

**RCA TUBE
HANDBOOK
HB-3**

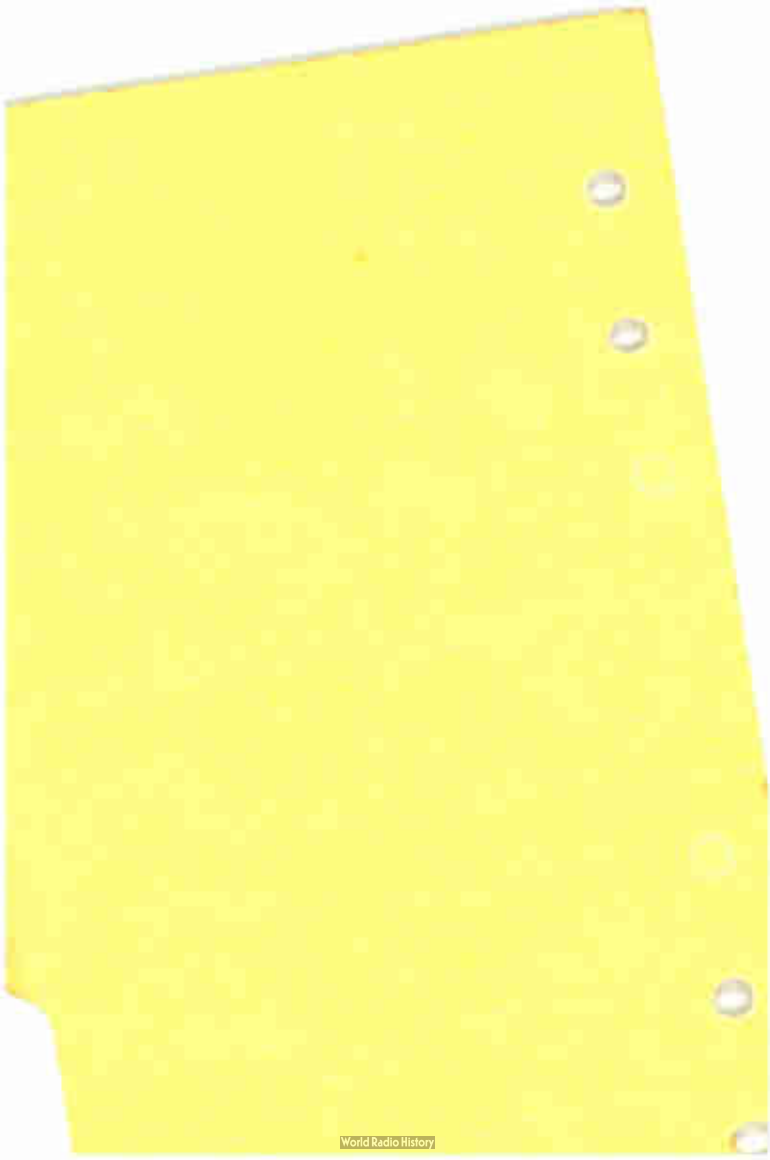


CATHODE-RAY TUBE, STORAGE TUBE, & MONOSCOPE SECTION

This Section contains data for black-and-white and color TV picture tubes, oscillograph tubes, special-purpose kinescopes, storage tubes, and monoscopes.

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

**Cathode-Ray Tubes, Storage
Tubes, & Monoscopes**



RCA PICTURE TUBE GUIDE

Black-and-White Picture Tubes

Greatest Deflection Angle (Approx.) Degrees	Heater Volts/mA	Focusing Method §	Design-Maximum Anode Volts	RCA Type
ELECTROSTATIC DEFLECTION TYPE				
Round Glass Envelope				
	6.3/600	E	6500	7JP4
MAGNETIC DEFLECTION TYPES				
Round Glass Envelope				
50	6.3/600	E	29,500	5TP4
52	6.3/600	M	15,500	16LP4A
55	6.3/600	M	13,000	10BP4A
55	6.3/600	M	13,000	10FP4A
55	6.3/600	M	13,000	12KP4A
60	6.3/600	M	16,500	16DP4A
70	6.3/600	M	17,500	16WP4A
Rectangular Metal Envelope				
70	6.3/600	M	17,500	17CP4 ^d
70	6.3/600	E	17,500	17TP4 ^d
Rectangular Glass Envelope				
Conventional Rectangular Glass Types				
70	6.3/600	M	17,500	16RP4B
70	6.3/600	M	15,500	16TP4
70	6.3/600	M	17,500	17BP4D
70	6.3/600	E	17,500	17HP4C
70	6.3/600	E	17,500	17LP4B ^o
70	6.3/600	M	20,000	17QP4B
70	6.3/600	M	20,000	20DP4D
70	6.3/600	E	17,500	20HP4E
70	6.3/600	M	20,000	21EP4C ^o
70	6.3/600	E	20,000	21FP4D ^o
70	6.3/600	M	20,000	21WP4B

RCA PICTURE TUBE GUIDE

Black-and-White Picture Tubes

Greatest Deflection Angle (Approx.) Degrees	Heater Volts/mA	Focusing Method §	Design-Maximum Anode Volts	RCA Type
Rectangular Glass Envelope Cont'd				
Conventional Rectangular Glass Types				
70	6.3 600	E	20,000	21XP4B
70	6.3 600	E	20,000	21YP4B
70	6.3 600	M	20,000	21ZP4C
72	6.3 600	E	22,000	21AVP4C
72	6.3/600	M	20,000	21AWP4A
90	6.3 600	E	9000	8DP4
90	8.4 450	E	15,500	14ATP4
90	6.3/600	E	15,500	14WP4
90	6.3 600	E	17,500	17BJP4
90	6.3/600	E	17,500	17CFP4
90	6.3/600	E	17,500	17CYP4
90	6.3/600	M	20,000	21AMP4B
90	6.3 600	E	22,000	21CBP4A
90	6.3 600	E	22,000	21DLP4
90	6.3 600	E	22,000	21DSP4 ^b
90	6.3 600	E	22,000	24AEP4
90	6.3 600	E	22,000	24ATP4 ^b
90	6.3 600	E	22,000	24AUP4
90	6.3 600	M	22,000	24CP4B
90	6.3 600	M	22,000	27RP4A
92	6.3 600	E	20,000	19BDP4 ^b
92	6.3 600	E	22,000	23AHP4
92	6.3 600	E	22,000	23ASP4
92	6.3 600	E	25,000	23BJP4 ^b
92	6.3/450	E	22,000	23CGP4
94	6.3 600	E	23,000	23DAP4 ^b
110	6.3 450	E	15,000	11CP4

Black-and-White Picture Tubes

Greatest Deflection Angle (Approx.) Degrees	Heater Volts/mA	Focusing Method §	Design-Moximum Anode Volts	RCA Type
Rectangular Glass Envelope Cont'd				
Conventional Rectangular Glass Types				
110	8.4/450	E	17,500	17CDP4
110	6.3/600	E	17,500	17CSP4
110	2.68/450	E	17,500	17DAP4
110	6.3/600	E	23,000	17DKP4
110	6.3/450	E	17,500	17DQP4 ^b
110	2.68/450	E	17,500	17DRP4 ^c
110	6.3/600	E	20,000	17DSP4
110	6.3/450	E	17,500	17DXP4
110	6.3/450	E	20,000	17EFP4
110	6.3/600	E	20,000	21CQP4
110	6.3/600	E	22,000	21DEP4A
110	6.3/600	E	20,000	21DFP4
110	6.3/450	E	20,000	21DHP4
110	6.3/600	E	20,000	21EQP4
110	6.3/600	E	22,000	21FAP4
110	6.3/600	E	20,000	21FDP4
110	6.3/600	E	22,000	23ARP4
110	6.3/600	E	22,000	23DBP4 ^b
110	6.3/600	E	22,000	24AHP4
110	6.3/600	E	22,000	24BAP4 ^b
110	6.3/600	E	20,000	24BEP4
114	6.3/450	E	20,000	16AYP4
114	2.68/450	E	20,000	19ABP4
114	6.3/450	E	17,500	19AHP4
114	6.3/450	E	20,000	19AJP4 ^b
114	6.3/600	E	23,000	19AVP4
114	6.3/450	E	23,000	19AYP4

RCA PICTURE TUBE GUIDE

Black-and-White Picture Tubes

Greatest Deflection Angle (Approx.) Degrees	Heater Volts/mA	Focusing Method §	Design- Maximum Anode Volts	RCA Type
Rectangular Glass Envelope Cant'd Conventional Rectangular Glass Types				
114	6.3/600	E	23,000	19BTP4
114	6.3/600	E	20,000	19CHP4 ^b
114	6.3/450	E	20,000	19CMP4 ^b
114	6.3/600	E	20,000	19CXP4 ^b
114	6.3/600	E	20,000	19XP4
114	6.3/600	E	20,000	19YP4
114	6.3/450	E	22,000	20RP4
114	6.3/450	E	23,500	23CQP4
114	6.3/600	E	23,500	23FP4A
114	6.3/600	E	22,000	23MP4
114	6.3/600	E	22,000	23NP4 ^b
Bi-Panel Rectangular Glass Types				
92	6.3/600	E	22,000	23BDP4 ^d
92	6.3/600	E	25,000	23BKP4
92	6.3/600	E	25,000	23BLP4 ^e
92	6.3/600	E	25,000	23BTP4
92	6.3/600	E	22,000	23YP4
110	6.3/600	E	22,000	23BGP4 ^b
110	6.3/450	E	23,000	23BQP4
110	6.3/450	E	23,000	23CBP4 ^d
110	6.3/600	E	22,000	23CP4
110	6.3/600	E	23,500	23CP4A
110	6.3/600	E	22,000	23EP4 ^b
110	6.3/600	E	22,000	23GP4
110	6.3/450	E	22,000	23JP4 ^b
114	6.3/600	E	20,000	19AFP4
114	6.3/600	E	20,000	19AUP4 ^d

Black-and-White Picture Tubes

Greatest Deflection Angle (Approx.) Degrees	Heater Volts/mA	Focusing Method §	Design-Maximum Anode Volts	RCA Type
Rectangular Glass Envelope Cont'd				
Filled Rim Rectangular Glass Types				
92	6.3/600	E	25,000	23EYP4 ^b
110	6.3/450	E	15,000	11GP4
110	6.3/450	E	23,000	23FRP4 ^b
110	6.3/600	E	23,000	23FSP4
114	6.3/600	E	23,000	19EBP4
114	6.3/450	E	21,000	19EGP4 ^b
Banded Rectangular Glass Types				
90	12.0/75	E	12,000	9WP4
92	6.3/450	E	25,000	23EKP4
92	6.3/600	E	25,000	23ENP4
92	6.3/600	E	25,000	23FBP4 ^e
94	6.3/450	E	23,500	23EZP4 ^{b, g}
110	6.3/450	E	15,000	11HP4A
110	6.3/450	E	16,000	12BNP4A
110	4.2/450	E	14,000	12CNP4
110	6.3/600	E	23,000	23ETP4
110	6.3/450	E	23,000	23FDP4 ^b
110	6.3/450	E	23,000	23FMP4 ^b
110	6.3/450	E	23,000	23GJP4A ^b
110	6.3/600	E	23,000	23GSP4 ⁹
110	6.3/450	E	22,000	23GWP4 ^b
110	6.3/450	E	23,000	23HFP4A
110	6.3/450	E	23,000	23HGP4 ⁹
110	6.3/450	E	23,500	23HUP4A ^b
110	6.3/450	E	22,000	23HWP4A ^{b, g}
110	6.3/450	E	23,000	23HXP4
110	6.3/450	E	23,000	23JEP4
110	6.3/450	E	23,500	23JGP4 ^b
114	6.3/450	E	20,000	16BGP4
114	6.3/450	E	20,000	16CHP4A ^b
114	6.3/450	E	18,000	16CMP4A
114	6.3/450	E	22,000	17EMP4 ^b

RCA PICTURE TUBE GUIDE

Black-and-White Picture Tubes

Greatest Deflection Angle (Approx.) Degrees	Heater Volts/mA	Focusing Method §	Design-Maximum Anode Volts	RCA Type
Rectangular Glass Envelope Cont'd				
Banded Rectangular Glass Tubes				
114	6.3/450	E	23,000	19DQP4
114	6.3/600	E	23,000	19DRP4
114	6.3/600	E	20,000	19DSP4 ^b
114	6.3/450	E	20,000	19EAP4 ^b
114	6.3/450	E	22,000	19DUP4 ^b
114	6.3/600	E	18,000	19EHP4A
114	6.3/450	E	21,000	19ENP4A ^b
114	6.3/450	E	23,500	19FEP4B ^b
114	6.3/450	E	18,000	19FJP4A
114	6.3/450	E	23,000	19FLP4
114	6.3/600	E	23,000	19FNP4 ^g
114	6.3/450	E	20,000	19FQP4 ^{b, g}
114	6.3/450	E	23,000	19GEP4A ^g
114	6.3/450	E	23,000	19GJP4A
114	6.3/450	E	23,000	20SP4 ^b
114	6.3/450	E	23,000	20TP4
114	6.3/450	E	23,000	21FVP4
114	6.3/450	E	22,000	21FYP4 ^{b, g}
114	6.3/450	E	23,500	21GAP4A ^b
114	6.3/450	E	23,000	23EQP4
114	6.3/600	E	23,000	23ERP4

Color Picture Tubes

Greatest Deflection Angle (Approx.) Degrees	Heater Volts/mA	Focusing Method §	Design-Maximum Anode Volts	RCA Type
ROUND GLASS ENVELOPE				
Conventional Types				
45	6.3/1800	E	22,000	15GP22
70	6.3/1600	E	27,500	21CYP22A
70	6.3/1800	E	27,500	21FBP22
70	6.3/1800	E	27,500	21FBP22A ^f
70	6.3/1800	E	27,500	21GUP22 ^f
Integral Protective Window Types				
70	6.3/1800	E	27,500	21FJP22 ^d
70	6.3/1800	E	27,500	21FJP22A ^{d,f}
70	6.3/1800	E	27,500	21GVP22 ^{d,f}
ROUND METAL ENVELOPE				
70	6.3/1800	E	27,500	21AXP22A
RECTANGULAR GLASS ENVELOPE				
Conventional Types				
90	6.3/900	E	22,500	15KP22 ^f
90	6.3/900	E	27,500	19EXP22 ^f
90	6.3/900	E	27,500	19GVP22 ^f
90	6.3/900	E	27,500	22KP22 ^f
90	6.3/900	E	27,500	25BP22A ^f
90	6.3/900	E	27,500	25YP22 ^f
Integral Protective Window Types				
90	6.3/900	E	22,500	15LP22 ^{d,f}
90	6.3/900	E	27,500	19EYP22 ^{d,f}
90	6.3/900	E	27,500	19GWP22 ^{d,f}
90	6.3/900	E	27,500	22JP22 ^{d,f}
90	6.3/900	E	27,500	25AP22A ^{d,f}
90	6.3/900	E	27,500	25XP22 ^{d,f}
92	6.3/1350	E	27,500	23EGP22A ^d

RCA PICTURE TUBE GUIDE

Color Picture Tubes

Greatest Deflection Angle (Approx.) Degrees	Heater Volts/mA	Focusing Method §	Design-Maximum Anode Volts	RCA Type
Banded Types				
90	6.3/900	E	22,500	15NP22 ^f
90	6.3/900	E	27,500	19HCP22 ^f

Test Picture Tubes

ROUND GLASS ENVELOPE				
53	6.3/600	E	20,000	5AXP4
RECTANGULAR GLASS ENVELOPE				
70	6.3/1800	E	27,500	1828P22
90	6.3/600	E	22,000	8XP4
90	6.3/900	E	27,500	1830P22
110	6.3/600	E	22,000	8YP4

§ E - Electrostatic; M = Magnetic

a Cylindrical Faceplate

b Low G₂ Type

c Internal Magnetic Shield

d Faceplate Treated

e Low G₂ Type, Faceplate Treated

f Hi-Life type, features rare-earth red-emitting phosphor

g Integral Mounting Lugs

Group Phosphor P22

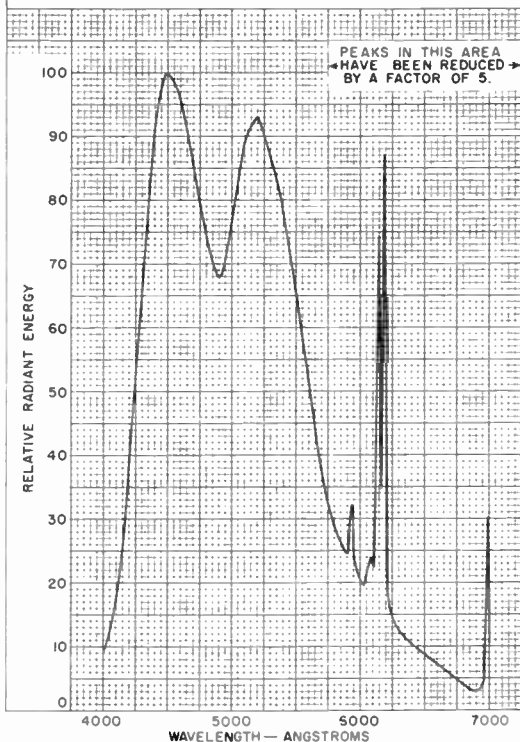
Rare-Earth (Red), Sulfide (Blue & Green) Type^a

Spectral-Energy Emission Characteristic

^a The relative intensities of the narrow-emission bands of the red phosphor are dependent on the resolution of the measuring device.

SIMULTANEOUS EXCITATION OF RED PHOSPHOR, BLUE PHOSPHOR,
AND GREEN PHOSPHOR TO PRODUCE 9300° K + 27 M.P.C.D.
WHITE (X = 0.281, Y = 0.311).

COMPONENT COLOR	C.I.E. COORDINATES	
	X	Y
RED	0.670	0.524
BLUE	0.155	0.061
GREEN	0.290	0.590



92CM-13088 RI



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

Group Phosphor P22

Rare-Earth (Red), Sulfide (Blue & Green) Type

PERSISTENCE CHARACTERISTIC

The persistence of the group phosphorescence is *medium short*. Persistence of the component phosphors is such that after excitation is removed, brightness decays to a level not exceeding 10 per cent of the initial value in:

- 22 microseconds (Approx.) Blue phosphor
- 60 microseconds (Approx.) Green phosphor
- 1 millisecond (Approx.) Red phosphor

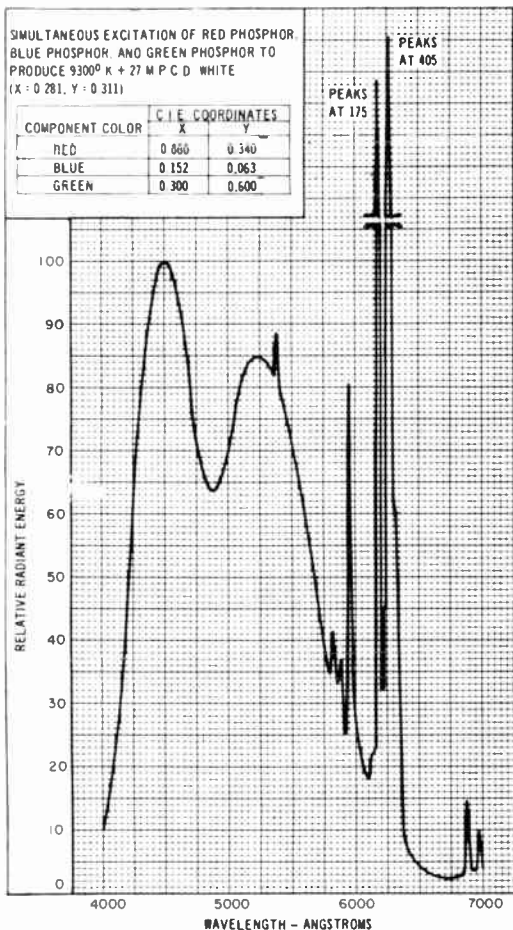


Group Phosphor P22

New Rare-Earth (Red), Sulfide (Blue & Green) Type^a

Spectral-Energy Emission Characteristic

^a The relative intensities of the narrow-emission bands of the red phosphor are dependent on the calibration of the measuring device.



92LM-1952



RADIO CORPORATION OF AMERICA
Electronic Components and Devices

Harrison, N. J.

PHOSPHOR P22
4-67

Group Phosphor P22

New Rare-Earth (Red), Sulfide (Blue & Green) Type

PERSISTENCE CHARACTERISTIC

The persistence of the group phosphorescence is *medium short*. Persistence of the component phosphors is such that after excitation is removed, brightness decays to a level not exceeding 10 per cent of the initial value in:

22 microseconds (Approx.)	Blue phosphor
60 microseconds (Approx.)	Green phosphor
1 millisecond (Approx.)	Red phosphor



CATHODE-RAY TUBE, STORAGE TUBE, & MONOSCOPE CLASSIFICATION CHART

SPECIAL-PURPOSE KINESCOPIES					
Approx. Bulb Dia. Inches	Focusing Method	Deflection Method	Minimum Screen Size Inches	Maximum Anode Volts ^a	Tube Type
Monitor Types					
7	M	M	6-1/2	8,000	7CP4
7	E	M	6	12,000	7TP4
8b	E	M	7-13/16 ^b	14,000 ^c	8HP4
8b	E	M	7-3/4 ^b	22,000 ^c	8NP4
10	E	M	9-1/8	20,000	10SP4
17 ^b	E	M	15-9/16 ^b	22,000 ^c	17DWP4
21 ^b	E	M	20-1/4 ^b	22,000 ^c	21EYP4
Display Cathode-Ray Tube					
12 ^b	E	M	Has integral protective window	16,000	4557
Projection Types					
5	E	M	4-1/2 ^d	40,000 ^c	5AZP4
7	E	M	5 x 3-3/4 ^e	80,000 ^c	7NP4
7	E	M	5 x 3-3/4 ^e	80,000 ^c	7WP4
7	E	M	5 x 3-3/4 ^e	80,000 ^c	4486
View-Finder Type					
5	M	M	4-1/4	8,000	5FP4A
Transcriber Type					
5	E	M	4-1/4	27,000	5WP11
<p>E - Electrostatic.</p> <p>M - Magnetic.</p> <p>a Design-Center values unless otherwise noted.</p> <p>b Diagonal.</p> <p>c Absolute value.</p> <p>d Quality circle diameter.</p> <p>e Quality rectangle.</p>					

CATHODE-RAY TUBE, STORAGE TUBE, & MONOSCOPE CLASSIFICATION CHART

FLYING-SPOT CATHODE-RAY TUBES					
Approx. Bulb Dia. Inches	Focusing Method	Deflection Method	Phosphor ^a	Maximum Anode Volts	Tube Type
Black-and-White Television Types					
5	E	M	P15	27,000 ^b	5WP15
5	E	M	P16	27,000 ^b	5ZP16
Color-Television Type					
5	E	M	P24	27,000 ^b	5AUP24
MONOSCOPES					
Approx. Bulb Dia. Inches	Focusing Method	Deflection Method	Features	Maximum Anode Volts ^c	Tube Type
2	E	E	Customized metal stencil electrode pattern	2,500 ^d	4560
5	E	M	Indian Head Pattern	1,500 ^b	2F21
5	E	M	Pattern individually styled to customer requirements	1,500 ^b	1699
<p>E = Electrostatic. M = Magnetic.</p> <p>^a See sheet <i>Features of Fluorescent Screens</i>. ^b Design-center value. ^c Pattern-electrode voltage. ^d Absolute-maximum value.</p>					

CATHODE-RAY TUBE, STORAGE TUBE, & MONOSCOPE CLASSIFICATION CHART

OSCILLOGRAPH TUBES

Phosphor	Approx. Bulb Dia. Inches	Max. Anode Volts ^o	Tube Type
Electrostatic-Deflection & Focus Types			
P1	1	1,500	1EP1
P1	2	1,100	2AP1A
P1	2	2,500	2BP1
P1	2	600	902A
P1	3	1,500	3AP1A
P1	3	2,750	3AQP1
P1	3	2,000	3BP1A
P1	3	2,500	3KP1
P1	3	2,500	3RP1
P1	3	2,500	3RP1A
P1	3	2,500	3WP1
P1	5	2,000	5BP1A
P1	5	2,500	5UP1
P1	7	4,000	7UP1
P1	5	2,800 ^b	4499
P2	1	1,500	1EP2
P7	3	2,500	3KP7
P7	3	2,500	3RP7A
P7	5	2,500	5UP7
P11	1	1,500	1EP11
P11	2	2,500	2BP11
P11	3	2,500	3KP11
P11	3	2,500	3WP11
P11	5	2,500	5UP11
P31	5	2,500	5UP31
P31	7	4,000	7UP31

^o Design-center value.

