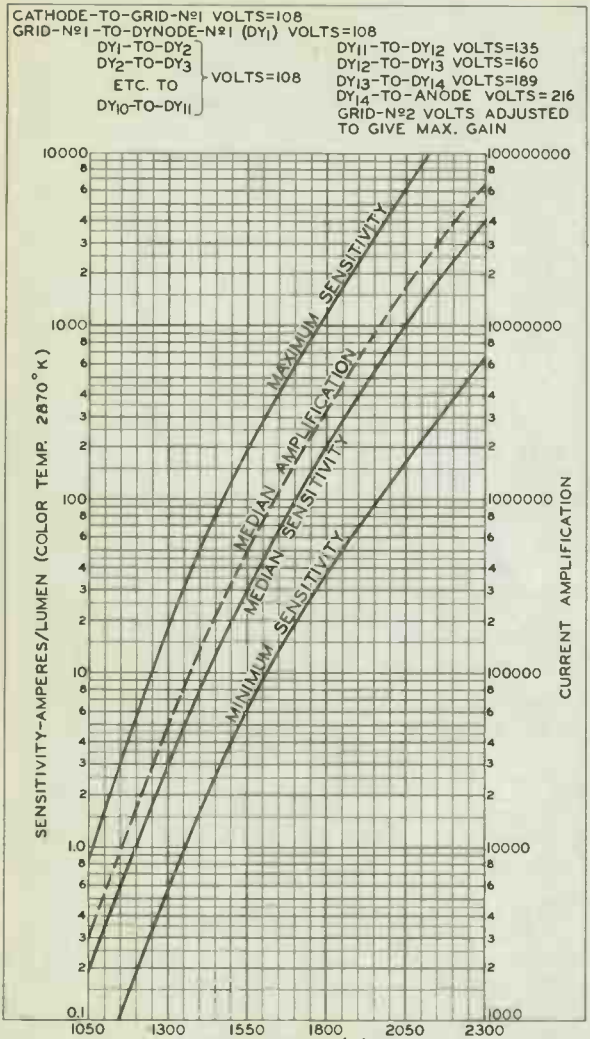
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8848

RCA

6810

CHARACTERISTICS



6810-A

MULTIPLIER PHOTOTUBE

14-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE WITH 1-11/16" CURVED, SEMITRANSPARENT CATHODE AND S-11 RESPONSE
VERY SHORT TIME-RESOLUTION CAPABILITY

Supersedes Type 6810

DATA

General:

Spectral Response	S-11	
Wavelength of Maximum Response	4400 ± 500	angstroms
Cathode, Semitransparent:		
Shape	Curved Circular	
Window:		
Area	2.2	sq. in.
Minimum diameter	1-11/16	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	7-1/2"	
Seated Length	6-11/16" ± 3/16"	
Maximum Diameter	2-3/8"	
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	20B	

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

LOW-LIGHT, 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:*

ANODE-SUPPLY VOLTAGE (DC)	2400 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.14 AND ANODE (DC)	400 max.	volts

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MULTIPLIER PHOTOTUBE

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 accelerating-electrode voltage adjusted to give maximum gain

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms	–	0.6	–	amp/μw
Cathode radiant, at 4400 angstroms	–	0.048	–	μa/μw
Luminous:#				
At 0 cps	120	750	4500	amp/lumen
With dynode No.14 as output electrode†	–	525	–	amp/lumen
Cathode luminous:				
With tungsten light source▲	40	60	–	μa/lumen
With blue light source**◆	0.04	–	–	μa
Current Amplification	–	12.5×10^6	–	
Equivalent Anode-Dark-Current Input●■	–	5×10^{-10}	2×10^{-9}	lumen
Equivalent Noise Input★	–	6×10^{-12}	–	lumen
Greatest Transit-Time Spread: Within a circle centered on tube face and having a diameter of—				
1-1/8"	–	1	–	millμsec
1-9/16"	–	3	–	millμsec

HIGH-OUTPUT-PULSE SERVICE

With supply voltage (E) across voltage divider providing electrode voltages shown in Table I—Column B

Maximum Ratings, *Absolute Values:*

ANODE-SUPPLY VOLTAGE (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

●,#,†,▲,**,◆,■,★: See next page.

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MULTIPLIER PHOTOTUBE

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 accelerating-electrode voltage adjusted to give maximum gain

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms	–	0.6	–	amp/μw
Cathode radiant, at 4400 angstroms	–	0.048	–	μa/μw
Luminous:#				
At 0 cps	–	750	–	amp/lumen
With dynode No.14 as output electrode†	–	525	–	amp/lumen
Cathode luminous:				
With tungsten light source▲	40	60	–	μa/lumen
With blue light source**♦	0.04	–	–	μa
Current Amplification	–	12.5×10^6	–	
Equivalent Anode-Dark-Current Input♦●	–	1.1×10^{-9}	–	lumen
Equivalent Noise Input**	–	8×10^{-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.

●, #, ▲, †, ♦, **: See next page.

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MULTIPLIER PHOTOTUBE

* 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 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 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 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 2300 volts is recommended.

★★ Same as (★) except the supply voltage (E) is 2400 volts, and the external shield potential is −2400 volts.

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	1	1
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
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

6810-A

MULTIPLIER PHOTOTUBE

OPERATING CONSIDERATIONS

The *operating stability* of the 6810-A is dependent on the magnitude of the anode current and its duration. When the 6810-A is operated at high 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 6810-A 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 anode current should not exceed 250 microamperes.

Electrostatic and/or *magnetic shielding* of the 6810-A may be necessary.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-11 Response is shown at the front of this Section

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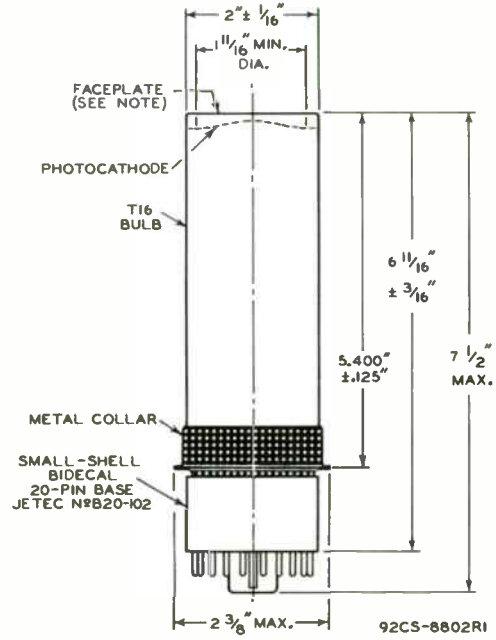
MULTIPLIER PHOTOTUBE



℄ 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 1-11/16" DIAMETER, DEVIATION FROM FLATNESS OF EXTERNAL SURFACE OF FACEPLATE WILL NOT EXCEED 0.010" FROM PEAK TO VALLEY.

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6810-A

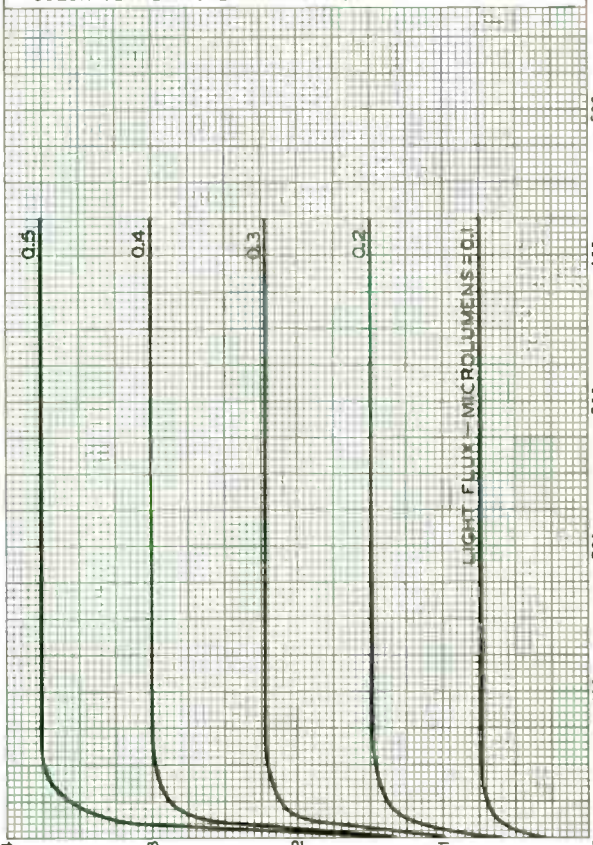
AVERAGE ANODE CHARACTERISTICS
LOW-LIGHT, LOW-NOISE, HIGH-GAIN SERVICE

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 MAX. GAIN.

LIGHT SOURCE IS TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.



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92CM-8846

6810-A

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6810-A

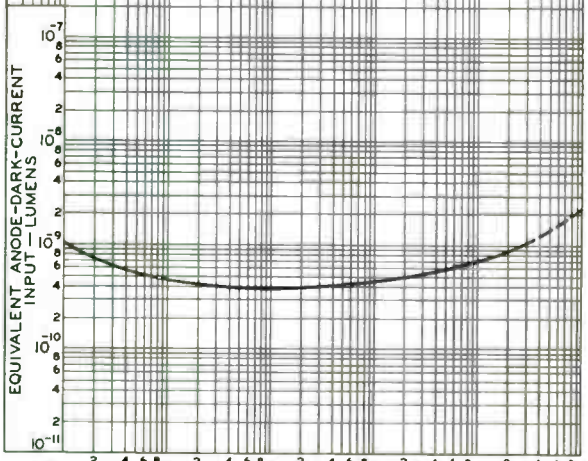
TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

LOW-LIGHT, 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}	1.50
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.



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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8848

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6810-A

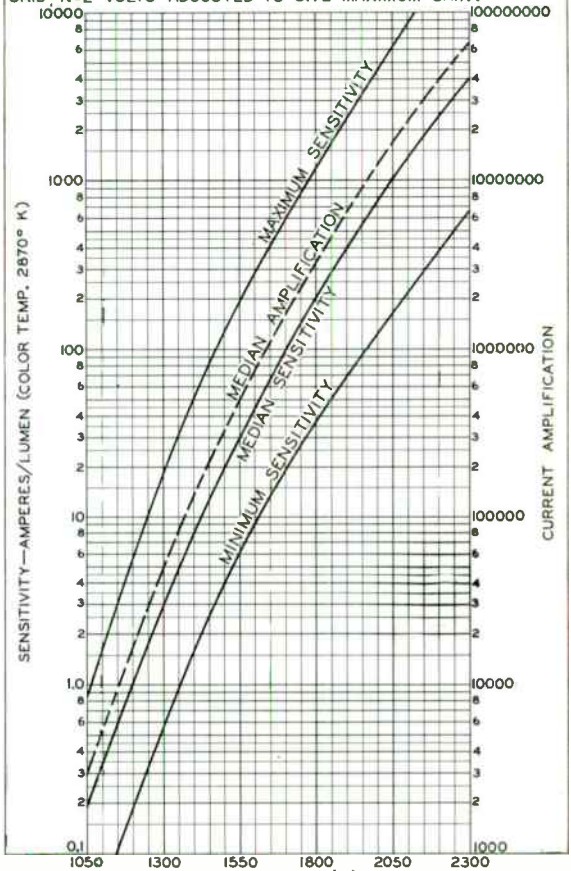
CHARACTERISTICS

LOW-LIGHT, 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 №1	1	DY_1 & DY_{12}	1.25
GRID №1 & DYNODE №1	1	DY_{12} & DY_{13}	1.5
DYNODE №1 (DY_1) & DY_2	1	DY_{13} & DY_{14}	1.75
ETC. THRU DY_{10} & DY_{11}		DY_{14} & ANODE	2

GRID-№2 VOLTS ADJUSTED TO GIVE MAXIMUM GAIN.



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92CL-8845RI

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6810-A

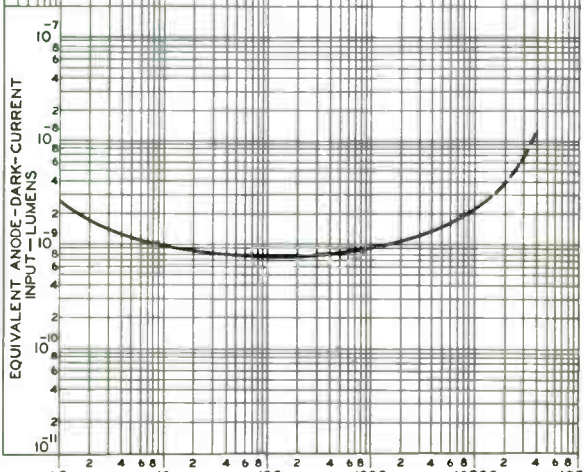
TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

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}	3.0
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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92CM-9356

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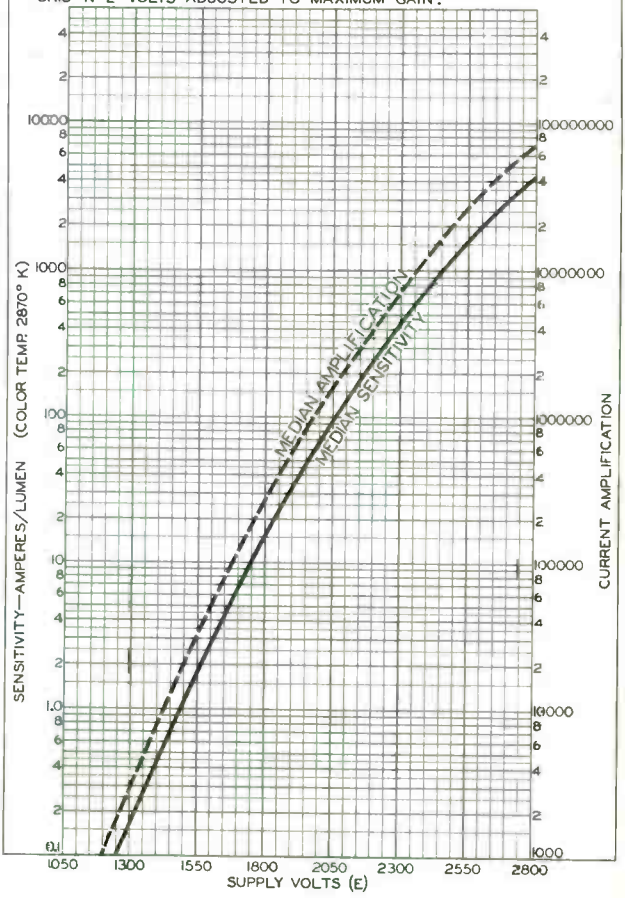
6810-A

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 Nº1	1	DY_8 & DY_9	1.9
GRID Nº1 & DYNODE Nº1 (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_6 & DY_7	1.2	DY_{12} & DY_{13}	4.8
DY_7 & DY_8	1.5	DY_{13} & DY_{14}	5
		DY_{14} & ANODE	4.8

GRID-Nº2 VOLTS ADJUSTED TO MAXIMUM GAIN.



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MULTIPLIER PHOTOTUBE

10-STAGE, HEAD-ON TYPE WITH
1-5/8" SEMITRANSPARENT CATHODE AND S-13 RESPONSE

DATA

General:

Spectral Response	S-13	
Wavelength of Maximum Response	4400 ± 500	angstroms
Cathode, Semitransparent:		
Shape	Circular	
Window:		
Area	2.0	sq. in.
Minimum diameter	1-5/8	in.
Index of refraction at 2000 angstroms	1.51	
Direct Interelectrode Capacitances (Approx.):		
Anode to dynode No.10	4.4	μμf
Anode to all other electrodes	7	μμf
Maximum Overall Length	6-9/16"	
Seated Length	5-5/8" ± 3/16"	
Maximum Diameter	2-5/16"	
Mounting Position	Any	
Weight (Approx.)	7 oz	
Bulb	T-16	
Faceplate	Fused Silica	
Maximum thickness	0.150"	
Base	Medium-Shell Diheptal 14-Pin (JETEC 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

DIRECTION OF LIGHT: INTO END OF BULB

Pin 10 – Dynode No.10
Pin 11 – Anode
Pin 12 – Internal Connection – Do Not Use
Pin 13 – Focusing Electrode
Pin 14 – Cathode

Maximum Ratings, *Absolute Values:*

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	1250 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE (DC or Peak AC)	250 max.	volts
DYNODE-No.1 SUPPLY VOLTAGE (DC or Peak AC)	300 max.	volts
FOCUSING-ELECTRODE VOLTAGE (DC or Peak AC)	300 max.	volts
AVERAGE ANODE CURRENT*	0.75 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

* Averaged over any interval of 30 seconds maximum.

TUBE DIVISION
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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 = 1000 volts (except as noted) and Focusing Electrode connected to Dynode No.1 at socket*

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms . .	–	19000	–	μamp/μwatt
Cathode radiant, at 4400 angstroms . .	–	0.047	–	μamp/μwatt
Luminous:♦				
At 0 cps	8	24	240	amp/lumen
With dynode No.10 as output electrode**	–	14	–	amp/lumen
Cathode luminous:				
With tungsten light source▲ . .	40	60	–	μamp/lumen
With blue light source●♦	0.04	–	–	μamp
Current Amplification.	–	400000	–	
Equivalent Anode-Dark-Current Input●■ . . .	–	1×10^{-9}	3×10^{-9}	lumen
Equivalent Noise Input:				
Luminous▲	–	6.7×10^{-12}	–	lumen
Ultraviolet†	–	1.6×10^{-14}	–	watt
Dark Current to Any Electrode Except Anode (At 25°C). . .	–	–	0.75	μamp

With E = 750 volts (except as noted) and Focusing Electrode connected to Dynode No.1 at socket*

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms . .	–	1650	–	μamp/μwatt
Cathode radiant, at 4400 angstroms . .	–	0.047	–	μamp/μwatt
Luminous:♦				
At 0 cps	–	2.1	–	amp/lumen
With dynode No.10 as output electrode**	–	1	–	amp/lumen

♦ 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.

*,**,▲,●,♦,▼,■,★,†: See next page.

TUBE DIVISION
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MULTIPLIER PHOTOTUBE

	Min.	Median	Max.	
Cathode luminous:				
With tungsten light source▲ . .	40	60	–	μamp/lumen
With blue light source◆	0.04	–	–	μamp
Current Amplification.	–	35000	–	

• In general, the focusing electrode is connected to dynode No.1 at the socket and operated at the same fixed potential as dynode No.1. However, in applications critical as to magnitude, uniformity, or speed of the response, the focusing electrode may be connected to the adjustable arm of a potentiometer between cathode and dynode No.1 in the voltage divider, and operated at an optimum potential within a range of 10 to 60 per cent of the dynode-No.1 potential.

•• 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: 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 150 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 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, 25°C tube temperature, 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.

† Determined under the same conditions as shown under (★) except that use is made of monochromatic source having radiation of 2537 angstroms.

OPERATING CONSIDERATIONS

The *operating stability* of the 6903 is dependent on the magnitude of the anode current and its duration. When the 6903 is operated at high 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 6903 usually recovers a substantial percentage of such loss in sensitivity.

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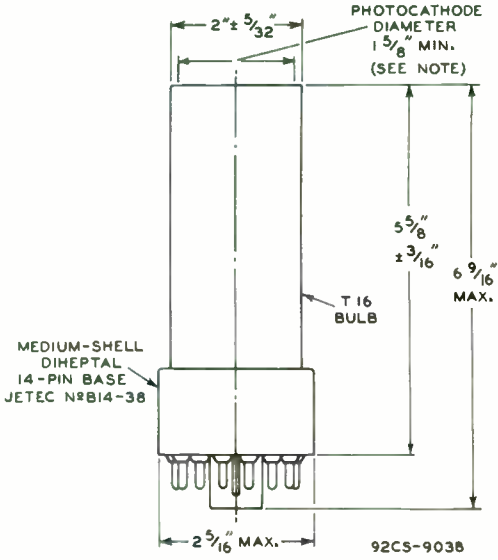
MULTIPLIER PHOTOTUBE

The use of an average anode current well below the maximum rated value of 0.75 milliampere is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 100 microamperes.

Electrostatic and/or *magnetic shielding* of the 6903 may be necessary.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-13 Response is shown at the front of this Section



℄ 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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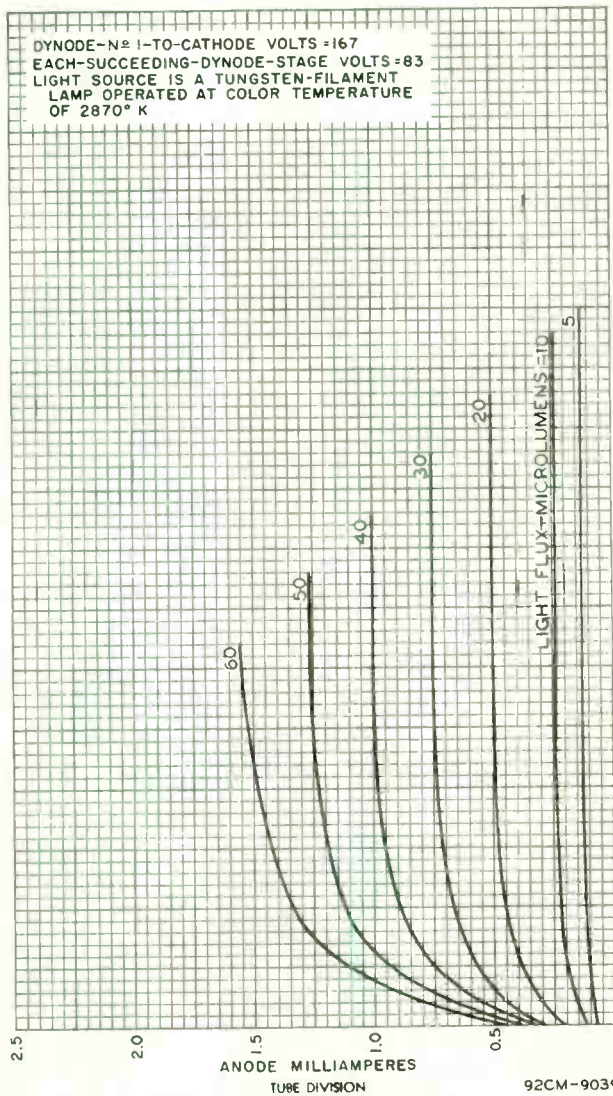
AVERAGE ANODE CHARACTERISTICS



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92CM-9039

6903

RCA

6903

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

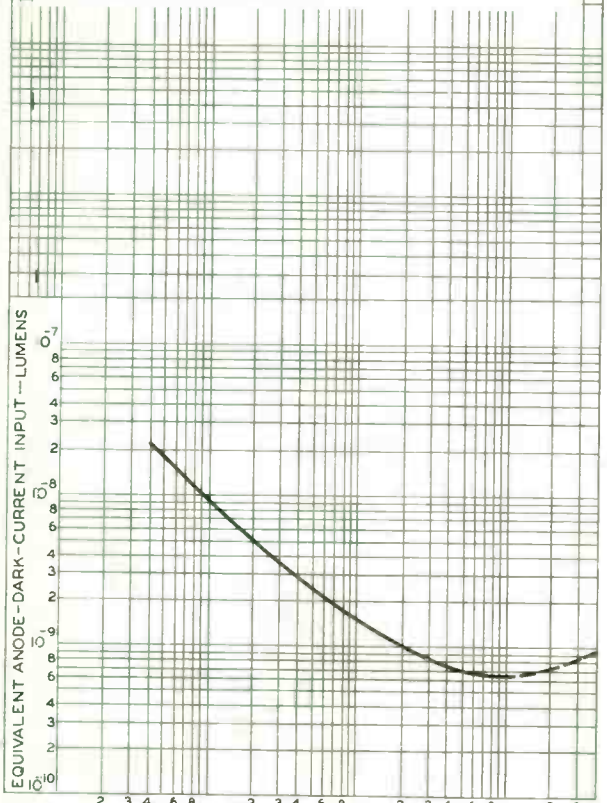
LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES $1/6$ OF E BETWEEN CATHODE AND DYNODE №1; $1/12$ OF E FOR EACH SUCCEEDING STAGE; AND $1/12$ OF E BETWEEN DYNODE №10 AND ANODE.

FOCUSING ELECTRODE IS CONNECTED TO DYNODE №1.

DASHED PORTION INDICATES INSTABILITY.

LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870°K.

TUBE TEMPERATURE = 25°C



TUBE DIVISION
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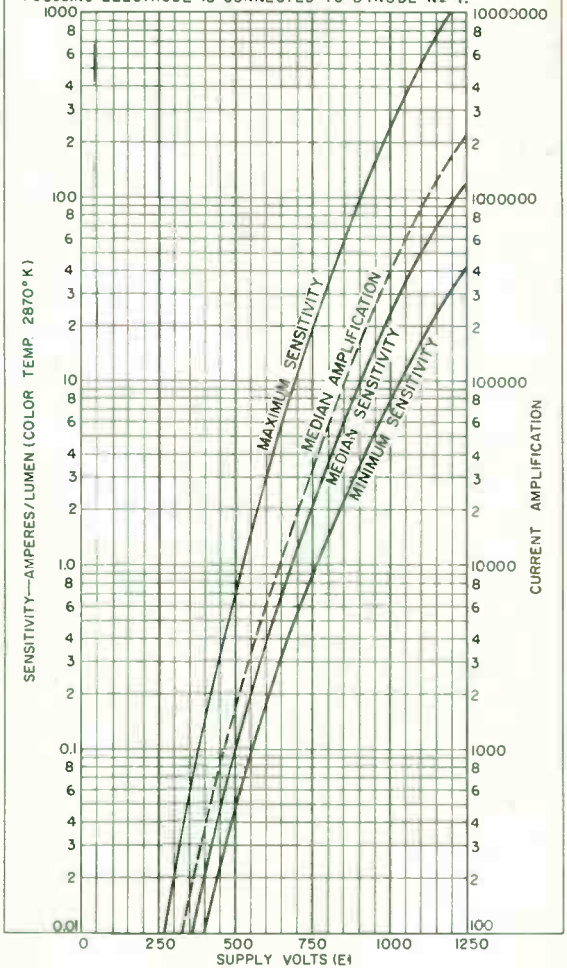
92CM-9032

6903

CHARACTERISTICS

SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER PROVIDING 1/E$_1$ 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 IS CONNECTED TO DYNODE Nº 1.



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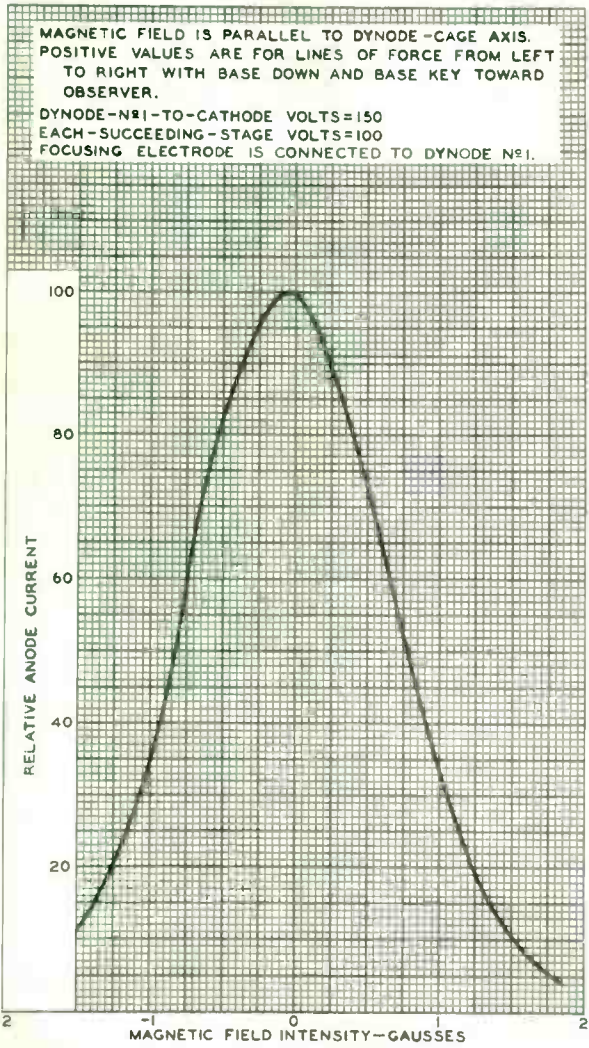
92CL-9033

EFFECT OF MAGNETIC FIELD ON ANODE CURPENT



6953

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 1	*Rating 11*	
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.

	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.

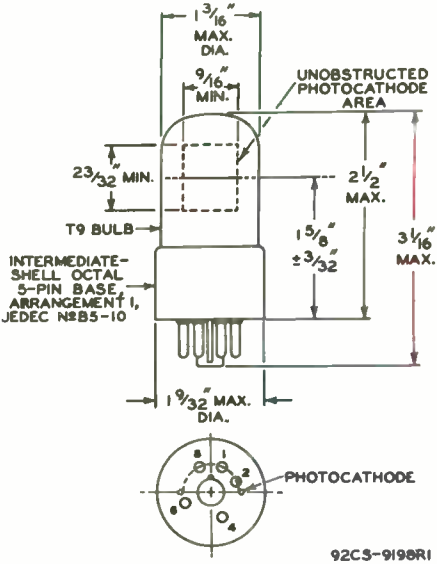
[d] The ratio of luminous sensitivity at an anode supply voltage of 90 volts to luminous sensitivity at an anode supply voltage of 25 volts. In each case, sensitivity is obtained under conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K, the light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

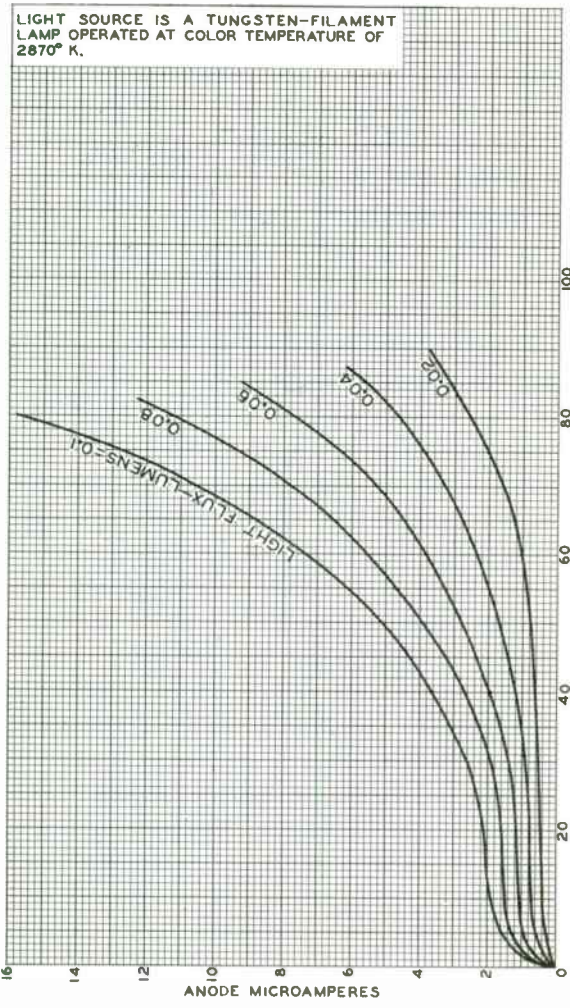
and

FREQUENCY-RESPONSE CHARACTERISTICS OF GAS PHOTOTUBES

are shown at the front of this section



AVERAGE ANODE CHARACTERISTICS



92CM-9226

6957

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)	0.650"
Width (Minimum)	0.540"
Area (Minimum)	0.35 sq. in.
Maximum Overall Length	2-7/32"
Maximum Seated Length	1-11/16"
Seated Length to Plane of Sensitive Surface	1" ± 3/32"
Maximum Diameter	1-9/32"
Operating Position	Any
Weight (Approx.)	0.9 oz
Bulb	T9
Base	Intermediate-Shell Octal 5-Pin (JETEC No. B5-10)
Basing Designation for BOTTOM VIEW	8HV

Pin 1 – No Connection
Pin 2 – No Connection
Pin 4 – Terminal
Pin 6 – No Connection
Pin 8 – Terminal

DIRECTION OF LIGHT: INTO END OF BULB

Maximum Ratings, *Absolute Values:*

POLARIZING VOLTAGE	250 max.	volts
POWER DISSIPATION:		
Sensitive surface fully illuminated	0.5 max.	watt
Sensitive surface partially illuminated	1.4 max.	watts/sq. in.
PHOTOCURRENT	50 max.	ma
AMBIENT-TEMPERATURE RANGE	-75 to +60	°C

Characteristics:

Under conditions with polarizing voltage of 50 volts dc and at ambient temperature of 25° C

	Min.	Median	Max.	
Sensitivity:				
Radiant#, at 5800 angstroms	–	300	–	μa/μw
Luminous*, at 0 cps	–	0.85	–	amp/lumen
Illumination♦, at 0 cps	2000	4000	8000	μa/ft-c
Photocurrent▲	–	–	20	μa
Rise				*See Curves*
Decay				*See Curves*

For conditions where the incident power is 6.65 microwatts.

*, ♦, ▲: See next page.

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TENTATIVE DATA

6957

PHOTOCONDUCTIVE CELL

* For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A light flux of about 2.5 millilumens is used.

♦ For conditions the same as shown under (*) except that an incident illumination of 1.0 foot-candle is used.

▲ Measured approximately 10 seconds after removal of incident illumination of 1.0 foot-candle.

DEFINITIONS

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

OPERATING CONSIDERATIONS

The *polarizing voltage* for the 6957 may be applied without regard to polarity.

Exposure of the 6957 to radiation so intense as to cause excessive heating of the cell may permanently damage it.

The *angle of view* of the 6957 may be narrowed by the use of a hood of the desired length placed around the bulb end of the cell.

In some applications where the light source is several feet from the cell, a simple lens arrangement in which a suitable lens at the light source is used to collimate the light beam and another lens is used in front of the cell to converge the beam onto the sensitive area, will serve to utilize the available amount of light most effectively.