^b Absolute-maximum value.

CATHODE-RAY TUBE, STORAGE TUBE, & MONOSCOPE CLASSIFICATION CHART

OSCILLOGRAPH TUBES (Cont'd)			
Phosphor	Approx. Bulb Dio. Inches	Max. Post Accel- erator Volts	Tube Type
Electrostatic-Deflection & Focus Types With Post-Deflection Accelerator			
P1	3	4,000	3JP1
P1	5	6,000	5ABP1
P1	5	6,000	5ADP1
P1	5	4,000	5CP1A
P7	3	4,000	3JP7
P7	5	6,000 ^b	4510
P11	5	6,000	5ABP11
P11	5	4,000	5CP11A
P31	5	6,000	5ABP31
P31	5	6,000	5ADP31
P31	5	8,000 ^b	4489
P31	7	8,000 ^b	4490
P31	8	8,000 ^b	4491

Phosphor	Approx. Bulb Dio. Inches	Max. Anode Volts	Tube Type
Magnetic-Deflection & Focus Types			
P7	5	8,000	5FP7A
P7	7	8,000	7BP7A
P7	7	8,000	7MP7
b Absolute-maximum value.			

CATHODE-RAY TUBE, STORAGE TUBE, & MONOSCOPE CLASSIFICATION CHART

STORAGE TUBES		
Name	Description	Tube Type
Display	Ruggedized, 5"-diameter type having electrostatic-focus and deflection writing gun	2053
Display	Ruggedized, 10"-diameter type having electrostatic-focus and deflection writing gun	4412
Display	5"-diameter type having electrostatic-focus and magnetic-deflection writing gun	4454
Display	5"-diameter type having electrostatic-focus and deflection writing gun	6866
Display	5"-diameter type having electrostatic-focus and magnetic-deflection writing gun	7183A
Display	Ruggedized, 5"-diameter type having two electrostatic-focus and deflection writing guns	7268B
Display	5"-diameter type having electrostatic-focus and deflection writing gun	7315
Radechon	Single-beam barrier-grid type for digital data storage	6499
Radechon	Variant of 6499 for binary memory systems in computers	1858
Graphochon	Single-converter type with reading gun and writing gun	7539



RCA PICTURE TUBE INTERCHANGEABILITY GUIDE

Replacement Classification Keys

▲ Replacement information is based primarily on electrical and mechanical similarity of the picture-tube types covered. The technician should make certain that replacement is in accord with all safety precautions required by the TV receiver for picture-tube insulation or mechanical mounting.

A. RCA type does not require an external ion-trap magnet.

B. The ball-type anode contact must be replaced with cavity-type contact.

C. Neck length and/or overall length of RCA type is slightly greater.

D. Direct replacement.

E. The RCA replacement type is electrically interchangeable—Mechanical modifications to the receiver may be required.

F. The RCA replacement type has a 6.3-volt/600-milliampere heater. The receiver picture tube heater circuit must be modified to use this replacement type.

G. A conversion Kit (RCA Part No. 12B202) is available for RCA receivers.

H. The RCA replacement type is mechanically interchangeable—Electrical modifications to the receiver may be required.

J. The RCA replacement is directly interchangeable in most cases; however, in some cases the red cathode lead may have to be interchanged with the blue or green cathode leads to obtain satisfactory black-and-white tracking. Replacement information is packed with the tube.

K. Pin No. 6 (focusing electrode) of the RCA replacement must be connected to Pin No. 11 at the socket. The original tube did not require an external voltage for focus.

L. The RCA replacement type is electrically interchangeable — Mounting hardware may have to be modified to accept the replacement type. In some small-cabinet receivers, the replacement may not be feasible.

M. The RCA replacement type is electrically interchangeable — The receiver socket should be replaced by RCA Part No. 112579, Eby Sales Co. Part No. 49-13DD, or equivalent.

N. A conversion Kit (RCA Part No. 12B101) is available for RCA receivers.

P. External conductive coating must be grounded.

* Band around periphery of tube panel must be grounded and isolated from the ac line voltage.

RCA PICTURE TUBE INTERCHANGEABILITY GUIDE

Type To Be Replaced			★	Replaced By RCA Type		
Type To Be Replaced			★	Replaced By RCA Type		
Color Picture Tubes						
11SP22	C-11WP22	D		19HFP22	H-19GWP22	D
11WP22					C-19GWP22/ 19EYP22	D
15AEP22	H-15AEP22	•D		19HJP22	H-19HCP22/ 19HKP22	•D
15AFP22	C-15AEP22	D		19HKP22	C-19HCP22/ 19HKP22	•D
15AGP22				19HNP22	H-19HNP22	•D
15LP22	H-15LP22	D			C-19HNP22	•D
	C-15LP22	D		19HQP22	H-19GVP22	D
15NP22	H-15NP22	•D			C-19GVP22/ 19EXP22	D
	C-15NP22	•D		19HRP22	H-19GWP22	D
15SP22	H-15AEP22	•D			C-19GWP22/ 19EYP22	D
	C-15AEP22	•D		19HXP22	H-19HCP22/ 19HKP22	•D
15TP22	H-15NP22	•D			C-19HCP22/ 19HKP22	•D
	C-15NP22	•D		19JBP22	H-19GVP22	D
15WP22	H-15LP22	D		19JDP22	C-19GVP22/ 19EXP22	D
	C-15LP22	D		19JGP22	H-19JWP22	D
15XP22	H-15NP22	•D			C-19JWP22	D
	C-15NP22	•D		19JHP22	H-19GWP22	D
17EZP22	H-17EZP22	•D			C-19GWP22/ 19EYP22	D
17FAP22	C-17EZP22	•D		19JKP22	H-19GWP22	D
					C-19GWP22/ 19EYP22	D
19EXP22	H-19GVP22	D		19JWP22	H-19JWP22	D
	C-19GVP22/ 19EXP22	D			C-19JWP22	D
19EYP22	H-19GWP22	D		21AXP22	C-21AXP22A	D
19FMP22	C-19GWP22	D		21AXP22A	C-21CYP22A	CN
19FXP22	H-19GWP22	D		21AXP22A/ 21AXP22	C-21FBP22	CJN
19GSP22	19EYP22	D			H-21GUP22	CJN
19GVP22	H-19GVP22	D			C-21GUP22/ 21FBP22A	CJN
19GVP22/ 19EXP22	C-19GVP22/ 19EXP22	D		21CYP22	C-21CYP22A	D
19GWP22	H-19GWP22	D		21CYP22A	C-21FBP22	J
19GWP22/ 19EYP22	C-19GWP22/ 19EYP22	D			H-21GUP22	J
19GXP22	H-19GVP22	C			C-21GUP22/ 21FBP22A	J
19GYP22	C-19GVP22/ 19EZP22	C		21FBP22	C-21FBP22	D
				21FBP22A	H-21GUP22	J
19GZP22	H-19GWP22	D			C-21GUP22/ 21FBP22A	J
	C-19GWP22/ 19EYP22	D		21FBP22	C-21FBP22	D
19HBP22	H-19GWP22	D		21FBP22A	H-21GUP22	J
	C-19GWP22/ 19EYP22	D			C-21GUP22/ 21FBP22A	J
19HCP22	H-19HCP22/ 19HKP22	•D				
19HCP22/ 19HKP22	C-19HCP22/ 19HKP22	•D				

★ See note on back of sheet 2 of this guide.

▲ See Replacement information in front of this guide.

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Type To Be Replaced	★ Replaced By RCA Type	▲	Type To Be Replaced	★ Replaced By RCA Type	▲
21FJP22	C-21FJP22	D	25AEP22	H-25YP22	D
21FJP22A	H-21GVP22	J		C-25YP22/ 25BP22A	D
21FKP22	C-21GVP22/ 21FJP22A	J		H-25XP22	D
21GFP22	H-22JP22	L	25AFP22	C-25XP22/ 25AP22A	D
21GLP22	C-22JP22	L	25AGP22	H-25AJP22	•D
21GRP22			25AJP22	C-25AJP22	•D
21GUP22	H-21GUP22	D	25ANP22	H-25XP22	D
21GUP22/	C-21FBP22	D	25AP22	C-25XP22/ 25AP22A	D
21FBP22A	C-21GUP22/ 21FBP22A	D	25AQP22		
21GVP22	H-21GVP22	D	25ASP22	H-25AJP22	•D
21GVP22/	C-21FJP22	D	25AWP22	C-25AJP22	•D
21FJP22A	C-21GVP22/ 21FJP22A	D	25AXP22		
21GWP22	H-22JP22	L	25AZP22		
	C-22JP22	L	25BMP22	H-25XP22	D
21GXP22	H-21GVP22	D		C-25XP22/ 25AP22A	D
21GYP22	C-21FJP22	D	25BP22	H-25YP22	D
	C-21GVP22/ 21FJP22A	D	25BP22A	C-25YP22/ 25BP22A	D
22ADP22	H-22UP22	•D	25CP22	H-25XP22	D
22AGP22	C-22UP22	•D	25CP22A	C-25XP22/ 25AP22A	D
22AHP22			25FP22	H-25YP22	D
22JP22	H-22JP22	D	25FP22A	C-25YP22/ 25BP22A	D
	C-22JP22	D	25GP22	H-25XP22	D
22KP22	H-22KP22	D	25GP22A	C-25XP22/ 25AP22A	D
	C-22JP22	D	25RP22	H-25YP22	D
22LP22	H-22JP22	D		C-25YP22/ 25BP22A	D
22QP22	C-22JP22	D	25SP22	H-25XP22	D
22RP22	H-22KP22	D		C-25XP22/ 25AP22A	D
	C-22KP22	D	25VP22	H-25XP22	D
22SP22	H-22JP22	D		C-25XP22/ 25BP22A	D
	C-22JP22	D	25WP22	H-25XP22	D
22UP22	H-22UP22	•D	25XP22	C-25XP22/ 25AP22A	D
22XP22	C-22UP22	•D	25XP22/		
22YP22	H-22JP22	D	25AP22A		
	C-22JP22	D	25YP22	H-25YP22	D
23EGP22	C-23EGP22	D	25YP22/	C-25YP22/ 25BP22A	D
23EGP22A	C-23EGP22A	D			
25ABP22	H-25XP22	D			
	C-25XP22/ 25AP22A	D			
25ADP22	H-25AJP22	•D			
	C-25AJP22	•D			

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Type To Be Replaced	★ Replaced By RCA Type	▲	Type To Be Replaced	★ Replaced By RCA Type	▲
25ZP22	H-25XP22 C-25XP22/ 25AP22A	D D	490BGB22	H-19GVP22 C-19GVP22/ 19E XP22	D D
370AB22 370CB22	H-15NP22 C-15NP22	• D • D	490BHB22	H-19GWP22 C-19GWP22/ 19E YP22	D D
490AB22 490ACB22 490ADB22	H-19GVP22 C-19GVP22/ 19E XP22	J J J	490BNB22	H-19JWP22 C-19JWP22	D D
490AEB22 490AFB22 490AGB22	H-19GWP22 C-19GWP22/ 19E YP22	J J J	490BRB22	H-19GWP22 C-19GWP22/ 19E YP22	D D D
490AHB22	H-19GVP22 C-19GVP22/ 19E XP22	J J	490BVB22 490BXB22	H-19JWP22 C-19JWP22	D D
490AHB22A	H-19GVP22 C-19GVP22/ 19E XP22	D D	490CB22 490DB22 490EB22 490EB22A	H-19GVP22 C-19GVP22/ 19E XP22	J J J
490AJB22 490AJB22A	H-19GWP22 C-19GWP22/ 19E YP22	D D	490FB22 490GB22		
490AKB22 490ALB22 490AMB22 490ANB22	H-19GVP22 C-19GVP22/ 19E XP22	J J J	490HB22 490JB22 490JB22A	H-19GVP22 C-19GVP22/ 19E XP22	D D D
490ARB22	H-19GWP22 C-19GWP22/ 19E YP22	J J	490KB22 490KB22A 490LB22 490MB22	H-19GVP22 C-19GVP22/ 19E XP22	J J J
490ASB22	H-19GWP22 C-19GWP22/ 19E YP22	D D	490NB22 490RB22 490SB22 490TB22	H-19GWP22 C-19GWP22/ 19E YP22	J J J
490BAB22	H-19GVP22 C-19GVP22/ 19E XP22	D D	490UB22	H-19GVP22 C-19GVP22/ 19E XP22	J J
490BCB22	H-19GWP22 C-19GWP22/ 19E YP22	D D	490VB22	H-19GWP22 C-19GWP22/ 19E YP22	J J
490BDB22	H-19GWP22 C-19GWP22/ 19E YP22	J J	490WB22	H-19GVP22 C-19GVP22/ 19E XP22	J J
			490XB22 490YB22 490ZB22	H-19GWP22 C-19GWP22/ 19E YP22	J J J

The type to be replaced may have a manufacturer's coding prefix such as AN, C, CR, H, HR, OC, RE, REA, etc. Since these prefixes do not affect the electrical characteristics or interchangeability of the type, the prefixes have been omitted from type numbers in this column.

▲ See Replacement information in front of this guide.

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Type To Be Replaced	★ Replaced By RCA Type		Type To Be Replaced	★ Replaced By RCA Type	
Black & White Picture Tubes					
7JP4	7JP4	D	16BQP4	16CMP4	•C
8DP4	8DP4	D	16CHP4	16ATP4	•E
9AEP4	9AEP4	•D	16BVP4	16CMP4A	•E
9WP4	9WP4	•D	16BWP4	16BGP4	•D
10ATP4	10ATP4	D	16CAP4		
11AP4	11HP4A	•D	16CEP4	16CMP4A	•D
11BP4			16CHP4	16CHP4A	•D
11CP4	11CP4	D	16CHP4A		
11GP4	11GP4	•D	16CJP4	16CMP4A	•D
11HP4	11HP4A	•D	16CMP4		
11HP4A			16CMP4A		
12BNP4	12BNP4A	•D	16CTP4	16BGP4	•C
12BNP4A			16CUP4	16CMP4A	•C
12CFP4	12CNP4	•D	16CVP4	16CHP4A	•CE
12CGP4	12BNP4A	•D	16KP4	16RP4B	A
12CNP4	12CNP4	•D	16KP4A		
12DEP4	12DEP4	•D	16QP4	16RP4B	AP
12DFP4	12DFP4	•D	16RP4	16RP4B	A
12DSP4	12DSP4	D	16RP4/ 16KP4		
14NP4	14WP4	A	16RP4A		
14NP4A			16RP4A/ 16KP4A		
14RP4			16RP4B	16RP4B	D
14RP4A			16TP4	16TP4	D
14SP4			16UP4	16RP4B	ACP
14WP4	14WP4	D	16XP4	16RP4B	AP
14WP4/ 14ZP4			17AP4	17BP4D	ACP
14ZP4			17ATP4	17BJP4	A
14ZP4/ 14WP4			17ATP4/ 17AVP4		
16ASP4	16CMP4A	•E	17ATP4A		
16AXP4			17ATP4A/ 17AVP4A		
16AYP4	16BGP4	•E	17AVP4		
16BFP4	16CMP4A	•C	17AVP4/ 17ATP4		
16BGP4	16BGP4	•D	17AVP4A		
16BKP4	16CHP4A	•C	17AVP4A/ 17ATP4A		
16BMP4	16BGP4	•CE			

▲ See Replacement information in front of this guide.

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Type To Be Replaced	★ Replaced By RCA Type	▲	Type To Be Replaced	★ Replaced By RCA Type	▲
17BJP4	17BJP4	D	17FP4		
17BP4	17BP4D	AP	17FP4A		
17BP4A	17BP4D	A	17HP4		
17BP4B			17HP4/ 17RP4	17HP4C	A
17BP4C			17HP4A		
17BP4D	17BP4D	D	17HP4B		
17BRP4	17DSP4	A	17HP4B/ 17RP4C		
17BUP4	17BJP4	A	17HP4C	17HP4C	D
17BZP4	17DSP4	D	17JP4	17BP4D	A
17BZP4/ 17CAP4/ 17CKP4			17KP4	17HP4C	AK
17BZP4/ 17CAP4/ 17CKP4/ 17BRP4			17KP4A		
17CAP4			17LP4	17LP4B	A
17CBP4	17BJP4	A	17LP4/ 17VP4		
17CFP4	17CFP4	D	17LP4A		
17CKP4	17DSP4	D	17LP4A/ 17VP4B		
17CLP4	17BJP4	AP	17LP4B	17LP4B	D
17CTP4	17EFP4	D	17QP4	17QP4B	A
17CWP4	17DSP4	D	17QP4A		
17CYP4	17CFP4	D	17QP4B	17QP4B	D
17DAP4	17DAP4	D	17RP4	17HP4C	A
17DHP4	17EFP4	P	17RP4C		
17DKP4	17DSP4	C	17SP4	17LP4B	AK
17DLP4	17DSP4	D	17UP4	17QP4B	A
17DQP4	17DQP4	D	17VP4	17LP4B	A
17DRP4	17DRP4	D	17VP4/ 17LP4		
17DSP4	17DSP4	D	17VP4B		
17DTP4	17DSP4	C	17YP4	17QP4B	A
17DXP4	17DXP4	D	19ABP4	19ABP4	D
17DZP4			19ACP4	19CHP4	D
17EAP4	17HP4C	AK	19ADP4	19AVP4	D
17EBP4	17EFP4	D	19AFP4	19AFP4	D
17EFP4	17EFP4	D	19AGP4	19AVP4	C
17EMP4	17EMP4	• D	19AHP4	19AYP4	D
17EWP4	17EWP4	• D	19AJP4	19AJP4	D
17FCP4	17FCP4	• D	19AKP4	19AVP4	D
			19ANP4	19AYP4	C
			19ARP4	19AFP4	D

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Type To Be Replaced	★ Replaced By RCA Type	▲	Type To Be Replaced	★ Replaced By RCA Type	▲
19ATP4	19AFP4	C	19DHP4	19DSP4	•D
19AUP4	19AFP4	D	19DKP4	19DRP4	•E
19AVP4	19AVP4	D	19DLP4	19CHP4	D
19AWP4	19AYP4	C	19DNP4	19DRP4	•E
19AXP4	19AYP4	D	19DQP4	19DQP4	•D
19AYP4			19DRP4	19DRP4	•D
19AZP4	19AVP4	D	19DSP4	19DSP4	•D
19BDP4	19BDP4	D	19DTP4	19DQP4	•C
19BHP4	19AVP4	D	19DUP4	19DUP4	•D
19BLP4	19AVP4	C	19DWP4	19DQP4	•D
19BMP4	19AFP4	C	19EAP4	19FEP4B	•D
19BRP4	19DRP4	•E	19EBP4	19EBP4	•D
19BSP4	19AVP4	C	19EDP4	19DRP4	•D
19BTP4			19EFP4	19DSP4	•D
19BVP4	19AVP4	D	19EGP4	19EGP4	•D
19BWP4	19AYP4	D	19EHP4	19DRP4	•D
19BXP4	19AYP4	E	19EHP4A		
19CAP4	19AVP4	C	19EJP4	19FEP4B	•D
19CDP4	19CXP4	D	19ELP4	19AVP4	D
19CFP4	19CHP4	CE	19EMP4	19EBP4	•C
19CHP4	19CHP4	D	19ENP4	19FEP4B	•D
19CJP4	19AVP4	D	19ENP4A		
19CKP4	19CHP4	E	19ERP4	19DRP4	•D
19CLP4	19BDP4	D	19ESP4	19DSP4	•D
19CMP4	19CMP4	D	19EUP4	19DRP4	•D
19CMP4A			19EVP4	19DQP4	•D
19CQP4	19CXP4	D	19EWP4		
19CRP4	19BDP4	D	19EZP4	19EZP4	•D
19CSP4	19CHP4	D	19FBP4	19EGP4	•D
19CUP4	19CMP4	D	19FCP4	19DQP4	•D
19CXP4	19CXP4	D	19FCP4A		
19CYP4	19AVP4	C	19FDP4		
19CZP4	19DQP4	•E	19FEP4	19FEP4B	•D
19DAP4			19FEP4A		
19DCP4	19DRP4	•D	19FEP4B	19FEP4B	•D
19DEP4	19AVP4	E	19FJP4	19DQP4	•D
19DFP4	19CHP4	D	19FJP4A		
			19FLP4	19FLP4	•D
			19FSP4	19FEP4B	•D
			19FTP4	19FLP4	•D

▲ See Replacement information in front of this guide.

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Type			Type		
To Be Replaced	★ Replaced By RCA Type	▲	To Be Replaced	★ Replaced By RCA Type	▲
19FWP4	19AYP4	D	21AFP4	21YP4B	AP
19GAP4	19GAP4	•D	21ALP4	21CBP4A	AP
19GBP4	19DQP4	•E	21ALP4A		
19GEP4	19GEP4A	•D	21ALP4B		
19GEP4A			21ALP4B/ 21ALP4A		
19GFP4			21AMP4	21AMP4B	A
19GHP4	19DUP4	•C	21AMP4A		
19GJP4	19DQP4	•D	21AMP4B	21AMP4B	D
19GJP4A			21ANP4	21CBP4A	AP
19GNP4	19DRP4	•D	21ANP4A		
19GRP4	19DQP4	•D	21AP4	21ZP4C	G
19GTP4	19FEP4B	•C	21AQP4	21AMP4B	AP
19XP4	19AVP4	D	21AQP4A		
19YP4	19AVP4	C	21ASP4	21XP4B	AP
19ZP4	19AVP4	D	21ATP4	21CBP4A	AP
20CP4	20DP4D	ACP	21ATP4A		
20CP4A	20DP4D	AC	21ATP4A/ 21ATP4		
20CP4B	20DP4D	ACP	21ATP4B		
20CP4C			21AUP4	21AVP4C	A
20CP4D	20DP4D	AP	21AUP4A		
20DP4A			21AUP4B		
20DP4A/ 20CP4A	20DP4D	A	21AUP4B/ 21AUP4A		
20DP4B	20DP4D	AP	21AUP4C	21AVP4C	D
20DP4C			21AVP4	21AVP4C	A
20DP4C/ 20CP4D	20DP4D	A	21AVP4/ 21AUP4		
20DP4D	20DP4D	D	21AVP4A		
20RP4	20RP4	•D	21AVP4B		
20SP4	20SP4	•D	21AVP4B/ 21AVP4A		
20TP4	20TP4	•D	21AVP4B/ 21AUP4B		
20XP4			21AVP4A		
20YP4	20SP4	•D	21AUP4A		
20ZP4	20SP4	•D	21AVP4C	21AVP4C	D
21ACP4	21AMP4B	A	21AWP4	21AWP4A	A
21ACP4/ 21AMP4			21AWP4A	21AWP4A	D
21ACP4A			21AYP4	21XP4B	A
21ACP4A/ 21AMP4A			21BAP4	21CBP4A	D
21ACP4A/ 21BSP4/ 21AMP4A			21BCP4	21YP4B	C
			21BDP4	21AVP4C	D
			21BNP4	21CBP4A	D

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Type To Be Replaced			Type Replaced By		
To Be Replaced	★	RCA Type ▲	To Be Replaced	★	RCA Type ▲
21BSP4		21AMP4B A	21EP4A		21EP4C A
21BTP4		21CBP4A A	21EP4B		
21CBP4		21CBP4A D	21EP4C		21EP4C D
21CBP4A			21EQP4		21EMP4/ D
21CBP4A/ 21CBP4/ 21CMP4			21ESP4		21EQP4
21CBP4B			21ETP4		
21CEP4		21EMP4/ D	21EVP4		21FDP4 CF
21CEP4A		21EQPA	21FAP4		21EMP4/ D
21CMP4		21CBP4A A	21EQP4		
21CQP4		21CQP4 D	21FDP4		21FDP4 D
21CUP4		21AMP4B A	21FLP4		21CBP4A D
21CVP4		21CBP4A D	21FP4		21FP4D AP
21DEP4		21CBP4A A	21FP4A		21FP4D A
21DEP4A			21FP4C		
21DEP4A/ 21DEP4/ 21CZP4			21FP4D		21FP4D D
21DFP4		21EMP4/ D	21KP4		21FP4D D
21DHP4		21EQP4	21KP4A		
21DLP4		21DHP4 D	21MP4		21YP4B E
21DLP4		21DLP4 D	21WP4		21WP4B A
21DMP4		21EMP4/ D	21WP4A		
21DMP4		21EQP4	21WP4B		21WP4B D
21DNP4		21CBP4A AP	21XP4		21XP4B A
21DQP4		21DLP4 D	21XP4A		
21DRP4		21CBP4A D	21XP4B		21XP4B D
21DSP4		21DSP4 D	21YP4		21YP4B A
21EAP4		21FDP4 F	21YP4A		
21EDP4		21EMP4/ D	21YP4B		21YP4B D
21EMP4		21EQP4	21ZP4		21ZP4C AP
21EMP4/ 21EQP4			21ZP4A		21ZP4C A
21EP4		21EP4C AP	21AP4B		
			21ZP4C		21ZP4C D
			23ACP4		23YP4 D
			23AFP4		
			23AGP4		23CP4 C
			23AHP4		23AHP4/ D
			23AKP4		23FP4A C

▲ See Replacement information in front of this guide.

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Type To Be Replaced	★ Replaced By RCA Type	▲	Type To Be Replaced	★ Replaced By RCA Type	▲
23ALP4	23CQP4	D	23DLP4	23ENP4	•C
23ANP4	23BKP4	D	23DLP4A		
23ARP4	23ARP4	D	23DNP4	23BKP4	D
23ASP4	23ASP4	D	23DP4	23CP4	C
			23DQP4	23BKP4	M
23ATP4	23BKP4	D	23DSP4	23ENP4	•M
23AUP4	23AHP4/	D	23DSP4A		
			23DTP4	23EKP4	•D
23AVP4	23CP4	C	23DXP4	23CP4	D
23AWP4	23BJP4	C	23DYP4	23ETP4	•P
23BAP4	23CP4	C	23DZP4	23EQP4	•D
23BDP4	23YP4	D	23ECP4	23ENP4	•D
23BFP4	23ENP4	D	23ENP4	23ENP4	•D
23BLP4			23EP4	23EP4	D
23BMP4	23YP4	D	23EQP4	23EQP4	•D
23BNP4	23CP4	D	23ESP4	23HFP4A	•D
23BP4	23CP4	C	23ETP4	23ETP4	•D
23BQP4	23BQP4	D	23EWP4	23EQP4	•D
23BTP4	23YP4	D	23EWP4A		
23BVP4			23EYP4	23EYP4	D
23BWP4			23EYP4	23EYP4	•D
23BXP4	23EKP4	•E	23EYP4	23EYP4	•D
23BZP4	23CGP4	D	23EYP4	23EYP4	•D
23CBP4	23BQP4	D	23FBP4	23ENP4	•D
23CEP4	23ARP4	D	23FCP4	23GJP4A	•D
23CGP4	23CGP4	D	23FDP4		
23CP4	23CP4	D	23FEP4	23ENP4	•D
23CP4A			23FHP4	23GJP4A	•D
23CQP4	23CQP4	D	23FJP4	23ETP4	•D
23CUP4	23CP4	C	23FLP4	23EKP4	•D
23CZP4	23AHP4	D	23FMP4	23HFP4A	•D
			23FP4	23FP4A	D
23DAP4	23DAP4	D	23FP4A		
23DBP4	23DBP4	D	23FRP4	23FRP4	•D
23DKP4	23EKP4	•D	23FSP4	23FSP4	•D
			23FVP4	23HFP4A	•D
			23FVP4A		

▲ See Replacement information in front of this guide.

RCA

Electronic Components

INTERCHANGEABILITY GUIDE 5

World Radio History

RCA PICTURE TUBE INTERCHANGEABILITY GUIDE

Type To Be Replaced	★	Replaced By RCA Type	▲	Type To Be Replaced	★	Replaced By RCA Type	▲
23FZP4		23GSP4	• D	23XP4		23YP4	D
23GBP4		23HFP4A	• D	23YP4			
23GEP4		23ENP4	• D	24ADP4		24CP4B	A
23GFP4		23HGFP4	• D	24ADP4/ 24VP4A/ 24CP4A/ 24TP4			
23GJP4		23GJP4A	• D	24AEP4		24AEP4	D
23GJP4A				24AHP4		24AHP4	D
23GP4		23CP4	D	24ALP4		24AHP4	D
23GSP4		23GSP4	• D	24ANP4		24AEP4	A
23GTP4		23ETP4	• D	24AUP4		24AUP4	D
23GUP4		23FRP4	• D	24AVP4		24BEP4	F
23GVP4		23HUP4A	• D	24BEP4		24BEP4	D
23GWP4		23GWP4	• D	24CP4		24CP4B	D
23GXP4		23GSP4	• D	24CP4A		24CP4B	A
23GZP4		23EKP4	• E	24CP4B		24CP4B	D
23HFP4		23HFP4A	• D	24DP4		24AEP4	^
23HFP4A				24VP4A			
23HGP4		23HGFP4	• D	24XP4		24CP4B	AP
23HLP4		23GSP4	• D	24YP4		24AEP4	A
23HWP4				24ZP4		24EAP4	D
23HWP4		23HWP4A	• D	230RB4		9WP4	• D
23HWP4A		23HWP4A	• D	310AVB4		12CNP4	• D
23HXP4		23HFP4A	• D	470ACB4		19AYP4	D
23HYP4		23JEP4	• D	500KB4		20TP4	• D
23JAP4		23GJP4A	• D	SG10FP4A		10 FP4 A	D
23JBP4		23FSP4	• C	SG14WP4		14WP4	D
23JEP4		23JEP4	• D	SG16KP4A		16RP4B	D
23JGP4		23FRP4	• D	SG17BJP4		17BJP4	D
23JHP4		23HFP4A	• D	SG17BP4B		17BP4D	D
23JLP4		23HUP4A	• D	SG17CKP4		17DSP4	D
23JP4		23JP4	D	SG17HP4B		17HP4C	D
23KP4		23FP4A	C	SG17LP4A		17LP4B	D
23KP4A				SG17QP4A		17QP4B	D
23LP4		23ETP4	• D	SG20CP4D		20DP4D	C
23MP4		23FP4A	D	SG21ACP4A		21AMP4B	D
23MP4/ 23MP4A/ 23WP4				SG21AUP4B		21AVP4C	D
23MP4A				SG21AWP4		21AWP4A	D
23NP4		23NP4	D	SG21DEP4A		21EMP4/ 21EQP4	D
23QP4		23CP4	D	SG21EP4B		21EP4C	D
23TP4		23YP4	D	SG21FLP4		21CBP4A	D
23UP4		23BQP4	D	SG21FP4C		21FP4D	D
23WP4		23FP4A	D	SG21WP4A		21WP4B	D

▲ See Replacement information in front of this guide.

RCA PICTURE TUBE INTERCHANGEABILITY GUIDE

Type			Type		
To Be Replaced	★ Replaced By RCA Type	▲	To Be Replaced	★ Replaced By RCA Type	▲
SG21XP4A	21XP4B	D	SG24AEP4	24AEP4	D
SG21YP4A	21YP4B	D	SG24CP4A	24CP4B	D
SG21ZP4B	21ZP4C	D			

▲ See Replacement information in front of this guide.

Safety Precautions For Color Picture Tubes

WARNING

X-Radiation.

Operation of the referenced color picture tube at abnormal conditions which exceed the 0.5 mR/h isodose-rate curve shown for this tube may produce soft X-rays which may constitute a health hazard on prolonged exposure at close range unless adequate external shielding is provided. Therefore, precautions must be exercised during servicing of TV receivers employing this tube to assure that the anode voltage and other tube voltages are adjusted to the recommended values so that the Design-Maximum Ratings will not be exceeded.

This color picture tube incorporates integral X-radiation shielding and must be replaced with a tube of the same type number or an RCA recommended replacement to assure continued safety.

Implosion Protection:

This picture tube employs integral implosion protection and must be replaced with a tube of the same type number or an RCA recommended replacement to assure continued safety.

Shock Hazard:

The high voltage at which the tube is operated may be very dangerous. Design of the TV receiver should include safeguards to prevent the user from coming in contact with the high voltage. Extreme care should be taken in the servicing or adjustment of any high-voltage circuit.

Caution must be exercised during the replacement or servicing of the picture tube since a residual electrical charge may be contained on the high-voltage capacitor formed by the external and internal conductive coatings of the picture tube funnel. To remove any undesirable residual high-voltage charges from the picture tube, "bleed off" the charge by shorting the anode contact button, located in the funnel of

Safety Precautions For Color Picture Tubes

the picture tube, to the external conductive coating before handling the tube. Discharging the high voltage to isolated metal parts such as cabinets and control brackets may produce a shock hazard.

Tube Handling:

Picture tubes should be kept in the shipping box or similar protective container until just prior to installation. Wear heavy protective clothing, including gloves and safety goggles with side shields, in areas containing unpacked and unprotected tubes to prevent possible injury from flying glass in the event a tube breaks. Handle the picture tube with extreme care. Do not strike, scratch or subject the tube to more than moderate pressure. Particular care should be taken to prevent damage to the seal area.

The equipment manufacturer should provide a warning label in an appropriate position on the equipment to advise the serviceman of all safety precautions.



FEATURES OF FLUORESCENT SCREENS

The fluorescent screens of the cathode-ray tubes covered in this Section are identified according to phosphor number, e.g., P1, P2, P4, P5, P7, etc.

Phosphor P1 produces a brilliant spot having yellowish-green fluorescence and medium persistence. Types having this phosphor are particularly useful for general oscillographic applications in which recurrent-wave phenomena are to be observed visually.

Phosphor P2 is a medium-persistence screen which exhibits yellowish-green fluorescence and phosphorescence. The phosphorescence may persist for over a minute under conditions of adequate excitation and low-ambient light. Types utilizing this phosphor are particularly useful for observing either low- or medium-speed non-recurring phenomena.

Phosphor P4 is a highly efficient screen having white fluorescence and medium-short persistence. Types having this phosphor are of particular interest for television picture tubes.

Phosphor P5 produces a highly actinic spot having blue fluorescence and medium-short persistence. Types having this phosphor are especially useful in photographic applications involving film moving at very high speeds.

Phosphor P7 is a very long-persistence, cascade (two-layer) screen. During excitation by the electron beam, this phosphor produces a purplish-blue fluorescence. After excitation, the screen exhibits a yellowish-green phosphorescence which persists for several minutes. Types having this phosphor are particularly useful where either extremely low-speed recurrent phenomena or medium-speed non-recurrent phenomena are to be observed.

Phosphor P11 produces a brilliant actinic spot of blue fluorescence and medium-short persistence to permit its use in all photographic applications except those in which film moves at high speed. P11 screens, because of their unusually high brightness characteristic, may also be used for visual observation of phenomena.

Phosphor P12 is a long-persistence phosphor which exhibits both yellowish-orange fluorescence and phosphorescence. Types utilizing this phosphor are particularly useful for observing low- and medium-speed recurring phenomena.

Phosphor P14 is a long-persistence cascade (two-layer) screen. During excitation by the electron beam, this phosphor exhibits purplish-blue fluorescence. After excitation, it exhibits a yellowish-orange phosphorescence which persists for a little over a minute. Types utilizing this phosphor are particularly useful for observing either low- and medium-speed non-recurring phenomena or high-speed recurring phenomena.



FEATURES OF FLUORESCENT SCREENS

Phosphor P15 has radiation in the visible green region and in the invisible near-ultraviolet region. The ultraviolet radiation has short persistence which is appreciably shorter than that of the visible radiation. This phosphor finds application in flying-spot cathode-ray tubes.

Phosphor P16 has violet as well as near-ultraviolet fluorescence and phosphorescence with very short persistence. This phosphor has a stable, exponential decay characteristic and is particularly useful for the high-speed scanning requirements of a flying-spot video-signal generator.

Phosphor P20 has high luminous efficiency, yellow-green fluorescence and medium-short persistence. The screen may be used in applications requiring relatively short persistence and good visual efficiency.

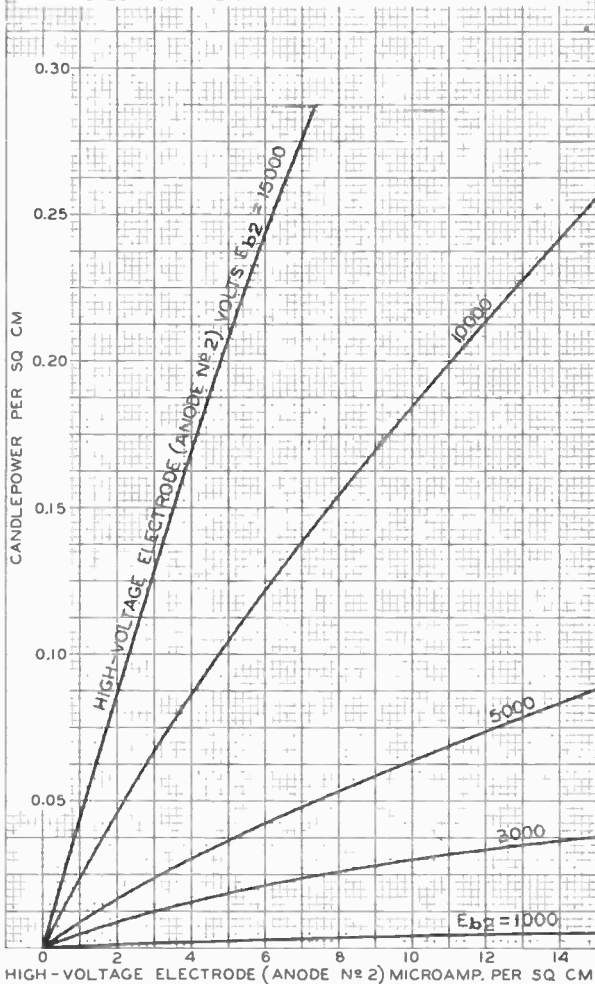
Phosphor P22 is the designation for three separate phosphors used in combination in a color picture tube. The separate phosphors are blue, green, and red, respectively. The persistence of the group phosphorescence is classified as medium.

Phosphor P24 is a short-persistence phosphor with green fluorescence and phosphorescence. Its spectral-energy emission characteristic has sufficient range to provide useable energy over the visible spectrum required for generating color signals from color transparencies.



AVERAGE CHARACTERISTICS OF PHOSPHOR N° 1

NOTE: THESE CURVES ARE GENERAL FOR CATHODE-RAY TYPES HAVING PHOSPHOR N° 1. APPLICATION OF THESE CURVES, THEREFORE, DEPENDS ON THE MAXIMUM RATINGS OF SPECIFIC TYPES.



NOV. 23, 1938

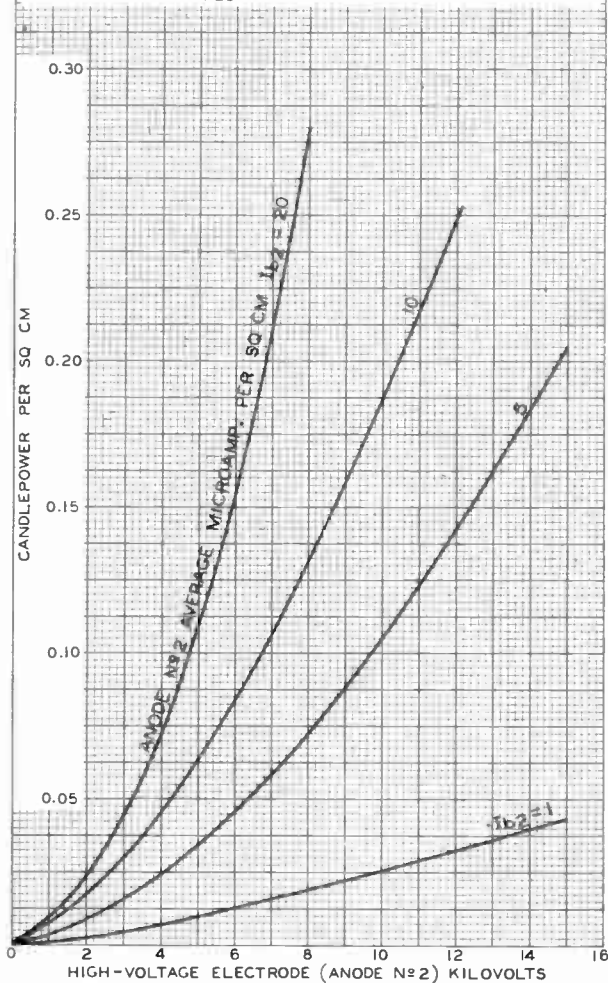
RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92C-6010



AVERAGE CHARACTERISTICS OF PHOSPHOR N°1

NOTE: THESE CURVES ARE GENERAL FOR CATHODE-RAY TYPES HAVING PHOSPHOR N°1. APPLICATION OF THESE CURVES, THEREFORE, DEPENDS ON THE MAXIMUM RATINGS OF SPECIFIC TYPES.