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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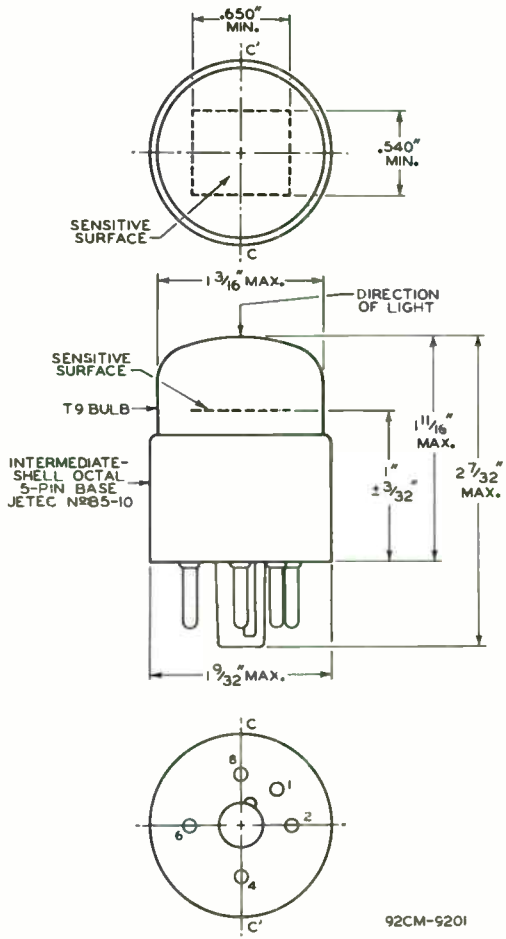
TENTATIVE DATA

6957

PHOTOCONDUCTIVE CELL

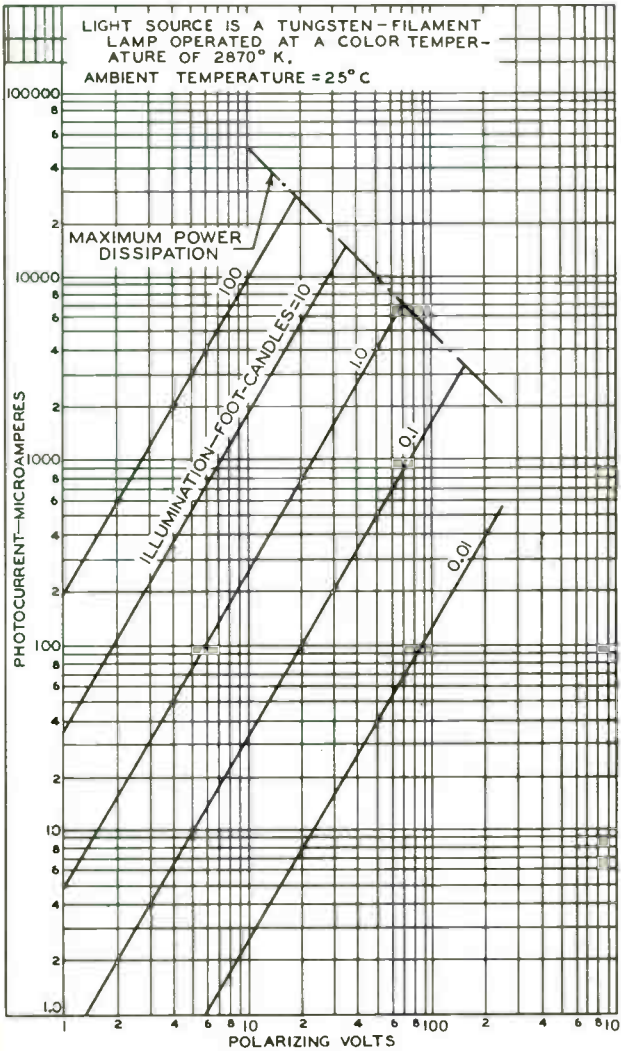


PLANE THROUGH MINOR AXIS (CC') OF SENSITIVE SURFACE AND CELL AXIS MAY VARY FROM PLANE THROUGH THE CELL AXIS AND PINS 4 AND 8 BY ANGULAR TOLERANCE (MEASURED ABOUT THE CELL AXIS) OF ± 10°.

RCA

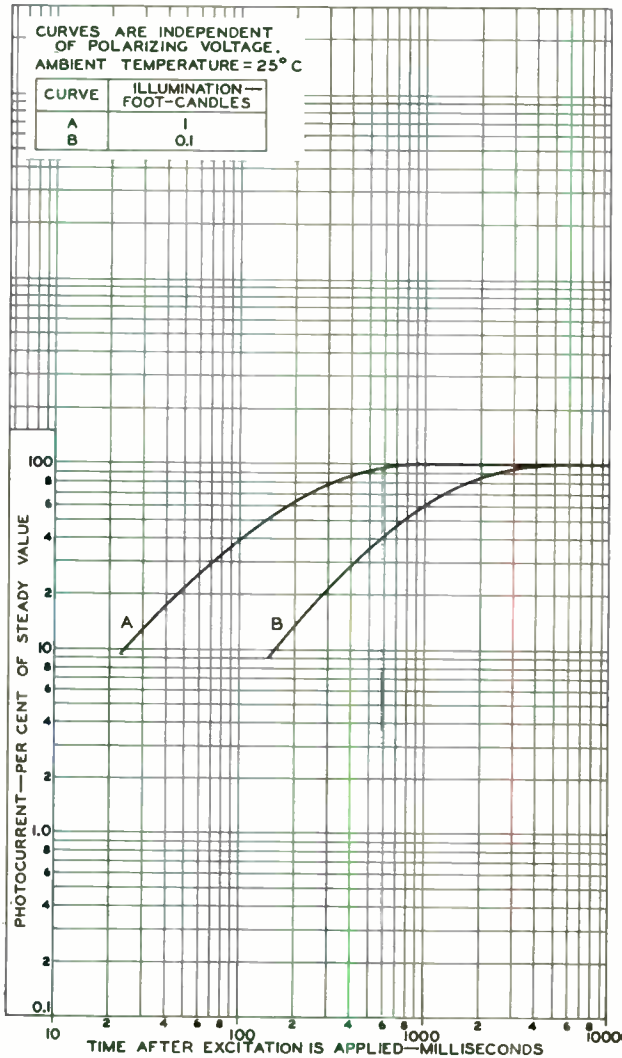
6957

AVERAGE CHARACTERISTICS



6957

TYPICAL RISE CHARACTERISTICS



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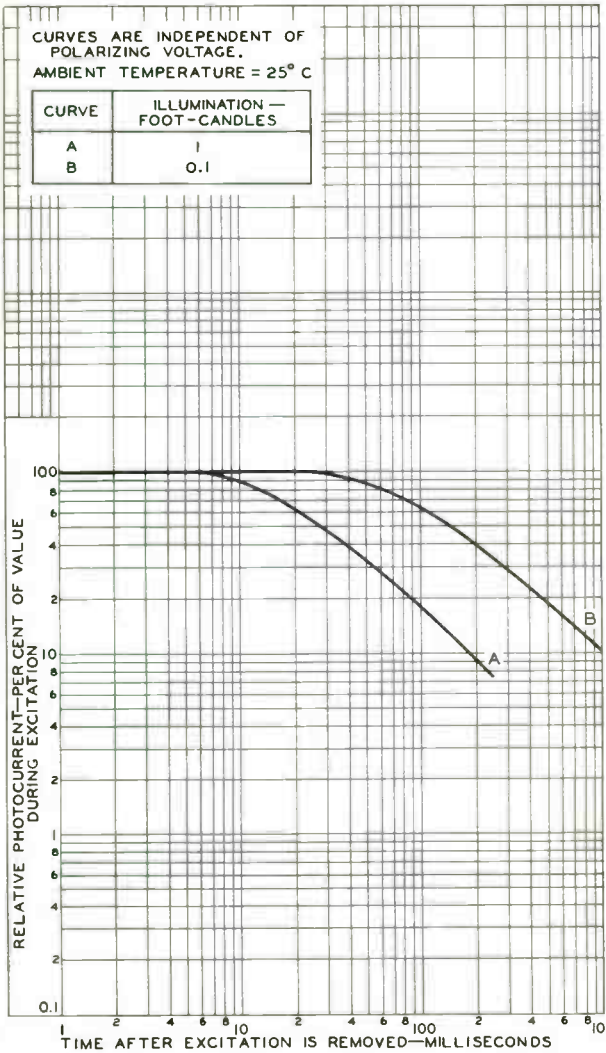
RCA

6957

TYPICAL DECAY CHARACTERISTICS



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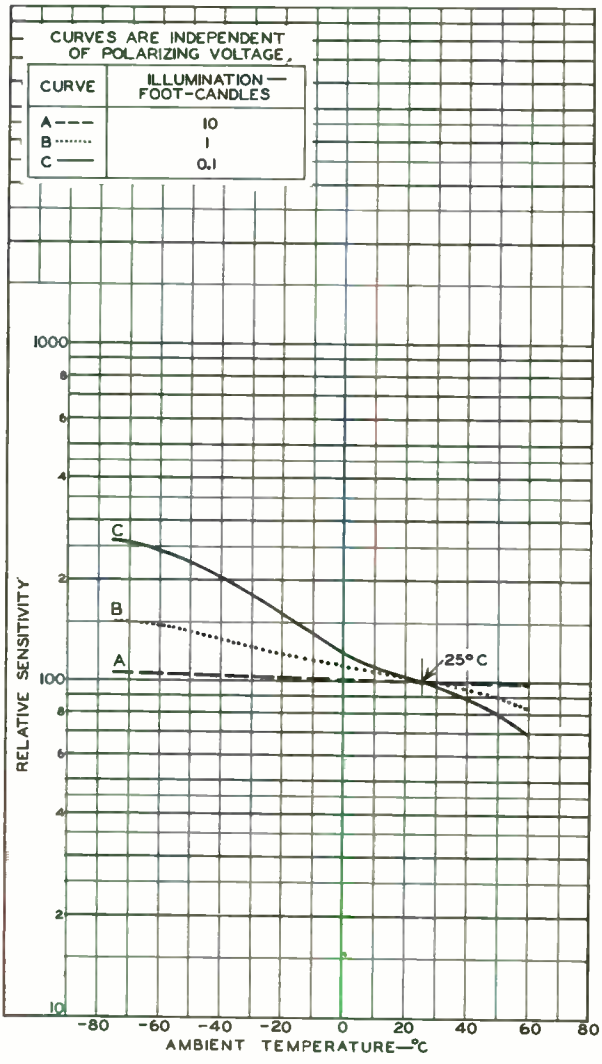
92CM-9202

RCA

6957

TYPICAL CHARACTERISTICS



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92CM-9208

7029

MULTIPLIER PHOTOTUBE

10-STAGE, DORMER-WINDOW TYPE WITH SEMITRANS-PARENT CATHODE ON REFLECTIVE SUBSTRATE AND S-17 RESPONSE

DATA

General:

Spectral Response	S-17	
Wavelength of Maximum Response	4900 ± 500	angstroms
Cathode, Semitransparent on Reflective Substrate:		
Shape	Rectangular on concave spherical surface	
Minumum projected length on plane of window	0.65	in.
Minimum projected width on plane of window	0.5	in.
Direct Interelectrode Capacitances (Approx.):		
Anode to dynode No.10	4	μμf
Anode to all other electrodes	7	μμf
Maximum Overall Length	3.75"	
Maximum Seated Length	3.25"	
Length from Base Seat to Center of Window Area	2.69" ± 0.19"	
Diameter	1.50" ± 0.06"	
Operating Position	Any	
Weight (Approx.)	3	oz
Bulb	T12 with Special End Contour	
Socket	Eby No.9058, or equivalent	
Base	Ultrashort Small-Shell Duodecal 12-Pin (JETEC No.B12-186), Non-hygroscopic	
Basing Designation for BOTTOM VIEW	12AH	

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

Maximum Ratings, *Absolute Values:*

For altitudes up to 60,000 feet

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	1250 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE (DC or Peak AC)	250 max.	volts
DYNODE-No.1 SUPPLY VOLTAGE (DC or Peak AC)	300 max.	volts
AVERAGE ANODE CURRENT●	20 max.	μa
AMBIENT-TEMPERATURE RANGE	-50 to +75	°C

●: See next page.

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RCA

7029

MULTIPLIER PHOTOTUBE

Characteristics Range Values for Equipment Design:

Under conditions with supply voltage (E) across voltage divider providing 1/11 of E per stage

With E = 1000 volts (except as noted)

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4900 angstroms.	–	27200	–	μa/μw
Cathode radiant, at 4900 angstroms	–	0.085	–	μa/μw
Luminous♦	10	40	300	amp/lumen
Cathode luminous:				
With tungsten light source▲	100	125	–	μa/lumen
With blue light source● .	0.006	–	–	μa
Current Amplification	–	320000	–	
Equivalent Anode-Dark-Current Input■	–	4×10^{-10}	–	lumen
Equivalent Noise Input★ . . .	–	1.1×10^{-11}	–	lumen

● 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 1 microlumen 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 0.001 lumen and 100 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 0.001 lumen. The load resistor has a value of 0.01 megohm, and 100 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 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, 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.

SPECIAL PERFORMANCE DATA

4-Hour Stability Life Performance:

This test is performed on each 7029. Before this test is made, the tube is kept in total darkness for 24 hours. Under conditions with supply volts E = 1000, tube temperature of 25° C, and light flux adjusted to give an

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

7029

MULTIPLIER PHOTOTUBE

anode current = 10 microamperes within 1 minute after turning on light source, the tube is operated for 4 hours. At the end of this period the anode current will not increase by more than 1 microampere nor decrease by more than 1.5 microamperes.

OPERATING CONSIDERATIONS

The *operating stability* of the 7029 is dependent on the magnitude of the anode current and its duration. When the 7029 is operated at high 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 7029 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum rated value of 20 microamperes is recommended when stability of operation is important. When greater stability is required, the anode current should not exceed 10 microamperes.

Electrostatic and/or magnetic shielding of the 7029 may be necessary. It is to be noted that the use of an external magnetic and/or electrostatic shield at high negative potential presents a safety hazard unless the shield is connected through a high impedance in the order of 10 megohms to the potential. 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-17 Response is shown at the front of this Section

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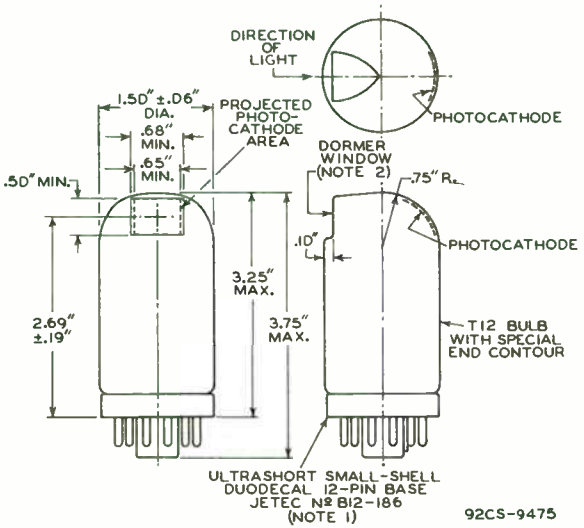
7029

MULTIPLIER PHOTOTUBE



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

NOTE 2: DORMER WINDOW IS ON OPPOSITE SIDE OF TUBE FROM BASE KEY.

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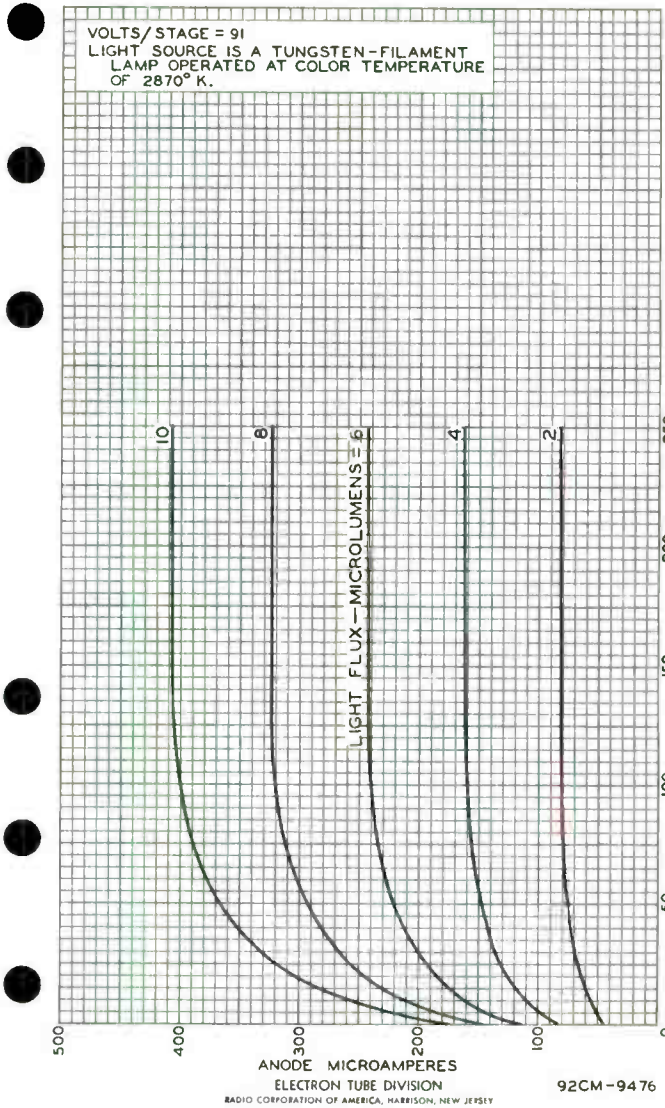
RCA

7029

AVERAGE ANODE CHARACTERISTICS



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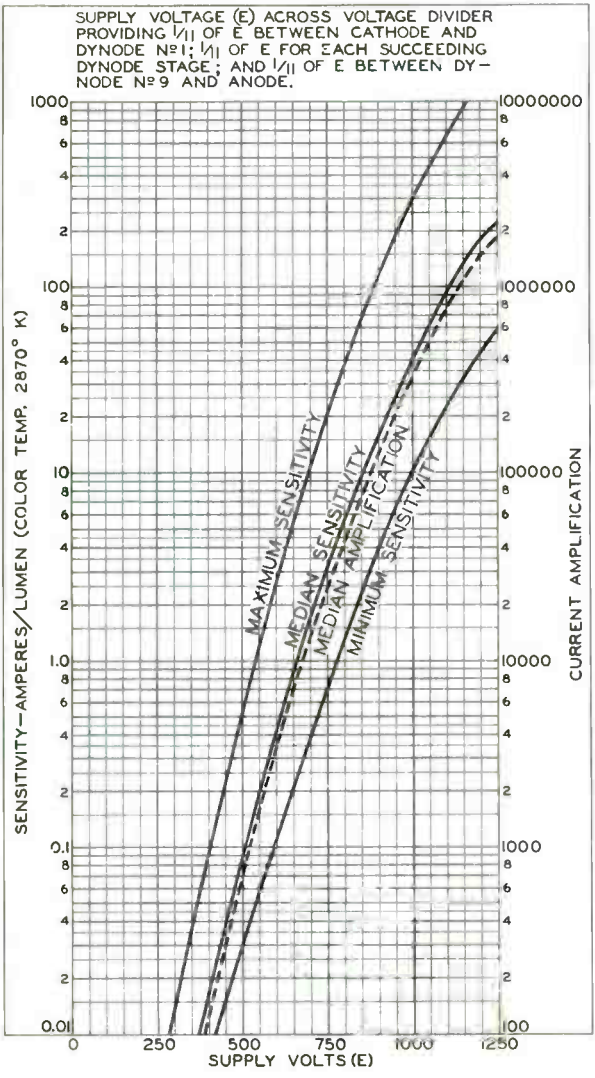
RCA

7029

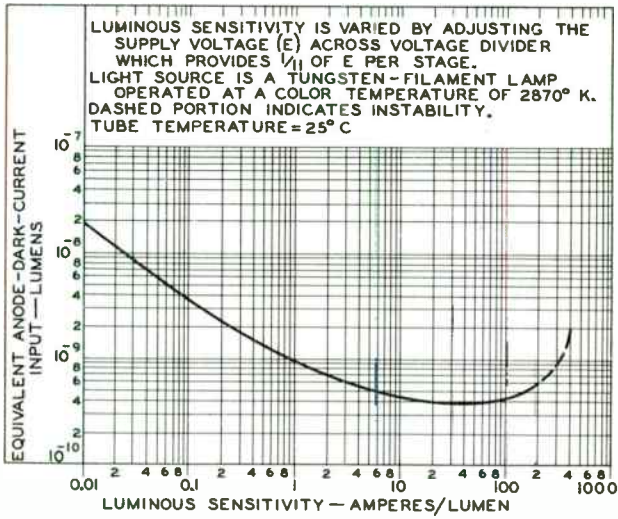
CHARACTERISTICS



RCA

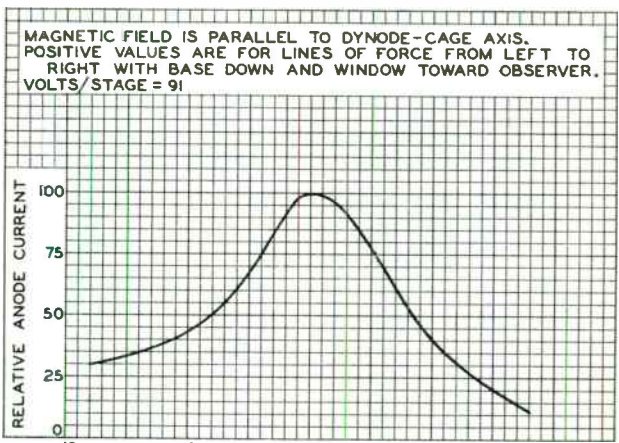
7029

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



92CS-9478

EFFECT OF MAGNETIC FIELD ON ANODE CURRENT



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92CS-9479

7037

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 . . . . . amp

Direct Interelectrode Capacitance:
- Anode to all other electrodes . . . . . 12 μμf

Photocathode, Semitransparent:
- Response. . . . . *See accompanying Spectral-Sensitivity Characteristics curve*
- 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
End Base. . . . Small-Shell Diheptal 14-Pin (JETEC No.B14-45)

BOTTOM VIEW■

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

■ See basing diagram on next page.

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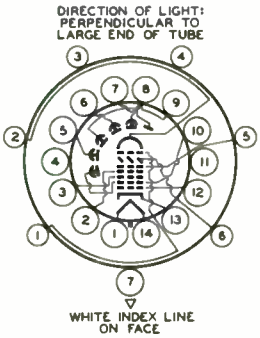
RCA

7037

IMAGE ORTHICON

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

Maximum and Minimum 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).	40 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

*: See next page.

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IMAGE ORTHICON

Typical Operation and Characteristics	Range Values:	
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	
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Anode Current (DC)	30	μa
Signal-Output Current (Peak to peak)	3 to 24	μa
Target-Temperature Range	40 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

* 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.

OPERATING CONSIDERATIONS

The *operating position* of the 7037 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.

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

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7037
IMAGE ORTHICON

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 7037 and the associated amplifier equipment. Unless vibration is prevented, distortion of the picture may occur.

Ordinarily, the temperature in a camera equipped with a blower will not exceed 45° C, except in very hot weather or unless the target heater is left on accidentally for a long period.

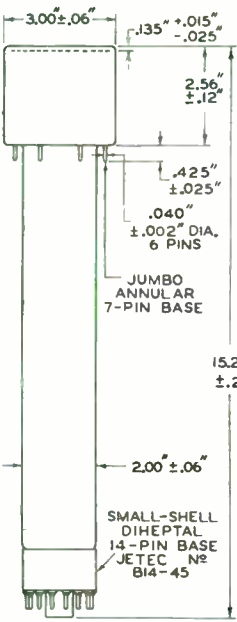
To keep the operating temperature of the large end of the tube from falling below 45° C, some form of controlled heating should be employed. Ordinarily, adequate heat will be supplied by the focusing coil, deflecting coils, and associated amplifier tubes so that the temperature can be controlled by the 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.

Resolution in excess of 500 lines at the center of the picture can be produced by the 7037 when operated for color reproduction.

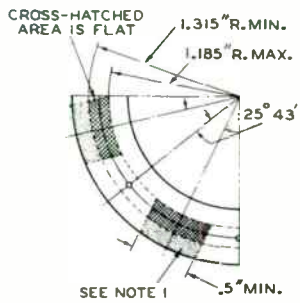
To utilize the resolution capability of the 7037 in the horizontal direction with the standard scanning rate of 525 lines, it is necessary to use a video amplifier having a bandwidth of at least 6 megacycles.

7037

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

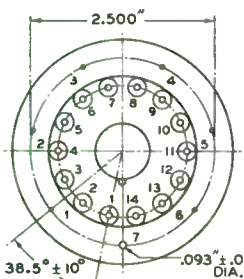
ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

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-8293R3

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RCA

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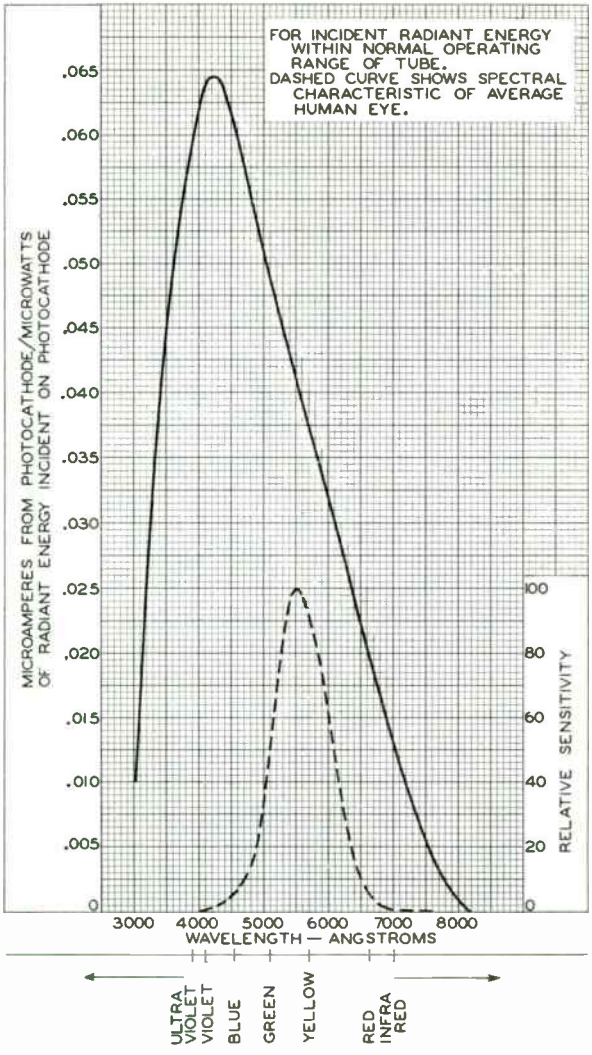
SPECTRAL-SENSITIVITY CHARACTERISTICS



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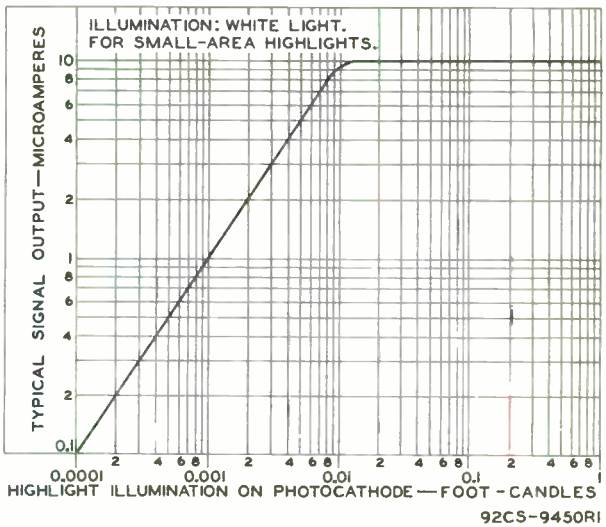
92CM-9442

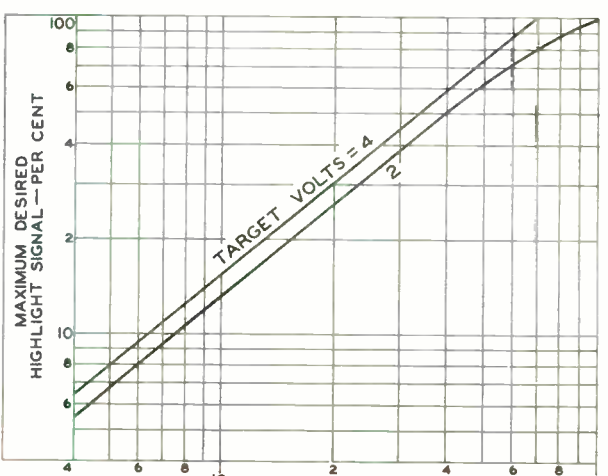
7037

BASIC LIGHT-TRANSFER CHARACTERISTIC



92CS-9450RI

LIGHT-TRANSFER CHARACTERISTICS



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92CS-9441

7038
VIDICON

600-LINE RESOLUTION

For film and live 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 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 . . . . . 6.25" ± 0.25"
Greatest Diameter. . . . . 1.125" ± 0.010"
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 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.

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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
Dark Current	0.02	μa
Target Current (Highlight)■.	0.3 to 0.4	μa

●, *, □, ●, ○, ●, **, †, ▲, ■, #: see next page.

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VIDICON

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 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.

▪ 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 80 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 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 7038 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 subtracted.

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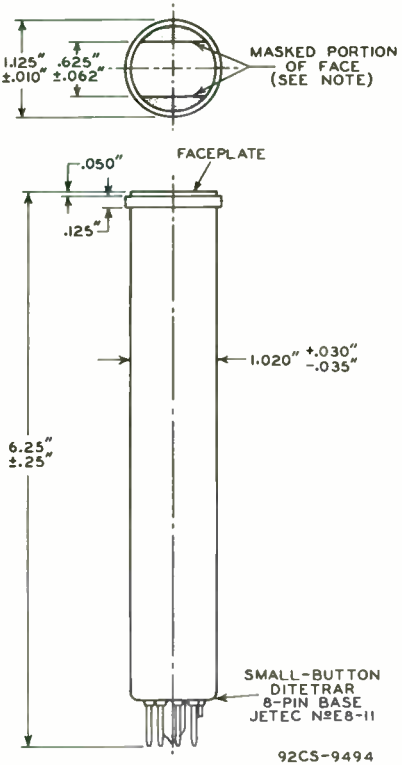
VIDICON



NOTE: STRAIGHT SIDES OF MASKED PORTIONS ARE PARALLEL TO THE PLANE PASSING THROUGH TUBE AXIS AND SHORT INDEX PIN.

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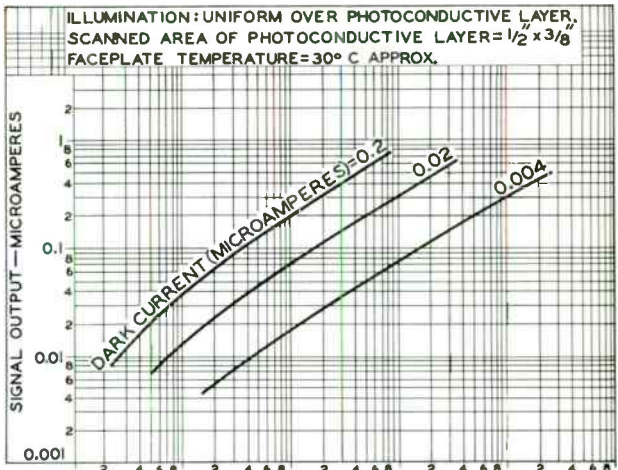
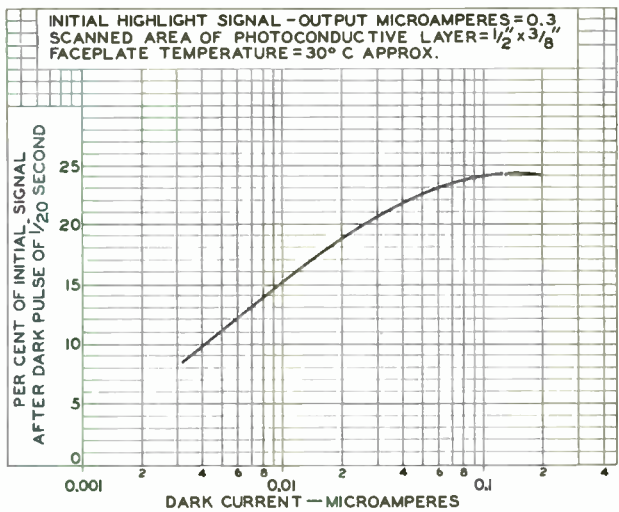
TYPICAL LIGHT-TRANSFER CHARACTERISTICS



2870° K TUNGSTEN ILLUMINATION ON TUBE FACE — FOOT-CANDLES

92CS-9495

TYPICAL PERSISTENCE CHARACTERISTIC



92CS-9504

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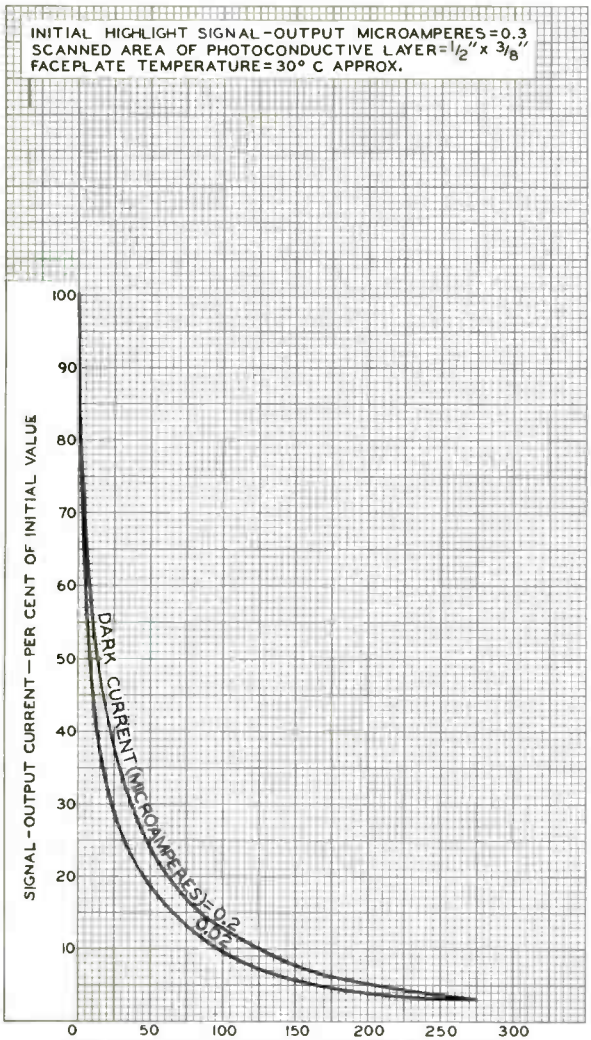
TYPICAL PERSISTENCE CHARACTERISTICS



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92CM-9505

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7038

SPECTRAL-SENSITIVITY CHARACTERISTICS

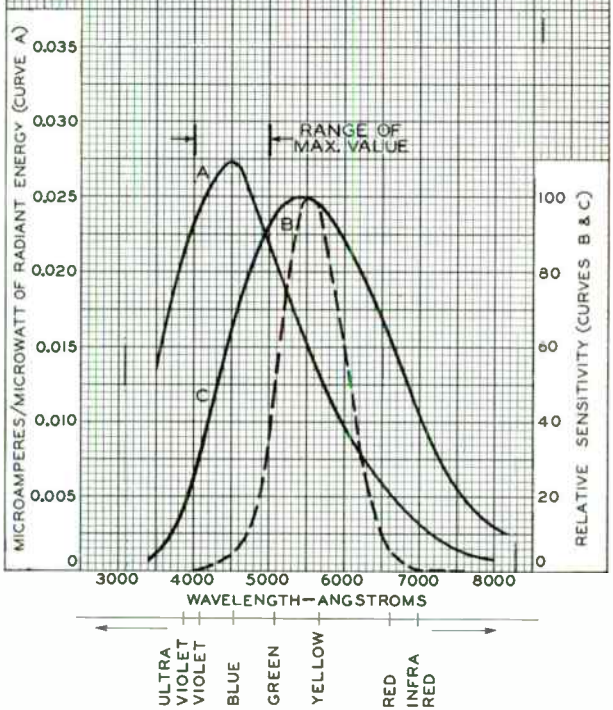
CURVE A: FOR EQUAL VALUES OF SIGNAL-OUTPUT CURRENT AT ALL WAVELENGTHS.

SIGNAL-OUTPUT MICROAMPERES FROM SCANNED AREA OF $\frac{1}{2}$" x $\frac{3}{8}$" = 0.02

DARK CURRENT (MICROAMPERES) = 0.02

CURVE B: SPECTRAL CHARACTERISTIC OF AVERAGE HUMAN EYE.

CURVE C: FOR EQUAL VALUES OF SIGNAL-OUTPUT CURRENT WITH RADIANT FLUX FROM TUNGSTEN SOURCE AT 2870° K.



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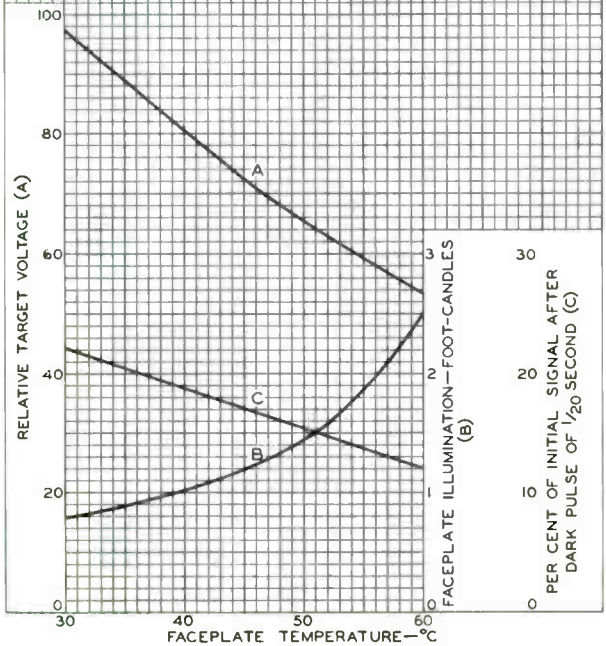
92CM-7783R2

RCA

7038

TYPICAL CHARACTERISTICS

HIGHLIGHT SIGNAL - OUTPUT MICROAMPERES = 0.2
DARK CURRENT (MICROAMPERES) = 0.2
SCANNED AREA OF PHOTOCONDUCTIVE LAYER = $1/2'' \times 3/8''$
CURVE A: RELATIVE TARGET VOLTAGE REQUIRED TO MAINTAIN DARK CURRENT OF 0.2 μA.
CURVE B: 2870° K INCANDESCENT ILLUMINATION REQUIRED TO PRODUCE SIGNAL - OUTPUT CURRENT OF 0.2 μA.
CURVE C: PERSISTENCE (LAG) CHARACTERISTIC FOR AN INITIAL SIGNAL-OUTPUT CURRENT OF 0.2 μA.



RCA

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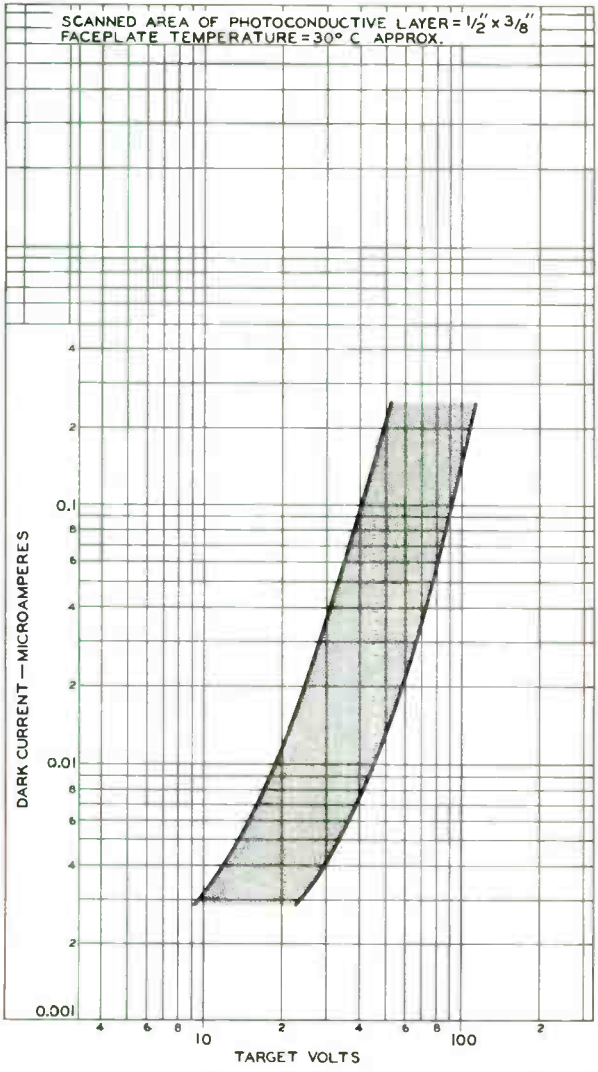
DARK-CURRENT RANGE



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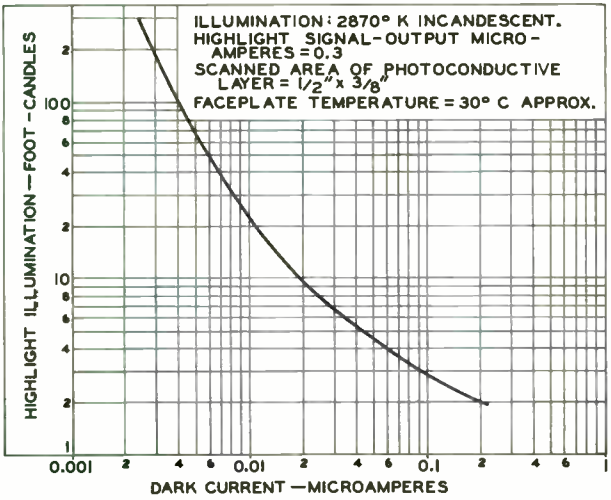
92CM-9497

7038

TYPICAL CHARACTERISTIC



92CS-9493

RCA

7043

VACUUM PHOTOTUBE

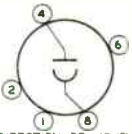
NON-DIRECTIONAL TYPE WITH S-4 RESPONSE

DATA

General:

Spectral Response	S-4
Wavelength of Max mum Response	4000 ± 500 angstroms
Cathode:	
Shape	Cylindrical
Minimum length	13/16"
Minimum diameter	9/16"
Direct Interelectrode Capacitance (Approx.)	6 μμf
Maximum Overall Length	3-5/16"
Maximum Seated Length	2-3/4"
Seated Length to Center of Cathode	1-7/8" ± 3/32"
Maximum Diameter	1-9/32"
Operating Position	Any
Weight (Approx.)	1.4 oz
Bulb	T9
Base	Intermediate-Shell Octal 5-Pin (JETEC No. B5-10)
Basing Designation for BOTTOM VIEW	8JD

Pin 1 – No Connection
Pin 2 – No Connection



Pin 4 – Anode
Pin 6 – No Connection
Pin 8 – Cathode

DIRECTION OF LIGHT: ANY THAT IS PERPENDICULAR TO AXIS OF PHOTOCATHODE

Maximum Ratings, *Absolute Values:*

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

Characteristics:

With an anode-supply voltage of 250▲ volts unless otherwise specified

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4000 angstroms	–	0.045	–	μa/μw
Luminous:#				
At 250 volts	20	45	65	μa/lumen
At 90 volts	–	41	–	μa/lumen
Luminous-Sensitivity Uniformity*	–	–	1.55	
Ratio of Luminous Sensitivity at 250 Volts to Luminous Sensitivity at 90 Volts	–	–	1.25	
Anode Dark Current at 25° C	–	–	0.0125	μa

●▲#*: See next page.

RCA

7043

VACUUM PHOTOTUBE

● Averaged over any interval of 30 seconds maximum.

▲ Operation of the 7043 below 50 volts is not recommended.

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.

* Ratio of highest sensitivity to lowest sensitivity when tube is rotated about its axis through 360°, with incident light perpendicular to axis of photocathode, and with light spot 1/2 inch in diameter.

OPERATING CONSIDERATIONS

Exposure to intense illumination, such as direct sunlight, may decrease the sensitivity of the 7043 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 7043 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. Since a phototube is a high-resistance device, it is important that insulation of associated circuit parts and wiring be adequate.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-4 Response is shown at the front of this Section

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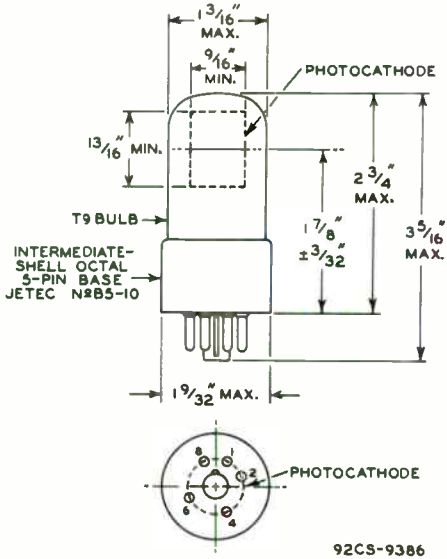
TENTATIVE DATA

7043

VACUUM PHOTOTUBE



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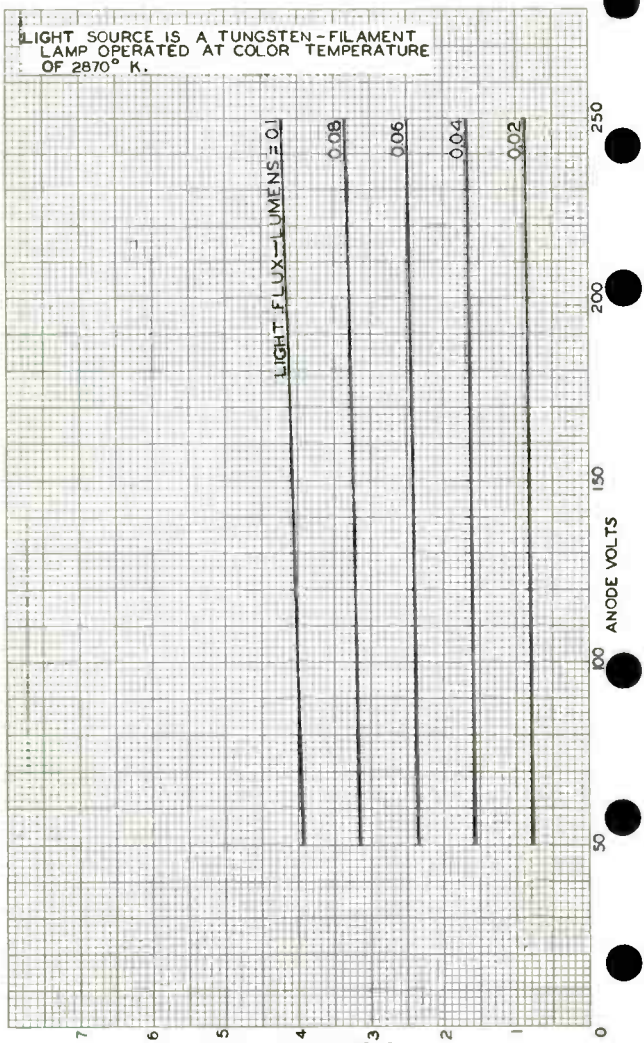
AVERAGE ANODE CHARACTERISTICS



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92CM-9387

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MULTIPLIER PHOTOTUBE

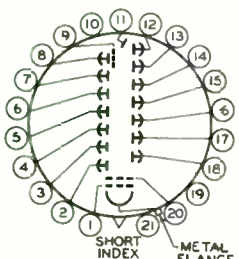
14-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE WITH 4-7/16" CURVED, SEMITRANSPARENT CATHODE AND EXTENDED S-11 RESPONSE VERY-SHORT TIME-RESOLUTION CAPABILITY

DATA

General:

Spectral Response	Extended S-11 *(See Curve)*	
Wavelength of Maximum Response	4200 ± 500 angstroms	
Faceplate, with flat external surface	Ultraviolet-Transmitting Glass	
Cathode, Semitransparent:		
Shape	Curved Circular	
Window:		
Area	15.5	sq. in.
Minimum diameter	4-7/16	in.
Index of refraction	1.468	
Direct Interelectrode Capacitances (Approx.):		
Anode to dynode No.14	2.4	μμf
Anode to all other electrodes	5	μμf
Dynode No.14 to all other electrodes	7	μμf
Maximum Overall Length	11-1/8"	
Seated Length	9-3/4° ± 1/4"	
Envelope	*See Dimensional Outline*	
Cathode Terminal	Metal Flange	
Operating Position	Any	
Weight (Approx.)	1 lb 14 oz	
Socket	Alden Part No.435SBA, or equivalent	
Base	Small-Button Thirtyfivar 21-Pin (JETEC No.E21-40)	
Basing Designation for BOTTOM VIEW	21A	

Pin 1 – Grid No.1
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.3 (Accelerating Electrode)
Pin 10 – No Connection
Pin 11 – Anode
Pin 12 – Dynode No.14
Pin 13 – Dynode No.12
Pin 14 – Dynode No.10
Pin 15 – Dynode No.8
Pin 16 – Dynode No.6
Pin 17 – Dynode No.4
Pin 18 – Dynode No.2
Pin 19 – No Connection



DIRECTION OF LIGHT: INTO END OF BULB

Pin 20 – Grid No.2
Pin 21 – No Connection
Metal Flange – Cathode

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MULTIPLIER PHOTOTUBE

Maximum Ratings, *Absolute Values:*

DC ANODE-SUPPLY VOLTAGE	3400 max.	volts
DC SUPPLY VOLTAGE BETWEEN DYNODE No.14 AND ANODE	400 max.	volts
DC SUPPLY VOLTAGE BETWEEN CONSECUTIVE DYNODES	400 max.	volts
DC SUPPLY VOLTAGE BETWEEN GRID No.3 AND DYNODE No.13	500 max.	volts
DC GRID-No.2 SUPPLY VOLTAGE	1500 max.	volts
DC SUPPLY VOLTAGE BETWEEN GRID-No.2 AND ANODE	2300 max.	volts
DC GRID-No.1 SUPPLY VOLTAGE	1200 max.	volts
DC SUPPLY VOLTAGE BETWEEN DYNODE No.1 AND GRID No.2	400 max.	volts
AVERAGE ANODE CURRENT●	2 max.	ma
AMBIENT-TEMPERATURE RANGE	-125 to +75	°C

Characteristics Range Values for Equipment Design:

Under conditions with supply voltage (E) across a voltage divider providing electrode voltages shown in Table I

With E = 2800 volts (except as noted), and with grid-No.3, grid-No.1, and dynode-No.1 voltages adjusted to give maximum gain

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4200 angstroms	–	0.140	–	amp/μw
Cathode radiant, at 4200 angstroms	–	0.046	–	μa/μw
Luminous:#				
At 0 cps	40	180	1500	amp/lumen
With dynode No.14 as output electrode†	–	108	–	amp/lumen
Cathode luminous:				
With tungsten light source▲	40	60	–	μa/lumen
With blue light source**♦	4	–	–	μa
Current Amplification	–	3×10^6	–	
Equivalent Anode-Dark-Current Input●■	–	2×10^{-9}	1.2×10^{-8}	lumen
	–	26×10^{-5}♦	156×10^{-5}♦	watt
Equivalent Noise Input★	–	1×10^{-11}	–	lumen
	–	13×10^{-7}♦	–	watt

●,#,†,▲,**,♦,■,★: See next page.

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MULTIPLIER PHOTOTUBE

	Min.	Median	Max.	
Greatest Transit-Time Spread: Within a circle centered on tube face and having a diameter of—				
3 inches.	–	0.5	–	milliμsec
4 inches.	–	4	–	milliμsec

With E = 3400 volts (except as noted), and with grid-No.3, grid-No.1, and dynode-No.1 voltages adjusted to give maximum gain

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4200 angstroms	–	0.91	–	amp/μw
Cathode radiant, at 4200 angstroms. . .	–	0.046	–	μa/μw
Luminous:#				
At 0 cps.	–	1200	–	amp/lumen
With dynode No.14 as output electrode†.	–	800	–	amp/lumen
Cathode luminous:				
With tungsten light source▲	40	60	–	μa/lumen
With blue light source**♦	4	–	–	μa
Current Amplification .	–	20×10^6	–	

● 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. This type of operation is suitable only for small output signals or for applications where linearity is not required.

▲ 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.

●,#,†,▲,*: See next page.

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MULTIPLIER PHOTOTUBE

● Measured at a tube temperature of 25° C and with the supply voltage (E) adjusted to give a luminous sensitivity of 500 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 2000 volts is recommended.

◆ Measured at 4200 angstroms.

★ Under the following conditions: Supply voltage (E) is 2800 volts, 25° C tube temperature, 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.

TABLE I

VOLTAGE TO BE PROVIDED BY DIVIDER

Between	3.8% of Supply Voltage (E) Multiplied By
Cathode and Grid No.1	2 approx.*
Cathode and Grid No.2	11.5
Grid No.2 and Dynode No.1	1 approx.*
Grid No.2 and Dynode No.2	2
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 Dynode No.13	1
Dynode No.13 and Dynode No.14	1
Dynode No.14 and Anode	1
Anode and Cathode	26.5

* Adjusted to give maximum gain.

OPERATING CONSIDERATIONS

Connection to the *metal flange* is made by a spring-finger ring bearing against the edge of the flange.

The *operating stability* of the 7046 is dependent on the magnitude of the anode current and its duration. When the 7046 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

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MULTIPLIER PHOTOTUBE

7046 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 anode current should not exceed 100 microamperes.

With certain orientations of the 7046, it will be observed that the earth's magnetic field is sufficient to cause a noticeable decrease in the response of the tube. To prevent such decrease in response of the tube, magnetic shielding must be provided. A suitable shield may be obtained from James Millen Mfg. Co., Malden, Mass. by ordering Part No.80805P. In general, it is recommended that the shield be connected to cathode potential.

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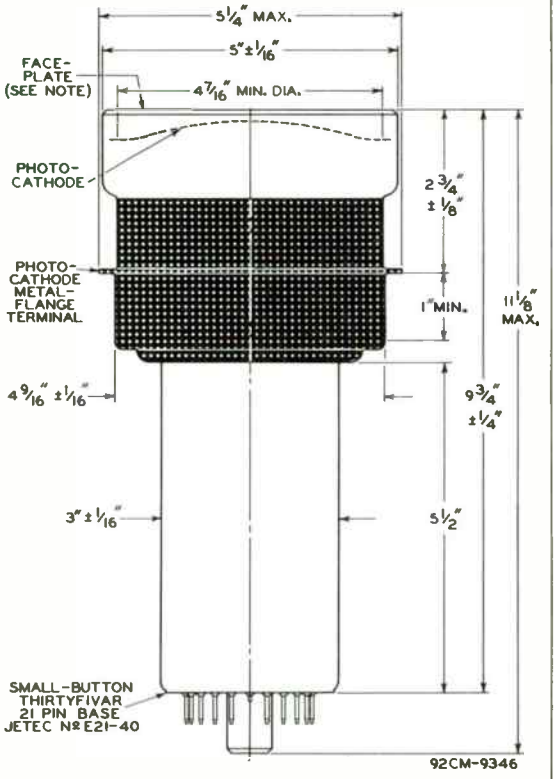
MULTIPLIER PHOTOTUBE



℄ 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 4-7/16" DIAMETER, DEVIATION FROM FLATNESS OF EXTERNAL SURFACE OF FACEPLATE WILL NOT EXCEED D.015" FROM PEAK TO VALLEY.

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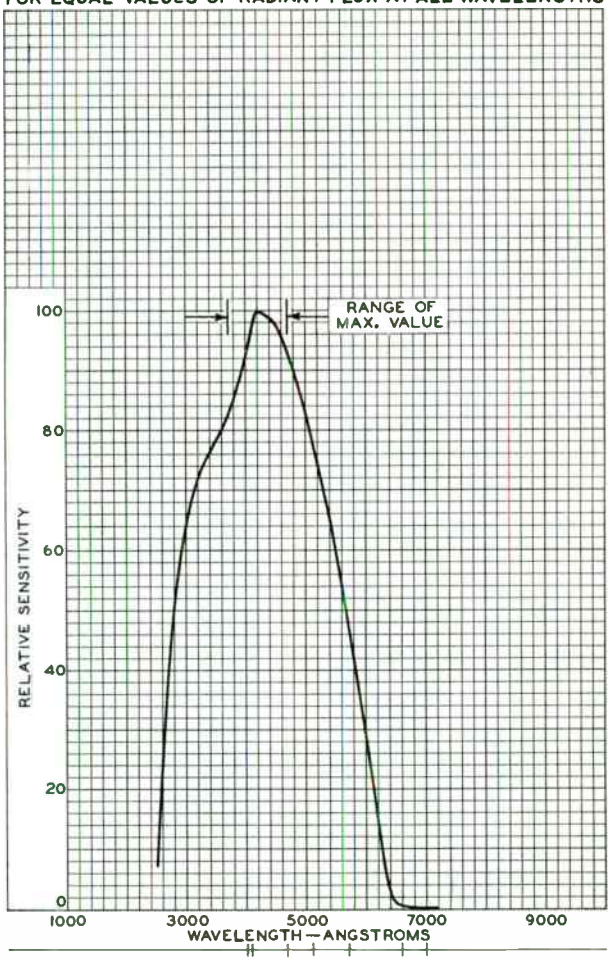
TENTATIVE
SPECTRAL SENSITIVITY CHARACTERISTIC
FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



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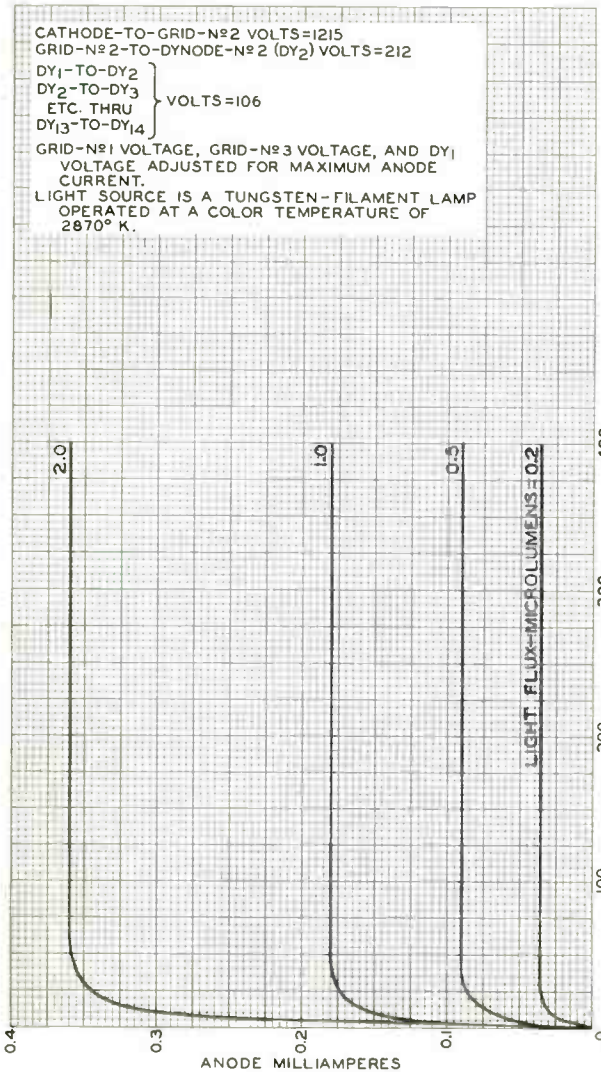
AVERAGE ANODE CHARACTERISTICS



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92CM-9377

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TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

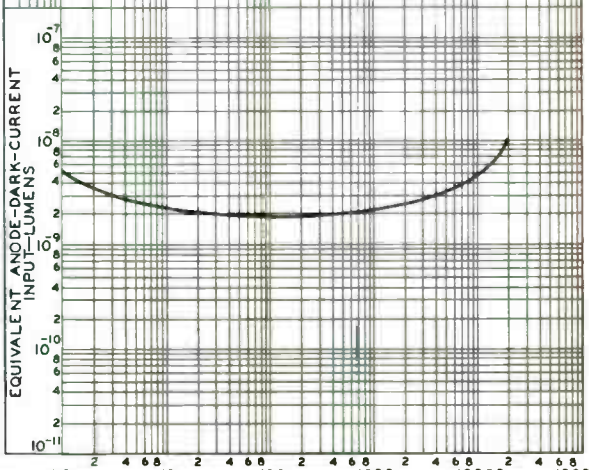
LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	3.8 % OF E MULTIPLIED BY
CATHODE & GRID №1	2 APPROX.*
CATHODE & GRID №2	11.5
GRID №2 & DYNODE №1 (DY_1)	1 APPROX.*
GRID №2 & DY_2	2
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} & DY_{13}	1
DY_{13} & DY_{14}	1
DY_{14} & ANODE	1
ANODE & CATHODE	26.5

*ADJUSTED TO GIVE MAXIMUM GAIN.

LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.

TUBE TEMPERATURE = 25° C



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

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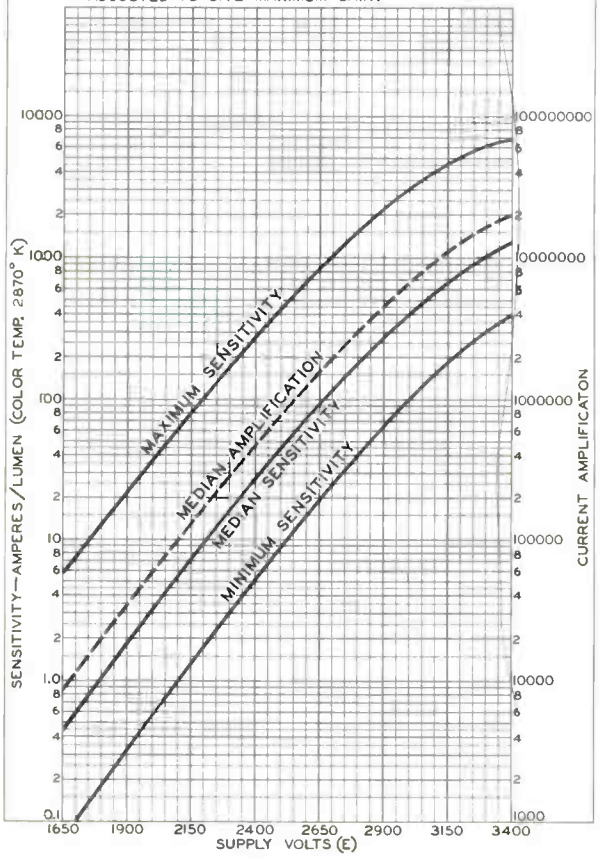
CHARACTERISTICS

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

BETWEEN	3.8% OF E MULT. BY
CATHODE & GRID Nº 1	2 APPROX.*
CATHODE & GRID Nº 2	11.5
GRID Nº 2 & DYNODE Nº 1 (DY_1)	1 APPROX.*
GRID Nº 2 & DYNODE Nº 2	2
DY_2 & DY_3 ETC. THRU DY_{14} & ANODE	1

*ADJUSTED TO GIVE MAXIMUM GAIN.



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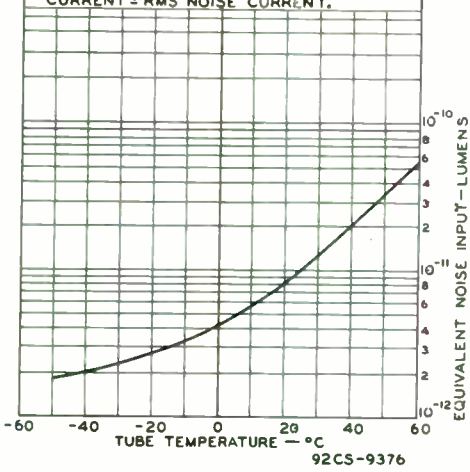
EQUIVALENT-NOISE-INPUT CHARACTERISTIC

CATHODE-TO-GRID-№2 VOLTS=1215
GRID-№2-TO-DYNODE-№2 (DY_2) VOLTS=212
DY_1-TO-DY_2
DY_2-TO-DY_3
ETC. THRU
DY_{14}-TO-ANODE
} VOLTS=106

GRID-№1 VOLTAGE, GRID-№3 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.



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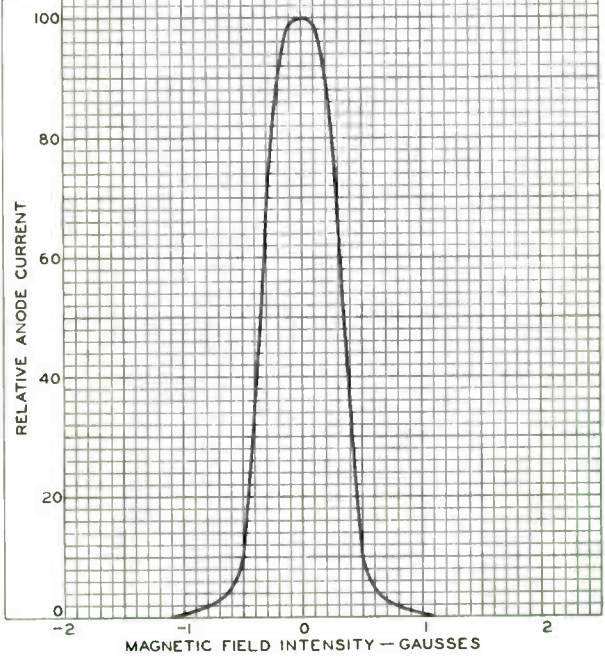
EFFECT OF MAGNETIC FIELD ON ANODE CURRENT

CATHODE-TO-GRID-№2 VOLTS=1215
GRID-№2-TO-DYNODE-№2 (DY_2) VOLTS=212
DY_1-TO-DY_2, DY_2-TO-DY_3 ETC. THRU DY_{14}-TO-ANODE } VOLTS=106
GRID-№1 VOLTAGE, GRID-№3 VOLTAGE, AND DY_1 VOLTAGE ADJUSTED FOR MAXIMUM ANODE CURRENT.
MAGNETIC FIELD IS PERPENDICULAR TO DYNODE SPACERS AND IS CENTERED BETWEEN CATHODE & DYNODE №1.
POSITIVE VALUES ARE FOR LINES OF FORCE FROM RIGHT TO LEFT WITH INDEX PIN OF BASE TOWARD RIGHT OF OBSERVER.



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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 7 – Dynode No.10
Pin 2 – Dynode No.3	Pin 8 – Dynode No.8
Pin 3 – Dynode No.5	Pin 9 – Dynode No.6
Pin 4 – Dynode No.7	Pin 10 – Dynode No.4
Pin 5 – Dynode No.9	Pin 11 – Dynode No.2
Pin 6 – Anode	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.

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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.

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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 1.2 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

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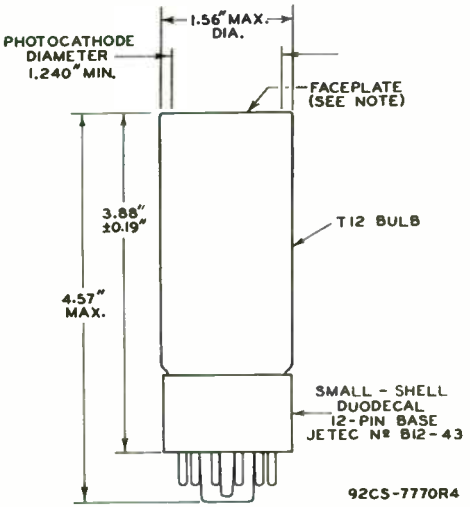
MULTIPLIER PHOTOTUBE



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.