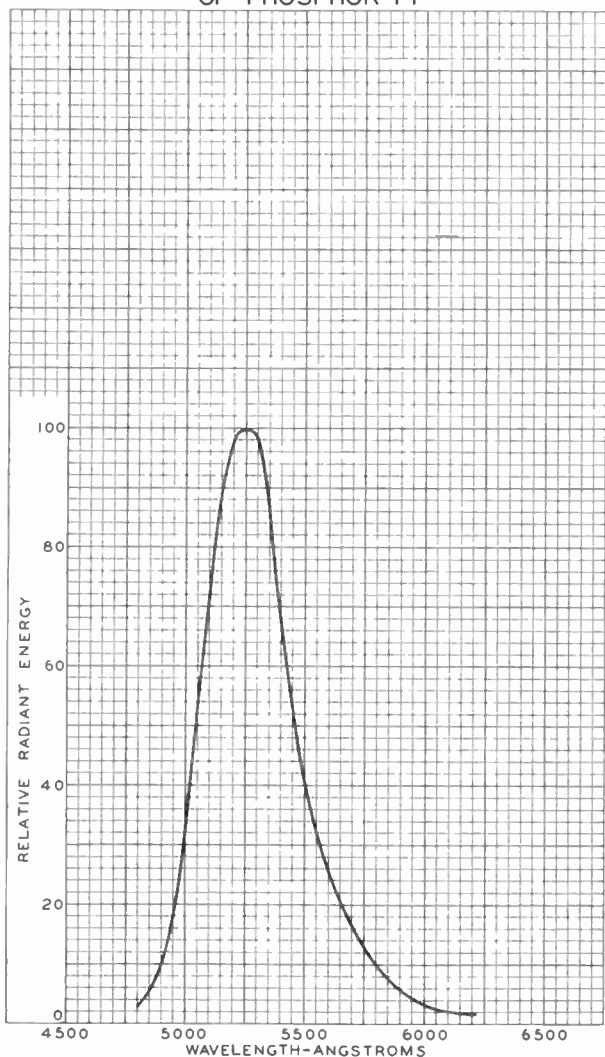
NOV. 23, 1938

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY INC

92C-6009



SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P1



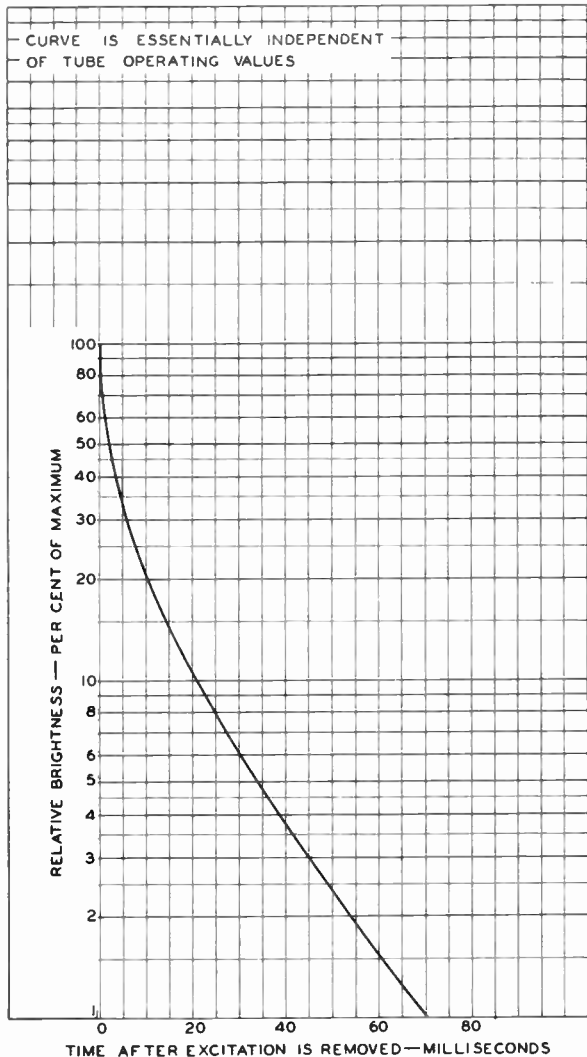
DEC.14,1948

TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-5372R1



PERSISTENCE CHARACTERISTIC OF PHOSPHOR P1



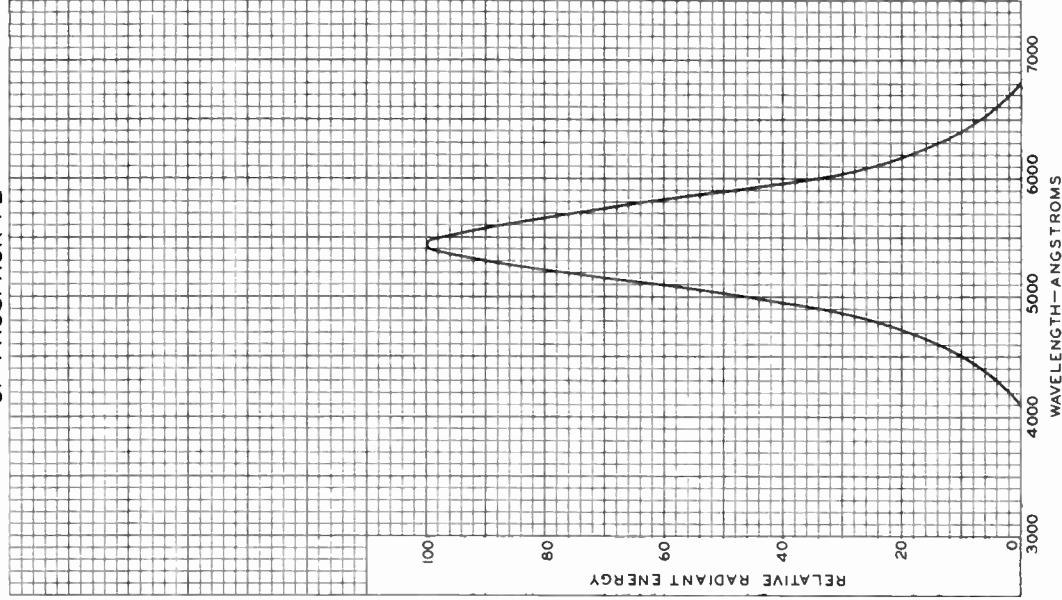
FEB. 1, 1951

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-5380R2

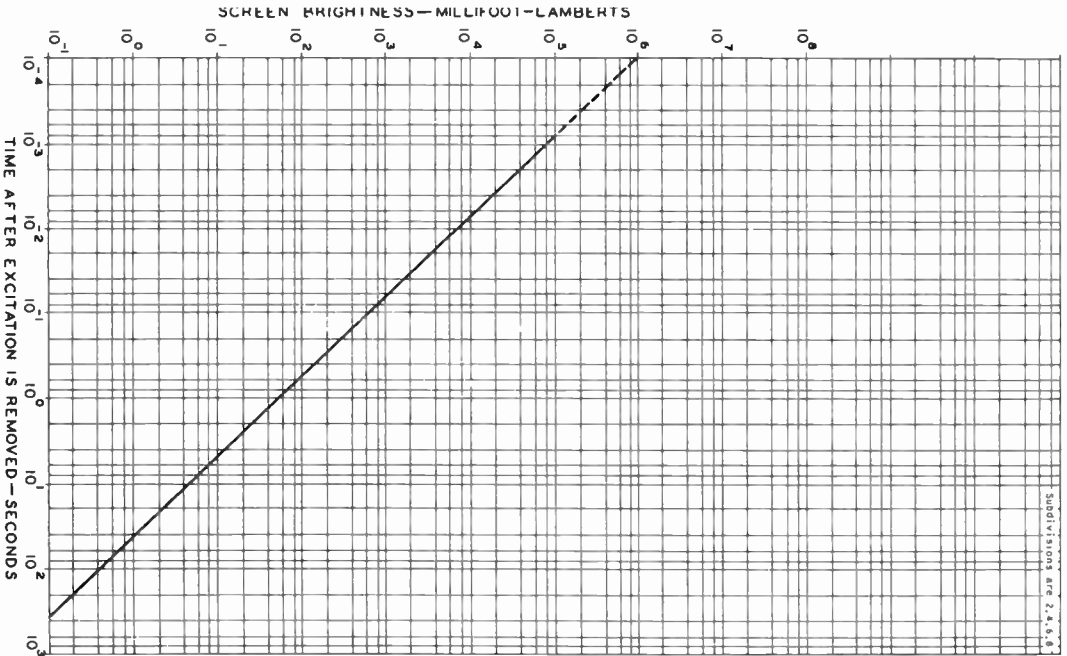


SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P2





PERSISTENCE CHARACTERISTIC OF PHOSPHOR P2



TUBE DIVISION

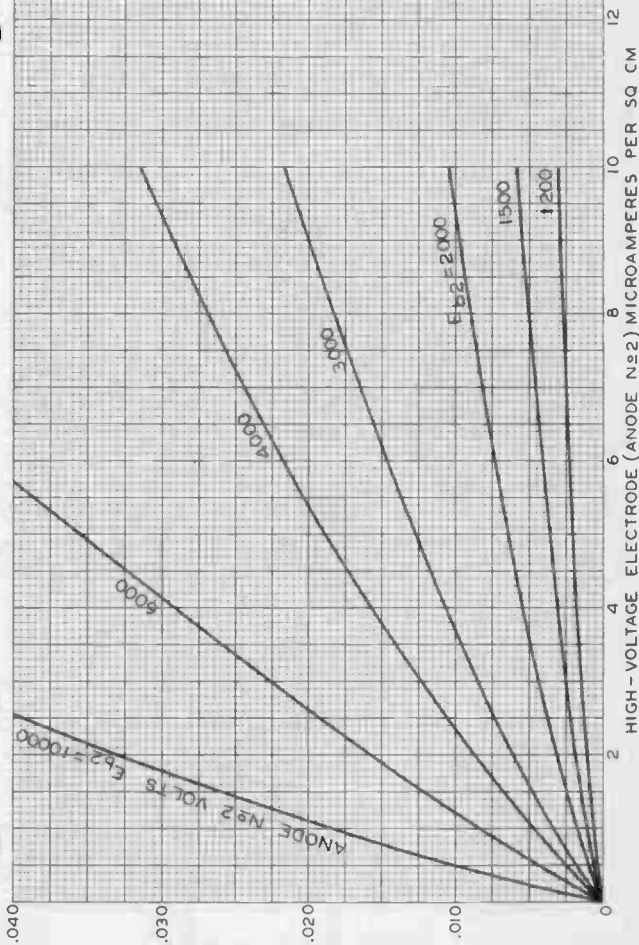
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7321



AVERAGE CHARACTERISTICS OF PHOSPHOR No 4

NOTE : THESE CURVES ARE GENERAL FOR CATHODE-RAY TUBES HAVING PHOSPHOR No 4. APPLICATION OF THESE CURVES, THEREFORE, DEPENDS ON THE MAXIMUM RATINGS OF SPECIFIC TYPES.



OCT. 5, 1938

CANDLEPOWER PER SQ CM

RCA RADIOTRON DIVISION

RCA MANUFACTURING COMPANY INC.

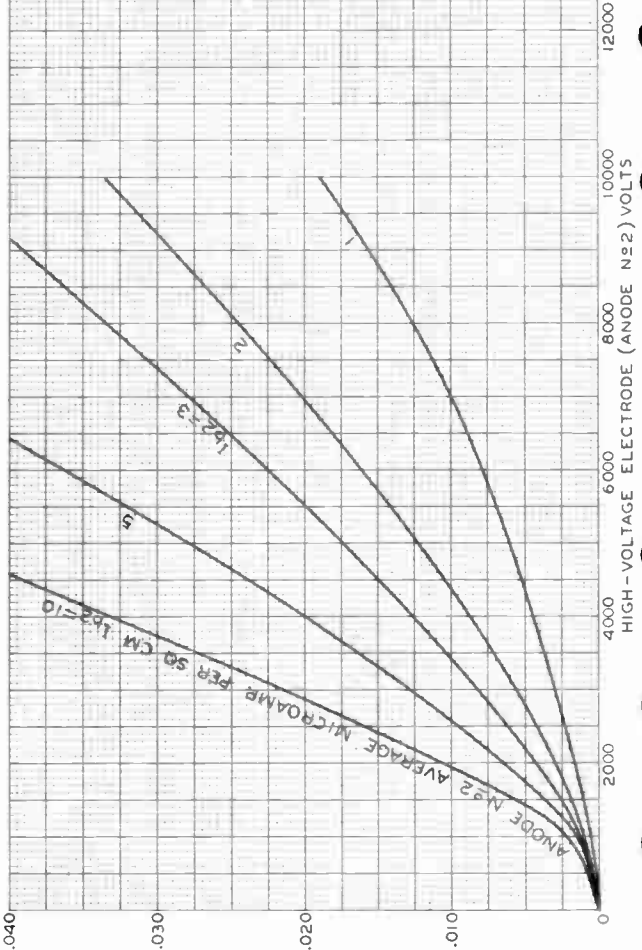
World Radio History

92C-4979



AVERAGE CHARACTERISTICS OF PHOSPHOR No 4

NOTE: THESE CURVES ARE GENERAL FOR CATHODE-RAY TYPES HAVING PHOSPHOR No 4. APPLICATION OF THESE CURVES, THEREFORE, DEPENDS ON THE THE MAXIMUM RATINGS OF SPECIFIC TYPES.



OCT. 5, 1938

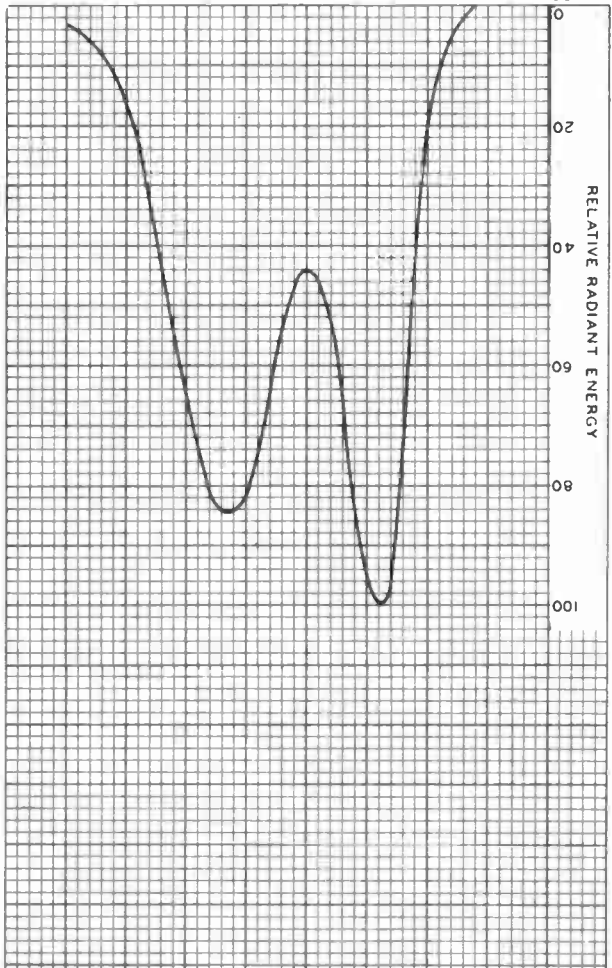
CANDLEPOWER PER SQ CM
RCA RADIOTRON DIVISION

92C-4978

SPECTRAL-ENERGY EMISSION CHARACTERISTIC
 OF PHOSPHOR №4
 USED IN DIRECTLY VIEWED KINESCOPES



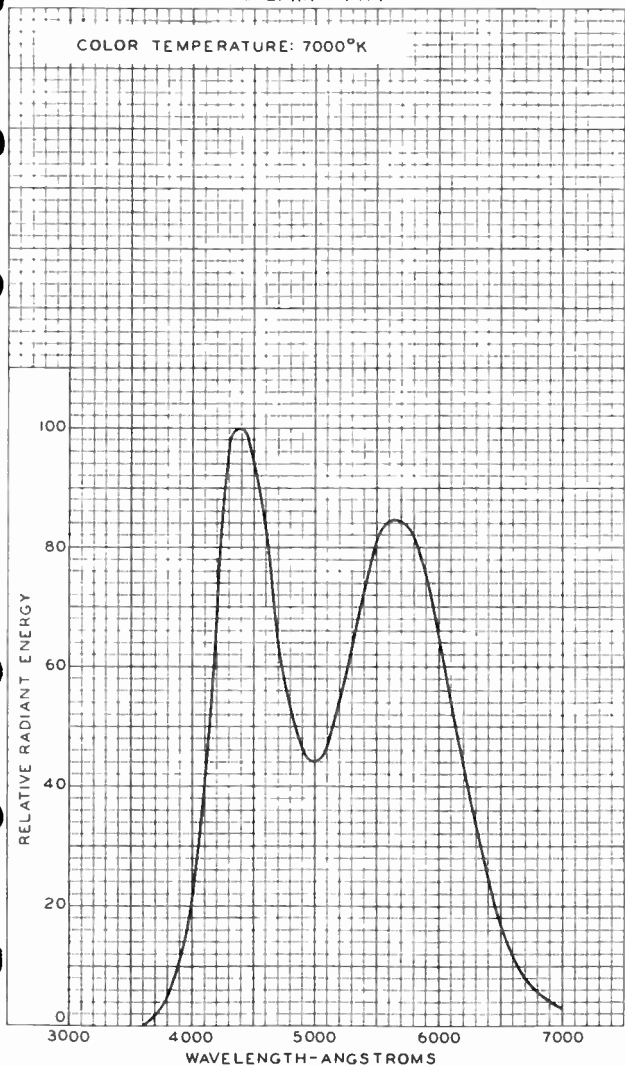
COLOR TEMPERATURE: 7000°K







SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P4 SULFIDE TYPE





PERSISTENCE CHARACTERISTIC OF PHOSPHOR P4 SULFIDE TYPE

FOR KINESCOPES

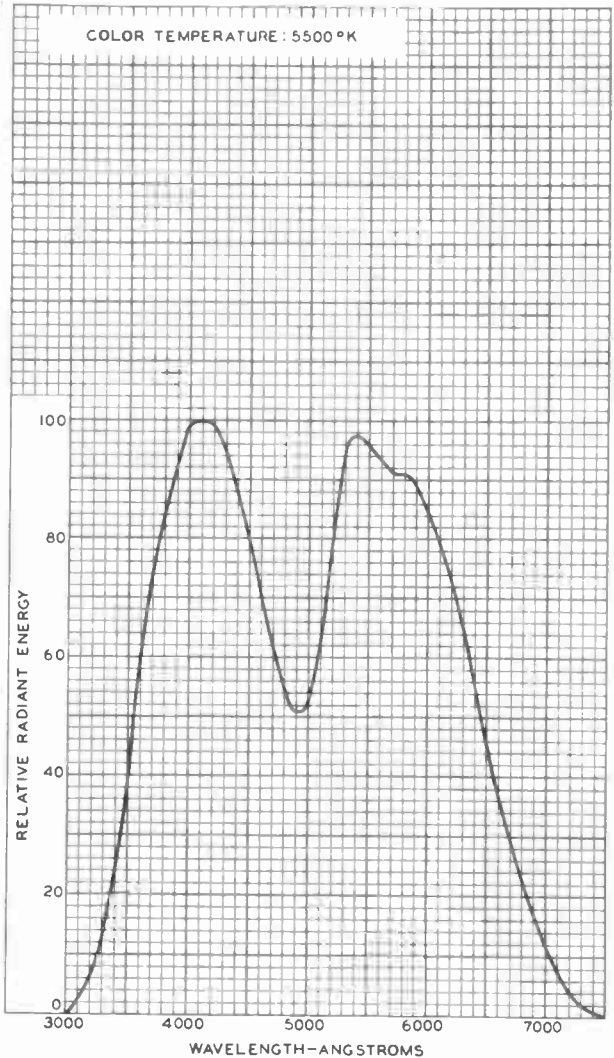
The persistence of the phosphorescence is such that its brightness does not exceed 7 per cent of the peak value in 33 milliseconds after excitation is removed.

FOR OSCILLOGRAPH TUBES

The persistence characteristics of the phosphorescence are the same as those shown for the P11 phosphor.



SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P4 SILICATE TYPE



AUG. 2, 1949

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7335



PERSISTENCE CHARACTERISTIC OF PHOSPOR P4 SILICATE TYPE

The persistence of the phosphorescence is such that its brightness does not exceed 7 per cent of the peak value in 33 milliseconds after excitation is removed.

NOV. 1, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

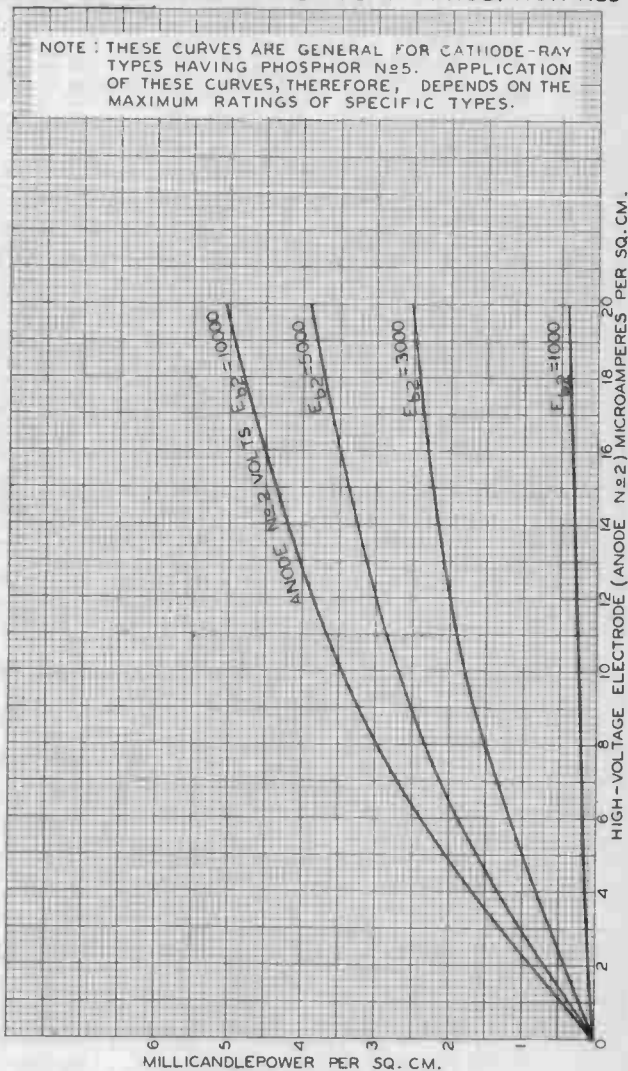
World Radio History

PERSIST. P4
SILICATE



AVERAGE CHARACTERISTICS OF PHOSPHOR No5

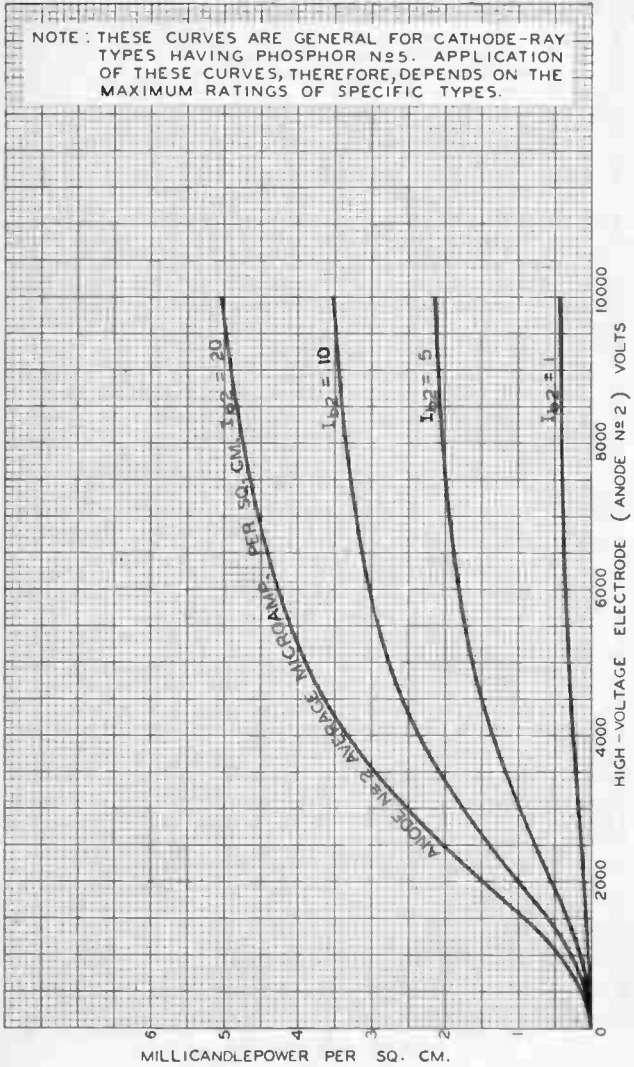
NOTE : THESE CURVES ARE GENERAL FOR CATHODE-RAY TUBES HAVING PHOSPHOR No5. APPLICATION OF THESE CURVES, THEREFORE, DEPENDS ON THE MAXIMUM RATINGS OF SPECIFIC TYPES.





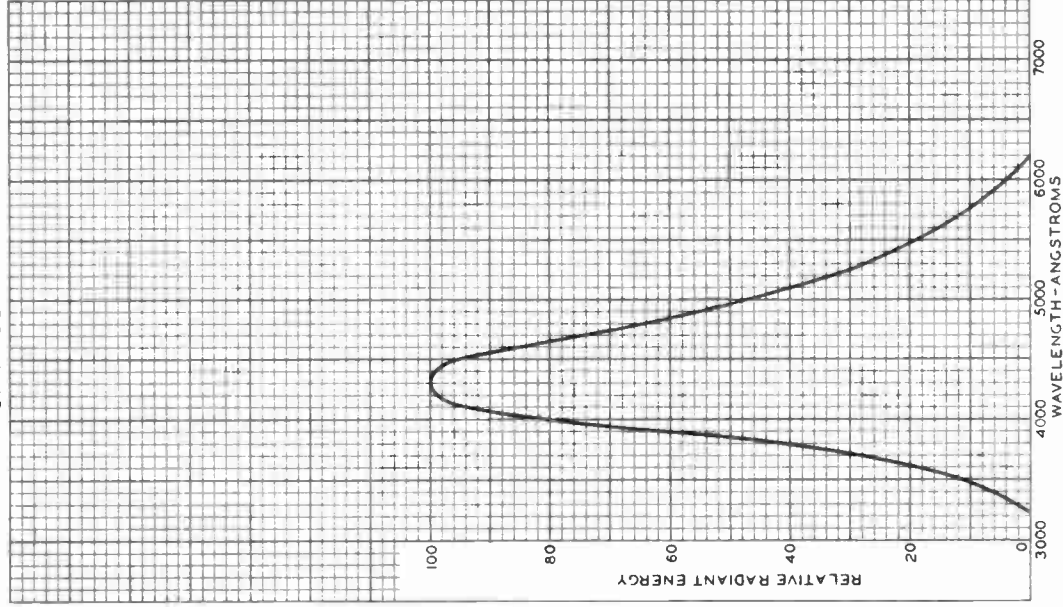
AVERAGE CHARACTERISTICS OF PHOSPHOR No5

NOTE: THESE CURVES ARE GENERAL FOR CATHODE-RAY TUBE TYPES HAVING PHOSPHOR No5. APPLICATION OF THESE CURVES, THEREFORE, DEPENDS ON THE MAXIMUM RATINGS OF SPECIFIC TYPES.