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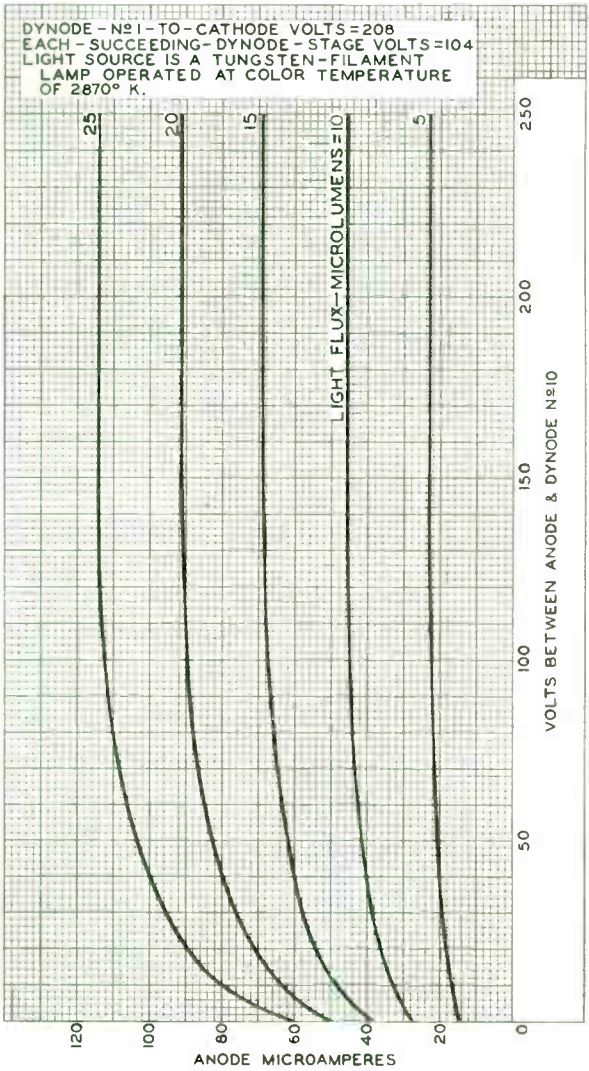
AVERAGE ANODE CHARACTERISTICS



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-9460RI

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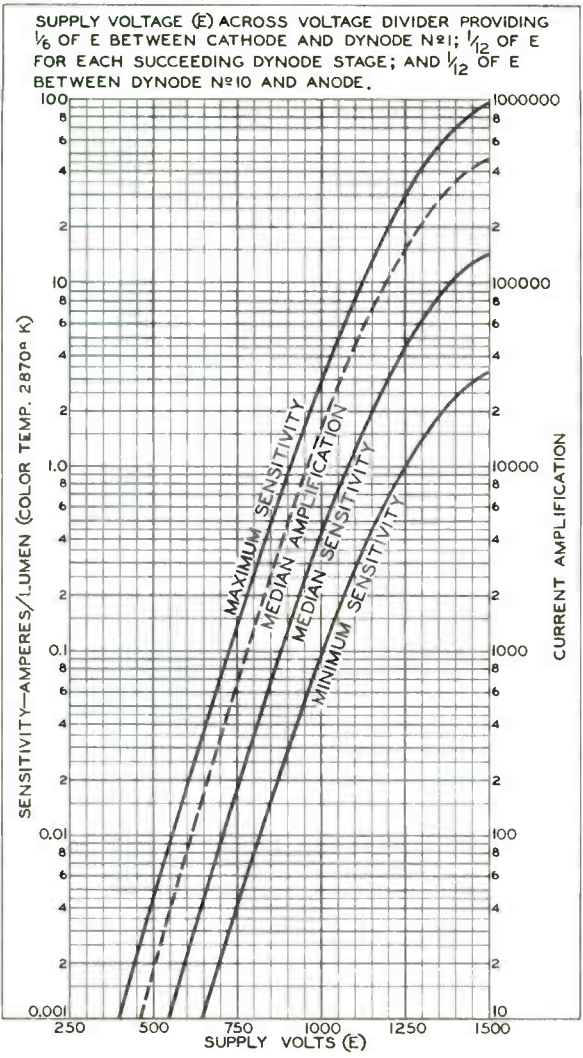
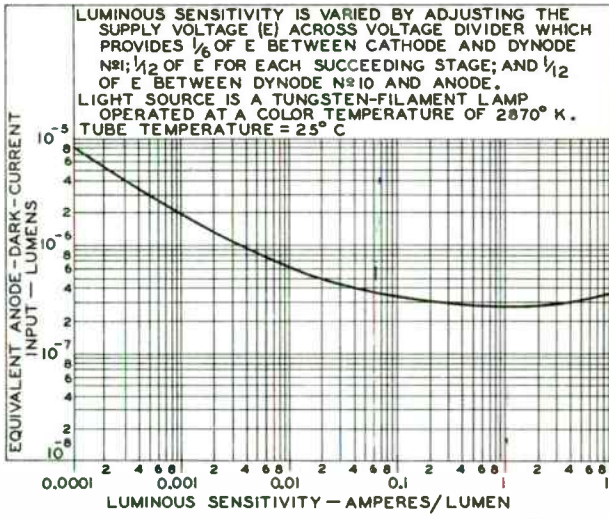
CHARACTERISTICS

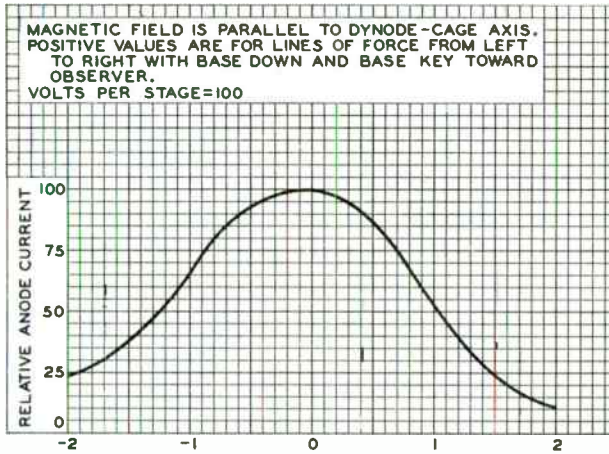


7102

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



EFFECT OF MAGNETIC FIELD ON ANODE CURRENT



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

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RCA

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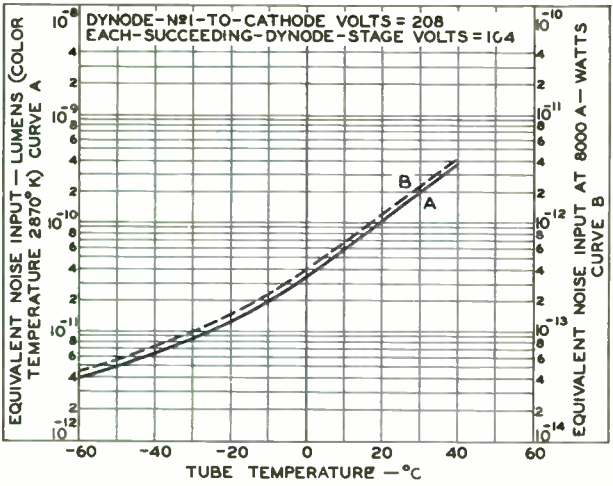
EQUIVALENT-NOISE-INPUT CHARACTERISTICS



92CS-9462

7117

MULTIPLIER PHOTOTUBE

9-STAGE TYPE WITH S-4 RESPONSE

For dc automobile-headlight-control service

DATA

General:

Spectral Response	S-4
Wavelength of Maximum Response	4000 ± 500 angstroms
Cathode:	
Minimum projected length*	0.93"
Minimum projected width*	0.31"
Direct Interelectrode Capacitances:	
Anode to dynode No.9	4.2 μμf
Anode to all other electrodes	5.5 μμf
Maximum Overall Length	3.12"
Maximum Seated Length	2.69"
Length from Base Seat to Center of Useful Cathode Area	1.55" ± 0.09"
Maximum Diameter	1.31"
Operating Position	Any
Weight (Approx.)	1.6 oz
Bulb	T9
Base	Small-Shell Neosubmagnal 11-Pin (JETEC No.B11-104), 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:*

ANODE-SUPPLY VOLTAGE (DC)	1250 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.9 AND ANODE (DC)	250 max.	volts
AVERAGE ANODE CURRENT°	0.1 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

Characteristics Range Values for Equipment Design:

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 dc

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4000 angstroms	–	35000	–	μa/μw

*,°: See next page.

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

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7117

MULTIPLIER PHOTOTUBE

	Min.	Median	Max.	
Luminous:▲				
At 0 cps.	–	35	–	amp/lumen
At 100 Mc	–	33	–	amp/lumen
Electrode Dark Current at 25° C:				
Anode	–	–	0.1	μa
Any other electrode except anode.	–	–	0.75	μa

With E = adjustable dc voltage

	Min.	Median	Max.	
Anode-to-Cathode Voltage (DC)#	630	900	1100	volts

* On plane perpendicular to the indicated direction of incident light.

o 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; and the load resistor has a value of 0.01 megohm.

\# For conditions where the light flux from a tungsten-filament lamp operated at a color temperature of 2870° K is transmitted through a filter (Corning No.3482) onto the photocathode. The value of light flux incident on the filter is 10 microlumens and the load resistor is 0.01 megohm. Supply voltage (E) is adjusted to give an anode current of 50 microamperes.

OPERATING CONSIDERATIONS

The *operating stability* of the 7117 is dependent on the magnitude of the anode current and its duration. When the 7117 is operated at high 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 7117 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum-rated value of 0.1 milliampere is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 10 microamperes.

A recommended design of voltage-divider network for use with the 7117 to provide stable operation and long tube life is shown in the accompanying circuit. This design provides linear operation within the range normally required for headlight control. At higher light levels, the network design limits the tube output to a safe value. The indicated design values provide headlight-control operation for an anode current in the range between 5 and 10 microamperes.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-4 Response is shown at the front of this Section

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

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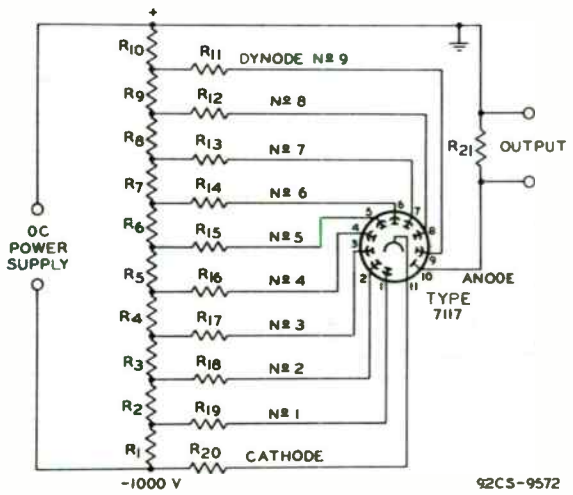
MULTIPLIER PHOTOTUBE

DIMENSIONAL OUTLINE
and
AVERAGE-ANODE-CHARACTERISTICS and
VARIATION-IN-SENSITIVITY-OF-PHOTOCATHODE
curves shown under Type 6328
also apply to the 7117

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

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

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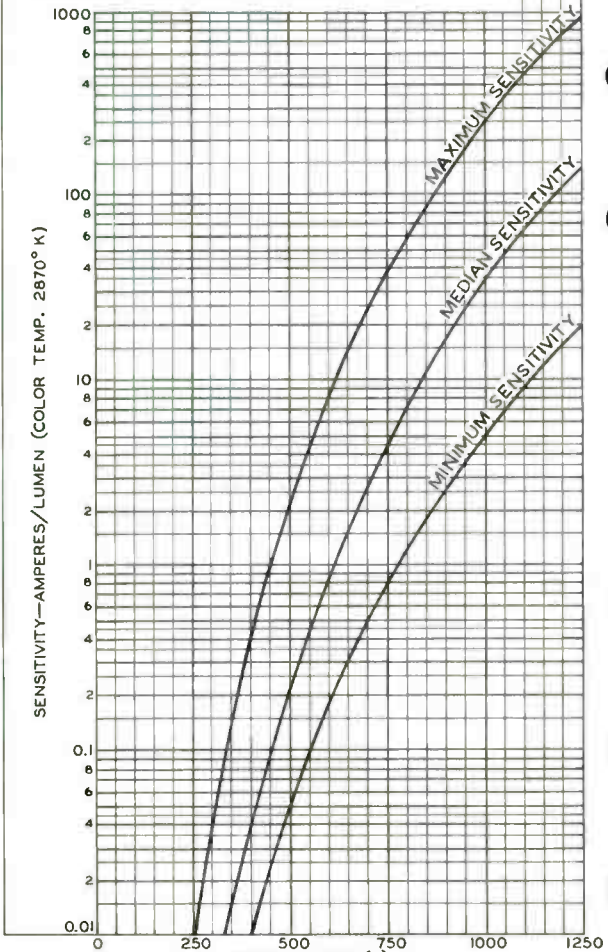
7117

LUMINOUS-SENSITIVITY RANGE

SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER PROVIDING $1/10$ OF E BETWEEN CATHODE AND DYNODE №1; $1/10$ OF E FOR EACH SUCCEEDING DYNODE STAGE; AND $1/10$ OF E BETWEEN DYNODE №9 AND ANODE.



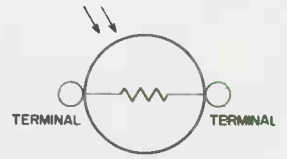
Photoconductive Cell

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.

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.

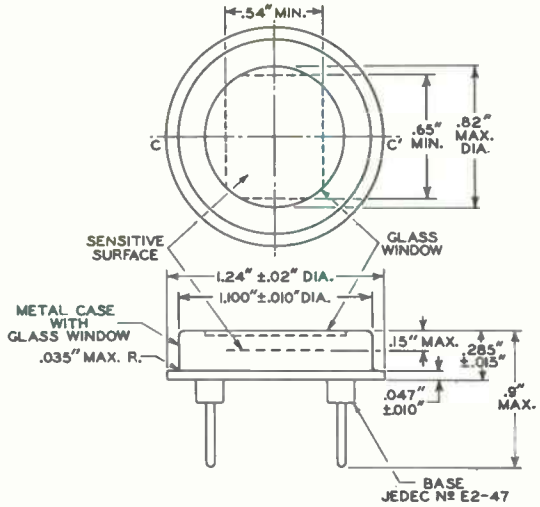
[e] For conditions where light flux from a tungsten-filament lamp operated at 2870° K is transmitted through a filter (Corning No.C.S. 1-62, Glass No.5900 which has an effective transmission of luminous flux of 13.3 per cent) onto the sensitive surface. The value of illumination incident on the sensitive 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

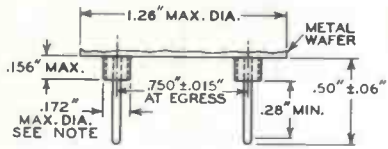
Electrical connection can be made to the base pins of the 7163 by soldering directly to the pins. Soldering of connections to the pins may be made close to the pin seals provided care is taken to conduct excessive heat away from the pin seal. Otherwise, the heat of the soldering operation will crack the glass seals of the pins and damage the cell. Connection can also be made to the base pins by use of insulated clips.

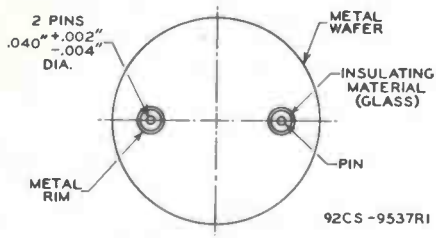
SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-15 RESPONSE is shown at front of this section



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°.

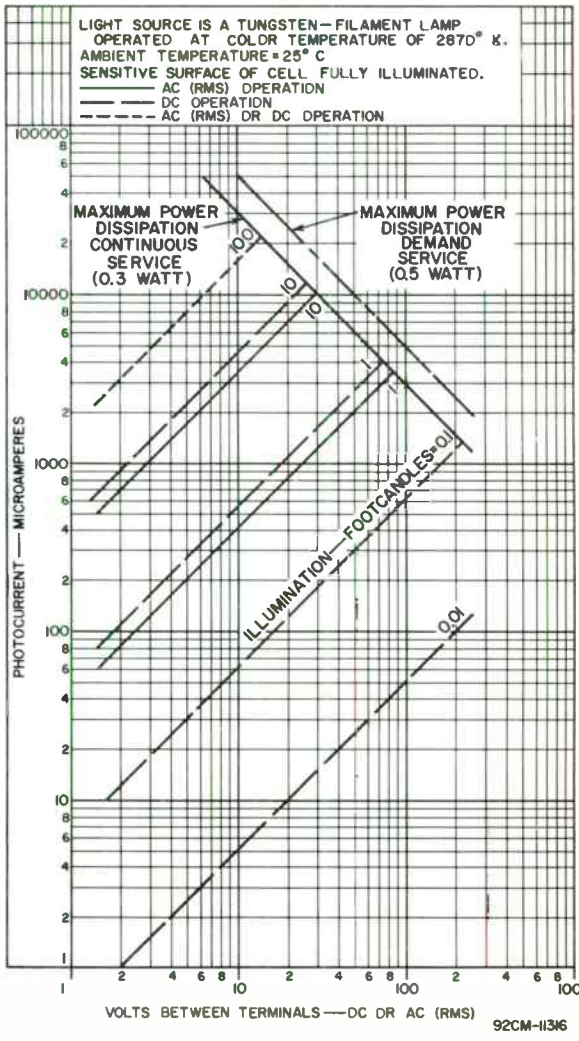
2-PIN BASE
JEDEC No. E2-47



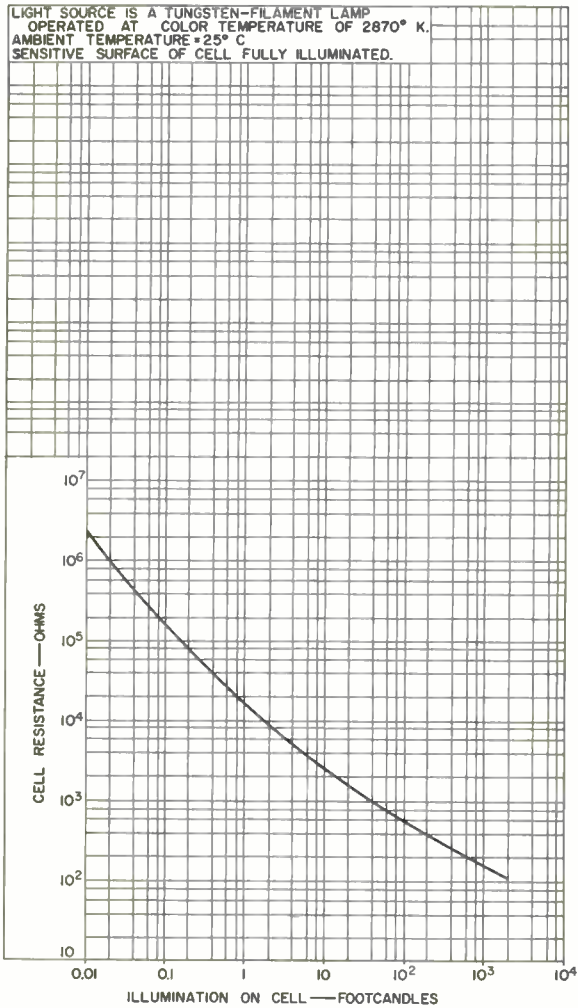


NOTE: FOR SOCKET DESIGN, PROVIDE CLEARANCE HOLE HAVING MINIMUM DIAMETER OF 0.188".

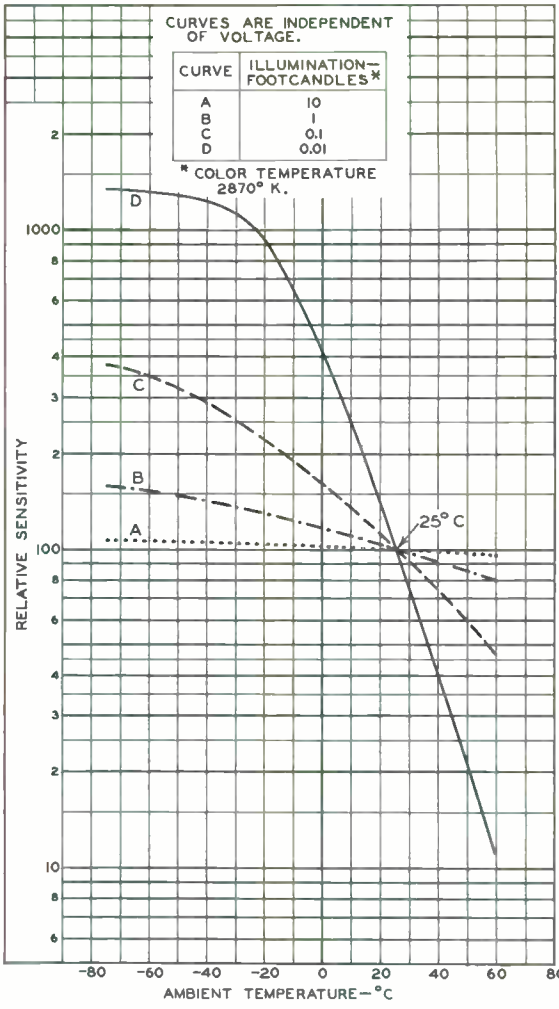
AVERAGE CHARACTERISTICS



AVERAGE CELL RESISTANCE (DC)

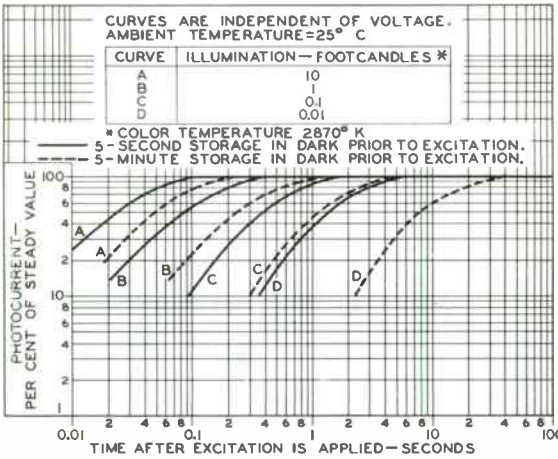


TYPICAL CHARACTERISTICS



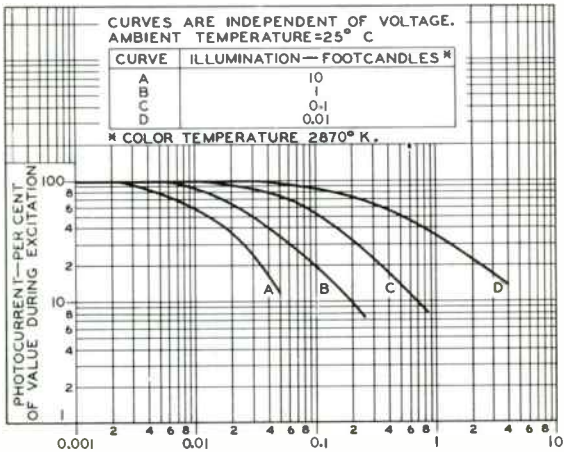
92CM-9538

TYPICAL RISE CHARACTERISTICS



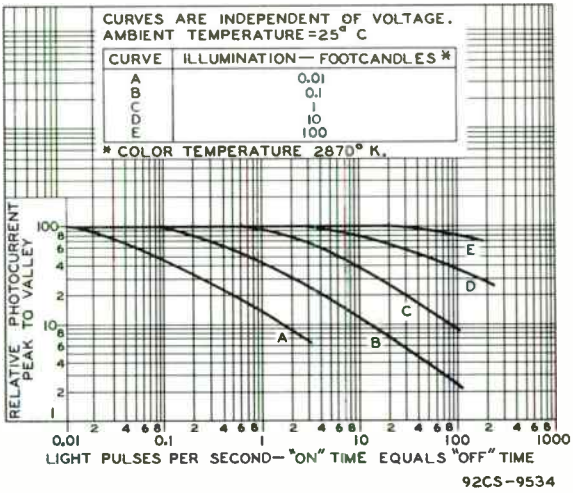
92CS-9532

TYPICAL DECAY CHARACTERISTICS



92CS-9533

RESPONSE CHARACTERISTICS



7163

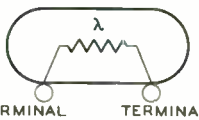
PHOTOCONDUCTIVE CELL

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	JETEC No. E2-47



DIRECTION OF LIGHT:
INTO FACE OF CELL

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:*

VOLTAGE BETWEEN TERMINALS (DC or Peak AC)	250 max.	volts
POWER DISSIPATION:		
Sensitive surface fully illuminated	0.3 max.	watt
Sensitive surface partially illuminated	0.85 max.	watt/sq. in.
PHOTOCURRENT	50 max.	ma
AMBIENT-TEMPERATURE RANGE	-75 to +60	°C

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

7163

PHOTOCONDUCTIVE CELL

Characteristics:

With ac voltage (rms) of 50 volts between terminals and ambient temperature of 25° C

	Min.	Median	Max.	
Sensitivity:				
Radiant#, at 5800 angstroms	–	290	–	μa/μw
Luminous*, at 0 cps	–	0.082	–	amp/lumen
Illumination*, at 0 cps	1	2	3	ma/ft-c
Photocurrent•	–	–	40	μa
Rise				*See Curves*
Decay				*See Curves*

For conditions where the incident power is 6.9 microwatts.

* For conditions where light flux from a tungsten-filament lamp operated at 2870° K is transmitted through a filter (Corning No.5900 having an effective transmission of luminous flux of 12.5 per cent) onto the sensitive surface. The value of illumination incident on the sensitive surface is 8 foot-candles measured before positioning the filter between the lamp and the cell.

• Measured approximately 10 seconds after removal of incident-illumination level as established by filter in (*).

DEFINITIONS

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

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.

The *voltage between terminals* of the 7163 may be applied without regard to polarity.

The *incident illumination* should cover an area of at least 0.1" in diameter.

Exposure of the 7163 to radiation so intense as to cause excessive heating of the cell may permanently damage it.

The *angle of view* of the 7163 may be narrowed by the use of a hood of the desired length placed in front of the cell.

In some applications where the light source is several feet from the cell, a simple lens used to collimate the light beam will serve to utilize the available amount of light most effectively.

7163

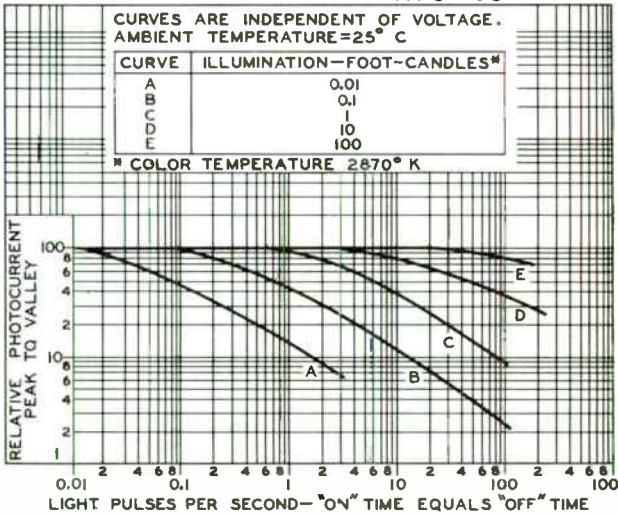
PHOTOCONDUCTIVE CELL

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

TENTATIVE DATA 2

RESPONSE CHARACTERISTICS



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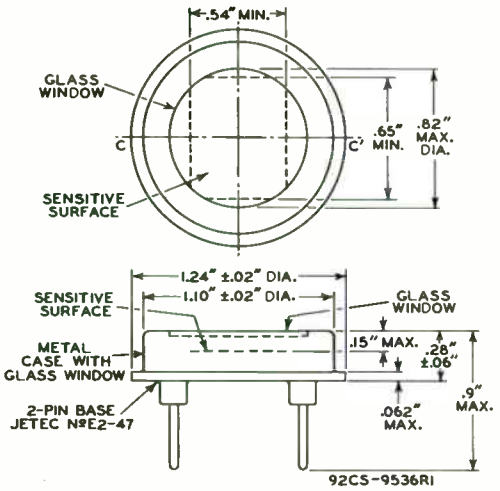
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7163

PHOTOCONDUCTIVE CELL



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°.

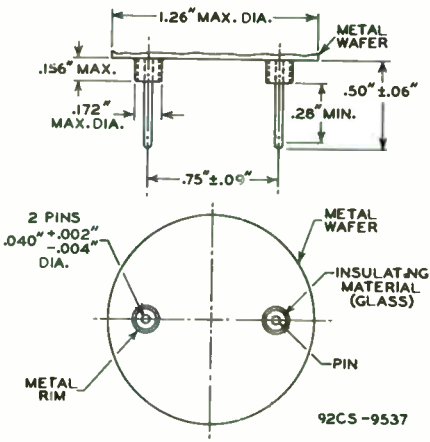
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

7163

PHOTOCONDUCTIVE CELL

2-PIN BASE
JETEC No. E2-47



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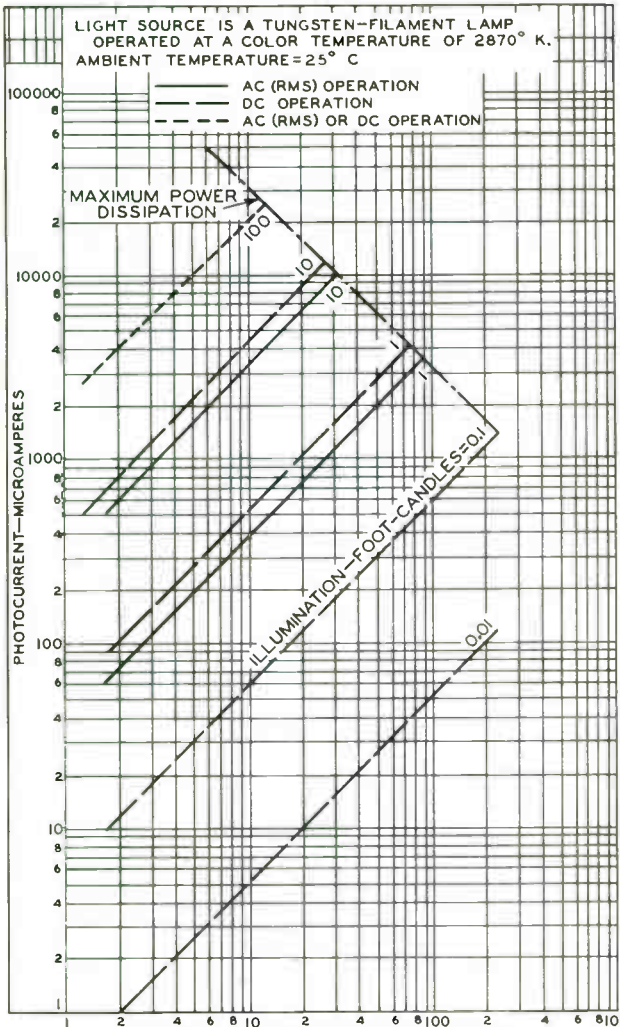
7163

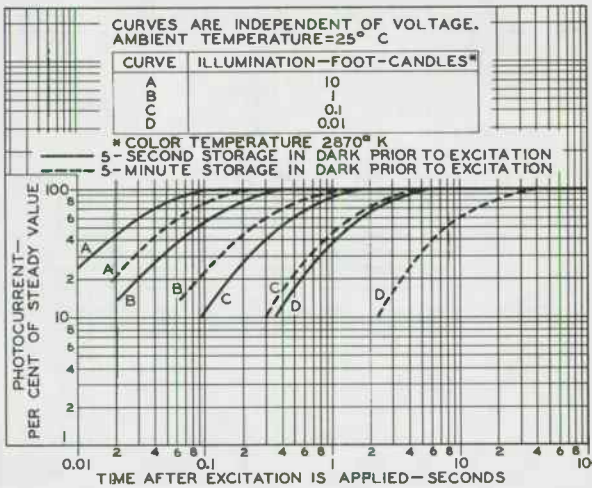
AVERAGE CHARACTERISTICS



RCA

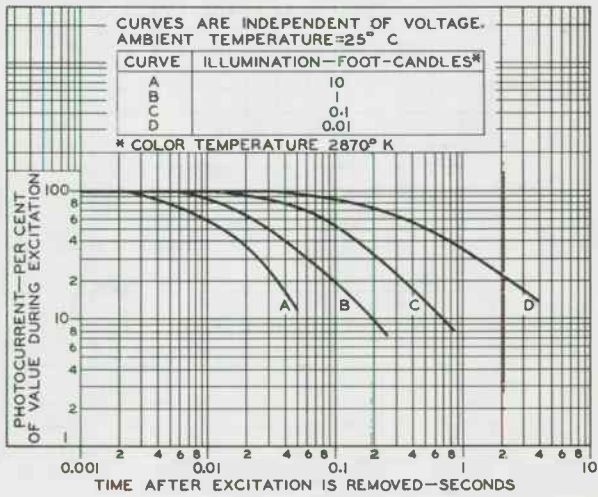
7163

TYPICAL RISE CHARACTERISTICS



92CS-9532

TYPICAL DECAY CHARACTERISTICS



92CS-9533

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

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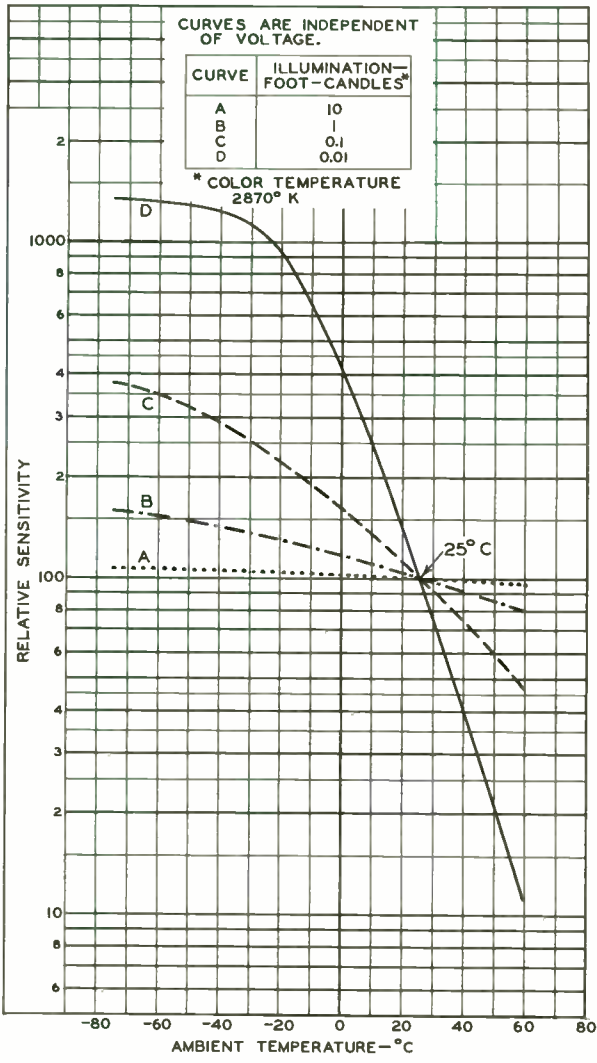
7163

TYPICAL CHARACTERISTICS



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

92CM-9538

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.

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

RCA

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.

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

7200

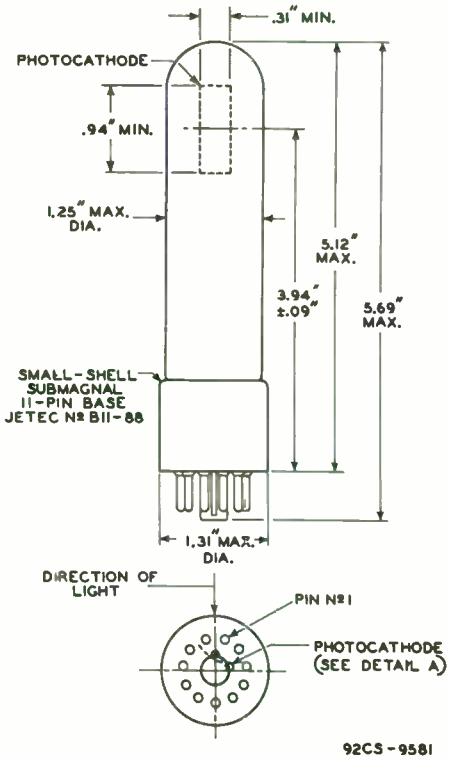
MULTIPLIER PHOTOTUBE

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



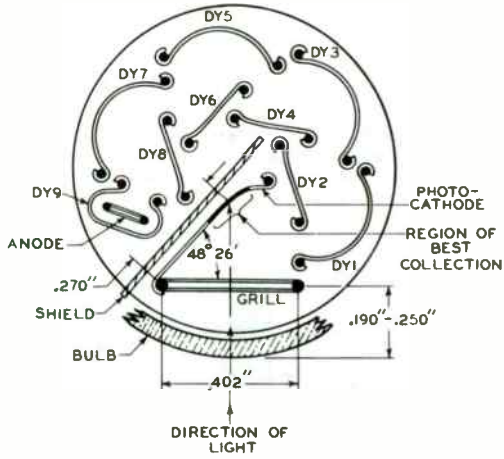
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

7200

MULTIPLIER PHOTOTUBE

DETAIL A



92CS-8674RI

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.

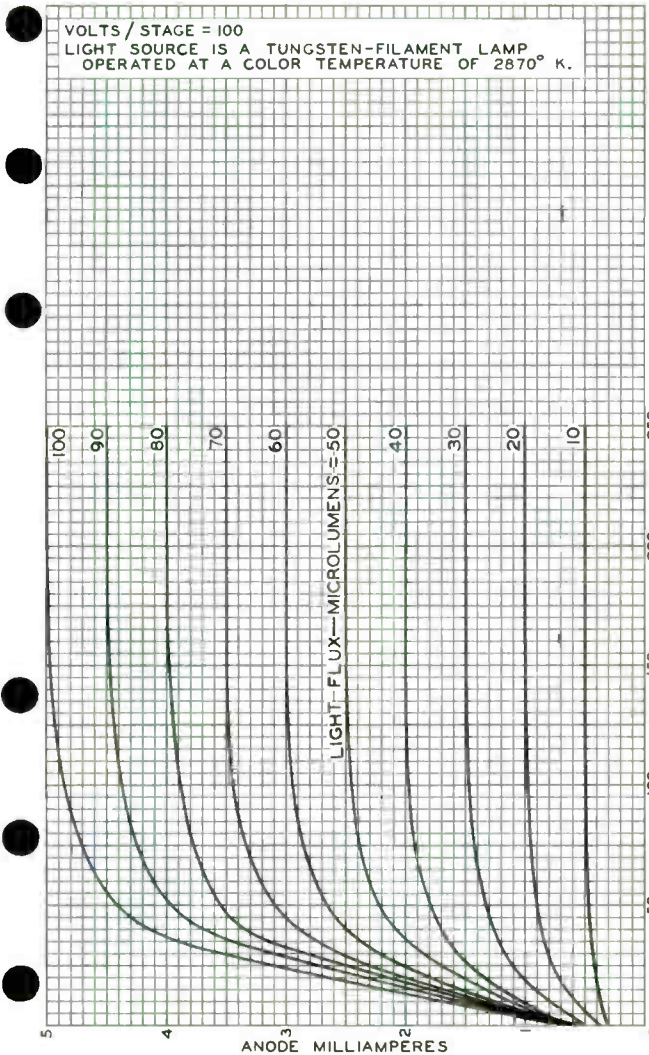
NOTE 2: THE MAXIMUM ANGULAR VARIATION BETWEEN THE PLANE THROUGH PINS 1 AND 11 AND THE PLANE OF THE GRILL WILL NOT EXCEED 6°.