SPECTRAL-ENERGY EMISSION CHARACTERISTIC
OF PHOSPHOR No 5



MAY 2, 1949

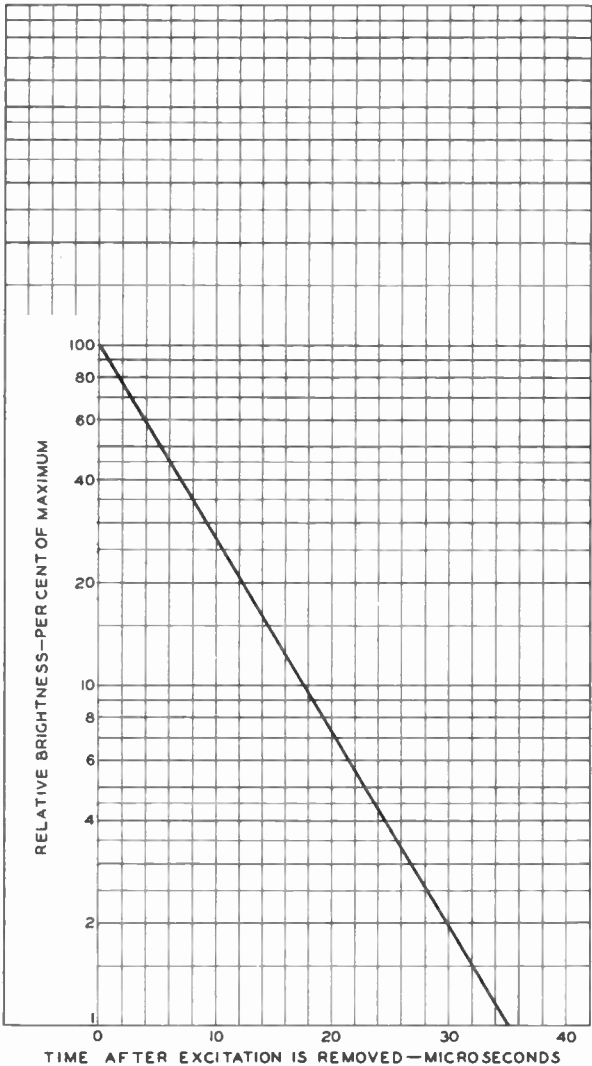
TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-5559R2



PERSISTENCE CHARACTERISTIC OF PHOSPHOR No 5



MAY 3, 1949

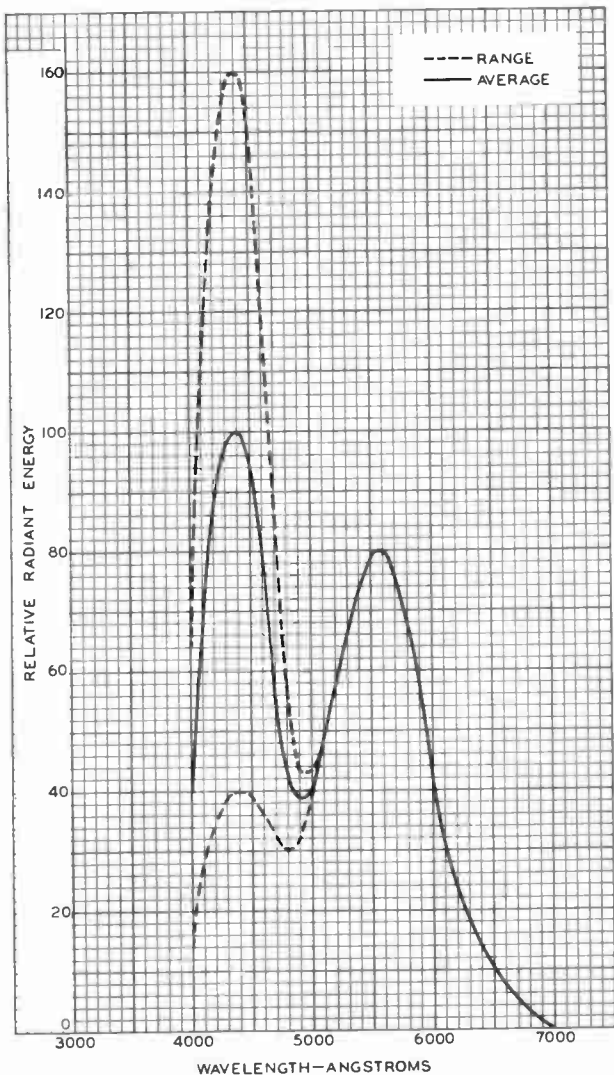
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7266

World Radio History



SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P7

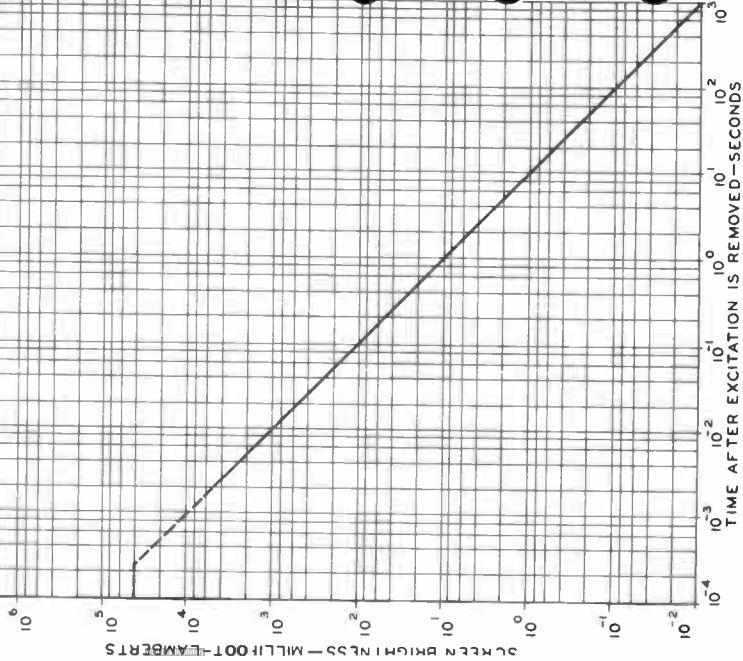




PERSISTENCE CHARACTERISTIC OF PHOSPHOR P7

Subdivisions are 2, 4, 6

FINAL HIGH-VOLTAGE -
ELECTRODE VOLTS: 4000-9000
SCREEN MICROAMP: 150
SCANNING AREA (CM): 7 x 7
SCANNING PERIOD (SEC): $\frac{1}{60}$
NUMBER OF LINES: 260 APPROX.
EXCITATION: SINGLE PULSE OF
0.24-MILLISECOND DURATION



TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

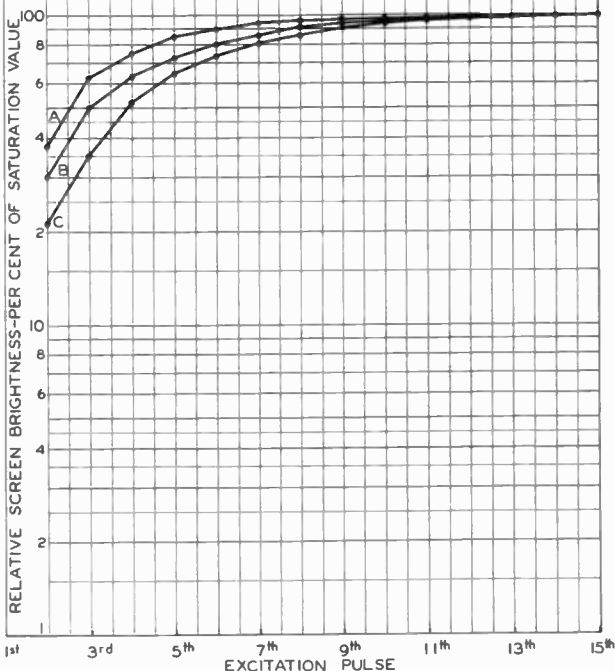
92CM-7015R4



BUILDUP CHARACTERISTICS OF PHOSPHOR P7

FINAL HIGH-VOLTAGE-ELECTRODE VOLTS: 4000-9000
SCANNING AREA (CM): 7x7
NUMBER OF LINES: 260 APPROX.
EXCITATION: PULSE OF $\frac{1}{60}$ -SECOND DURATION
SUPPLIED TO GRID N^o1 OF CATHODE-
RAY TUBE AT 1-SECOND INTERVALS
FOR EACH OF THE LOCI UNDER
THE INDICATED CONDITIONS.
BRIGHTNESS: MEASURED JUST BEFORE EACH
EXCITATION PULSE.

LOCUS	SCREEN MICROAMP
A	150
B	75
C	37



TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

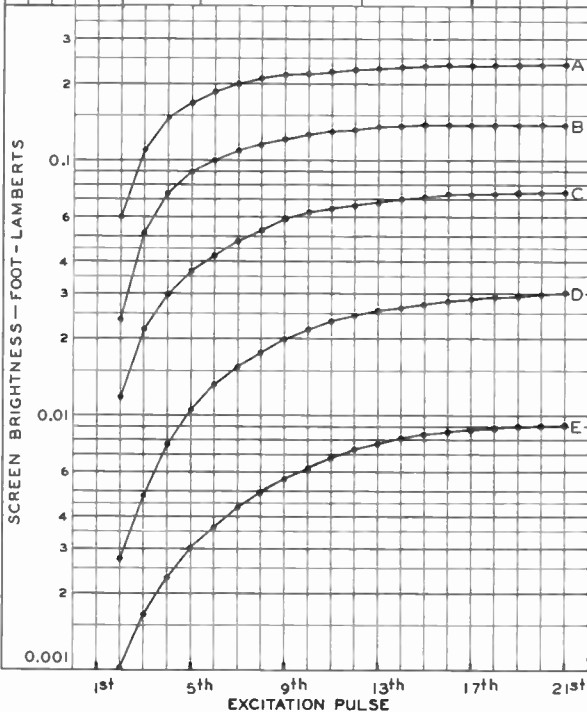
92CM - 7019R3



BUILDUP CHARACTERISTICS OF PHOSPHOR P7

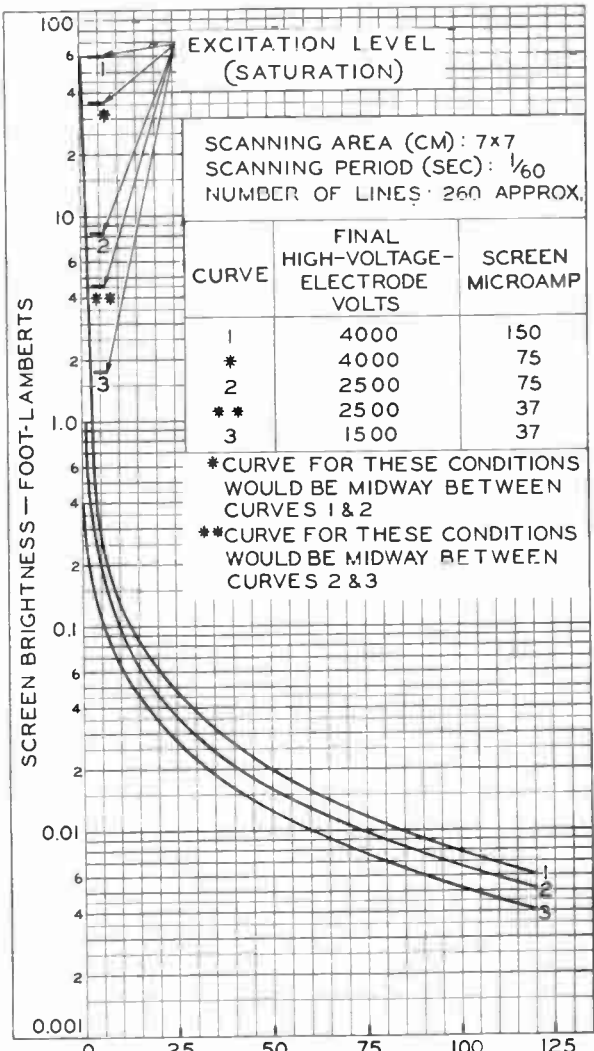
SCANNING AREA (CM): 7x7
NUMBER OF LINES: 260 APPROX.
EXCITATION: PULSE OF $\frac{1}{60}$ -SECOND DURATION SUPPLIED
TO GRID N^o1 OF CATHODE-RAY TUBE AT
1-SECOND INTERVALS FOR EACH OF THE
LOCi UNDER THE INDICATED CONDITIONS.
BRIGHTNESS: MEASURED JUST BEFORE EACH EXCITATION
PULSE.

LOCUS	FINAL HIGH-VOLTAGE- ELECTRODE VOLTS	SCREEN MICROAMP
A	4000	150
B	4000	75
C	2500	75
D	2500	37
E	1500	37





PERSISTENCE CHARACTERISTICS OF PHOSPHOR P7



TIME AFTER EXCITATION IS REMOVED-SECONDS

TUBE DIVISION

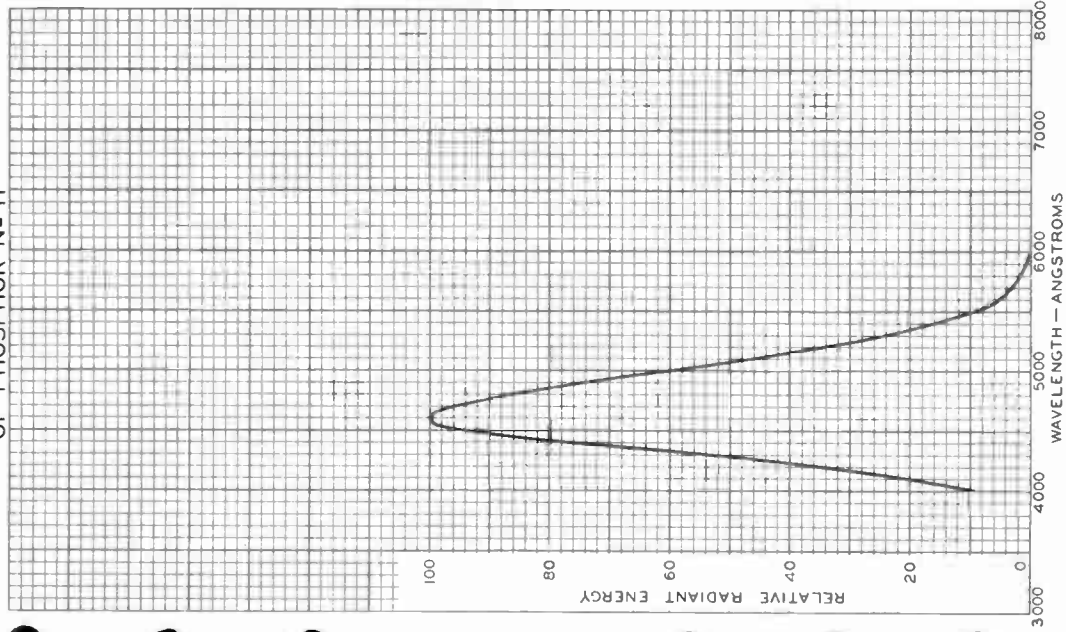
92CL-6804R5

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY





SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR No 11



APRIL 9, 1946

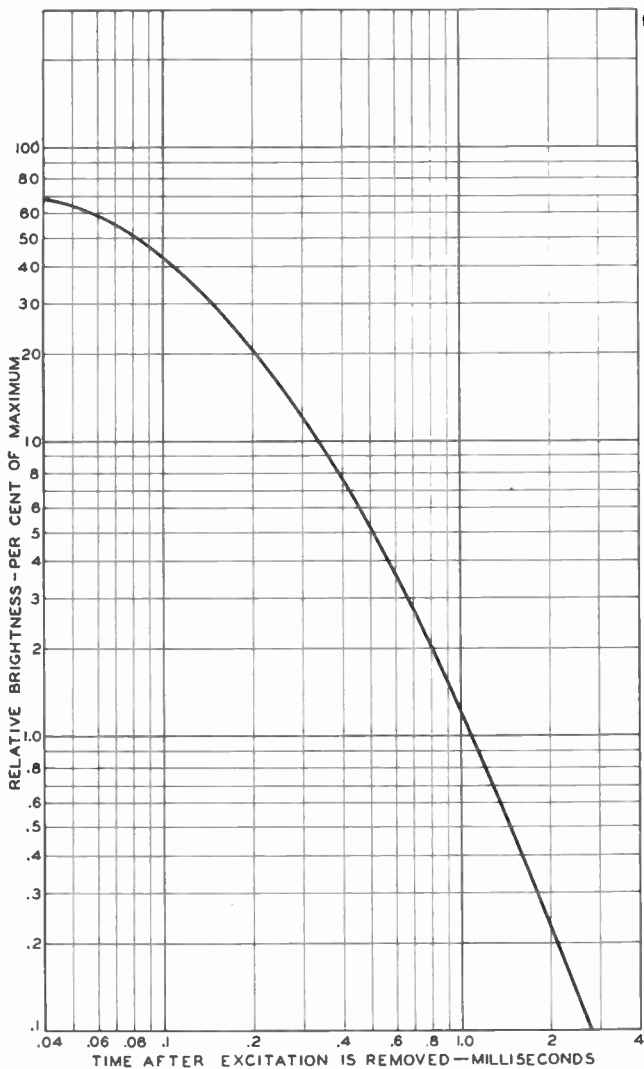
TUBE DEPARTMENT

RAD CO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6749



PERSISTENCE CHARACTERISTIC OF PHOSPHOR No 11



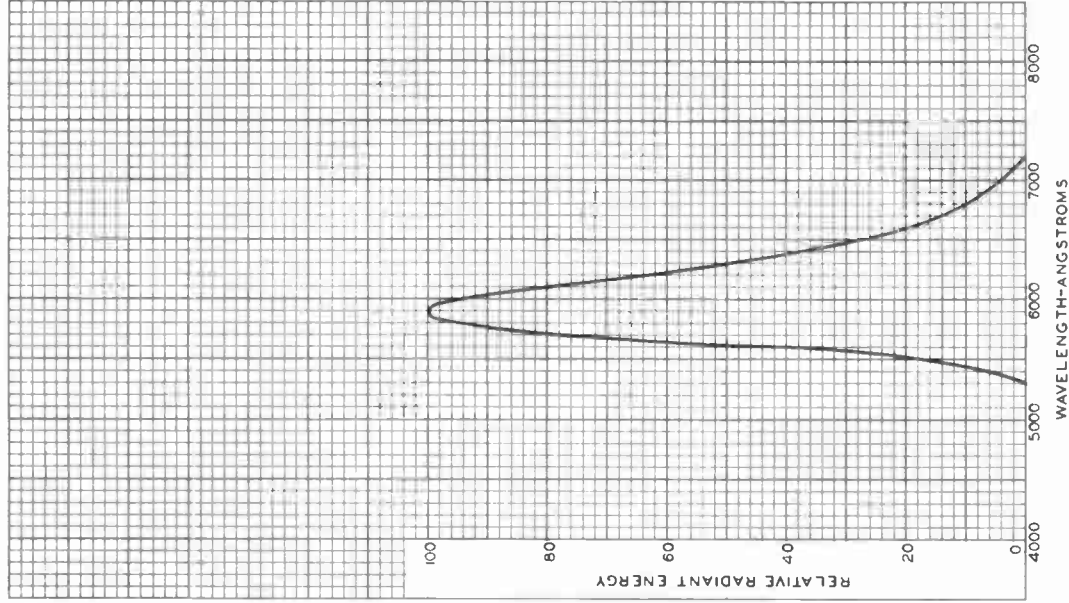
DECEMBER 9, 1948

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6608 R1



SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P12



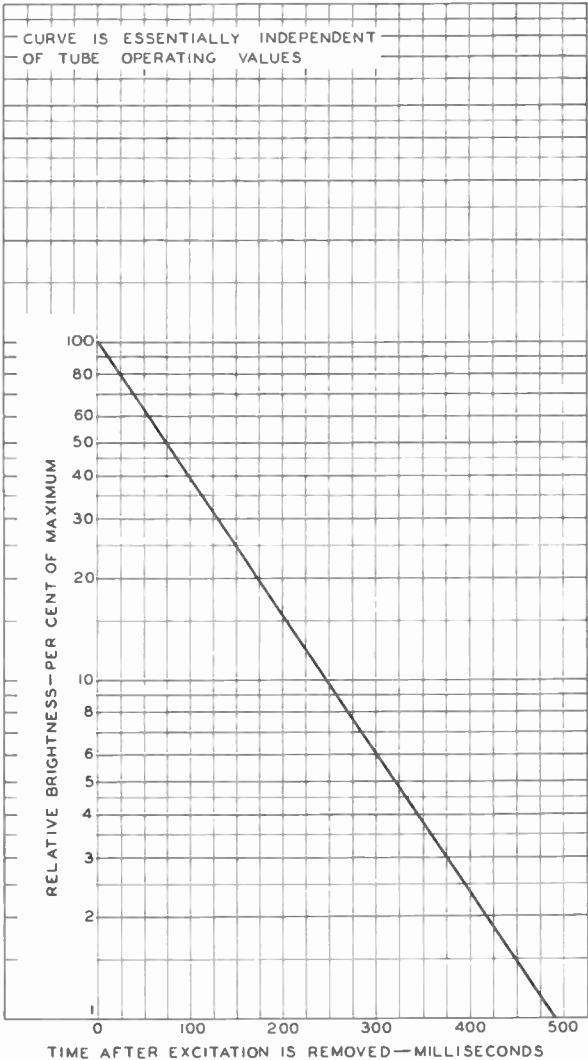
JULY 18, 1949

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-7317



PERSISTENCE CHARACTERISTIC OF PHOSPHOR P12



FEB. 1, 1951

TUBE DEPARTMENT

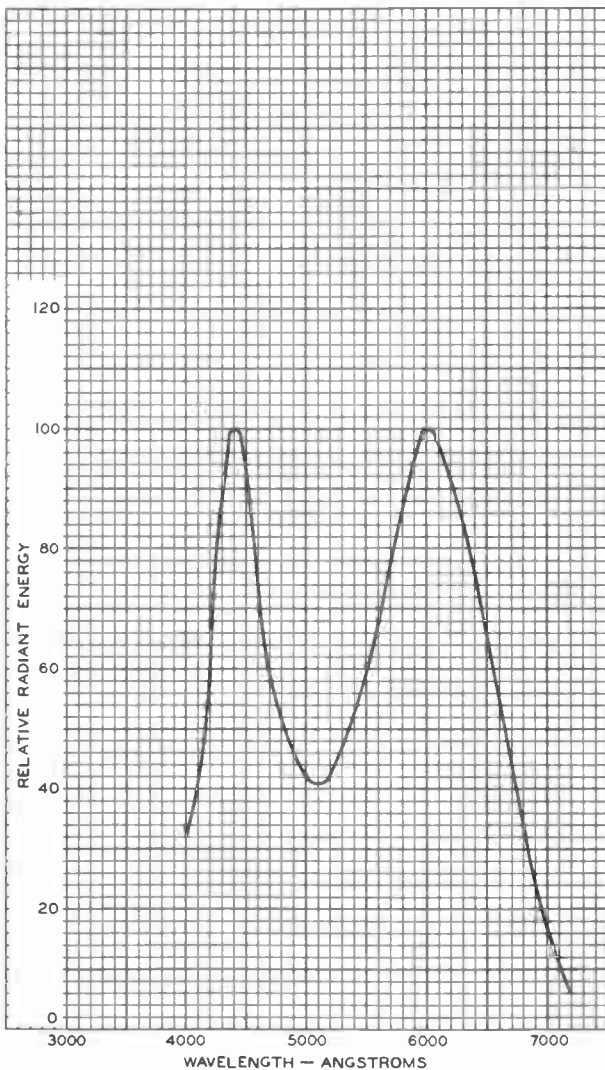
92CM - 7318RI

RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

World Radio History



SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P14



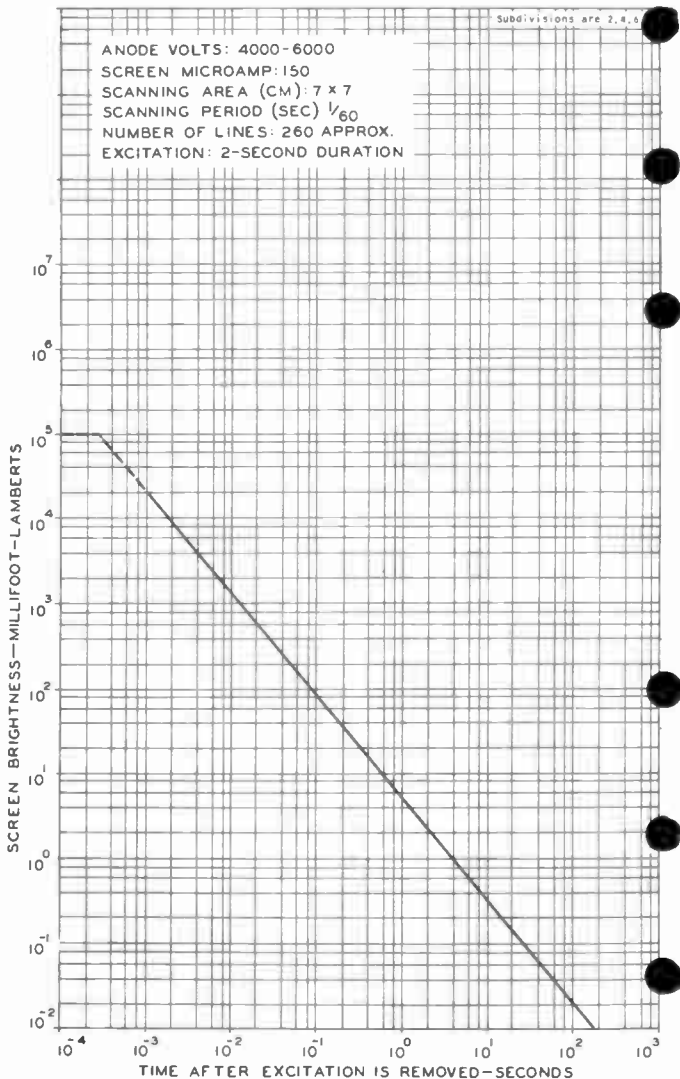
AUG. 1, 1951

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7675



PERSISTENCE CHARACTERISTIC OF PHOSPHOR P14



JAN. 26, 1951

TUBE DEPARTMENT

92CM-7326RI

RADIO CORPORATION OF AMERICA HARRISON NEW JERSEY

World Radio History



SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P15

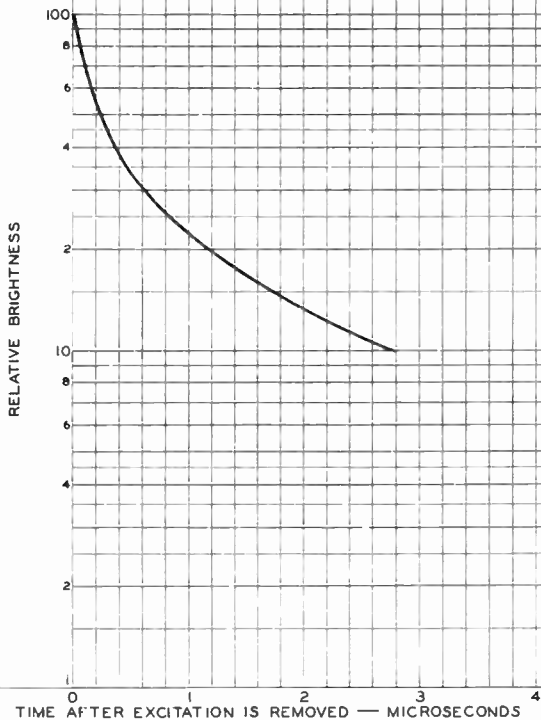




PERSISTENCE CHARACTERISTIC OF PHOSPHOR P15

COMPONENTS	EACH ESSENTIALLY INDEPENDENT OF TUBE OPERATING VALUES.
VISIBLE	SHOWN BY CURVE.
ULTRAVIOLET	DECAYS TO APPROXIMATELY 10% OF MAXIMUM IN NOT MORE THAN 0.05 MICROSECOND.

SPOT: SHARPLY FOCUSED.



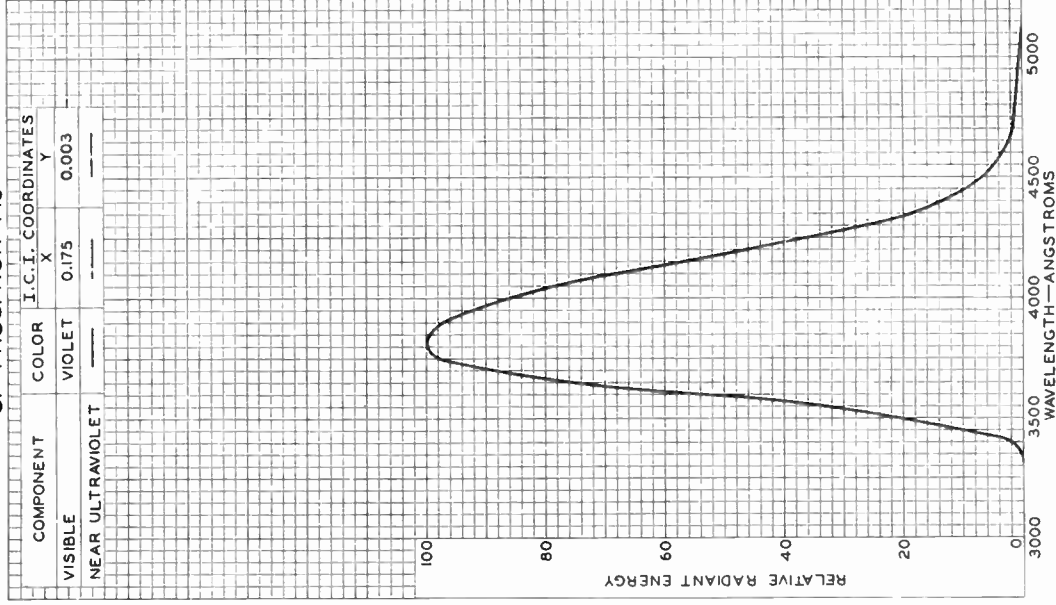
ELECTRON TUBE DIVISION

92CM-8540R1

RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY



SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P16



ELECTRON TUBE DIVISION

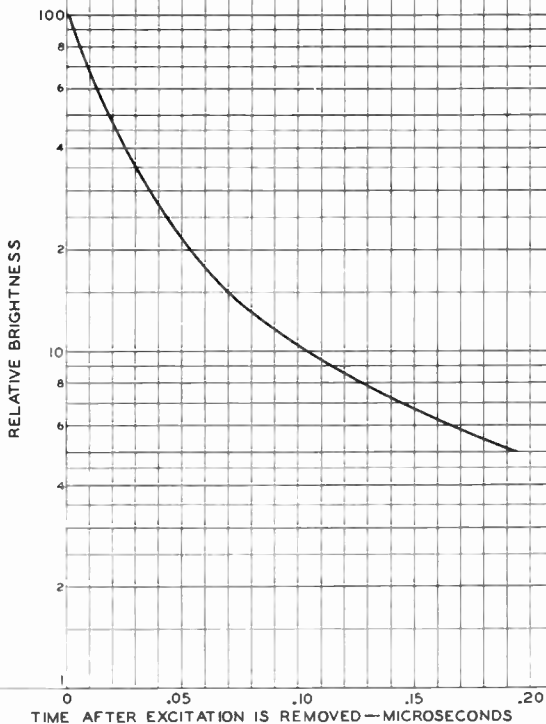
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7563RI



PERSISTENCE CHARACTERISTIC OF PHOSPHOR P16

CURVE IS ESSENTIALLY INDEPENDENT OF
TUBE OPERATING VALUES.
SPOT: SHARPLY FOCUSED.



ELECTRON TUBE DIVISION

92CM-7564RI

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

Phosphor P20

Spectral-Energy Emission Characteristic



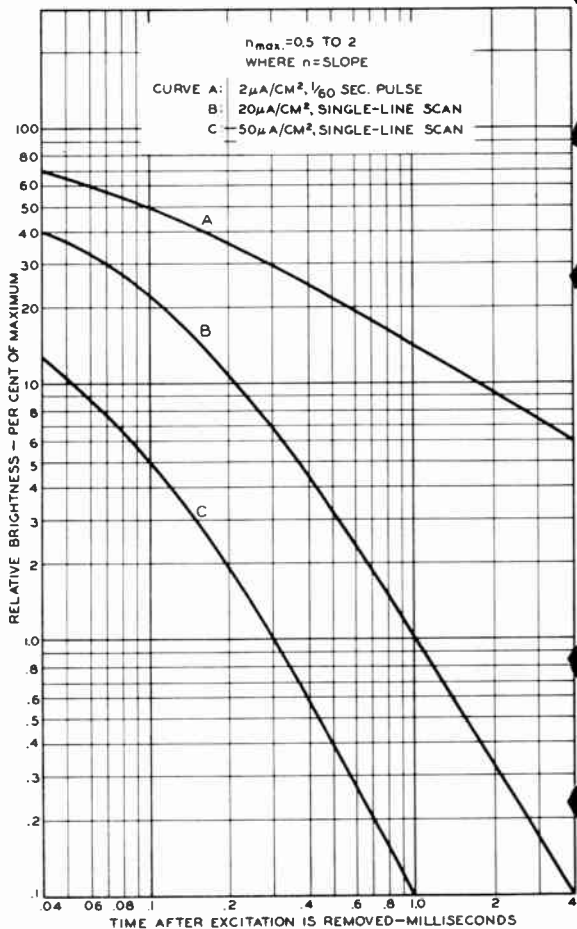
92CM-7647R2



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

GROUP PHOS-
P-20- P-20
4-66

Persistence Characteristic



92CM-6606R



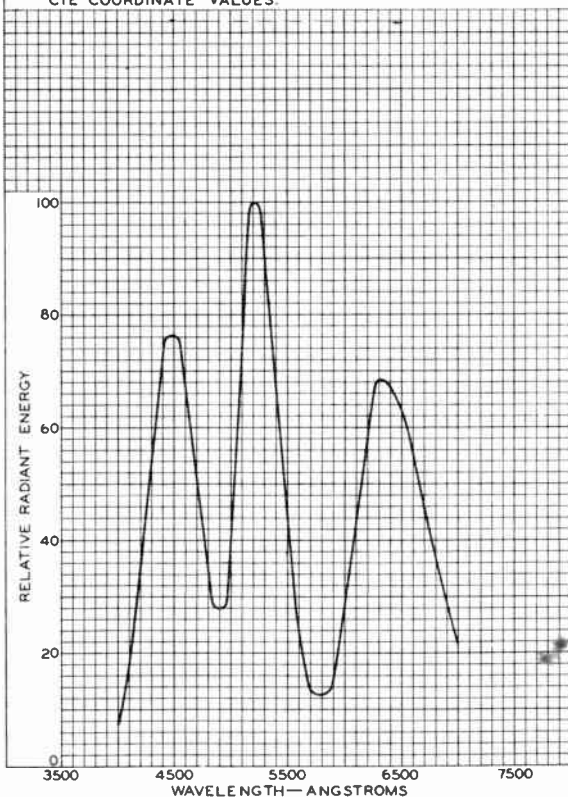
Group Phosphor P22

SPECTRAL-ENERGY EMISSION CHARACTERISTIC

SIMULTANEOUS EXCITATION OF BLUE PHOSPHOR, GREEN PHOSPHOR, AND RED PHOSPHOR TO PRODUCE 8500° K +27 M.P.C.D. WHITE ($X=0.287, Y=0.316$).

COMPONENT COLOR		CIE COORDINATES	
GENERAL DESCRIPTION	JEDEC DESIGNATION*	X	Y
BLUE	PURPLISH-BLUE	0.146	0.052
GREEN	YELLOWISH-GREEN	0.218	0.712
RED	REDDISH-ORANGE	0.674	0.326

*JEDEC COLOR CLASSIFICATION CORRESPONDING TO CIE COORDINATE VALUES.



92CM-7969R4



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GROUP PHOS-
PHOR P22
10-60

Group Phosphor P22

PERSISTENCE CHARACTERISTIC

The persistence of the group phosphorescence is such that its brightness does not exceed 7 per cent of the peak value in 33 milliseconds after excitation is removed.



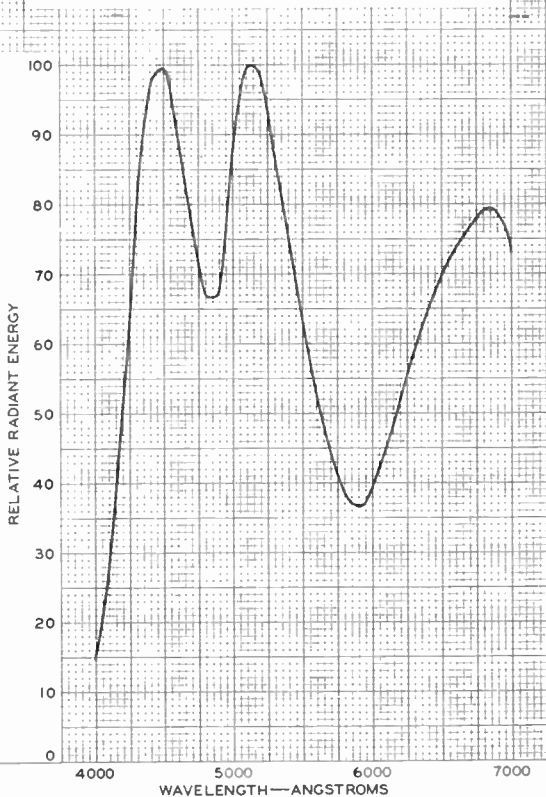
Group Phosphor P22

All-Sulfide Type

SPECTRAL-ENERGY EMISSION CHARACTERISTIC

SIMULTANEOUS EXCITATION OF BLUE PHOSPHOR, GREEN PHOSPHOR, AND RED PHOSPHOR TO PRODUCE 9300° K +27 M.P.C.D. WHITE (X=0.281, Y=0.311).

COMPONENT COLOR	C.I.E. COORDINATES	
	X	Y
BLUE	0.155	0.061
GREEN	0.265	0.585
RED	0.639	0.342



92CM-10857



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Electron Tube Division
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GROUP PHOS-
PHOR P22
5-61

Group Phosphor P22

All-Sulfide Type

PERSISTENCE CHARACTERISTIC

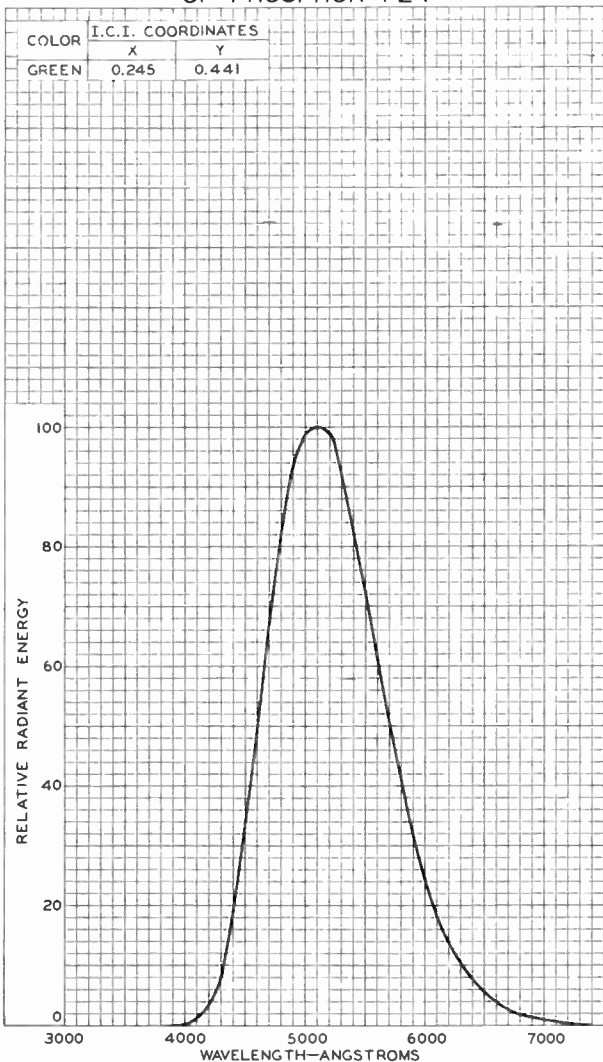
The persistence of the group phosphorescence is *medium short*. Persistence of the component phosphors is such that after excitation is removed, brightness decays to a level not exceeding 10 percent of the initial value in:

- 22 microseconds (Approx.) Blue phosphor
- 60 microseconds (Approx.) Green phosphor
- 60 microseconds (Approx.) Red phosphor





SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P24



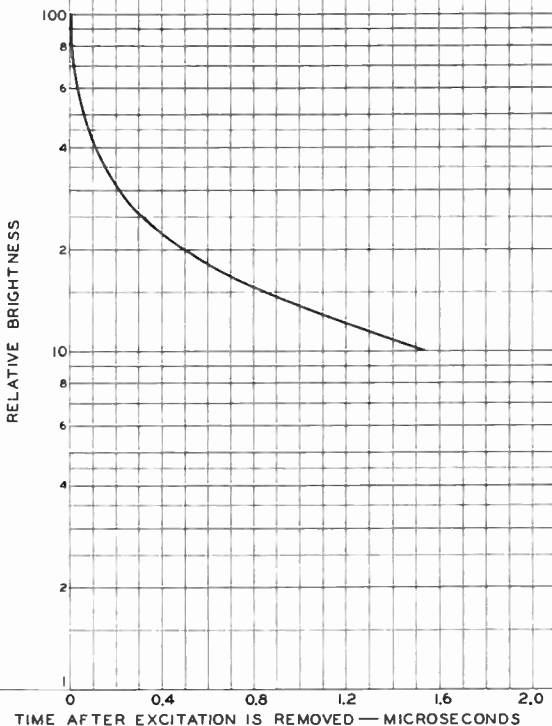
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8204R1



PERSISTENCE CHARACTERISTIC OF PHOSPHOR P24

CURVE IS ESSENTIALLY INDEPENDENT
OF TUBE OPERATING VALUES.
SPOT: SHARPLY FOCUSED.



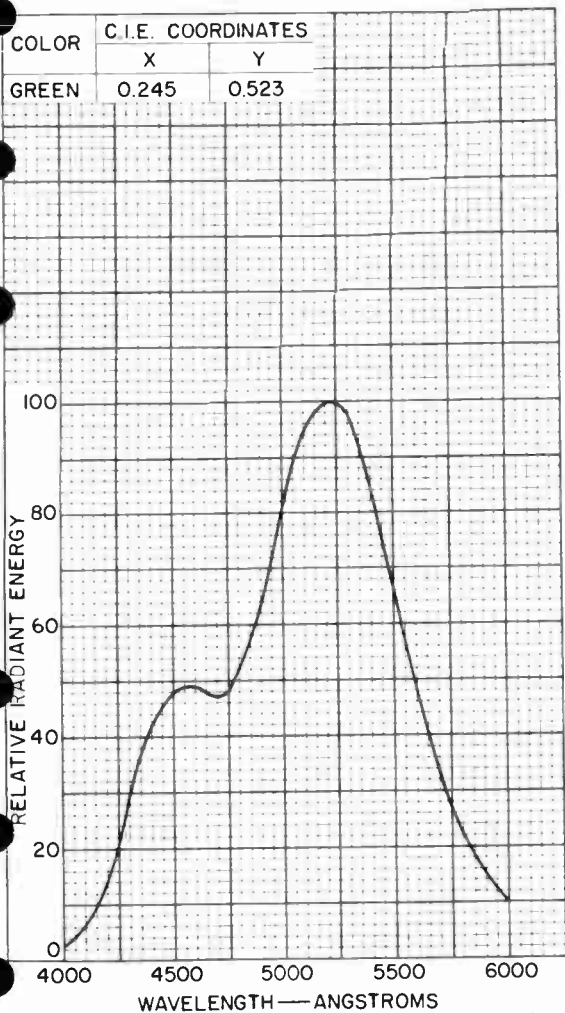
ELECTRON TUBE DIVISION

92CM - 8205R2

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

JEDEC PHOSPHOR P31

Spectral-Energy Emission Characteristic



92CM-11261

RCA

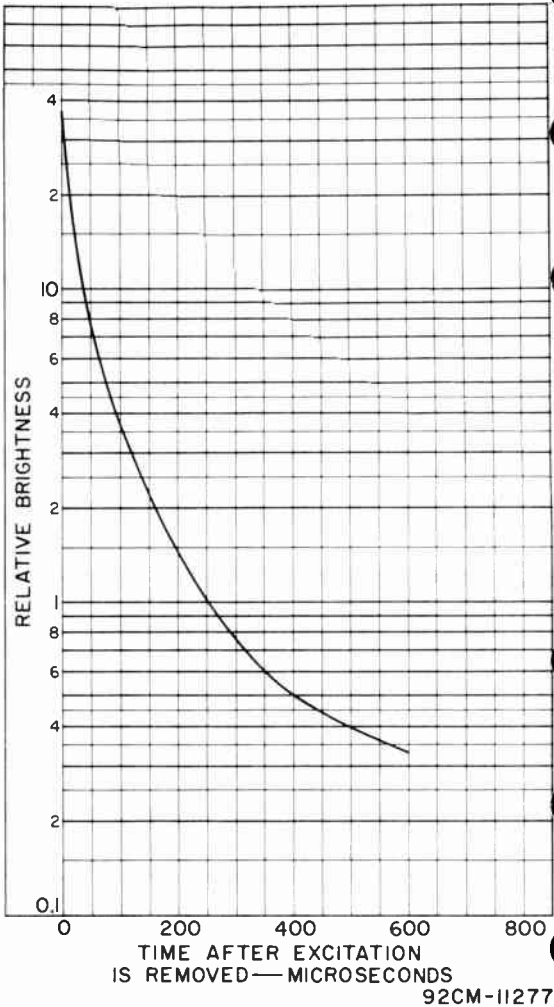
Electronic
Components

JEDEC PHOSPHOR P31

6-72

JEDEC PHOSPHOR P31

Persistence Characteristic



92CM-11277

Picture-Tube Dimensional Outlines

The *Dimensional Outlines* on the following pages provide the basic dimensions of RCA Picture Tubes. These Dimensional Outlines are classified by Bulb Designations in accordance with the designation system established by the American Standards Association. Tube neck length, tube overall length, base designation, and the configuration of the external conductive coating (when used) are not shown on these Dimensional Outlines. These items are covered on the data sheets for specific picture-tube types.

The terms used in the picture-tube data sheets to describe the *Type of External Conductive Coating* and the *Contact Area for Grounding* are defined below:

Type of External Conductive Coating

Regular Band. A band of external conductive coating of uniform height covering part of the bulb funnel. The band may entirely encompass the funnel except for an insulated area in the region of the anode (ultor) contact.

Modified Band. A coating configuration similar to a Regular Band except for special contouring of the upper and/or lower edges.

Special. A coating configuration not defined in the industry specification for the tube type.

Contact Area for Grounding

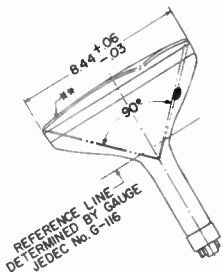
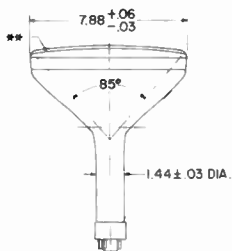
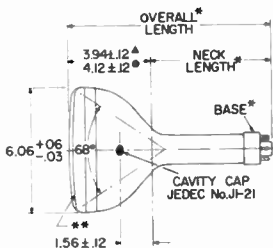
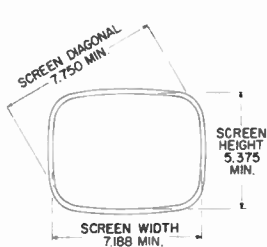
Near Reference Line. Refers to the position of the contact area usually employed for grounding a Regular or Modified Band of external conductive coating. A spring-finger contact mounted on the deflecting yoke or on the tube mounting assembly is normally employed for grounding the external conductive coating.

Special. Indicates that one or more contact areas for grounding the external conductive coating other than the area near the reference line are provided in the industry specification for the tube type.