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

RCA

7200

AVERAGE ANODE CHARACTERISTICS



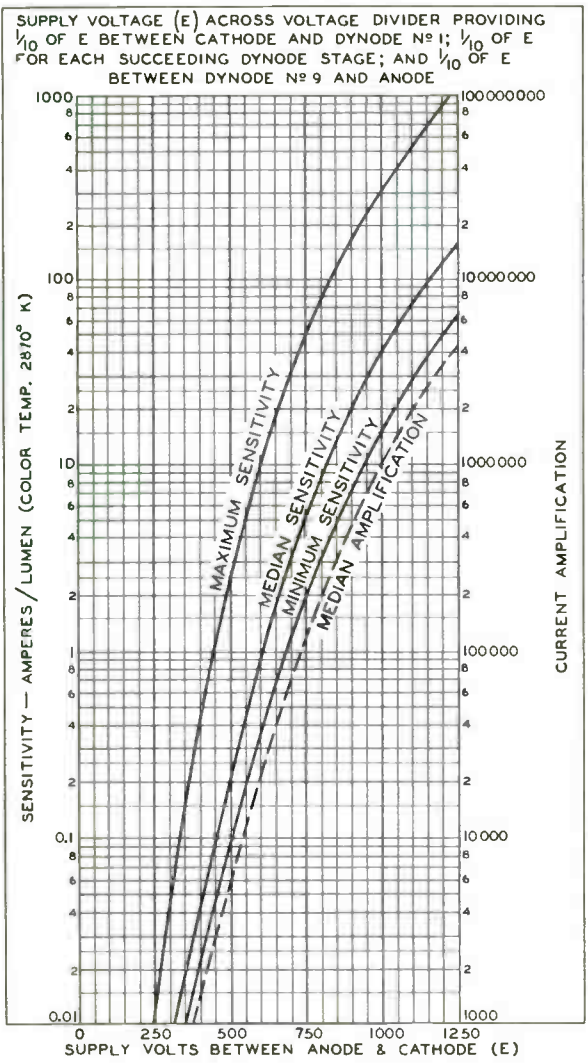
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9577

RCA

7200

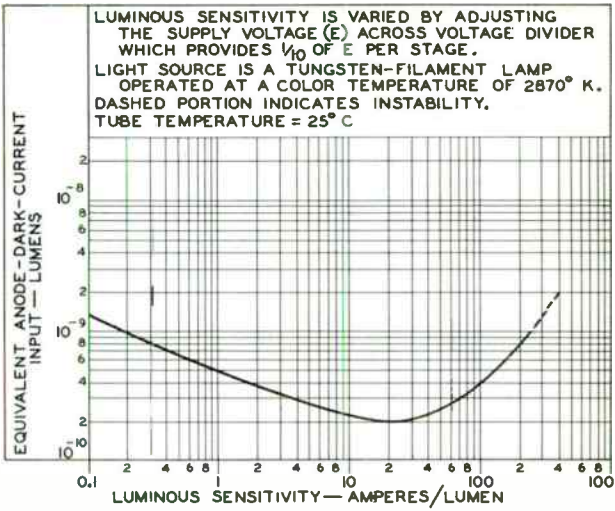
CHARACTERISTICS



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

92CM-9583

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



92CS-9586

7262-A

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	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 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	5.13" ± 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

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

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.

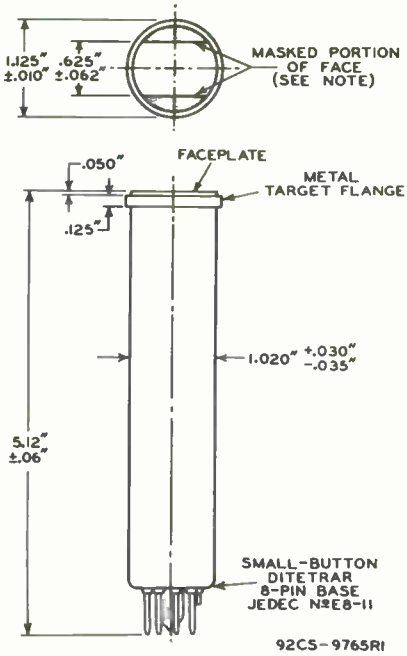
♣ The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

⊖ 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.

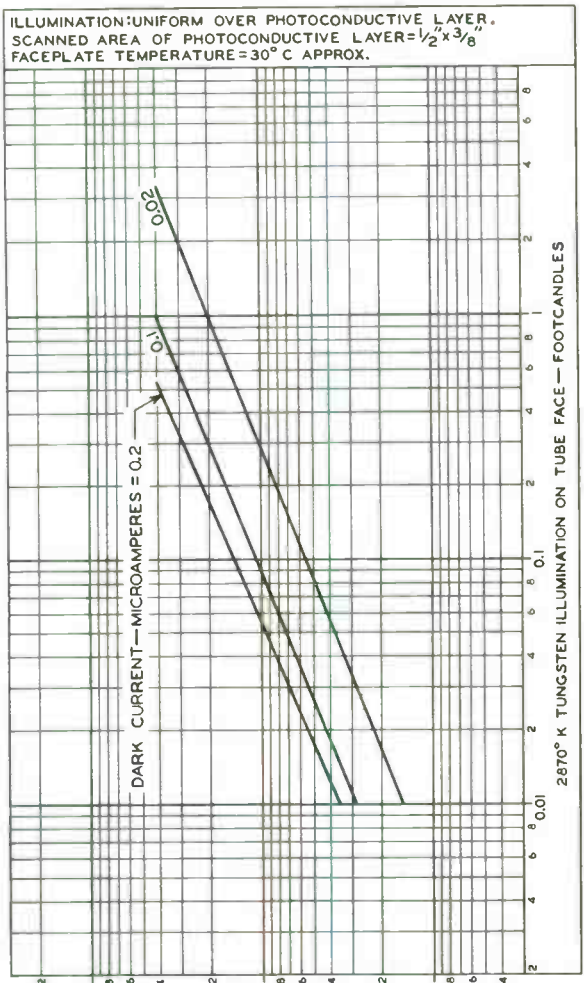
* The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct porportion to the change in scanning velocity.

♦ Defined as the component of the highlight target current after the dark-current component has been subtracted.

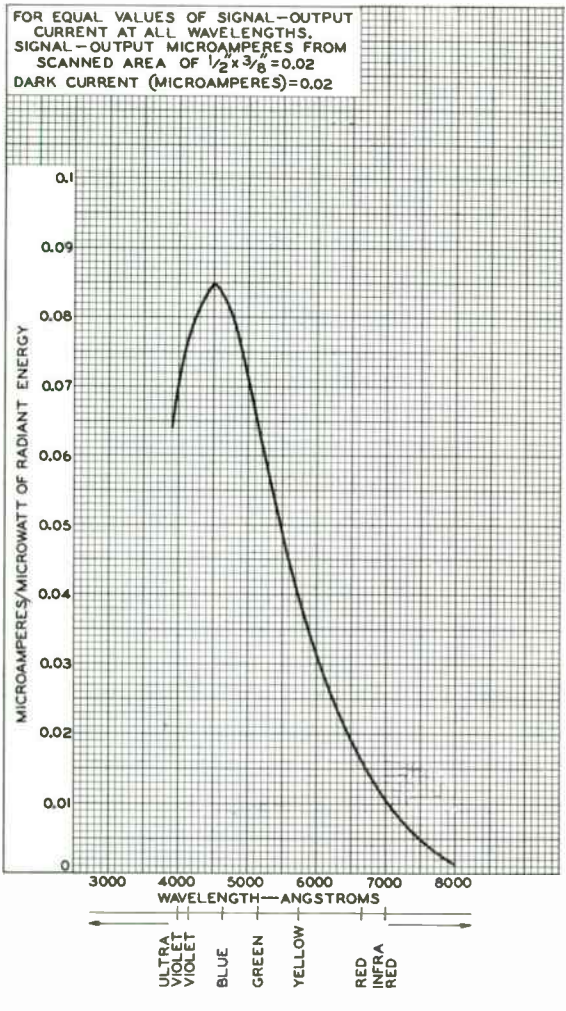


NOTE: STRAIGHT SIDES OF MASKED PORTIONS ARE PARALLEL TO THE PLANE PASSING THROUGH TUBE AXIS AND SHORT INDEX PIN.

TYPICAL LIGHT-TRANSFER CHARACTERISTICS

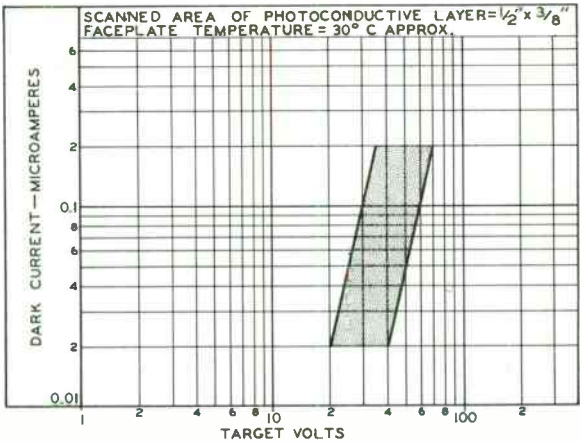


TYPICAL SPECTRAL-SENSITIVITY CHARACTERISTIC



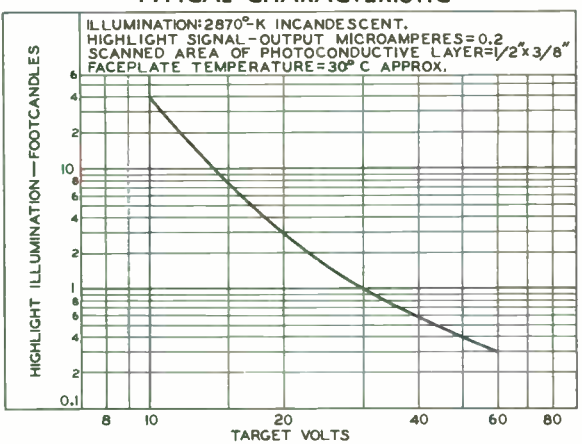
92CM-10698RI

DARK-CURRENT RANGE



92CS-10684RI

TYPICAL CHARACTERISTIC



92CS-10685RI

7263-A

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

7263-A

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

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 or 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 4.7.1.1) 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

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 3.2.20.28) 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.

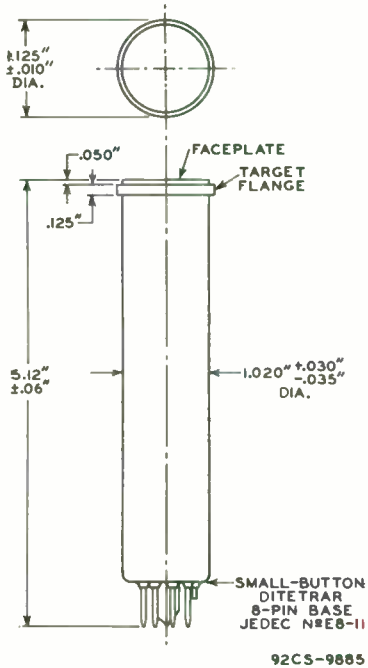
□ 5 June 1957, Procedure I of Military Specifications.

◊ 1 January 1956.

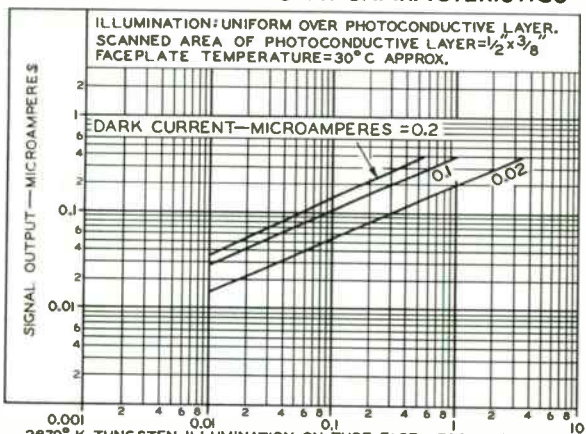
OPERATING CONSIDERATIONS

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.

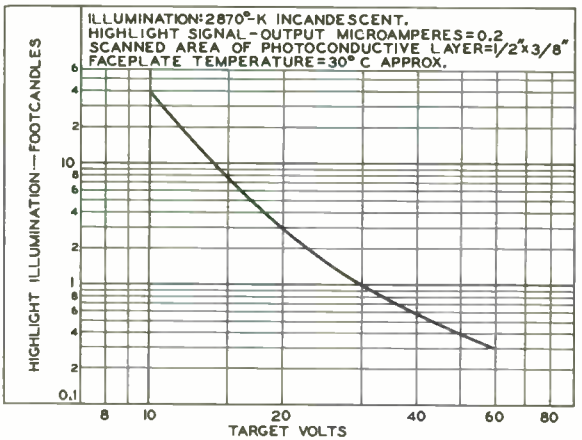


TYPICAL LIGHT-TRANSFER CHARACTERISTICS



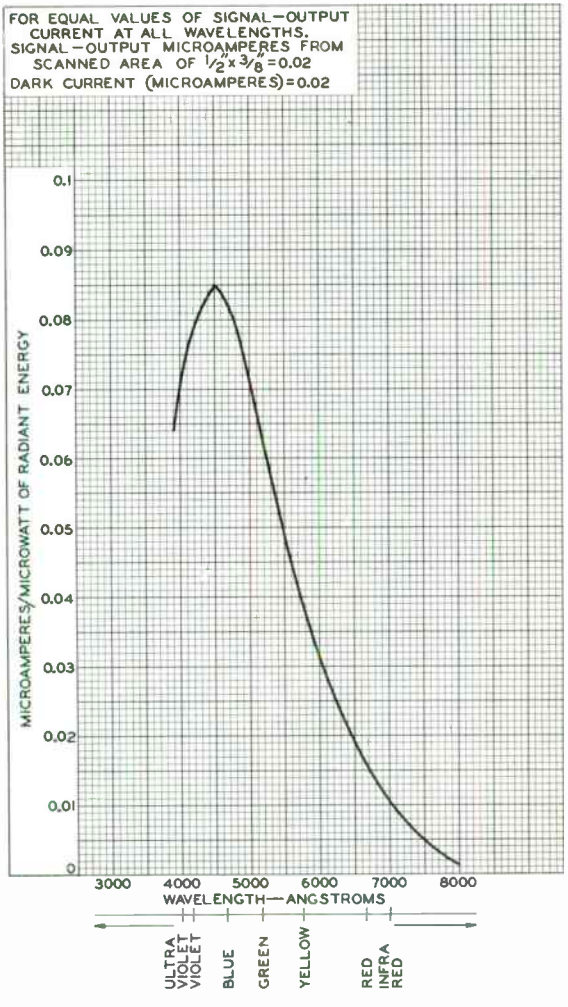
92CS-10689R2

TYPICAL CHARACTERISTIC



92CS-10685RI

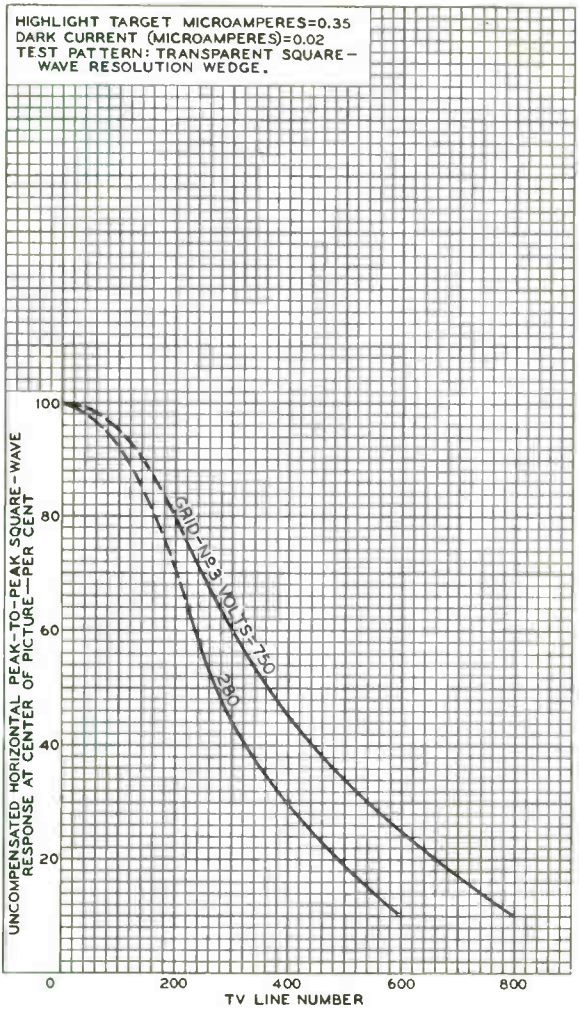
TYPICAL SPECTRAL-SENSITIVITY CHARACTERISTIC



92CM-10698RI

7263-A

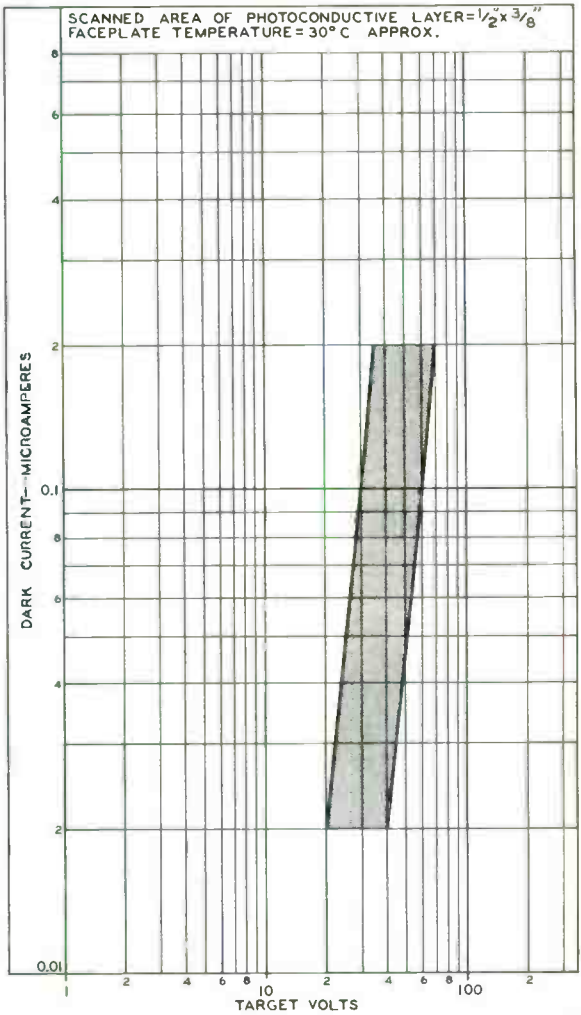
UNCOMPENSATED HORIZONTAL SQUARE-WAVE RESPONSE



92CM-10683RI

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.

DARK-CURRENT RANGE



92CM-10684RI

Vidicon

600-TO-900-LINE RESOLUTION

For Live-Scene Pickup with Color or Black-and-White TV Cameras in Industrial Closed-Circuit Systems. The 7735-A is Unilaterally Interchangeable with Type 7735.

DATA

General:

Heater, for Unipotential Cathode:
- Voltage (AC or DC) . . . . . 6.3 ± 10% volts
- Current at 6.3 volts . . . . . 0.6 amp

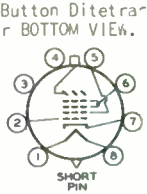
Direct Interelectrode Capacitance:▲
- Target to all other electrodes . . . . . 4.6 μμf

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 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 . . . . . 6.25" ± 0.25"
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 & GR D-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

7735-A

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●,#.	30 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
Signal–Output Current:●		
Typical.	0.2	μa
Minimum.	0.15	μa

▲ This capacitance, which effectively is the output impedance of the 7735-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.

● 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 and 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 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 1/30 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.

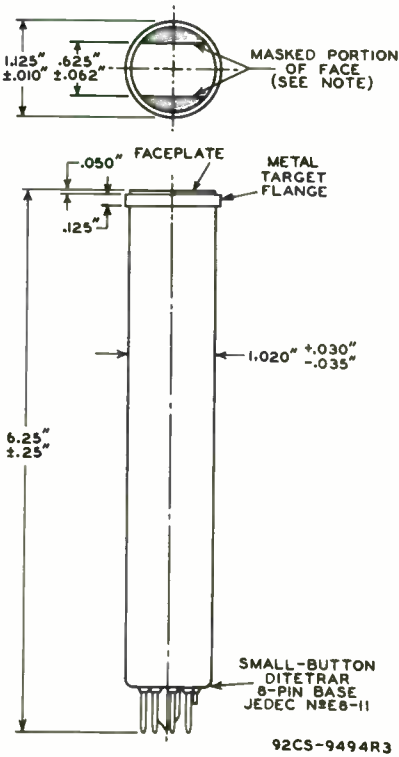
● Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

The target voltage for each 7735-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.

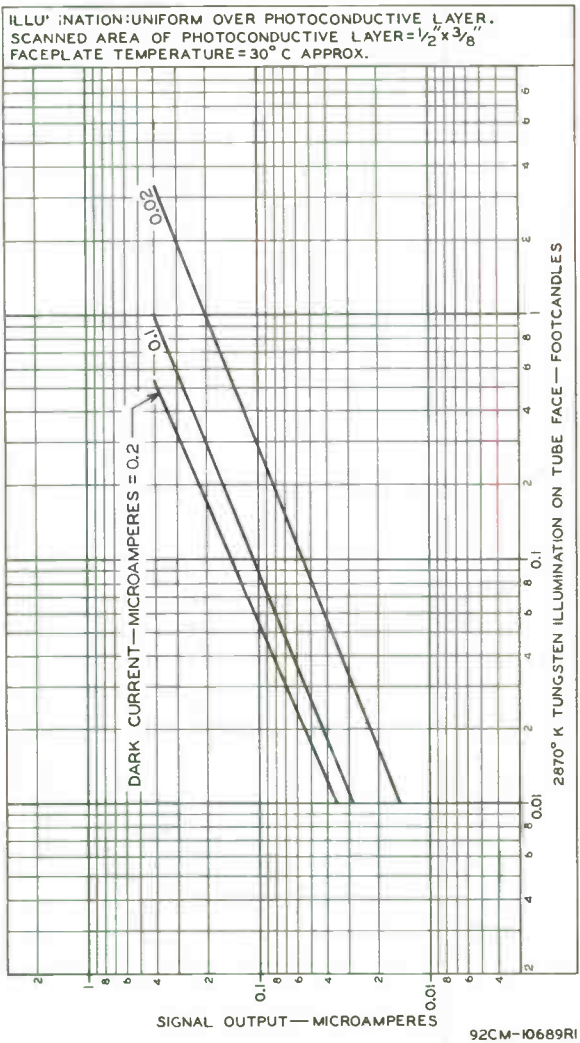
♣ Defined as the component of the highlight target current after the dark-current component has been subtracted.

7735-A

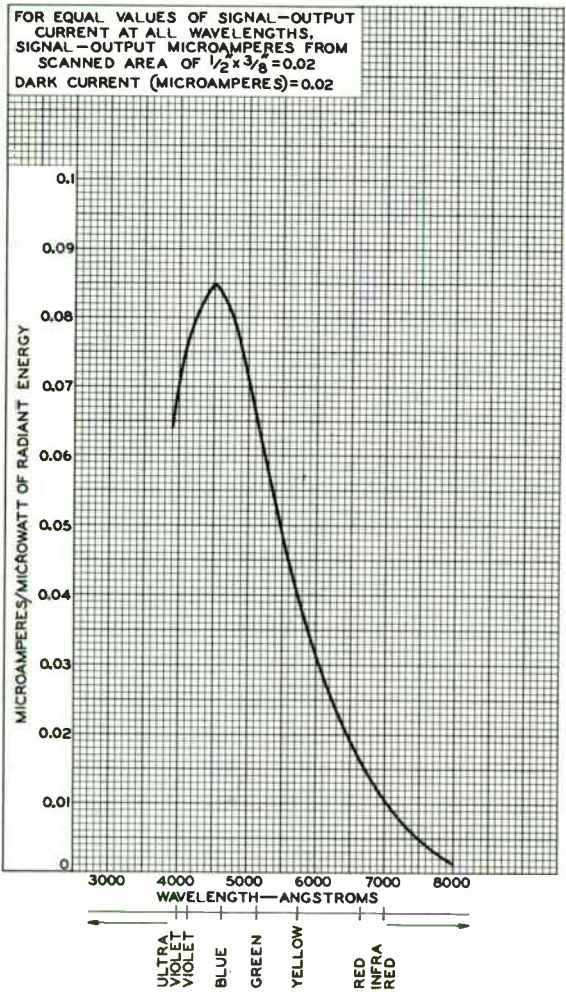


NOTE: STRAIGHT SIDES OF MASKED PORTIONS ARE PARALLEL TO THE PLANE PASSING THROUGH TUBE AXIS AND SHORT INDEX PIN.

TYPICAL LIGHT-TRANSFER CHARACTERISTICS

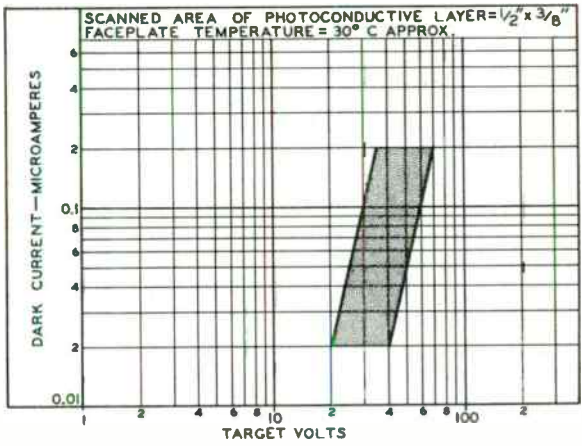


TYPICAL SPECTRAL-SENSITIVITY CHARACTERISTIC



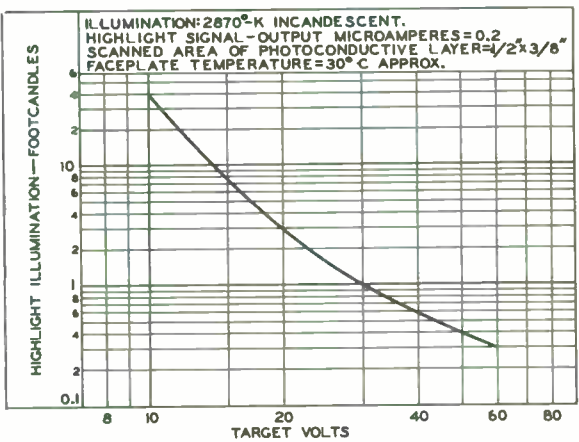
92CM-10698RI

DARK-CURRENT RANGE



92CS-10684RI

TYPICAL CHARACTERISTIC



92CS-10685RI

7293A

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	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; 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

7293A

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

BOTTOM VIEW

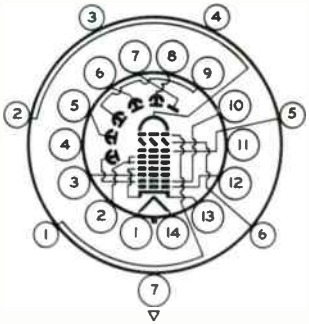
Pin 1 – Grid No.6
Pin 2 – Photocathode
Pin 3 – Internal Connection—Do Not Use
Pin 4 – Internal Connection—Do Not Use
Pin 5 – Grid No.5
Pin 6 – Target
Pin 7 – Internal Connection—Do Not Use

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

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 & Dyrode-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

7293A

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.

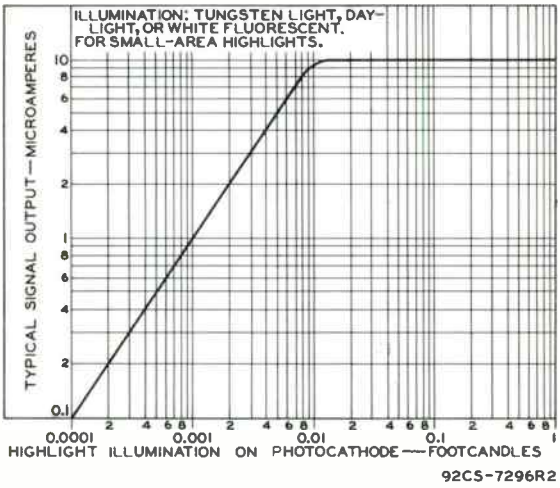
[f] Adjust to give the most uniformly shaded picture near maximum signal.

[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.

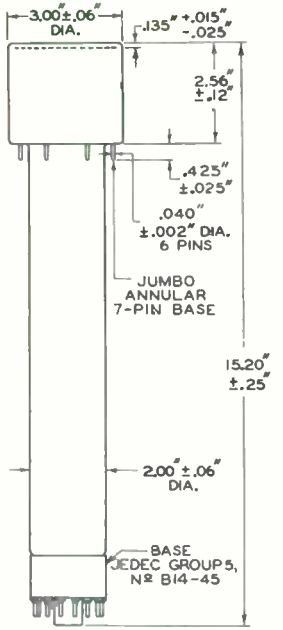
[h] Measured with amplifier having flat frequency response.

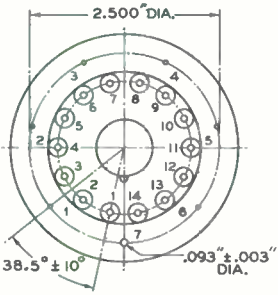
SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-10 RESPONSE is shown at front of this Section

BASIC LIGHT-TRANSFER CHARACTERISTIC



92CS-7296R2

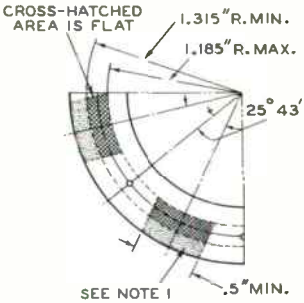




ENLARGED BOTTOM VIEW

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. PIN 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".

7295-A

Image Orthicon

MAGNETIC FOCUS **MAGNETIC DEFLECTION**
EXCELLENT RESOLUTION CAPABILITY

For Outdoor and Studio Pickup with High-Quality Black-and-White TV Cameras. The 7295-A is Unilaterally Interchangeable with Type 7295.

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	1.6" 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 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.

Target-to-Mesh Spacing	0.002	in.
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
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.

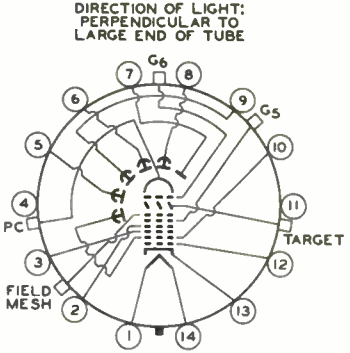
7295-A

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 – 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.	−700 max.	volts
Illumination	50 max.	fc
OPERATING TEMPERATURE:		
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•.	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
ANODE SUPPLY VOLTAGE★.	1650 max.	volts
VOLTAGE PER MULTIPLIER STAGE	350 max.	volts

Typical Operating Values:♦

Photocathode Voltage	−600	volts
Grid-No.6 Voltage (Image Focus)		
Approx. 50% of photocathode voltage♦	−250 to −350	volts
Target Voltage Above Cutoff♦	2 to 3	volts
Field-Mesh Voltage●	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♣	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
Target-Temperature Range	35 to 45	°C
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength of Focusing Coil (Approx.):●		
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, target voltage adjusted to 3 volts above cutoff, and with the camera lens adjusted so that the picture highlights are twice those required to reach the "knee" of the accompanying Basic Light-Transfer-Characteristic Curve except as otherwise specified

	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	−	30	μa
Ratio of Peak-to-Peak High-light Video Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc	−	65:1	−	
Photocathode Illumination at 2870° K Required to Reach "Knee" of Light Transfer Characteristic	−	0.04	0.075	fc
Amplitude Response at 400 TV Lines per Picture Height (Per cent of large-area black to large-area white)#	40	56	−	%

● With respect to grid No.4.

★ Dynode-voltage values are shown under Typical Operating Values.

♦ With 7295-A operated in RCA TK-12 camera at fixed photocathode voltage.

♦ Adjust for optimum focus.

♠ The target supply voltage should be adjustable from -5 to 5 volts.

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

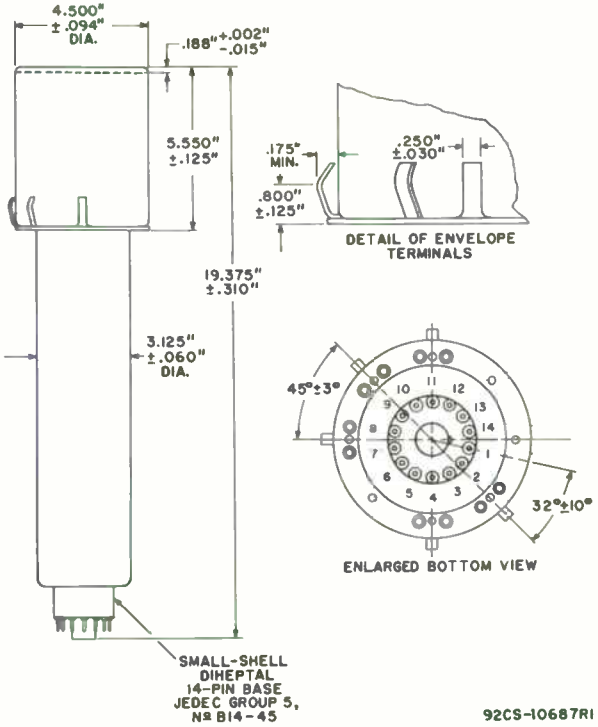
● Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

Measured with amplifier having flat frequency response.

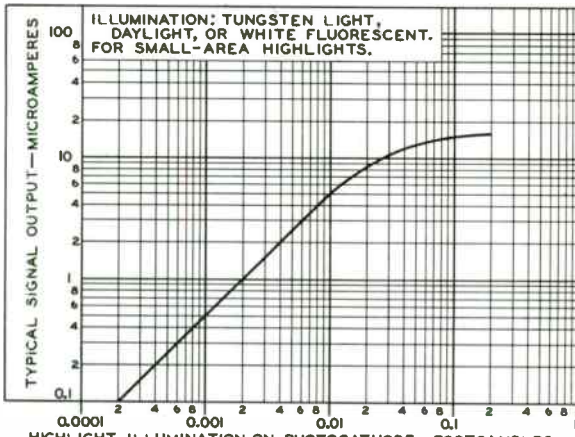
OPERATING CONSIDERATIONS

The *operating position* of the 7295-A 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



7389-A

Image Orthicon

MAGNETIC FOCUS **MAGNETIC DEFLECTION**

VERY HIGH SIGNAL-TO-NOISE RATIO

For High-Quality Black-and-White Studio TV Cameras. The 7389-A is Unilaterally Interchangeable with Type 7389.

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	1.6" 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.

Target-to-Mesh Spacing	0.001	in.
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	
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.

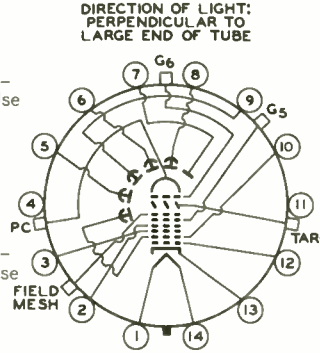
7389-A

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 - 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.	-700 max.	volts
Illumination	50 max.	fc
OPERATING TEMPERATURE:		
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•.	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
ANODE-SUPPLY VOLTAGE*.	1650 max.	volts
VOLTAGE PER MULTIPLIER STAGE	350 max.	volts

Typical Operating Values:♦

Photocathode Voltage	-600	volts
Grid-No.6 Voltage (Image focus) Approx. 50% of photocathode voltage♣	-250 to -350	volts
Target Voltage Above Cutoff♠	2 to 3	volts
Field Mesh Voltage●	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★	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
Target Temperature Range	35 to 45	°C
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength of Focusing Coil:●		
At center of scanning section (Approx.)	60	gausses
In plane of photocathode (Approx.)	120	gausses
Field Strength of Alignment Coil	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operating Values, target voltage adjusted to 3 volts above cutoff, and with the camera lens set to bring the picture highlights 1/2 stop above the "knee" of the Basic Light-Transfer-Characteristic Curve except as otherwise specified

	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	-	40	μa
Ratio of Peak-to-Peak High-light Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc	-	95:1	-	
Photocathode Illumination at 2870° K Required to Reach "Knee" of Light Transfer Characteristic	-	0.075	0.15	fc
Amplitude Response at 400 TV Lines per Picture Height (Per cent of large-area black to large-area white)	40	56	-	%

● With respect to grid No.4.

★ Dynode-voltage values are shown under *Typical Operating Values*.

♦ With 7389-A operated in RCA TK-12 camera at fixed photocathode voltage.

♣ Adjust for optimum focus.

♠ The target supply voltage should be adjustable from -5 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.

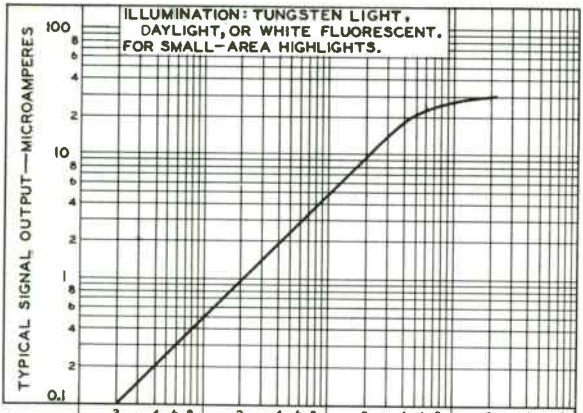
Measured with amplifier having flat frequency response.

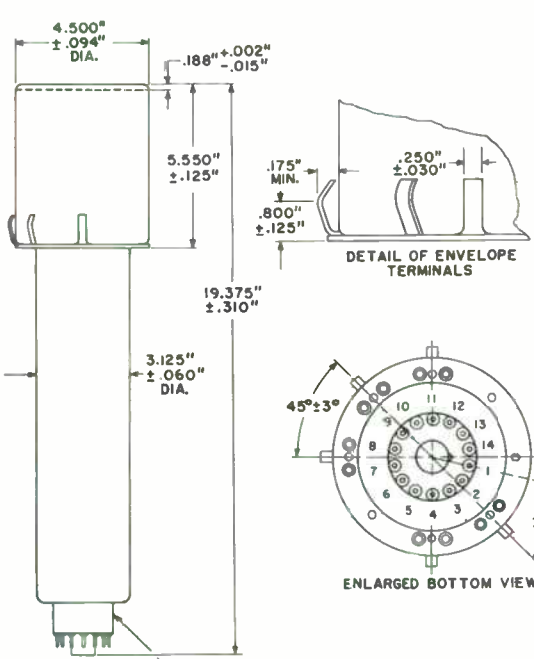
OPERATING CONSIDERATIONS

The *operating position* of the 7389-A 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





7697

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

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.

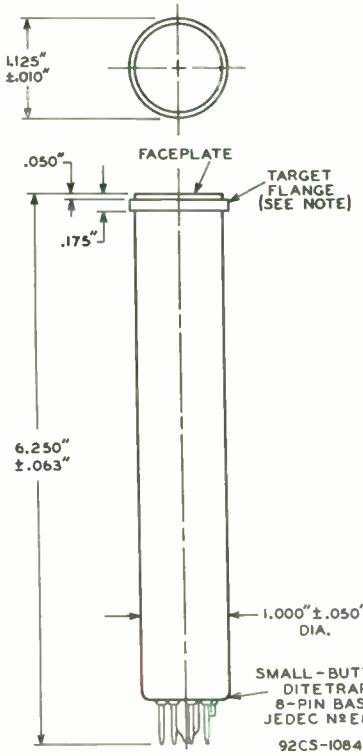
[d] With no blanking voltage on grid No.1.

[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.

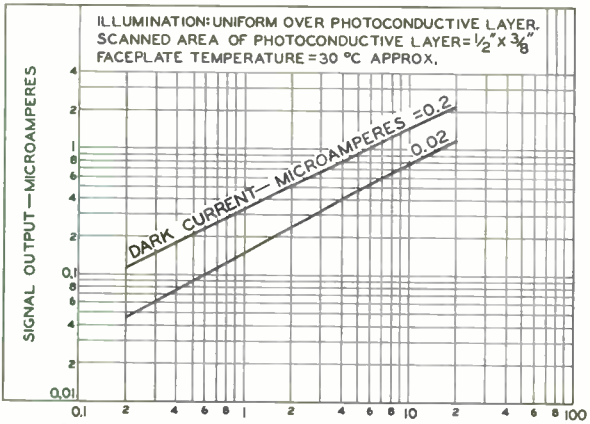
[g] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

[h] Defined as the component of the highlight target current after the dark-current component has been subtracted.



NOTE: THE TARGET CONNECTOR MUST BE CAPABLE OF MAKING CONTACT AT ANY POINT ON TARGET FLANGE.

TYPICAL LIGHT-TRANSFER CHARACTERISTICS



92CS-10847

Multiplier Phototube

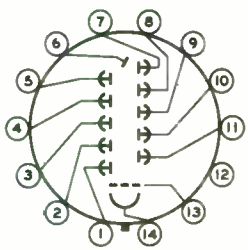
10-STAGE, HEAD-ON, SPHERICAL-FACEPLATE TYPE HAVING ENCLOSED, IN-LINE DYNODE STRUCTURE, 1.68"-DIAMETER, SPHERICAL, SEMITRANSPARENT PHOTOCATHODE, S-11 RESPONSE, AND VERY SHORT TIME-RESOLUTION CAPABILITY

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

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} to 6×10^{-12}	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} to 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

	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.

• 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.

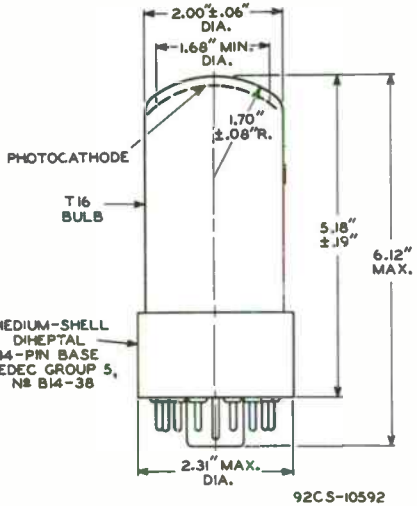
The use of an average anode current well below the maximum-rated value of 2 milliamperes is recommended when stability of operation is important. When maximum stability is required, the average anode current should not exceed 10 microamperes.

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.

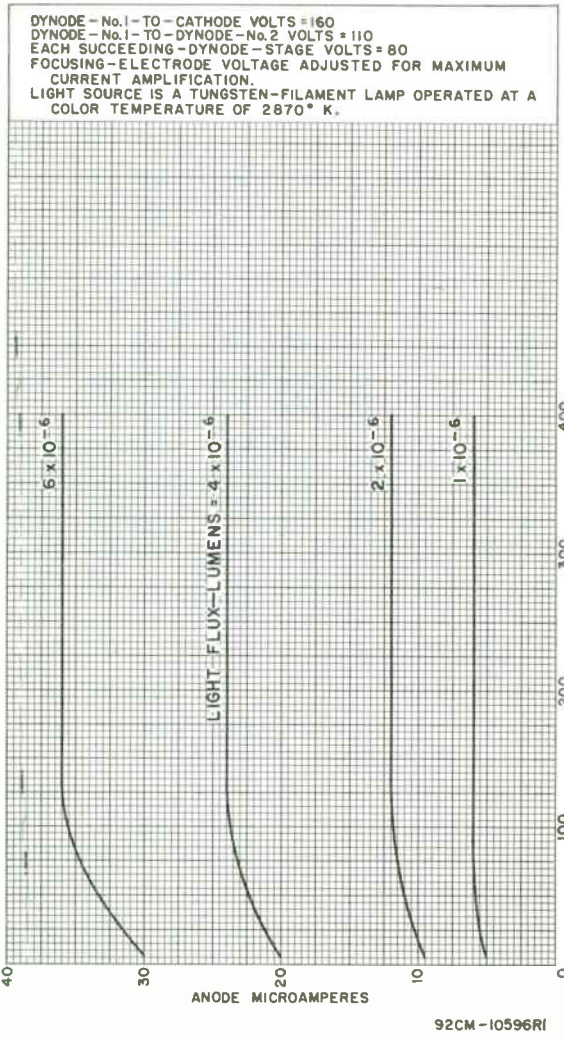
The *high voltages at which the 7746 is operated are very dangerous.* Care should be taken in the design of apparatus to prevent the operator from coming in contact with these high voltages. Precautions should include the enclosure of high-potential terminals and the use of interlock switches to break 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



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.

TYPICAL ANODE CHARACTERISTICS

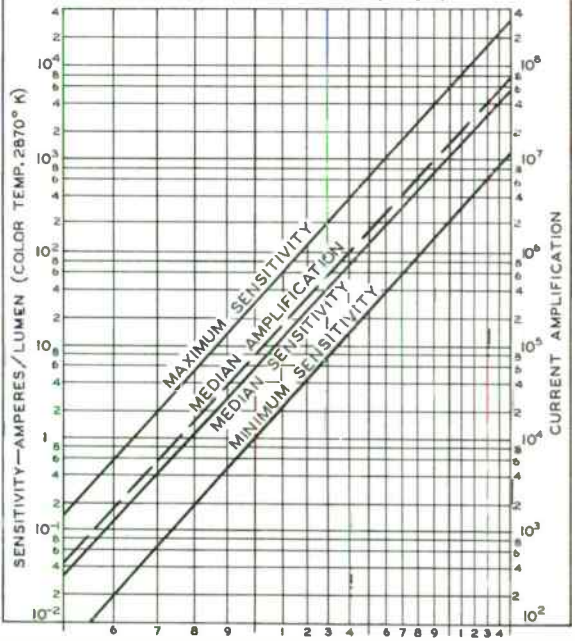


CHARACTERISTICS

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-10597RI

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

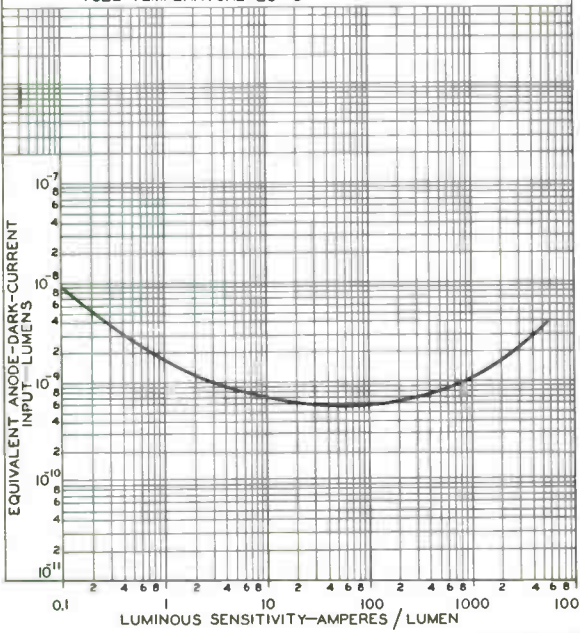
LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	8.06% OF E MULTIPLIED BY
CATHODE & DY1	2
DY1 & 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 & DY7	1
DY7 & DY8	1
DY8 & DY9	1
DY9 & DY_{10}	1
DY_{10} & ANODE	1
ANODE & CATHODE	12.4

FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED FOR MAXIMUM CURRENT AMPLIFICATION.

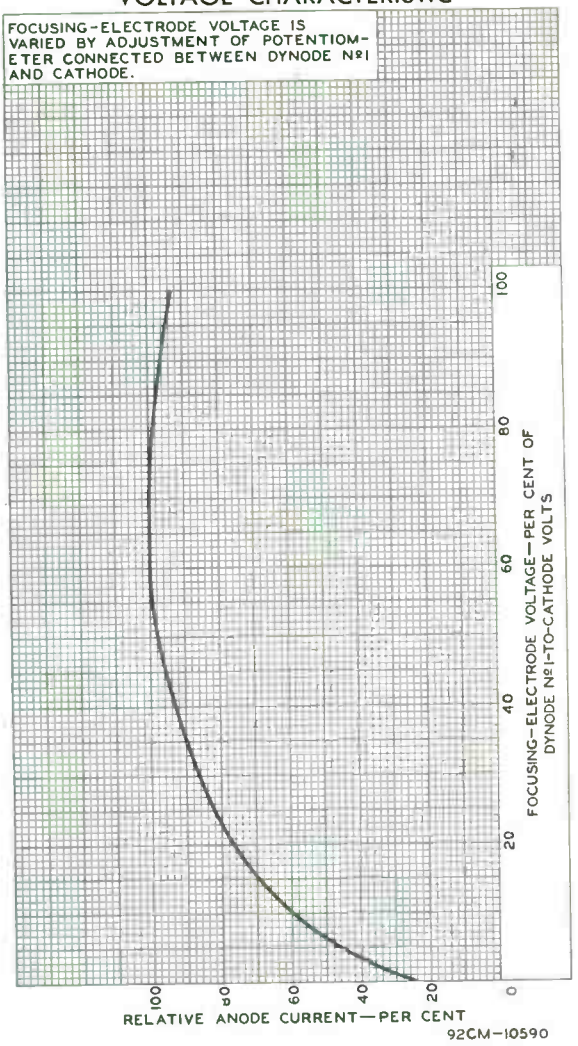
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.

TUBE TEMPERATURE=25° C

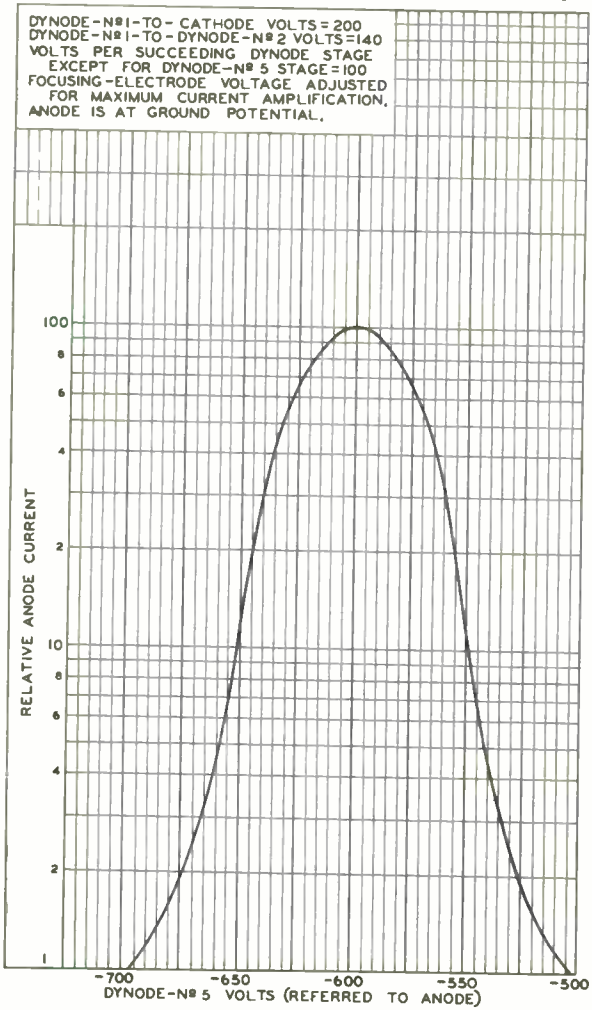


92CM-10593R1

AVERAGE FOCUSING-ELECTRODE-VOLTAGE CHARACTERISTIC



TYPICAL ANODE-CURRENT CHARACTERISTIC



92CM-10598

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 Ninar 9-Pin (JEDEC No.E9-37)	
Basing Designation for BOTTOM VIEW	9NG	

DIRECTION OF LIGHT: INTO END OF BULB

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
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

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.

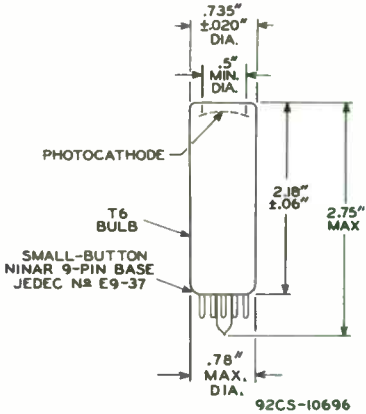
OPERATING CONSIDERATIONS

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.

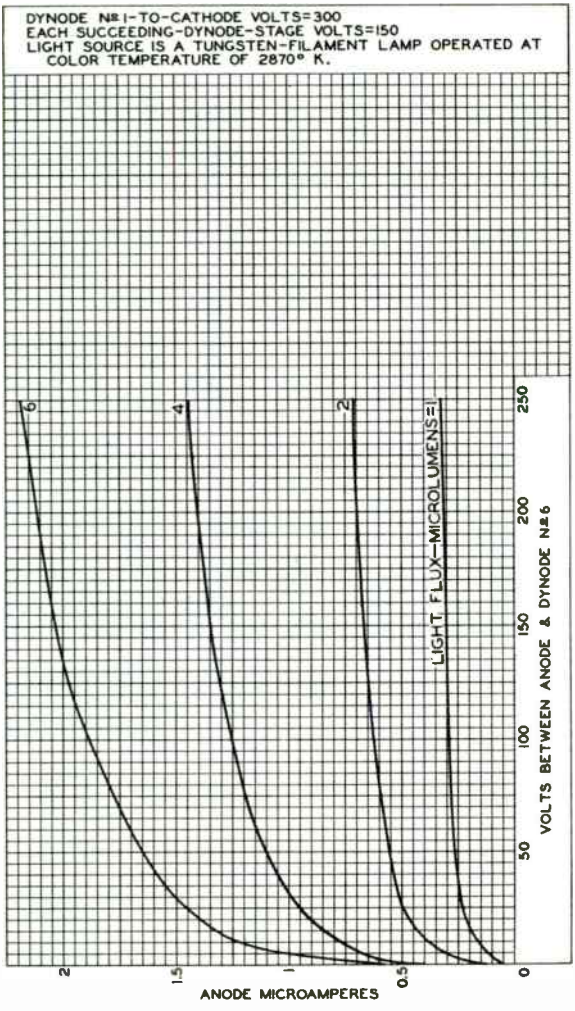
Electrostatic and/or magnetic shielding of the 7764 may be necessary.

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

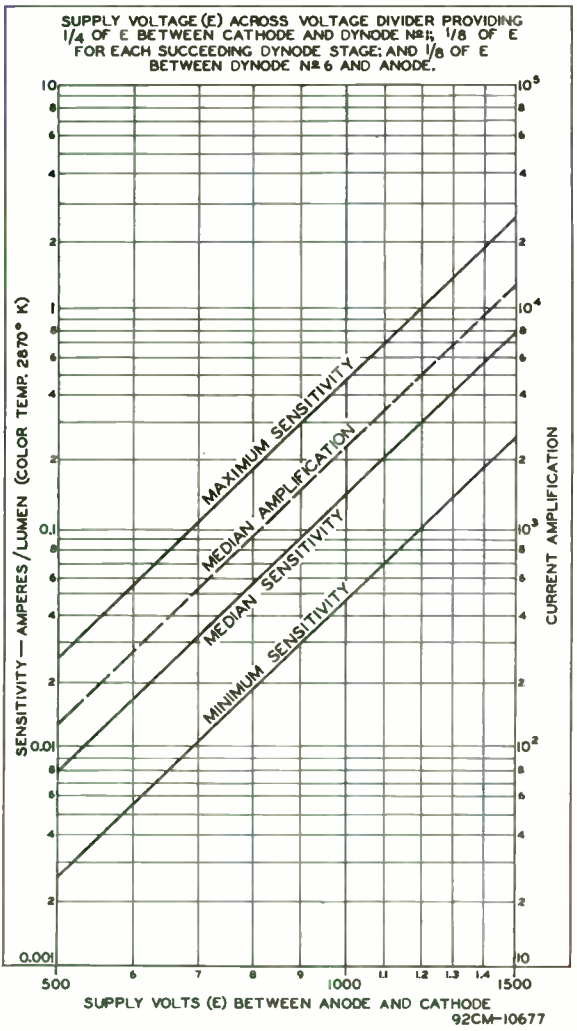


AVERAGE ANODE CHARACTERISTICS

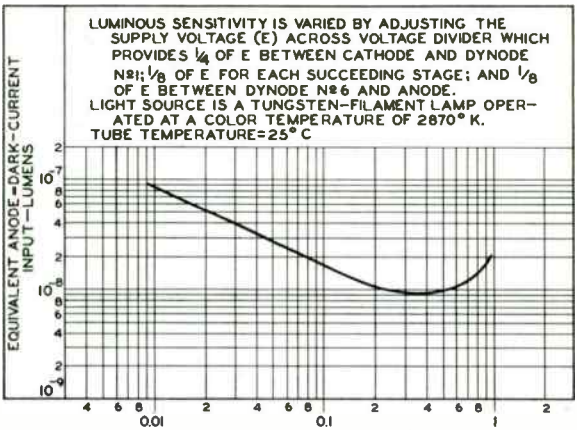


92CM-10673

CHARACTERISTICS



TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



92CS-10672

Multiplier Phototube

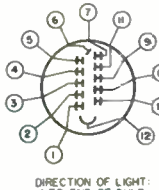
10-STAGE, HEAD-ON, FLAT-FACEPLATE, COMPACT TYPE HAVING IN-LINE DYNODE STRUCTURE, 0.5"-DIAMETER, CURVED, CIRCULAR, SEMITRANSPARENT PHOTOCATHODE AND S-11 RESPONSE

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.10	2.4	μμf
Anode to all other electrodes	3.2	μμf
Maximum Overall Length (Excluding flexible leads)	4.0"	
Maximum Diameter	0.78"	
Operating Position	Any	
Weight (Approx.)	0.9 oz	
Bulb	T6	
Base	Small-Button Thirteenar 12-Flexible-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



DIRECTION OF LIGHT: INTO END OF BULB

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

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)	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

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 dc (Except as noted)

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms.	–	0.006	–	amp/μw
Cathode radiant, at 4400 angstroms . .	–	0.048	–	amp/watt
Luminous, at 0 cps●.	3	7.5	60	amp/lumen
Cathode luminous★. .	40	60	–	μa/lumen
Current Amplification.	–	1.25×10^5	–	
Equivalent Anode-Dark-Current Input♦ . . .	–	5×10^{-10}	5×10^{-9}	lumen
Equivalent Noise Input♣	–	3×10^{-12}	1×10^{-11}	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. The load resistor has a value of 0.01 megohm.

♦ 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.

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.

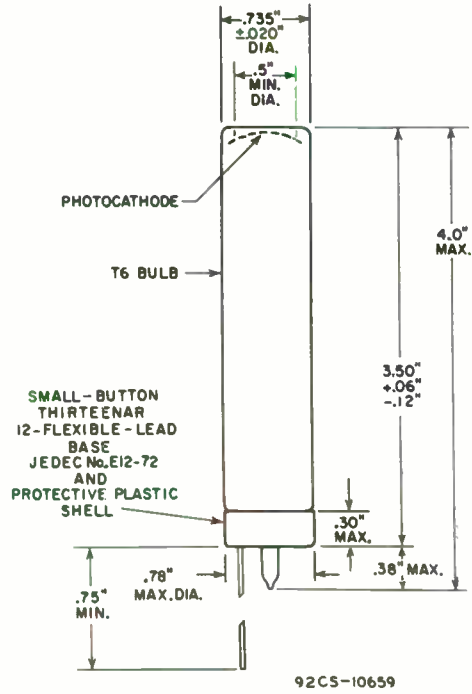
Electrostatic and/or *magnetic shielding* of the 7767 may be necessary.

The high voltages at which the 7767 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.

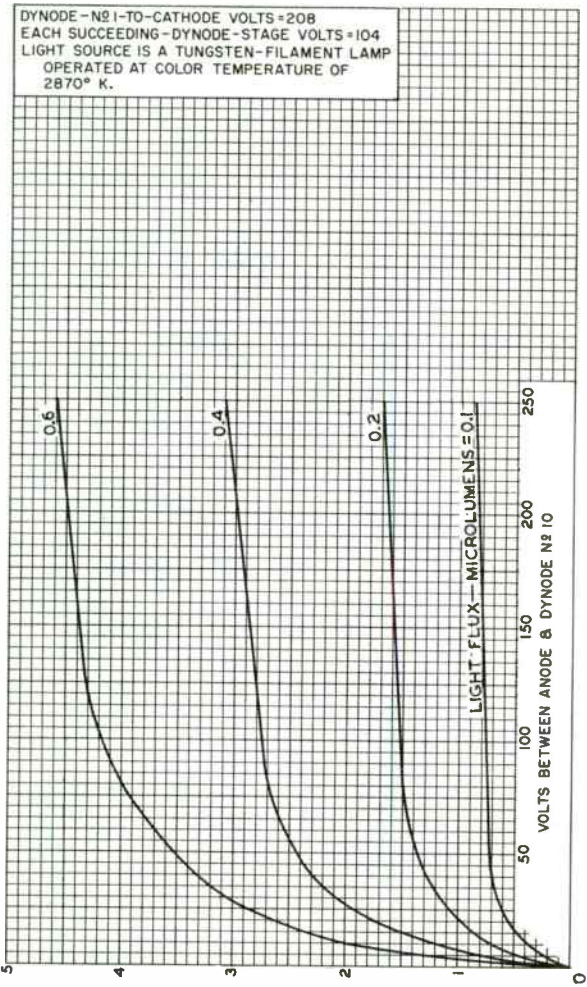
The *flexible leads* of the 7767 may be soldered into the associated circuit. If desired, the leads may be trimmed to within 1/4 inch of the protective plastic shell. When leads of reduced length are soldered, care must be taken to conduct excessive heat away from the lead seals. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the tube.

Under no circumstances is any device for support to be fastened to the protective plastic shell.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-11 Response
is shown at front of this Section

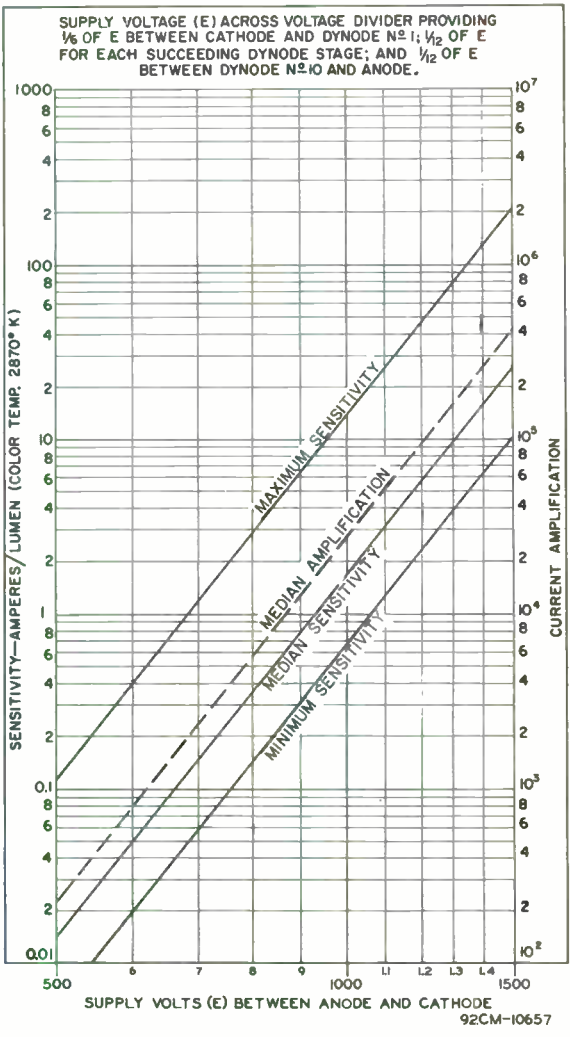


AVERAGE ANODE CHARACTERISTICS

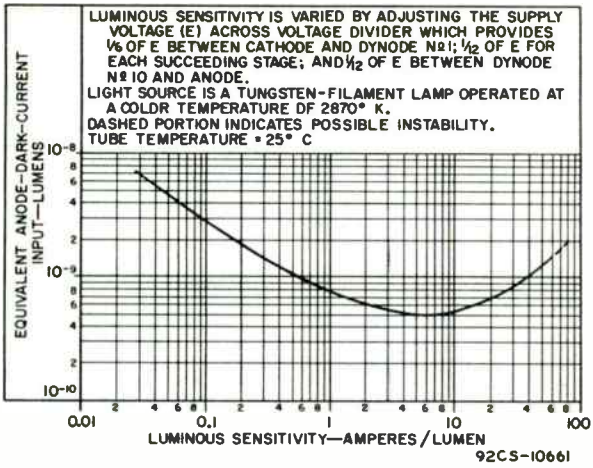


92CM-10660

CHARACTERISTICS



TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



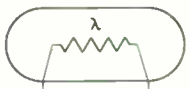
Photoconductive Cell

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)	0.00175 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



TERMINAL TERMINAL

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)	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

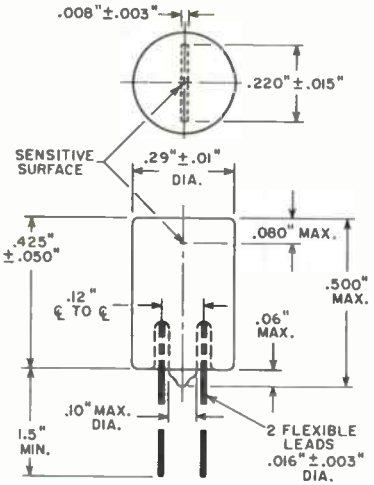
	Min	Median	Max.	
Sensitivity:				
Radiant▲ at 7300 angstroms	–	6550	–	a/w
Luminous●,★	–	41	–	a/lm
Illumination●,★	–	500	–	μa/fc
Photocurrent◆	–	–	0.05	μa

▲ For conditions where the incident power is 7.65×10^{-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.

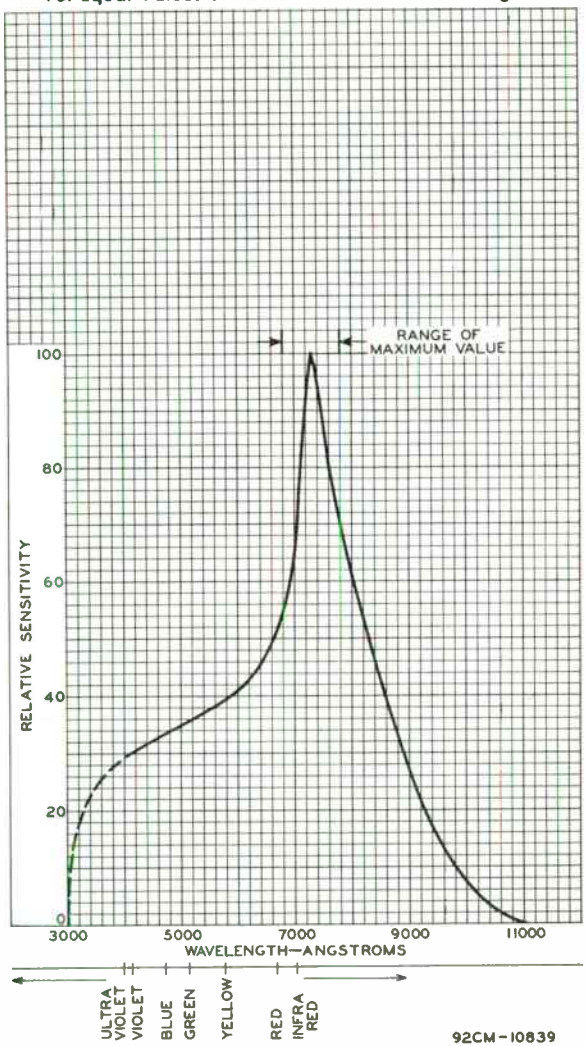
◆ Measured 20 seconds after removal of incident-illumination level of 0.01 footcandle.



92CS-10865

SPECTRAL-SENSITIVITY CHARACTERISTIC

For Equal Values of Radiant Flux at All Wavelengths



92CM-10839

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

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

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.

[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 protocathode 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 BD8S50, Serial No.AL281, manufactured by Harshaw Chemical Company, 1945 East 97 Street, CTeveland 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.	

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.

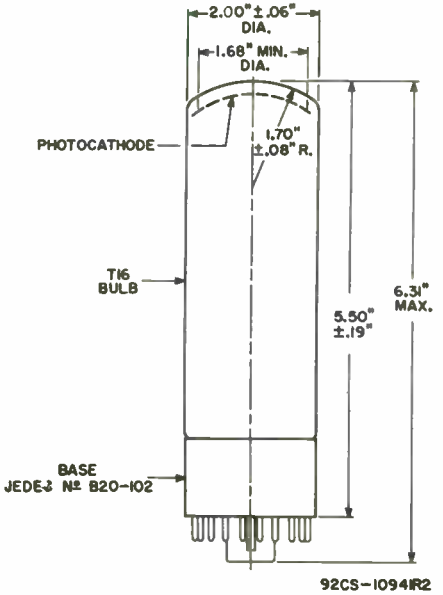
The use of an average anode current well below the maximum-rated value of 2 milliamperes is recommended when stability of operation is important. When maximum stability is required, the average anode current should not exceed 10 microamperes.

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.