Dimensional Outline Bulb J67-1/2 A

FOR PICTURE TUBES UTILIZING BULB J67-1/2 A
(For bulbs with and without integral protective window)



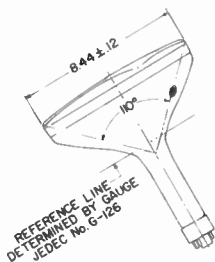
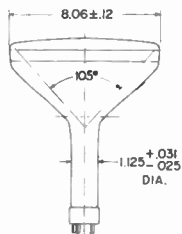
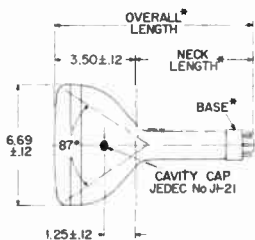
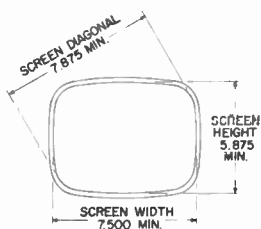
92CL-12472

DIMENSIONS IN INCHES

- ▲ See data for specific tube type.
- ** Integral protective window is indicated.
- ▲ For bulb without protective window.
- For bulb with protective window.

Dimensional Outline Bulb J67-1/2 B

FOR PICTURE TUBES UTILIZING BULB J67-1/2 B



92CL-12854

DIMENSIONS IN INCHES

* See data for specific tube type.

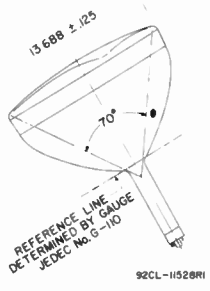
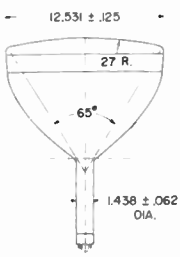
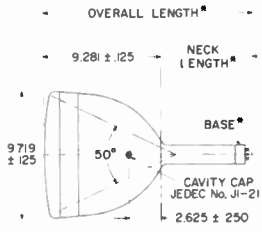
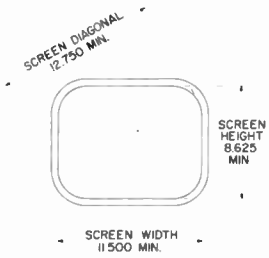


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CP*
OUTLINES 1A
4-65

Dimensional Outline Bulb J109-1/2 A/C

FOR PICTURE TUBES UTILIZING BULB J109-1/2 A/C



DIMENSIONS IN INCHES

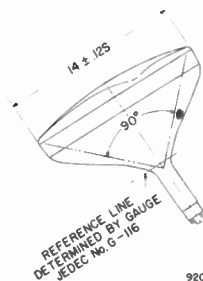
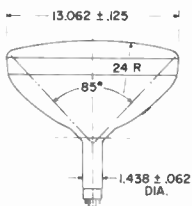
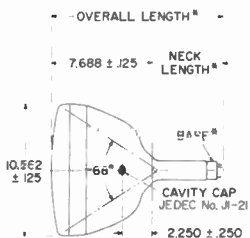
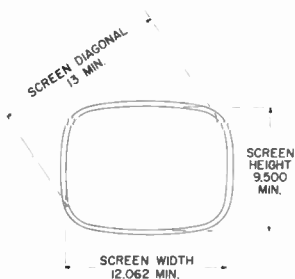
* See data for specific bulb type.



Dimensional Outline

Bulb J112 A/B

FOR PICTURE TUBES UTILIZING BULB J112 A/B



92CL-11506R1

DIMENSIONS IN INCHES

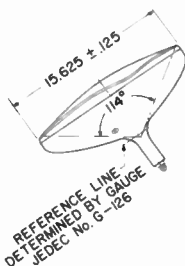
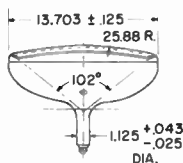
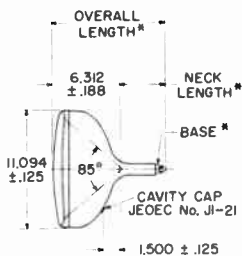
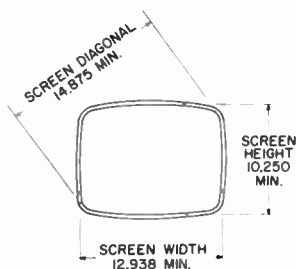
* See data for specific tube type.



Dimensional Outline

Bulb J125 A

FOR PICTURE TUBES UTILIZING BULB J125 A
AND PROTECTIVE WINDOW (FPI25 A)

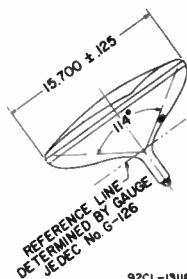
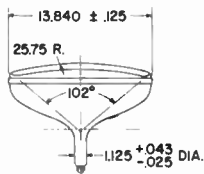
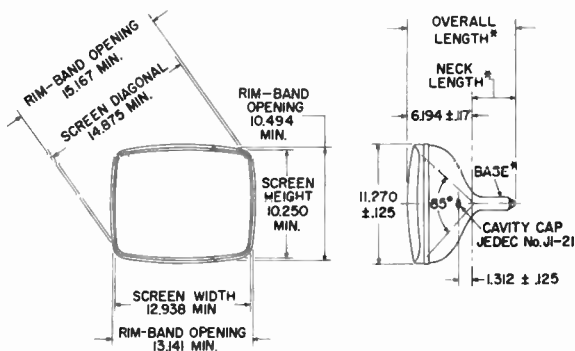


92CL-12264RI

DIMENSIONS IN INCHES

* See data for specific tube type.

FOR PICTURE TUBE UTILIZING BULB J125 B



92CL-13118

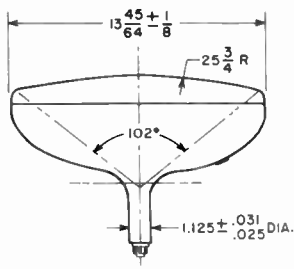
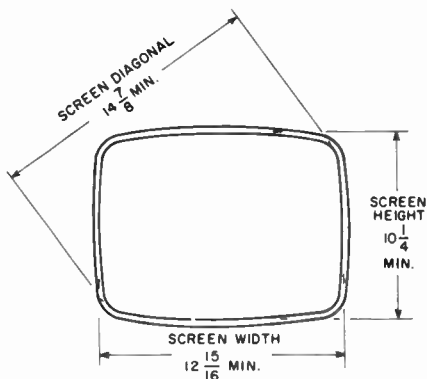
DIMENSIONS IN INCHES

* See data for specific tube type.



Dimensional Outline

FOR PICTURE TUBES UTILIZING BULB J125 C2



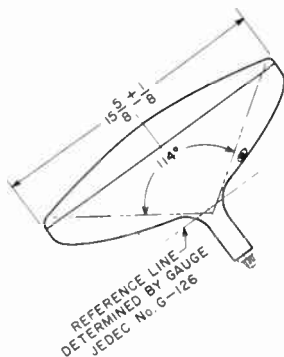
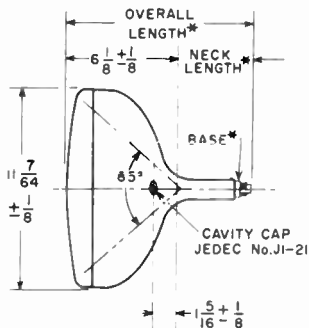
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Bulb J125 C2

BULB J125 C2



92CL-12037

DIMENSIONS IN INCHES



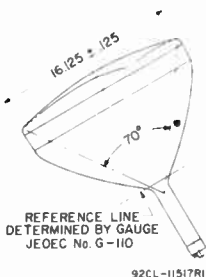
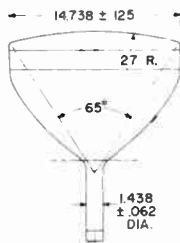
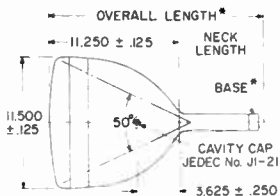
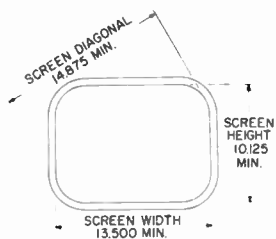
RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.

World Radio History

CONTINUED
1.60

Dimensional Outline Bulb J129 A/B

FOR PICTURE TUBES UTILIZING BULB J129 A/B

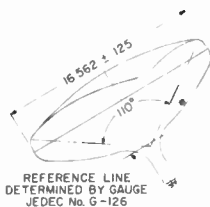
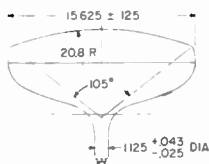
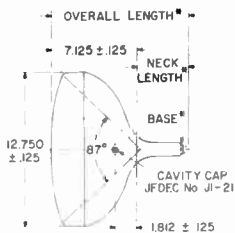
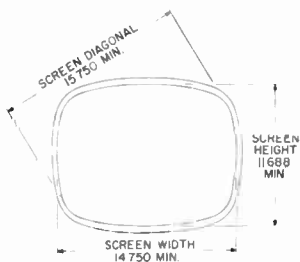


DIMENSIONS IN INCHES

* See data for specific tube type.

Dimensional Outline Bulb J132-1/2 A/B

FOR PICTURE TUBES UTILIZING BULB J132-1/2 A/B



92CL-11589R1

DIMENSIONS IN INCHES

* See data for specific tube type.



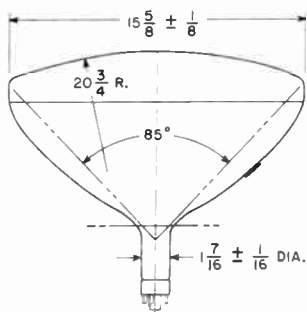
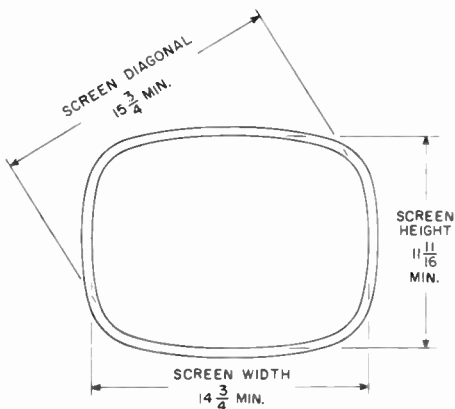
RADIO CORPORATION OF AMERICA
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World Radio History

CRT
OUTLINES 5
10-65

Dimensional Outline

FOR PICTURE TUBES UTILIZING BULB J132-1/2 C/D



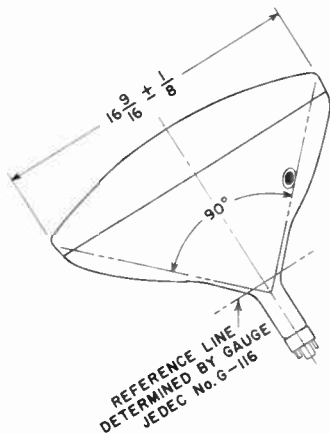
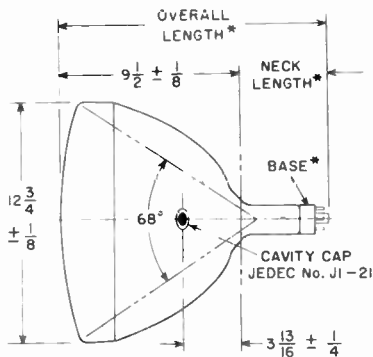
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Bulb J132-1/2 C/D

BULB J132-1/2 C/D



92CL-11514

ALL DIMENSIONS IN INCHES

* see data for specific tube type.



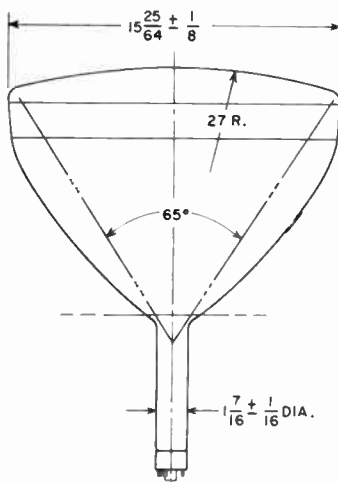
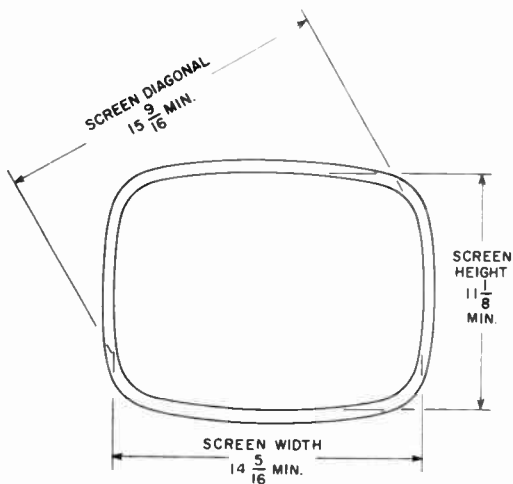
RADIO CORPORATION OF AMERICA
Electron Tube Division
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World Radio History

CRT
OUTLINES 6
3-62

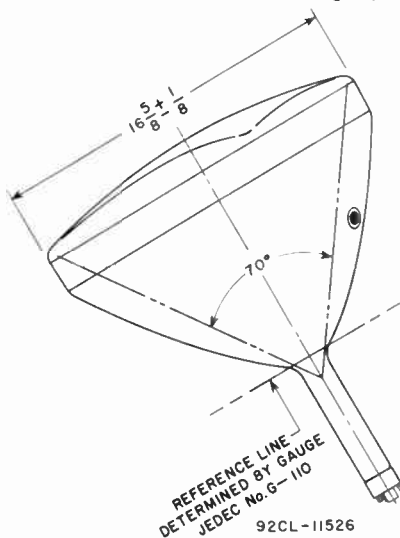
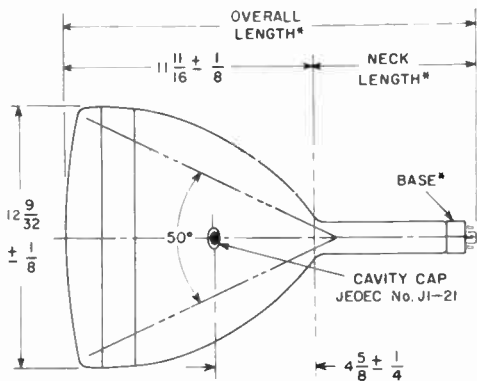
Dimensional Outline

FOR PICTURE TUBES UTILIZING



Bulb J133 B/D

BULB J133 B/D



ALL DIMENSIONS IN INCHES

* See data for specific tube type.



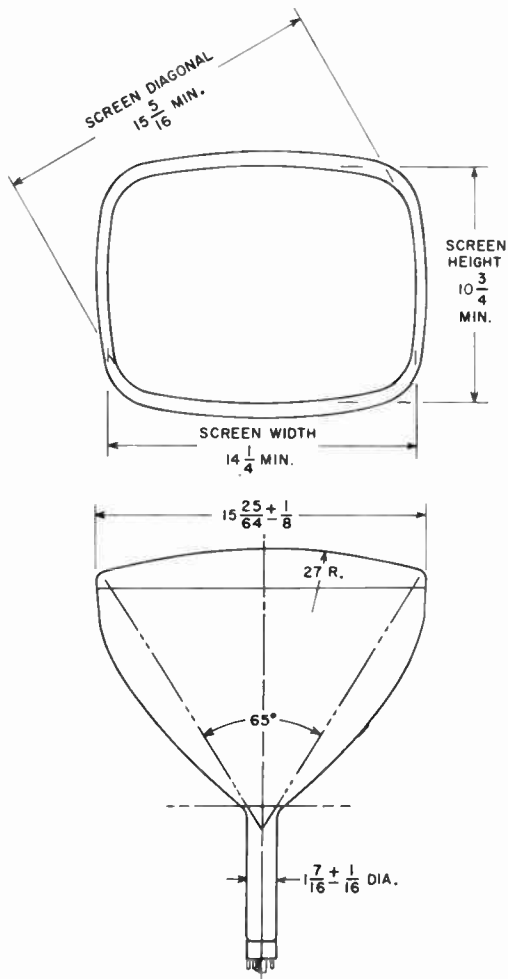
RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.

World Radio History

CRT
OUTLINES 7
3-62

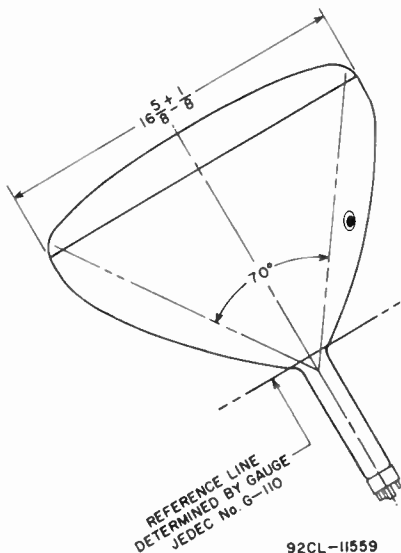
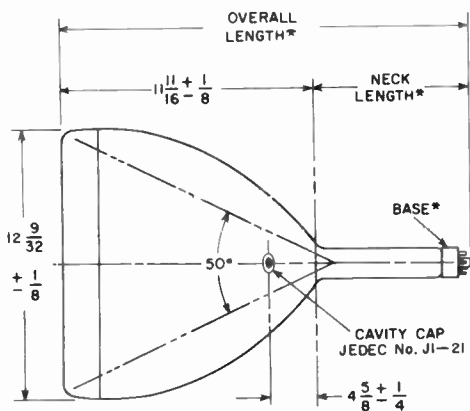
Dimensional Outline

FOR PICTURE TUBES UTILIZING



Bulb J133 C/E

BULB J133 C/E



ALL DIMENSIONS IN INCHES

* See data for specific tube type.



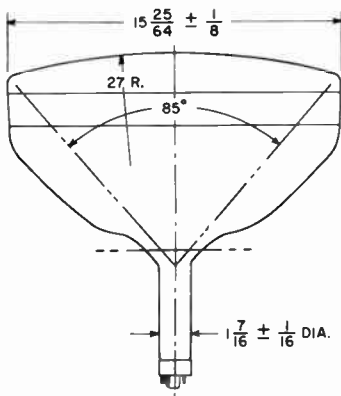
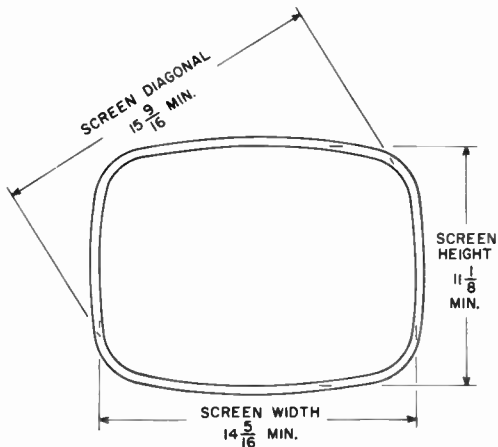
RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.

World Radio History

CRT
OUTLINES B
3-62

Dimensional Outline

FOR PICTURE TUBES UTILIZING



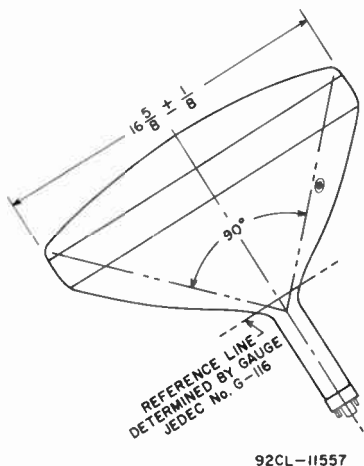
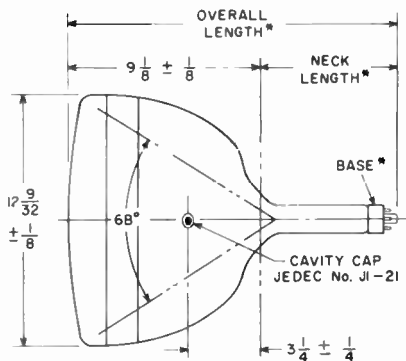
RADIO CORPORATION OF AMERICA
Electron Tube Division

Harrison, N. J.



Bulb J133 F/G

BULB J133 F/G



DIMENSIONS IN INCHES

* See data for specific tube type.



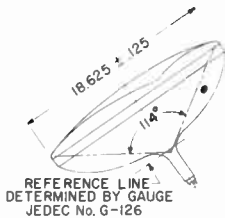
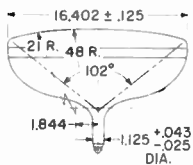
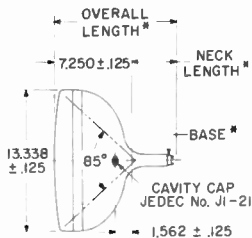
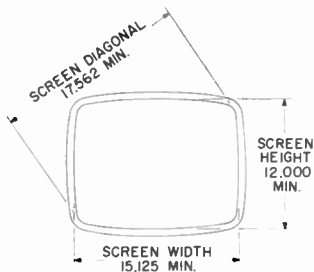
RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.

CRT
OUTLINES 9
10-65

Dimensional Outline

Bulb J149 A

FOR PICTURE TUBES UTILIZING BULB J149 A

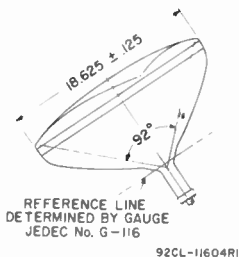
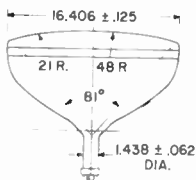
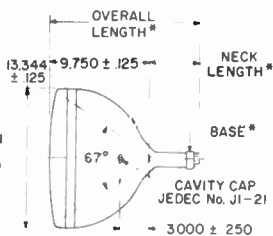
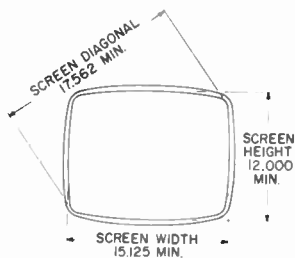


92CL-11510R1

DIMENSIONS IN INCHES

* See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J149 B



DIMENSIONS IN INCHES

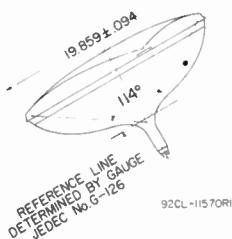
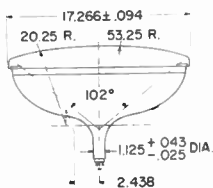
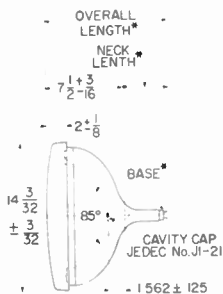
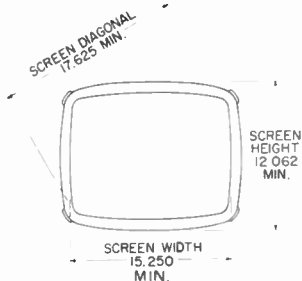
* See data for specific tube type.