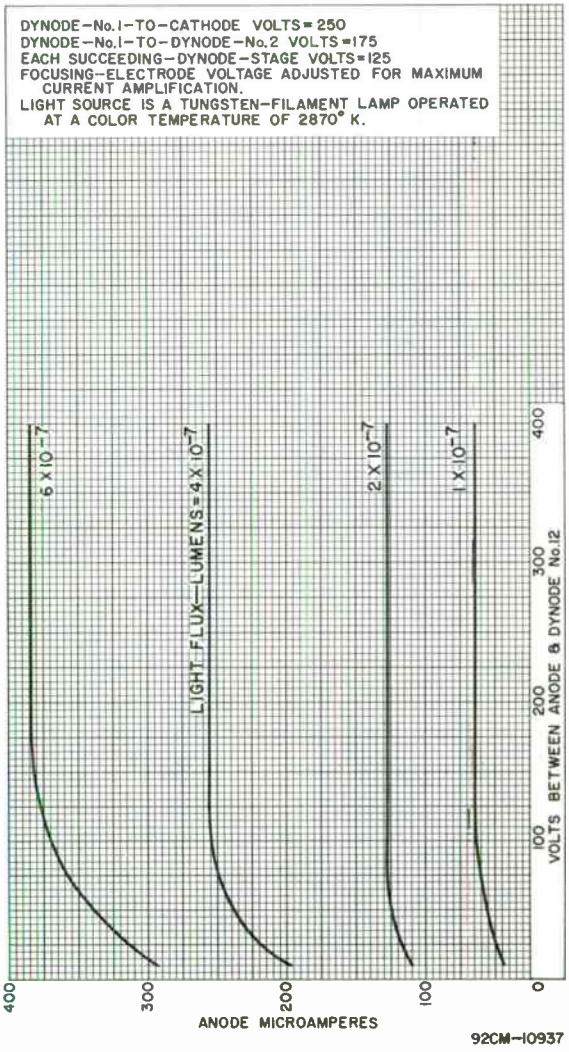
The *high voltages at which the 7850 is operated are very dangerous*. Care should be taken in the design of apparatus to prevent the operator from coming in contact with these high voltages. Precautions should include the enclosure of high-potential terminals and the use of interlock switches to break 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



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.

TYPICAL ANODE CHARACTERISTICS



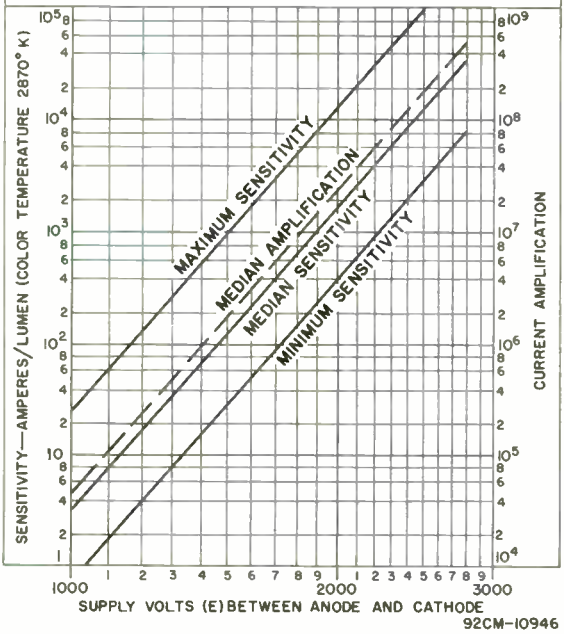
92CM-10937

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.



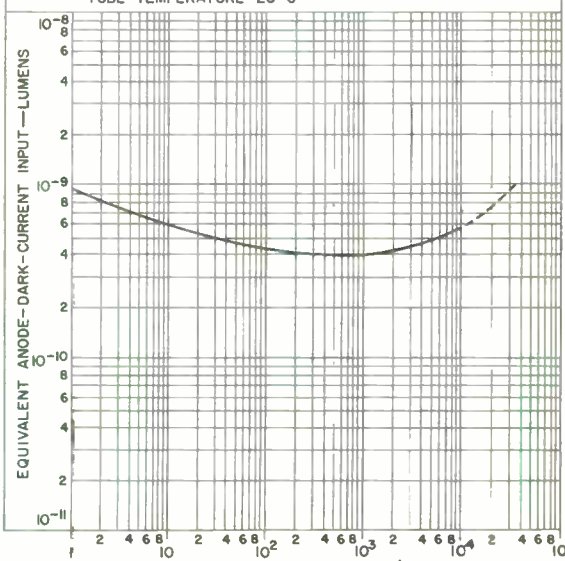
92CM-10946

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

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

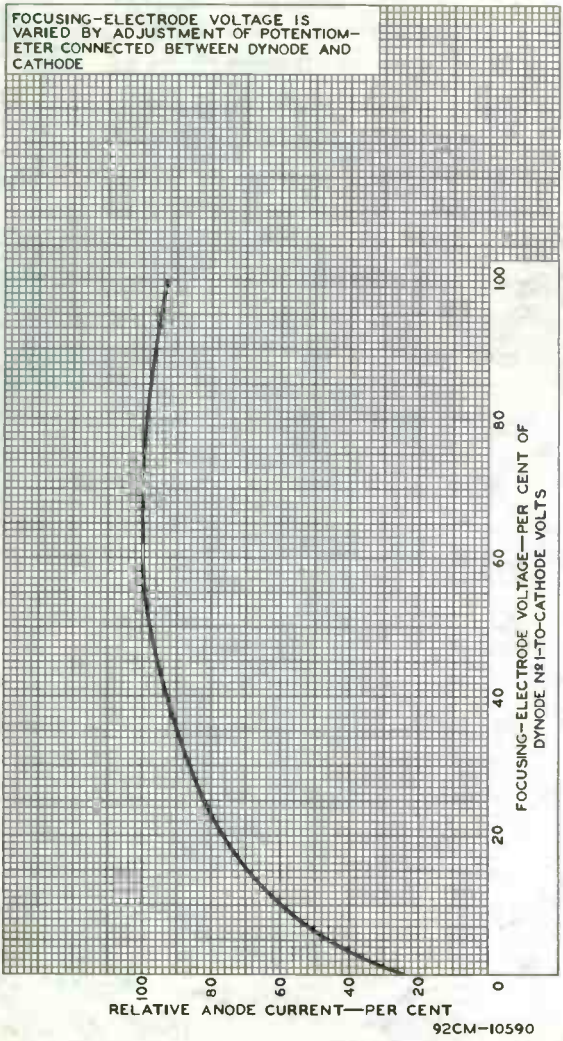
BETWEEN	6.95 % OF E MULTIPLIED BY
CATHODE & DY_1	2
DY_1 & DY_2	1.4
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1
DY_7 & DY_8	1
DY_8 & DY_9	1
DY_9 & DY_{10}	1
DY_{10} & DY_{11}	1
DY_{11} & DY_{12}	1
DY_{12} & ANODE	1
ANODE & CATHODE	14.4

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

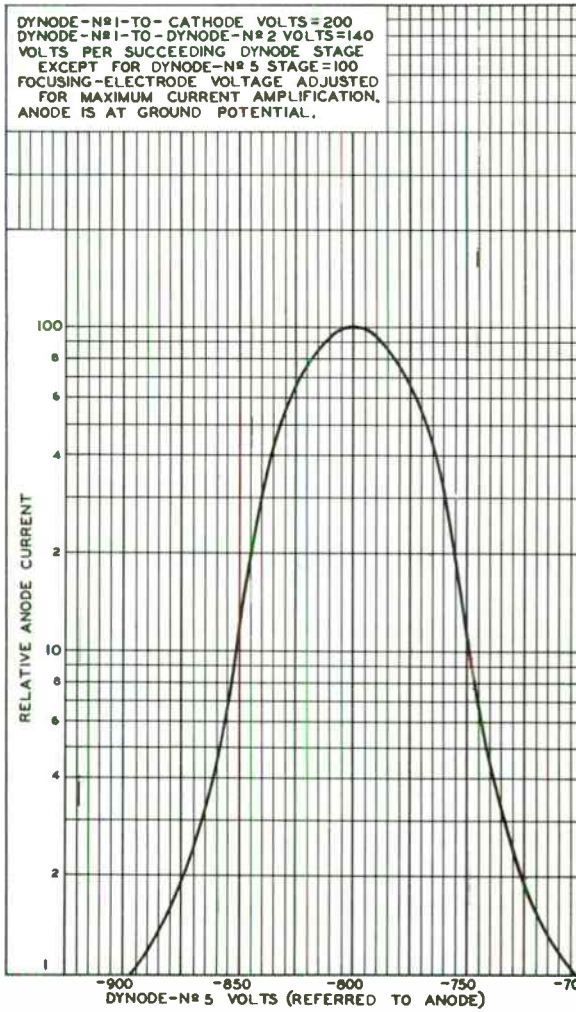


92CM-10940

AVERAGE FOCUSING-ELECTRODE-VOLTAGE CHARACTERISTIC



TYPICAL ANODE-CURRENT CHARACTERISTIC



92CM-10959

Vidicon

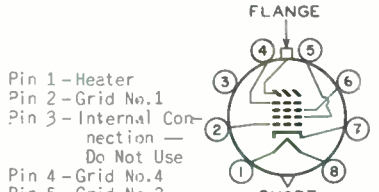
1200-LINE RESOLUTION

For Broadcast Film-Pickup or Data Transmission with Color or 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:[a]		
Target to all other electrodes	8	μμf
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"
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. The masking is for orientation only and does not define the proper scanned area of the photoconductive layer.		
Focusing Method		Magnetic
Deflection Method		Magnetic
Focusing-Alignment Assembly		Cleveland Electronics[b] No.15 VFA 259, or equivalent
Deflecting Yoke[c]		Cleveland Electronics[b] No.15 VY 258, or equivalent
Overall Length		7.75" ± 0.25"
Greatest Diameter		1.59" ± 0.01"
Weight (Approx.)		5.25 oz
Operating Position		Any
Bulb		T12
Socket		Cinch[d] No.133 98 11 049, Alden[e] No.208 SPEC, or equivalent
Base		Small-Button Superditetrar 8-Pin (JEDEC No.E8-78)
Basing Designation for BOTTOM VIEW		8LB



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
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	70 max.	°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[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	0.65	
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.)	46	gausses
Field Strength of Adjustable Alignment Coil[k]	0 to 4	gausses

Average-sensitivity operation

Faceplate Illumination (Highlight)	8	fc
Target Voltage[m,n]	20 to 50	volts
Dark Current[p]	0.02	μa
Signal-Output Current[q] (Typical)	0.3	μa

Minimum-lag operation

Faceplate Illumination (Highlight)	36	fc
Target Voltage[m,n]	10 to 30	volts
Dark Current[p]	0.005	μa
Signal-Output Current[q] (Typical)	0.3	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 order of 100 megohms.

[b] Cleveland Electronics Incorporated, 1974 East 61 Street, Cleveland, Ohio.

[c] For minimum geometric distortion, the deflecting yoke should be located in its proper axial position 3/4 inch from the face of the tube.

[d] Cinch Manufacturing Corporation, 1026 South Homan Avenue, Chicago 24, Illinois.

e Alden Products Company, 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 1.5 times the grid-No.3 voltage value, and the focusing-alignment assembly and deflecting yoke positioned as shown in accompanying *Recommended Locations of Focusing-Alignment Assembly and Deflecting Yoke*.

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 gausses.

j with no blanking voltage or grid No.1.

k 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.

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 8051 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.

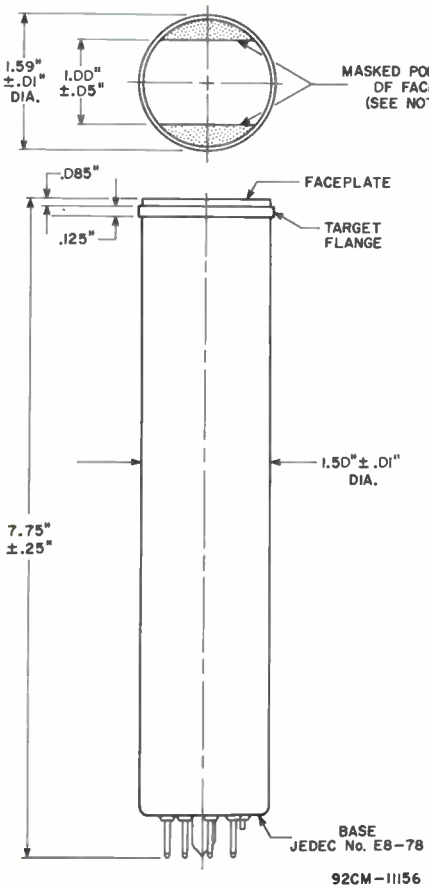
q Defined as the component of the highlight target current after the dark-current component has been subtracted.

RESOLUTION CAPABILITY

Resolution capability of the 8051 may be expressed in several ways: A typical value for *Limiting Resolution* is 1200 TV lines; typical *Equivalent Sine-Wave Response* (N_E) is approximately 270 TV lines per picture height; and typical *Response to a 400 TV Line Square-Wave Test Pattern* is 60 per cent.

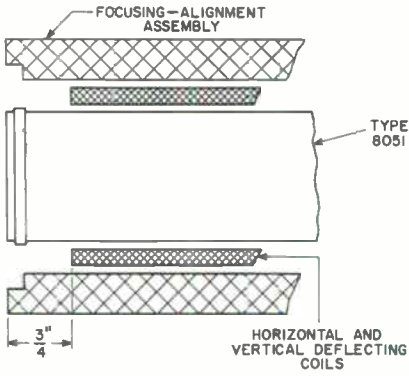
SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-18 RESPONSE is shown at front of this Section

8051



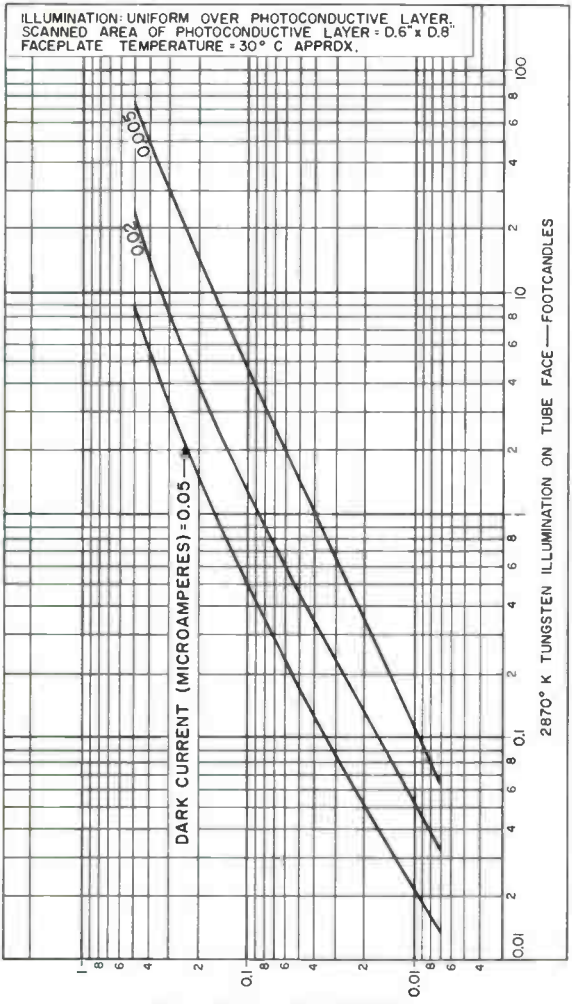
NOTE: STRAIGHT SIDES OF MASKED PORTIONS ARE PARALLEL TO THE PLANE PASSING THROUGH TUBE AXIS AND SHORT INDEX PIN.

RECOMMENDED LOCATIONS OF FOCUSING-ALIGNMENT ASSEMBLY AND DEFLECTING YOKE



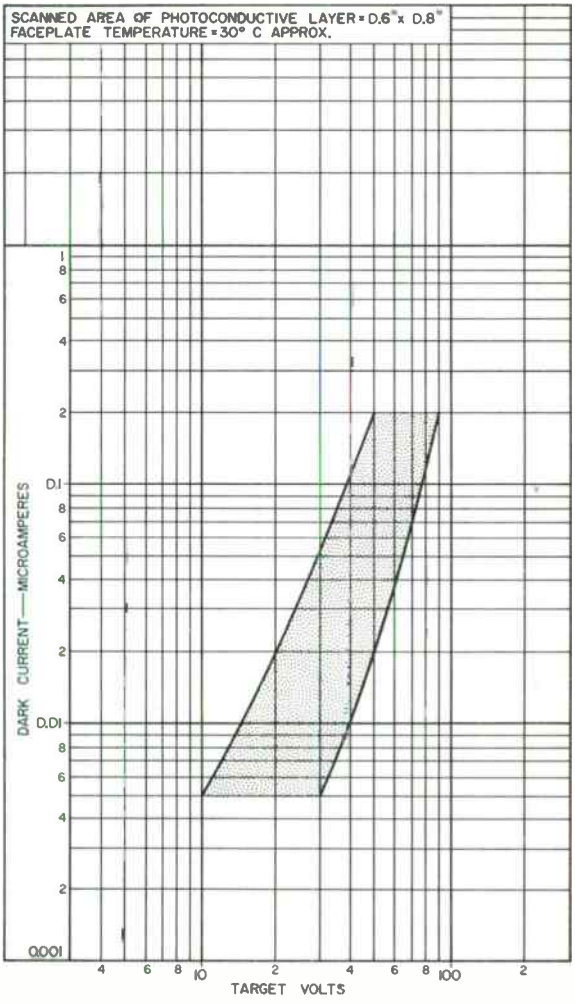
92CS-11160

TYPICAL LIGHT-TRANSFER CHARACTERISTICS



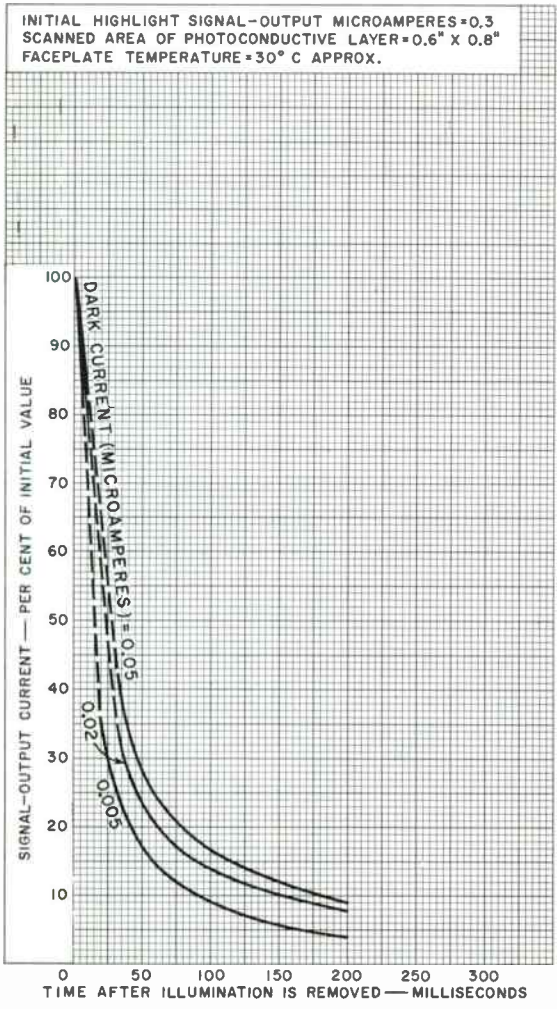
RADIO CORPORATION OF AMERICA
Electron Tube Division Harrison, N. J.

DARK-CURRENT RANGE



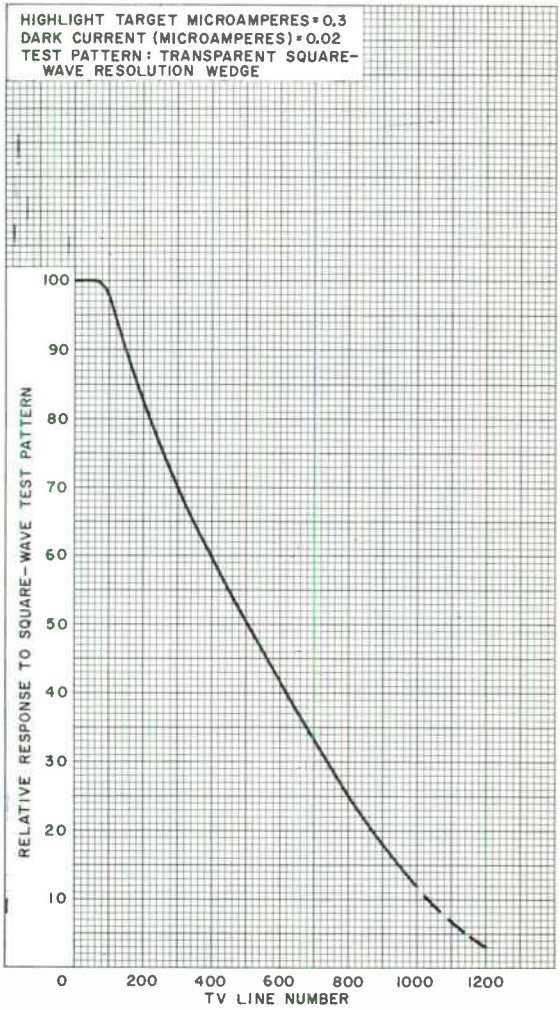
92CM-11162

TYPICAL PERSISTENCE CHARACTERISTICS



92CM-11153

UNCOMPENSATED HORIZONTAL RESPONSE TO A SQUARE-WAVE TEST PATTERN



92CM-11157

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

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.	
Sens tivity:				
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

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.

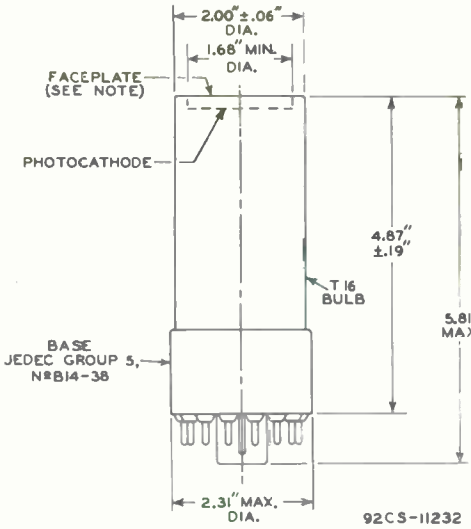
[h] Under the following conditions: Supply voltage (E) is as shown, 25° C tube temperature, external shield is connected to cathode, bandwidth 1 cycle per second, light source as shown under (c) interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the 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.

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.	

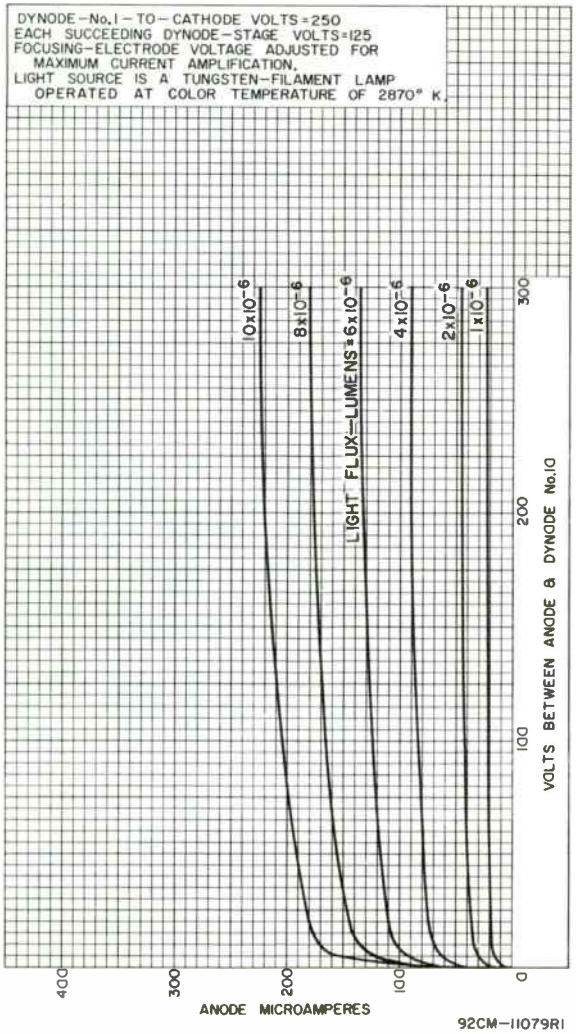
SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOSENSITIVE DEVICE HAVING S-11 RESPONSE
is shown at the front of this section



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.

TYPICAL ANODE CHARACTERISTICS



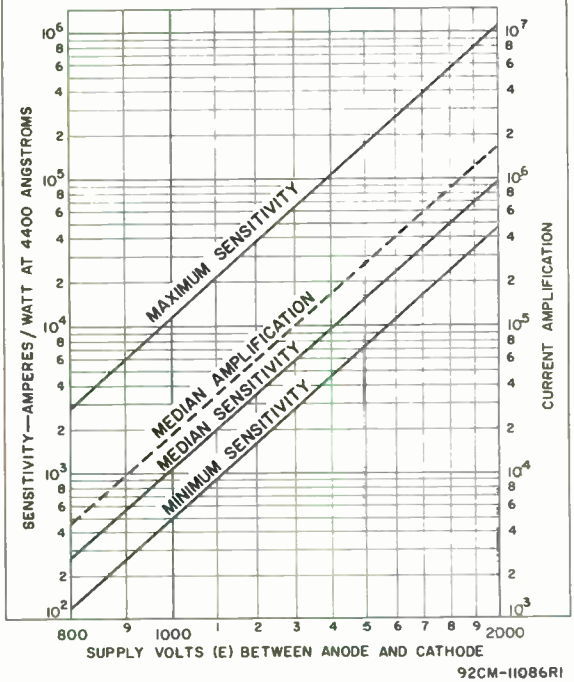
92CM-11079R1

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.



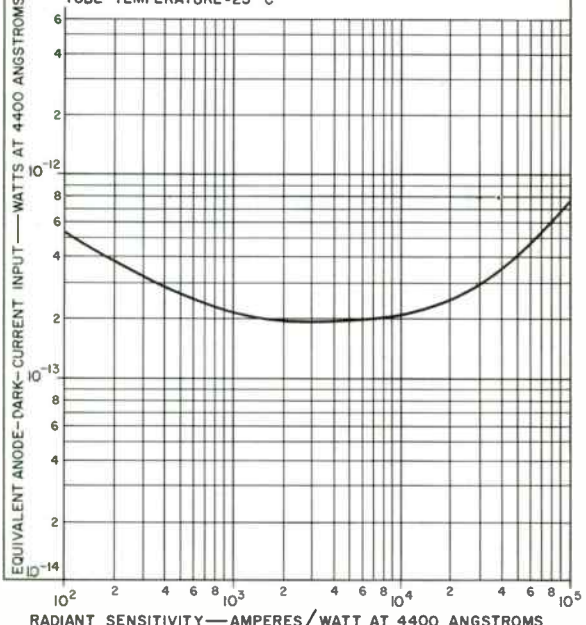
92CM-11086RI

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

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

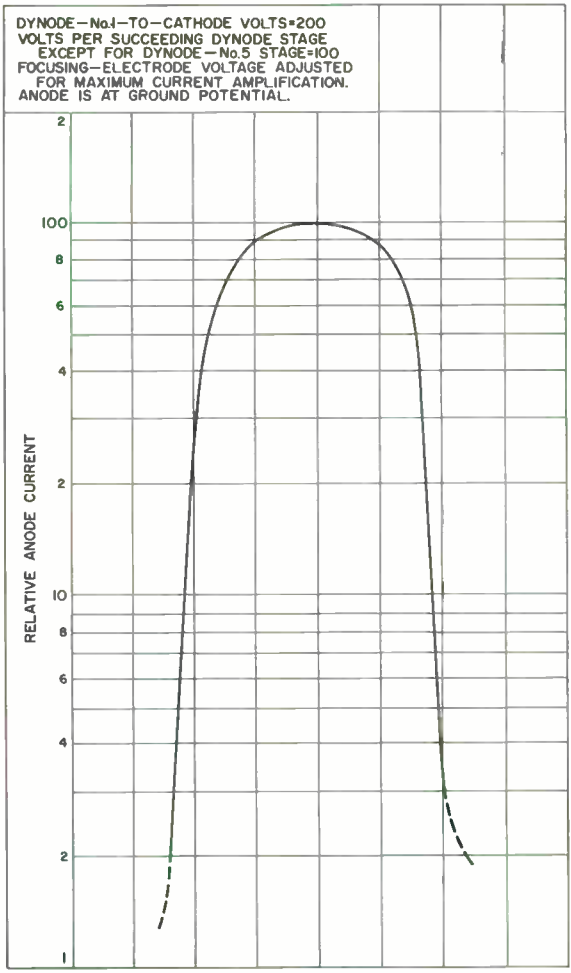
BETWEEN	8.3 % OF E MULTIPLIED BY
CATHODE & DY_1	2
DY_1 & DY_2	1
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1
DY_7 & DY_8	1
DY_8 & DY_9	1
DY_9 & DY_{10}	1
DY_{10} & ANODE	1
ANODE & CATHODE	12

FOCUSING—ELECTRODE VOLTAGE IS ADJUSTED FOR MAXIMUM CURRENT AMPLIFICATION.
TUBE TEMPERATURE=25° C



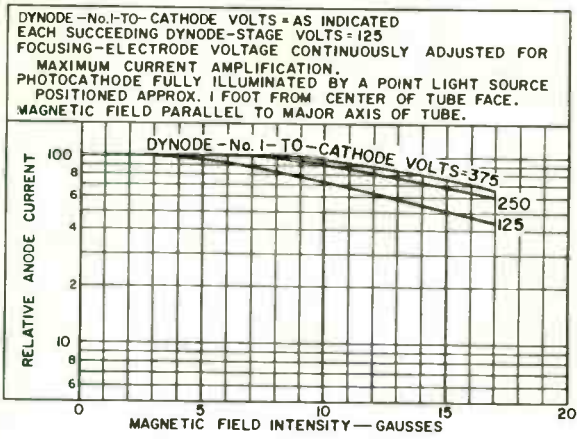
92CM-11146

TYPICAL ANODE-CURRENT CHARACTERISTIC

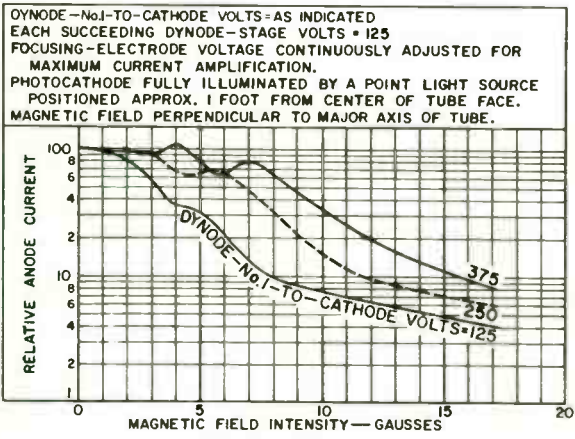


92CM—11078

TYPICAL ANODE-CURRENT CHARACTERISTICS



92CS-11235RI



92CS-11236RI

Multiplier Phototube

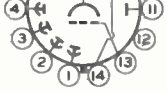
10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE HAVING VENETIAN-BLIND-TYPE DYNODE STRUCTURE, 2.59" MINIMUM-DIAMETER, FLAT, CIRCULAR, SEMITRANSPARENT PHOTOCATHODE AND S-11 RESPONSE

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

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} 4.4×10^{-10}	9×10^{-13} –	w lm
Equivalent Noise Input at 4400 angstroms[h]	– –	3.3×10^{-15} 2.7×10^{-12}	1.3×10^{-14} –	w 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
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.

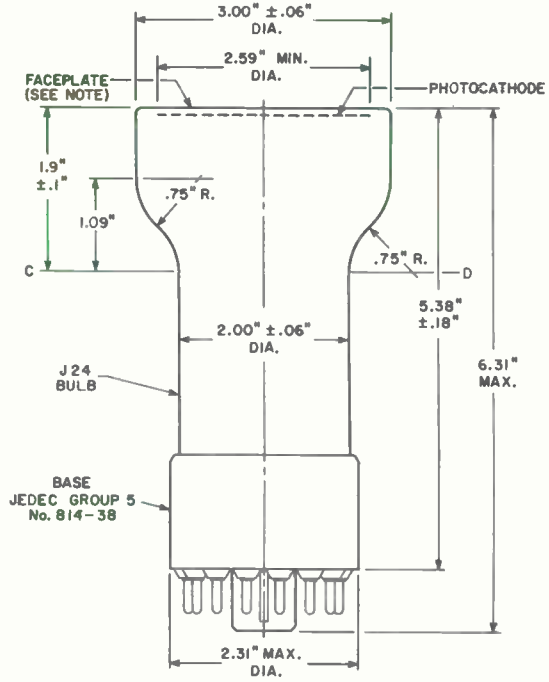
[j] At a tube temperature of 25° C and with supply voltage (E) adjusted to give a radiant sensitivity of 7200 amperes per watt. Dark current may be reduced by the use of a refrigerant.

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

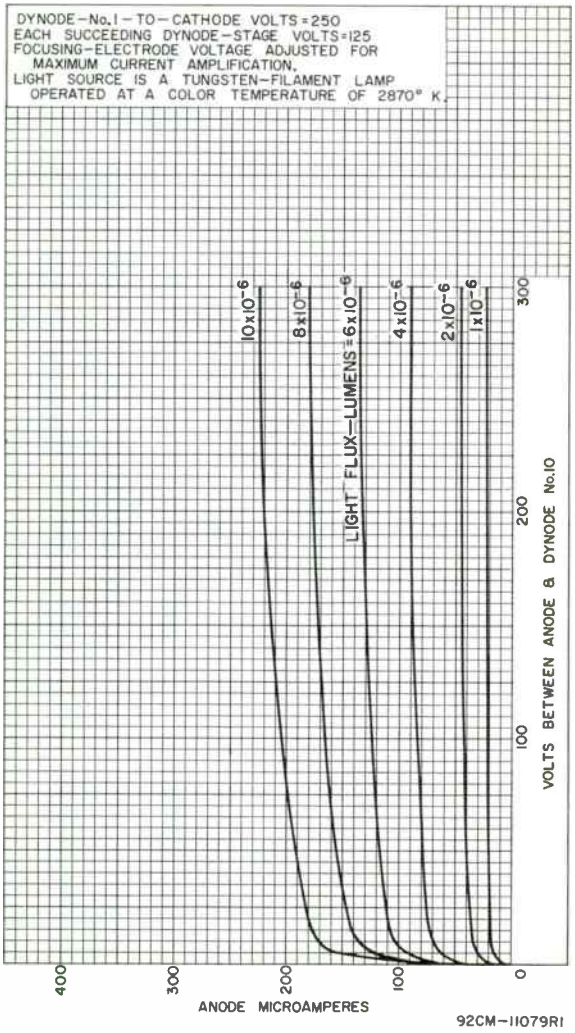


92CM-11080RI

CENTER LINE OF BULB WILL NOT DEV ATE 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

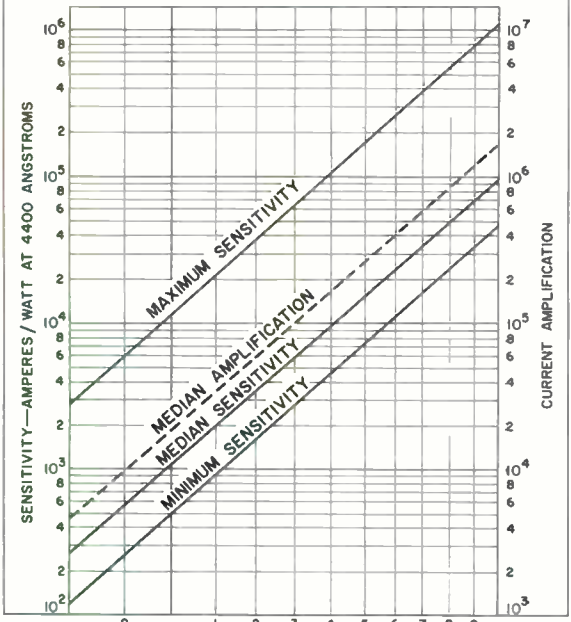


CHARACTERISTICS

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.



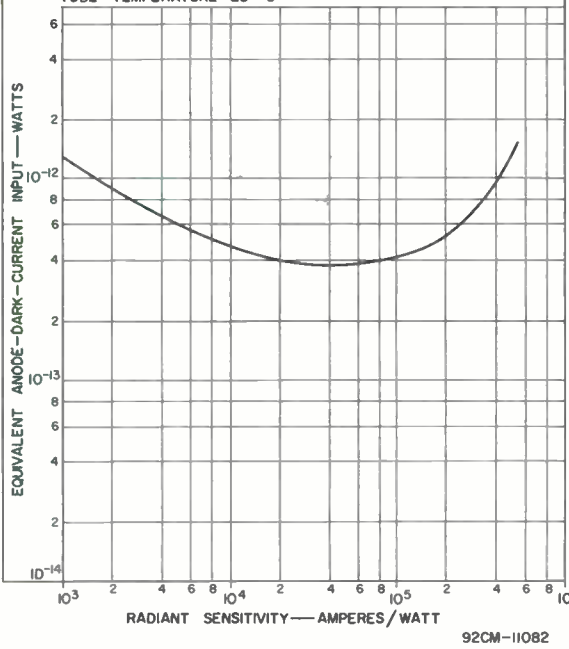
92CM-11086RI

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

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

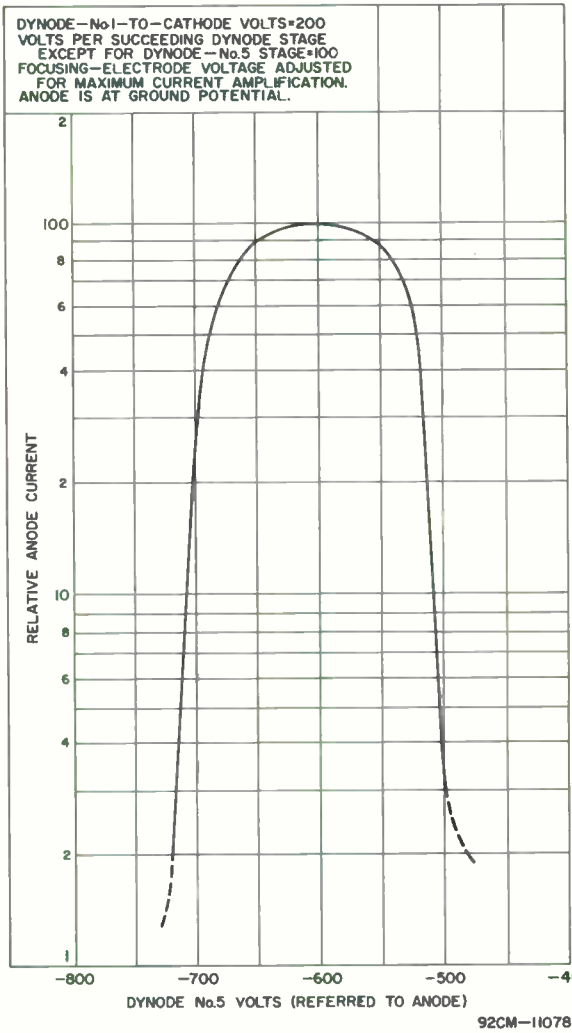
BETWEEN	8.3 % OF E MULTIPLIED BY
CATHODE & DY_1	2
DY_1 & DY_2	1
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1
DY_7 & DY_8	1
DY_8 & DY_9	1
DY_9 & DY_{10}	1
DY_{10} & ANODE	1
ANODE & CATHODE	12

FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED FOR MAXIMUM CURRENT AMPLIFICATION.
TUBE TEMPERATURE = 25° C

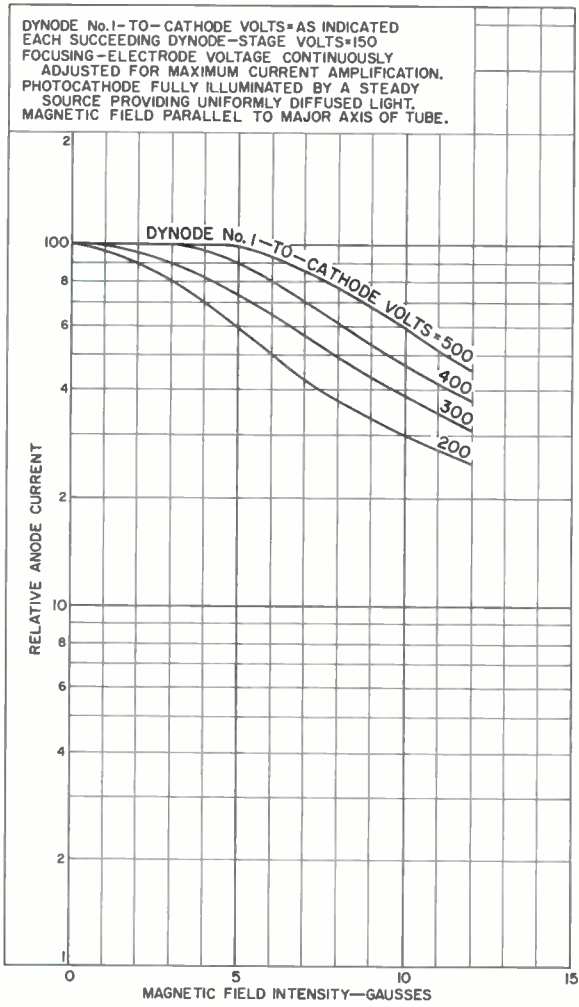


92CM-11082

TYPICAL ANODE-CURRENT CHARACTERISTIC

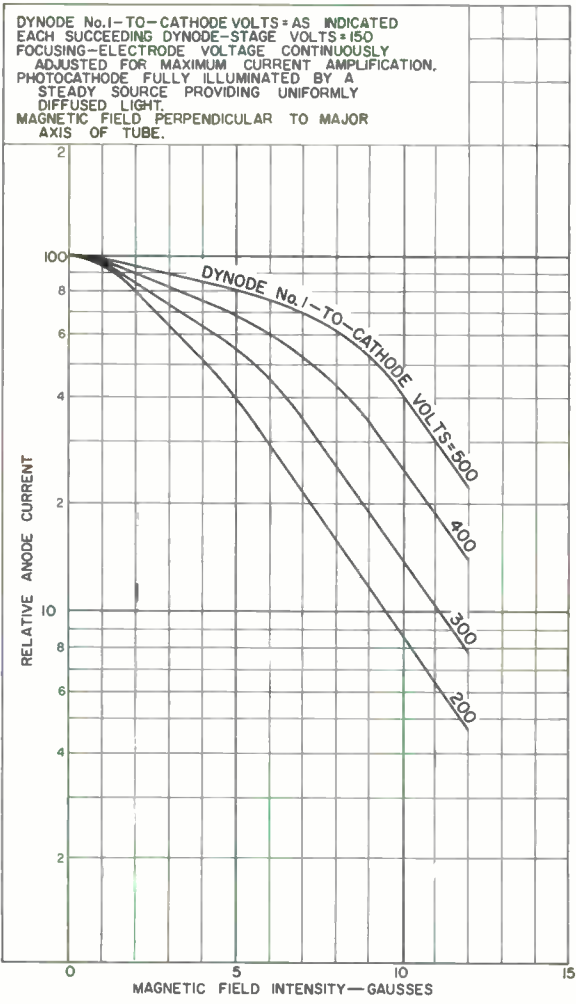


TYPICAL ANODE-CURRENT CHARACTERISTIC



92CM-11084RI

TYPICAL ANODE-CURRENT CHARACTERISTIC



92CM-11085RI

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	Circh 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

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

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.

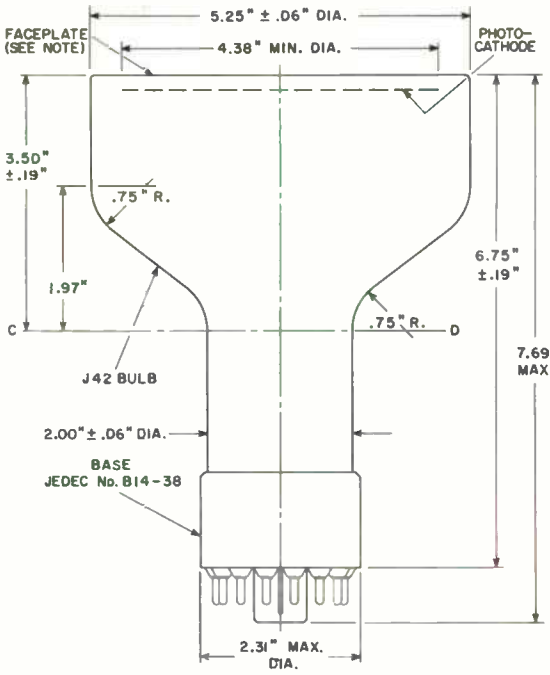
[j] At a tube temperature of 25° C and with supply voltage (E) adjusted to give a radiant sensitivity of 7200 amperes per watt. Dark current may be reduced by the use of a refrigerant.

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

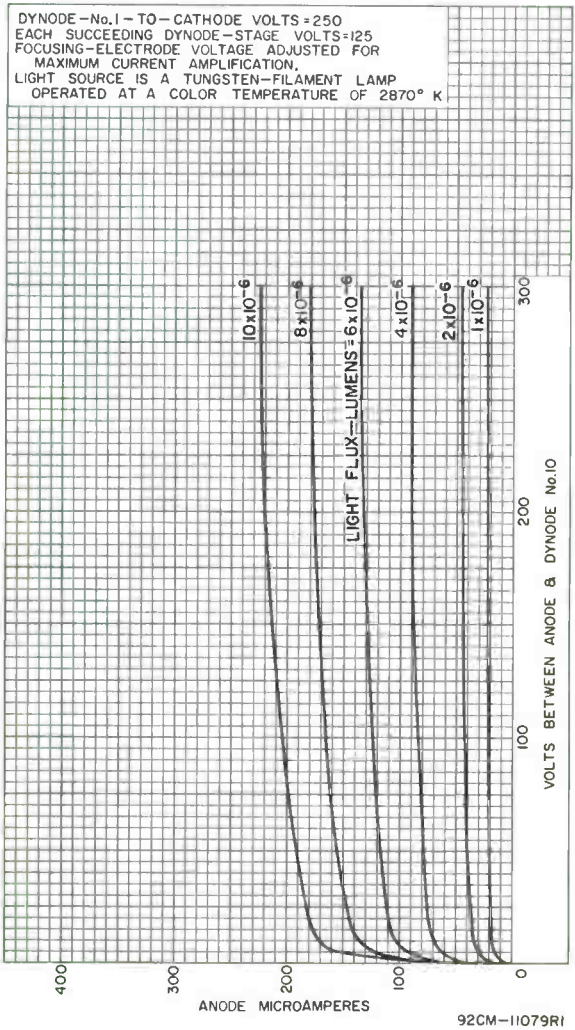


92CM-11148RI

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.

TYPICAL ANODE CHARACTERISTICS



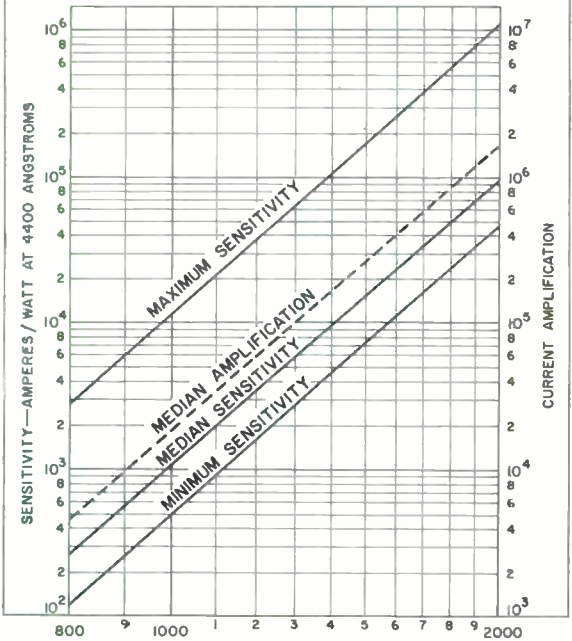
92CM-11079R1

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.



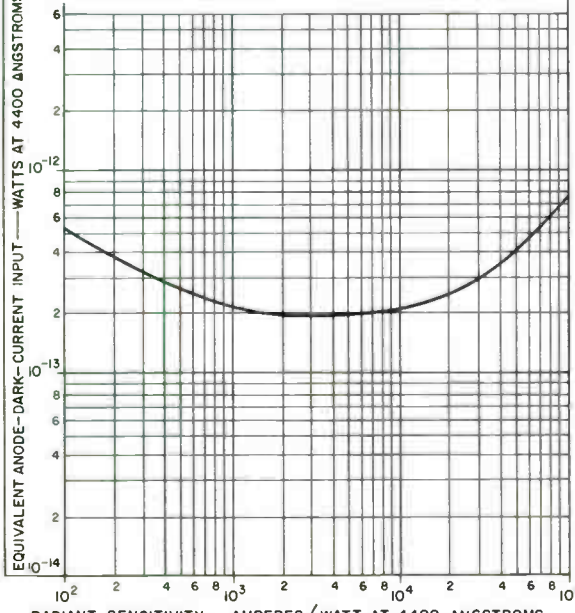
TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

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

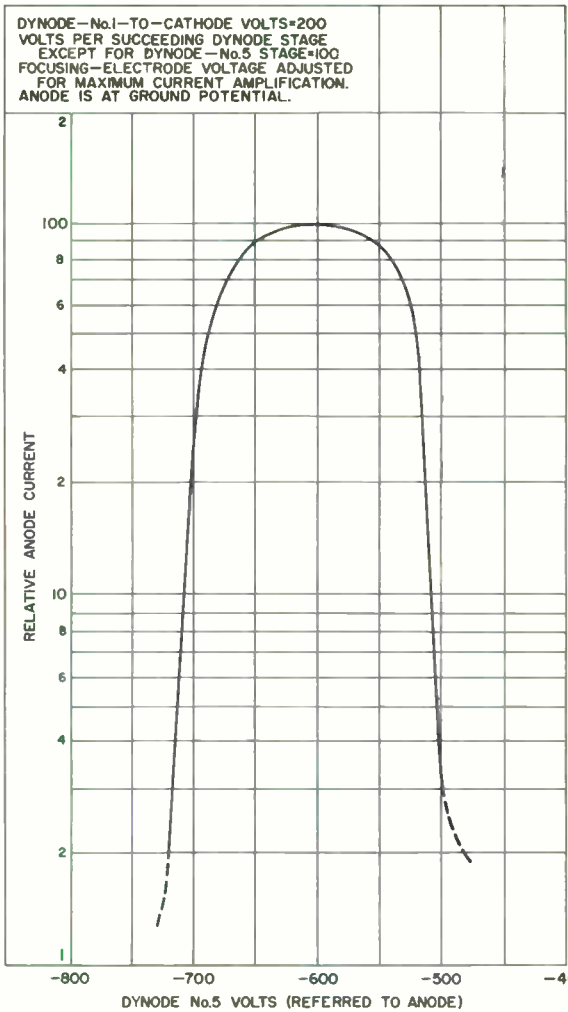
FOCUSING—ELECTRODE VOLTAGE IS ADJUSTED FOR MAXIMUM CURRENT AMPLIFICATION.

TUBE TEMPERATURE=25° C



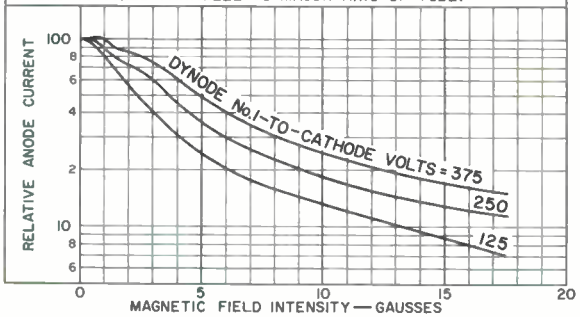
92CM-11146

TYPICAL ANODE-CURRENT CHARACTERISTIC



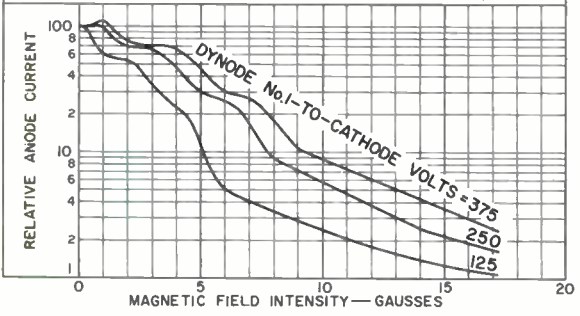
TYPICAL ANODE-CURRENT CHARACTERISTICS

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-11187RI

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-11188RI

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

8093A

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

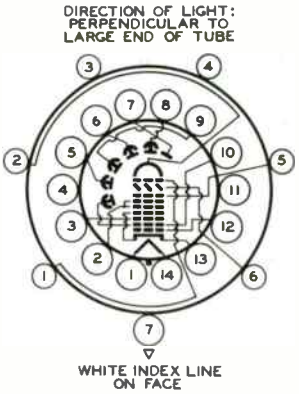
BOTTOM VIEW

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



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

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

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.

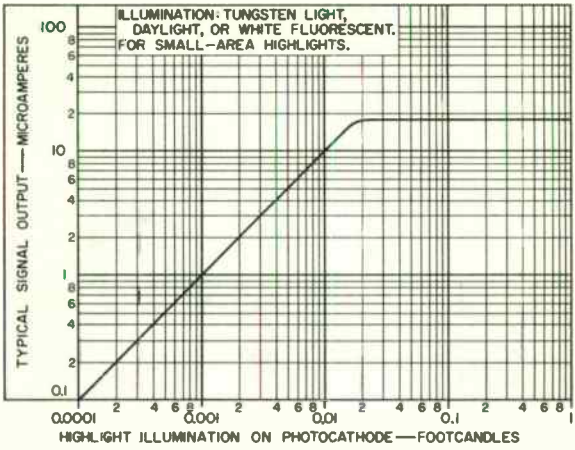
[g] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

[h] Measured with amplifier having flat frequency response.

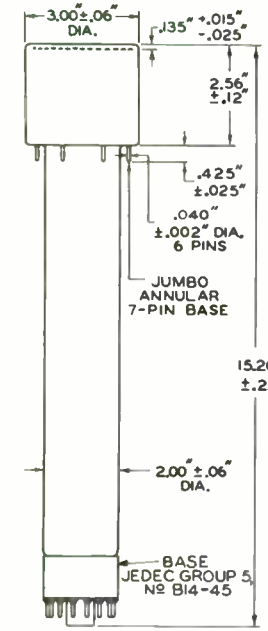
[j] Variation of response over scanned area.

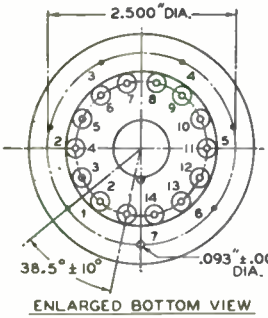
SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-10 RESPONSE
is shown at front of this section

BASIC LIGHT-TRANSFER CHARACTERISTIC



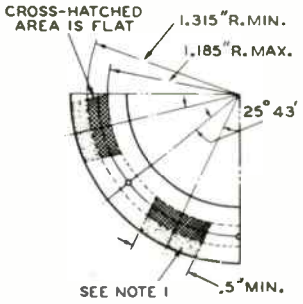
8093A





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".

92CM-8293R3

Vidicon

LOW-POWER (0.6-WATT) HEATER
ELECTROSTATIC FOCUS **MAGNETIC DEFLECTION**
For Compact, Lightweight, Transistorized TV Cameras

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at heater volts = 6.3	0.095	amp
Direct Interelectrode Capacitance:[a]		
Target to all other electrodes	5.0	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 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.		
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 Yoke	Cleveland Electronics[b] No.VY 111 3, or equivalent	
Alignment Coil	Cleveland Electronics[b] No.VA 118, or equivalent	
Socket	Cinch[c] 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.3
Pin 4 – Grid No.5
Pin 5 – Grid No.2
Pin 6 – Grid 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.5 VOLTAGE[d]	750 max.	volts
GRID-No.4 VOLTAGE[d]	750 max.	volts
GRID-No.3 VOLTAGE	200 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	0.2 max.	μa
PEAK TARGET CURRENT[e]	0.4 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.5 (Decelerator) Voltage	300	500	volts
Grid-No.4 Voltage	180	300	volts
Grid-No.3 (Beam-Focus-Electrode) Voltage	0 to 60	50 to 100	volts
Grid-No.2 (Accelerator) Voltage	300	300	volts
Grid-No.1 Voltage for picture cutoff[f]	-45 to -100	-45 to -100	volts
Typical Electrode Currents:			
Grid No.5	1.2	2	μa
Grid No.4	0.015	1.5	μa
Grid No.3	0.001	0.0015	μa
Grid No.2	300	300	μa
Lag:[g]			
Typical	15	-	%
Maximum	20	-	%
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μa and 0.2 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	600	700	TV Lines

Amplitude Response to a 400 TV Line Square-Wave Test Pattern at center of picture.	15	25	%
Alignment Coil	h	h	

Average-Sensitivity Operation

Under typical operating conditions specified for either low- or high-voltage operation

Faceplate Illumination (Highlight).	1.0	fc
Target Voltage[j,k].	20 to 40	volts
Dark Current[m].	0.02	μa
Signal-Output Current[n] . . .	0.2	μa

High-Sensitivity Operation

Under typical operating conditions specified for either low- or high-voltage operation[p]

Faceplate Illumination (Highlight).	0.1	fc
Target Voltage[j,k].	30 to 60	volts
Dark Current[m].	0.10	μa
Signal-Output Current[n] . . .	0.10	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 ordes of 100 megohms.

[b] Cleveland Electronics Incorporated, 1974 East 61 Street, Cleveland, Ohio. This deflecting yoke and alignment coil provide proper tube operation but are not designed for minimum weight applications.

[c] Cinch Manufacturing Corporation, 1026 South Homan Avenue, Chicago 24, Illinois.

[d] The maximum voltage difference between grids No.4 and No.5 should not exceed 300 volts.

[e] Video amplifiers must be designed properly to handle peak target currents of this magnitude to avoid amplifier overload or picture distortion.

[f] With no blanking voltage on grid No.1.

[g] 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.

[h] 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.

[j] Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

[k] The target voltage for each 8134 must be adjusted to that value which gives the desired operating dark current.

[m] 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.

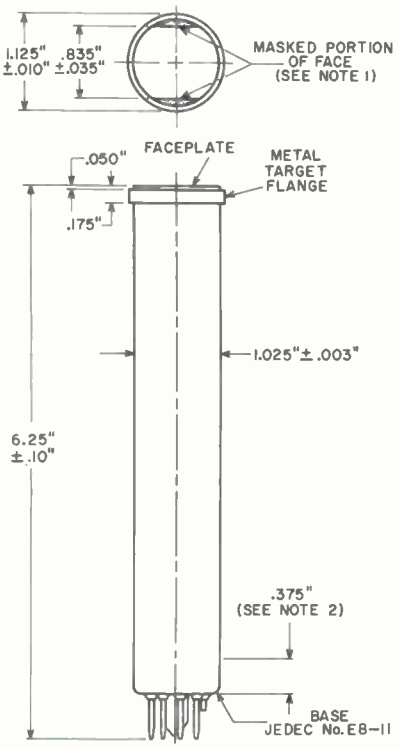
[n] Defined as the component of the highlight target current after the dark-current component has been subtracted.

[p] Operation at this higher sensitivity level will result in a decrease in the resolution capability of the 8134.

OPERATING CONSIDERATIONS

Resolution of the 8134 is about 600 TV lines per picture height when operated with a grid-No.5 voltage of 300 volts and a grid-No.4 voltage of 180 volts. A resolution capability of over 700 TV lines is obtained when the 8134 is operated with a grid-No.5 voltage of 500 volts and a grid-No.4 voltage of 300 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.

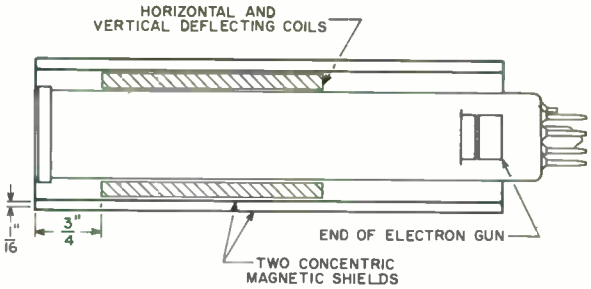


NOTE 1: STRAIGHT SIDES OF MASKED PORTIONS ARE PARALLEL TO THE PLANE PASSING THROUGH TUBE AXIS AND SHORT PIN.

NOTE 2: WITHIN THIS DISTANCE, DIAMETER OF BULB IS 1.025" + 0.003" -0.030".

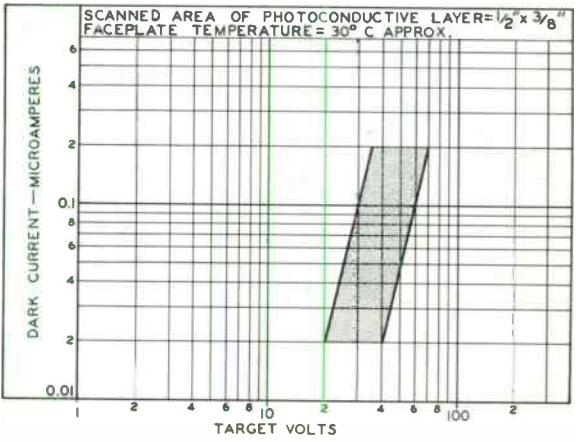
RECOMMENDED LOCATION OF DEFLECTING YOKE

For optimum geometry and optimum output-signal uniformity



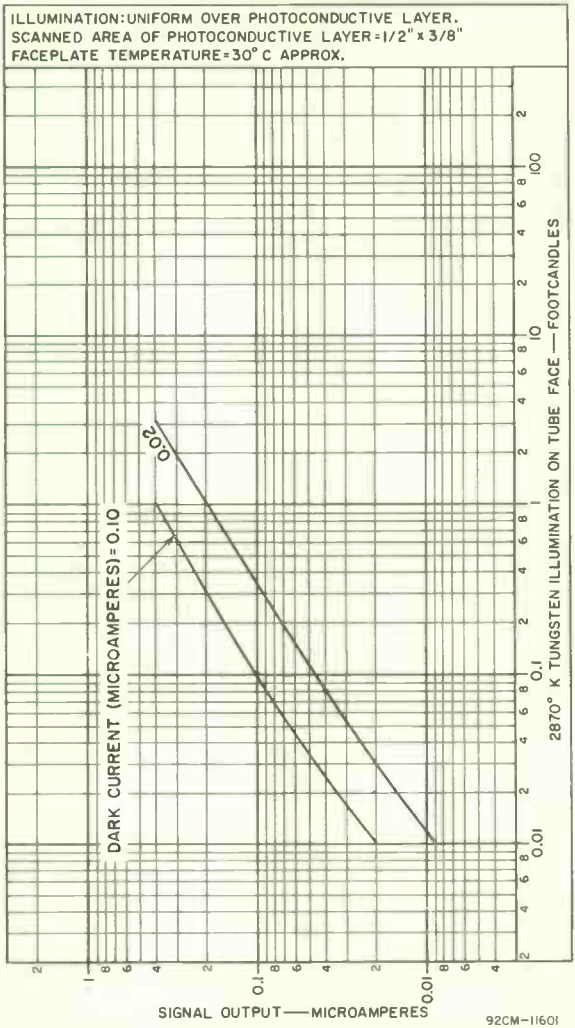
92CS-11595

DARK-CURRENT RANGE

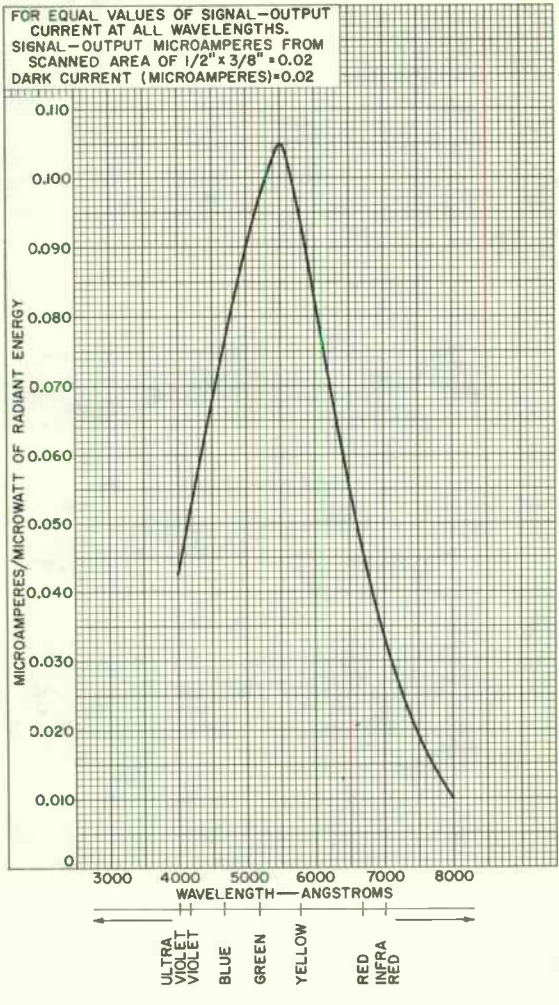


92CS-10684RI

TYPICAL LIGHT-TRANSFER CHARACTERISTICS

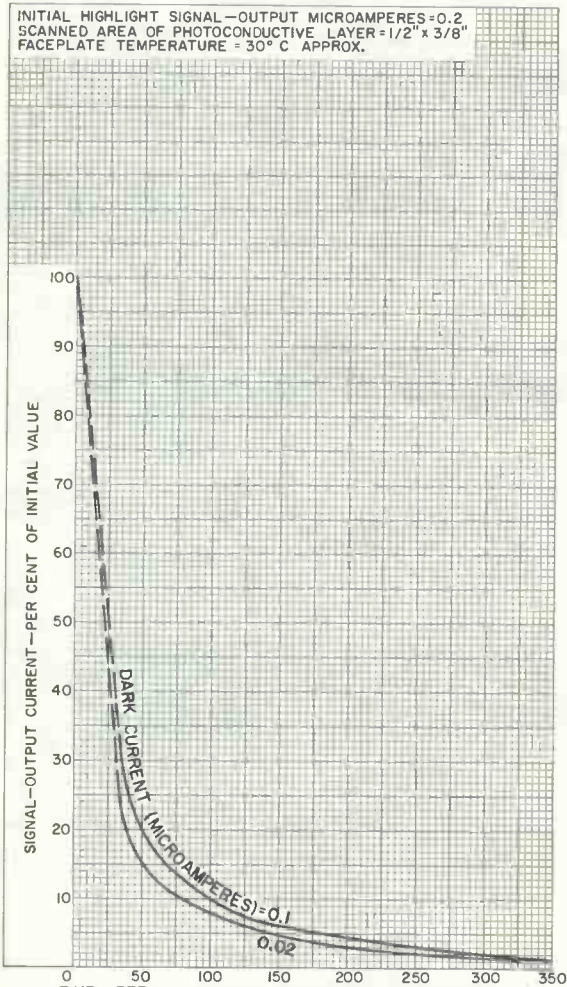


TYPICAL SPECTRAL-SENSITIVITY CHARACTERISTIC



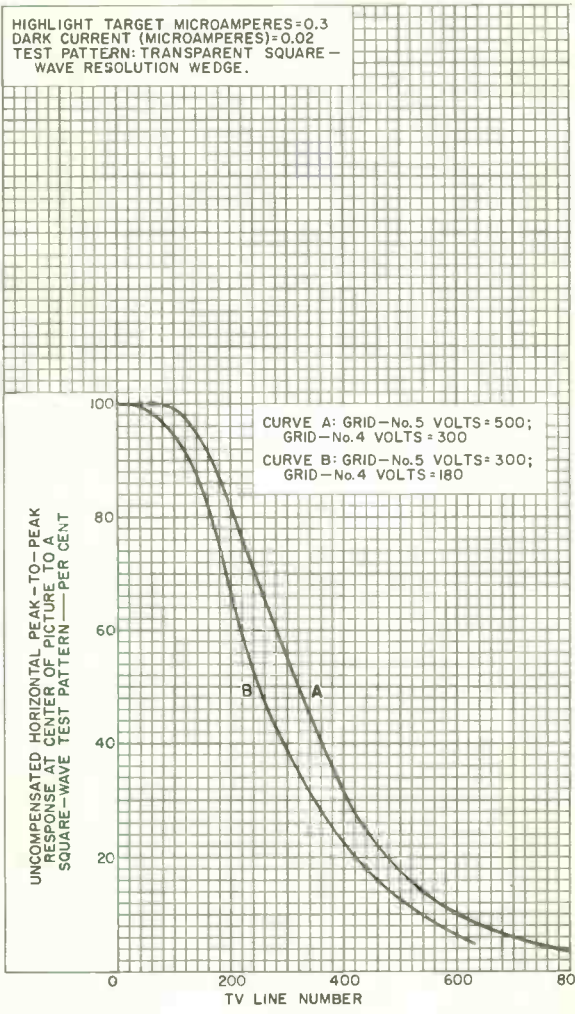
92CM-11619

TYPICAL PERSISTENCE CHARACTERISTICS



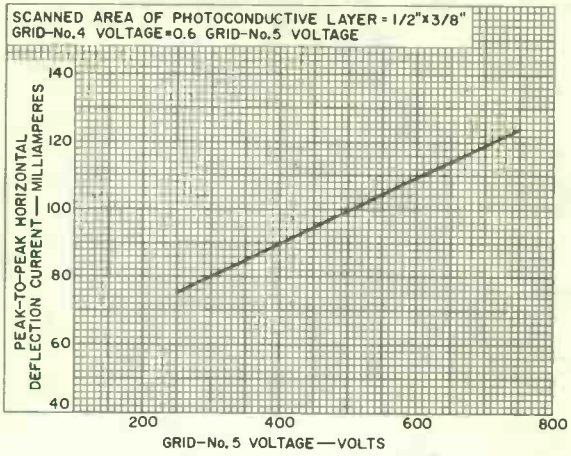
92CM-11615

TYPICAL HORIZONTAL SQUARE-WAVE RESPONSE CHARACTERISTICS



92CM-11609

TYPICAL HORIZONTAL-DEFLECTION-CURRENT CHARACTERISTIC



92CS-11605