Dimensional Outline

Bulb J149 C

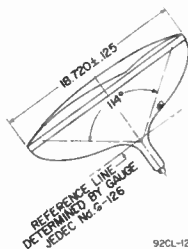
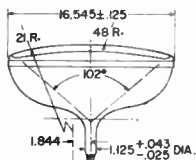
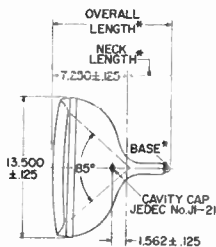
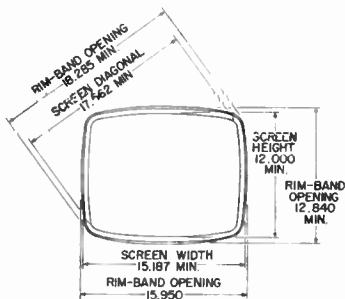
FOR PICTURE TUBES UTILIZING BULB J149 C AND PROTECTIVE PANEL



DIMENSIONS IN INCHES

* See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J149 F



92CL-12356R1

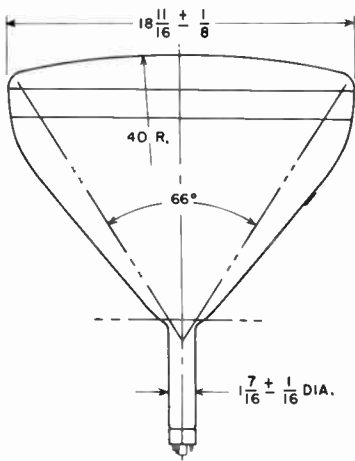
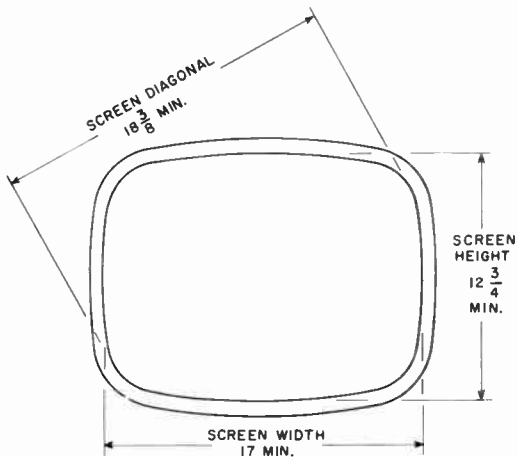
DIMENSIONS IN INCHES

*See data for specific tube type.



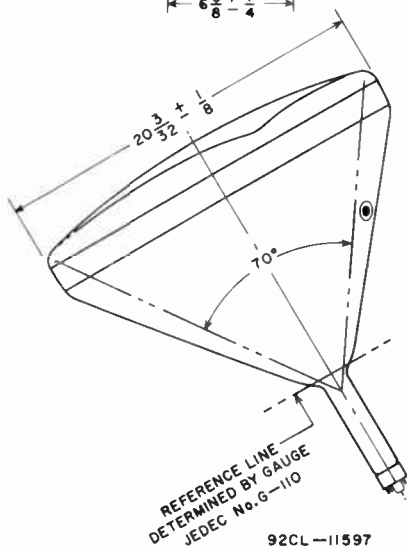
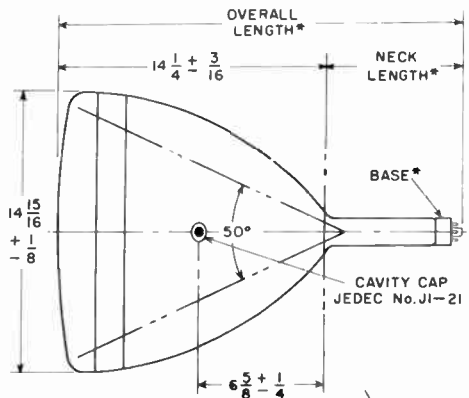
Dimensional Outline

FOR PICTURE TUBES UTILIZING BULB J161 C/D



Bulb J161 C/D

BULB J161 C/D



ALL DIMENSIONS IN INCHES

* See data for specific tube type.

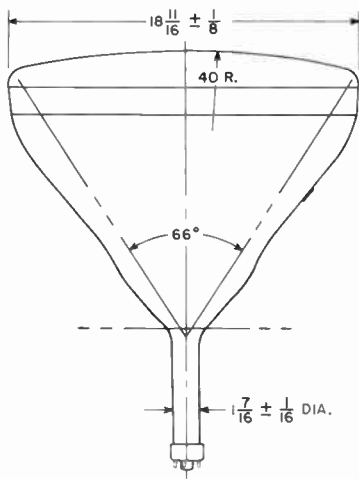
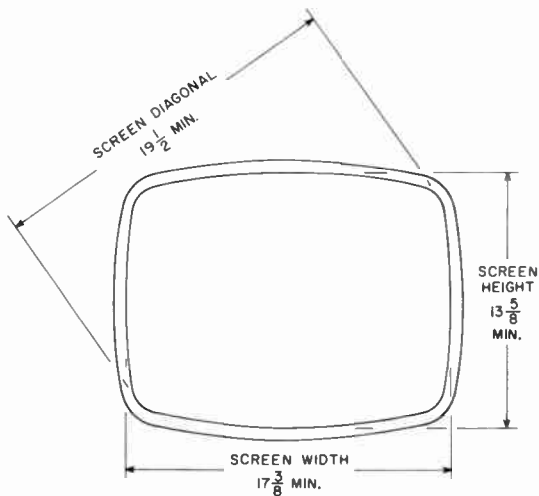


RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.

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Dimensional Outline

FOR PICTURE TUBES UTILIZING



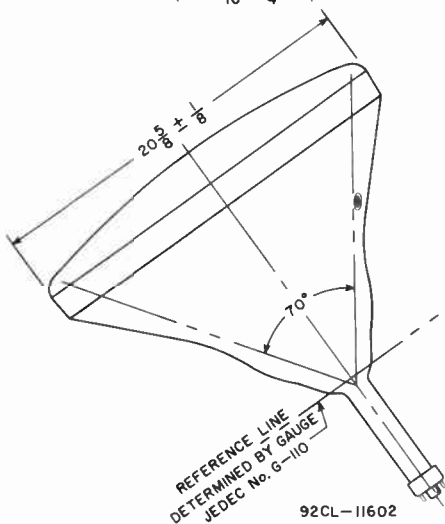
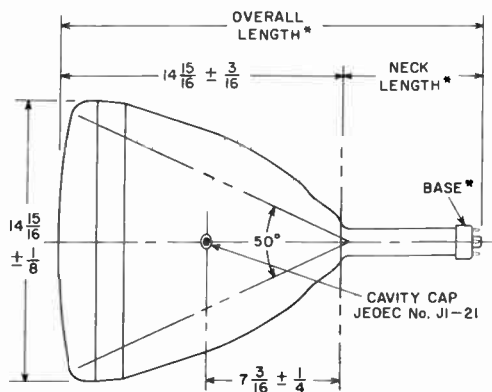
RADIO CORPORATION OF AMERICA
Electron Tube Division

Harrison, N. J.



Bulb J165 Z

BULB J165 Z



ALL DIMENSIONS IN INCHES

*See data for specific tube type.



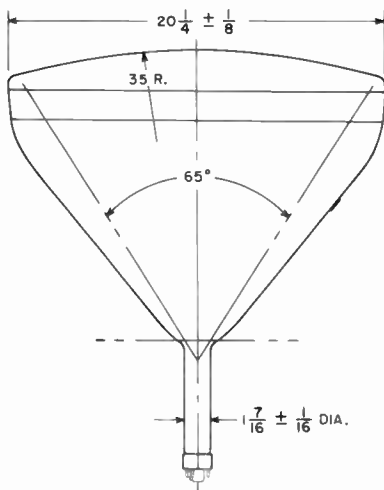
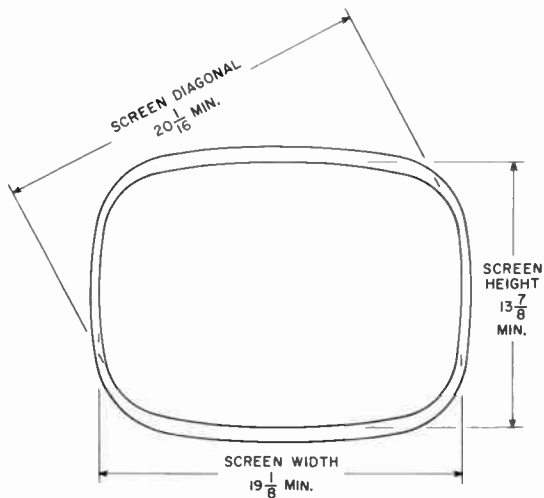
RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.

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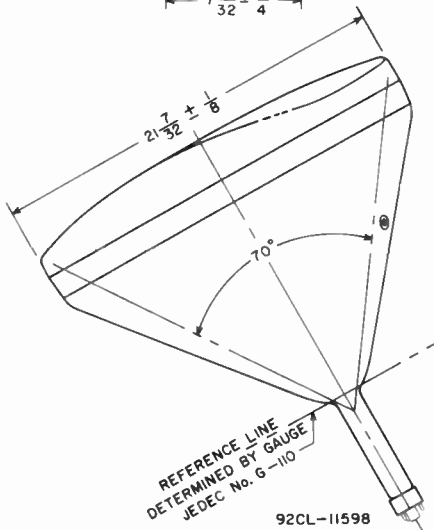
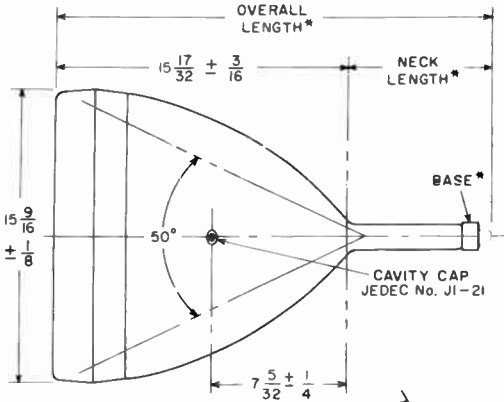
Dimensional Outline

FOR PICTURE TUBES UTILIZING



Bulb J170 A/C

BULB J170 A/C



ALL DIMENSIONS IN INCHES

* See data for specific tube type.



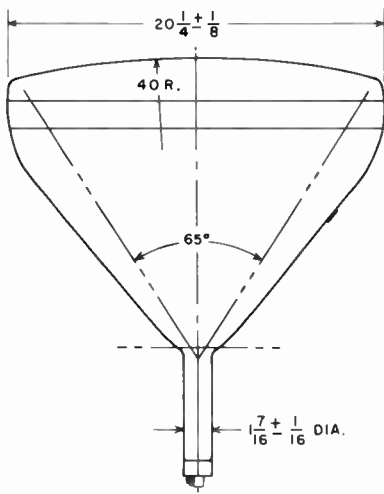
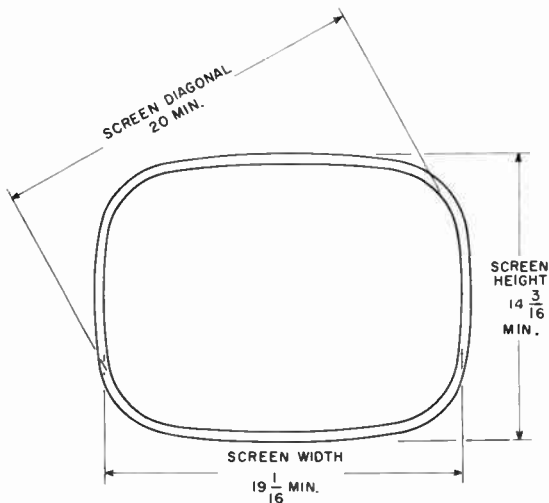
RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.

World Radio History

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Dimensional Outline

FOR PICTURE TUBES UTILIZING



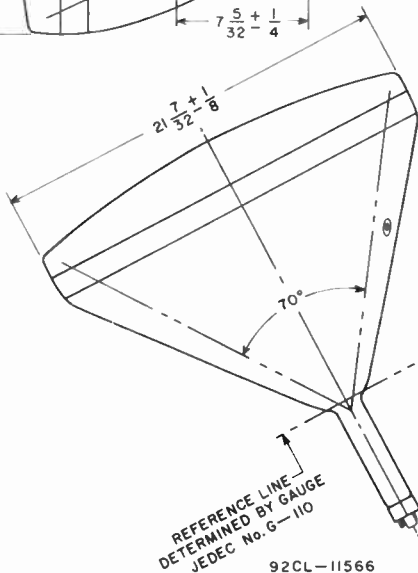
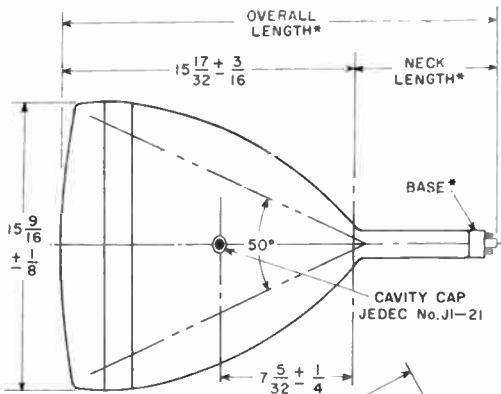
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Bulb J170 B/D

BULB J170 B/D



ALL DIMENSIONS IN INCHES

* See data for specific tube type.



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Electron Tube Division

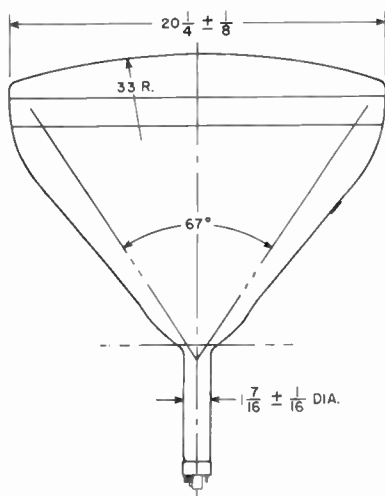
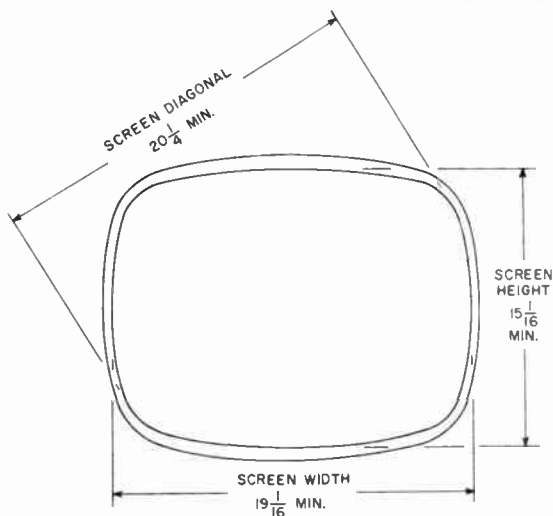
World Radio History

Harrison, N. J.

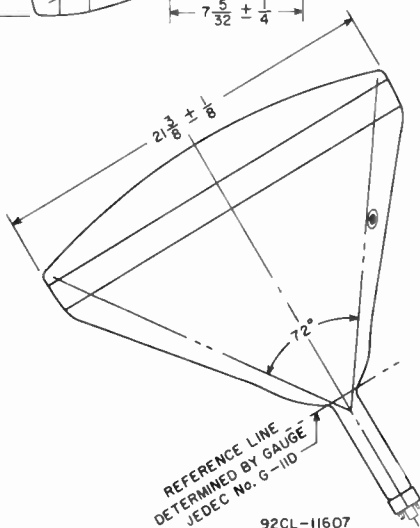
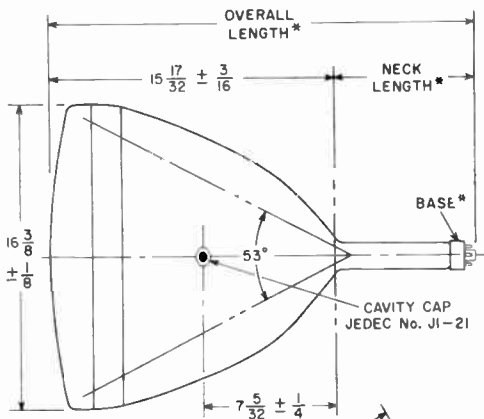
CRT
OUTLINES 16
3-62

Dimensional Outline

FOR PICTURE TUBES UTILIZING



BULB J171 B/F



ALL DIMENSIONS IN INCHES

*See data for specific tube type.

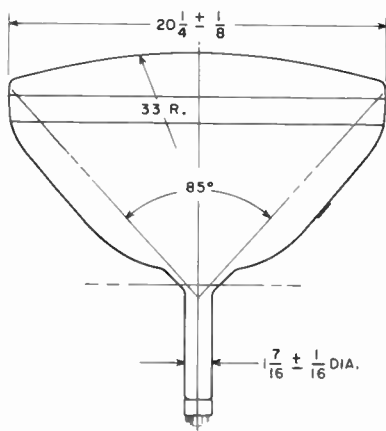
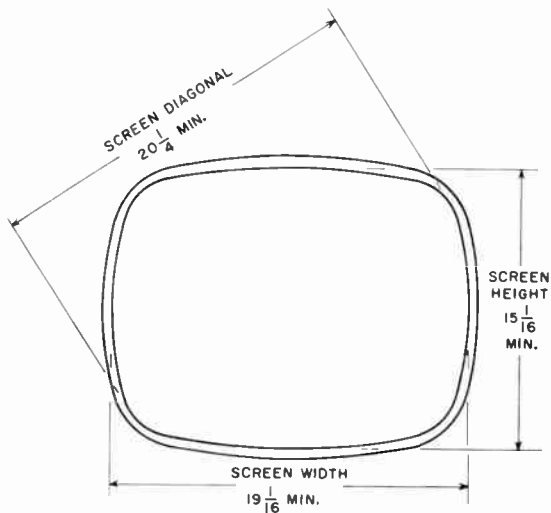


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Electron Tube Division
Harrison, N. J.

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Dimensional Outline

FOR PICTURE TUBES UTILIZING

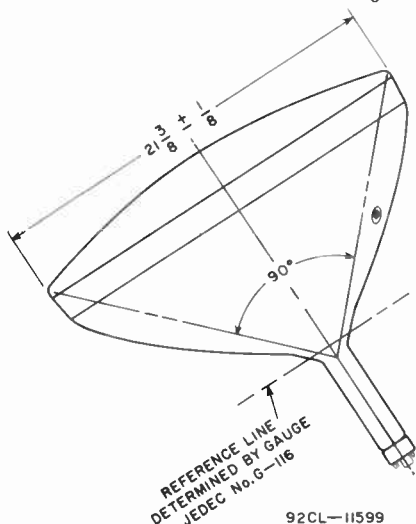
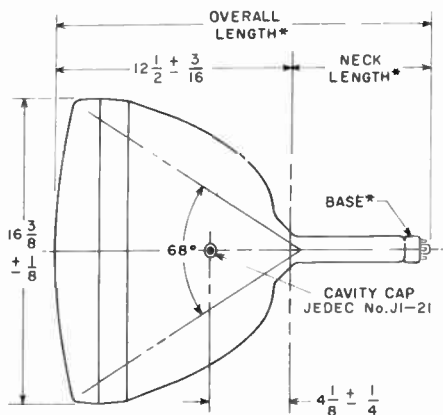


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Electron Tube Division

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BULB J171 D/E



ALL DIMENSIONS IN INCHES

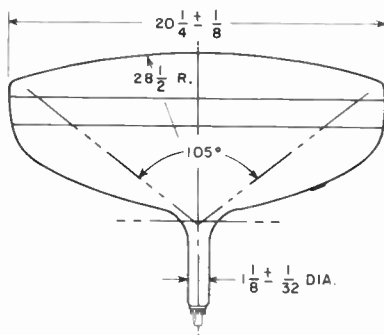
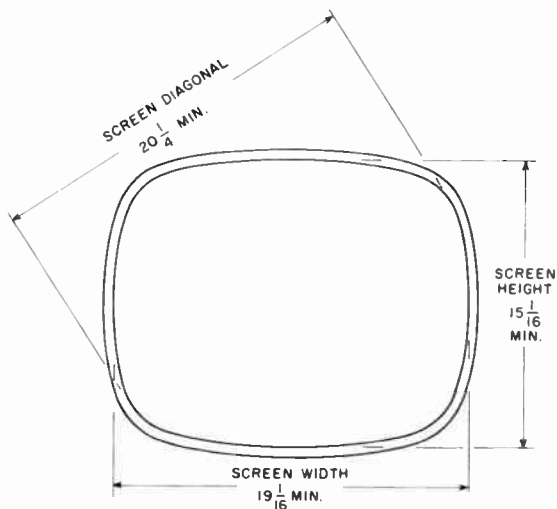
* See data for specific tube type.



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Electron Tube Division
Harrison, N. J.

Dimensional Outline

FOR PICTURE TUBES UTILIZING



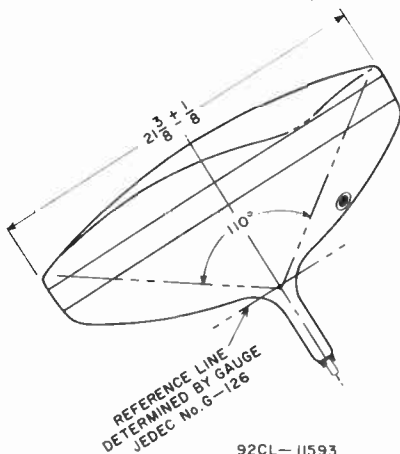
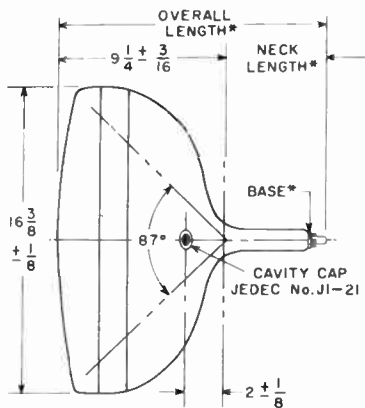
RADIO CORPORATION OF AMERICA
Electron Tube Division

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Bulb J171 G/K

BULB J171 G/K



92CL-11593

ALL DIMENSIONS IN INCHES

* See data for specific tube type.



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Electron Tube Division

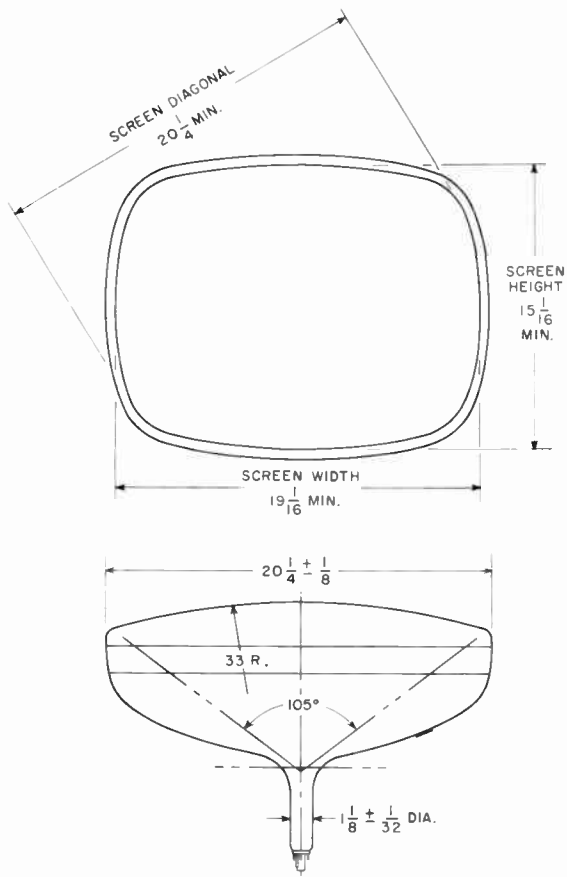
Harrison, N. J.

World Radio History

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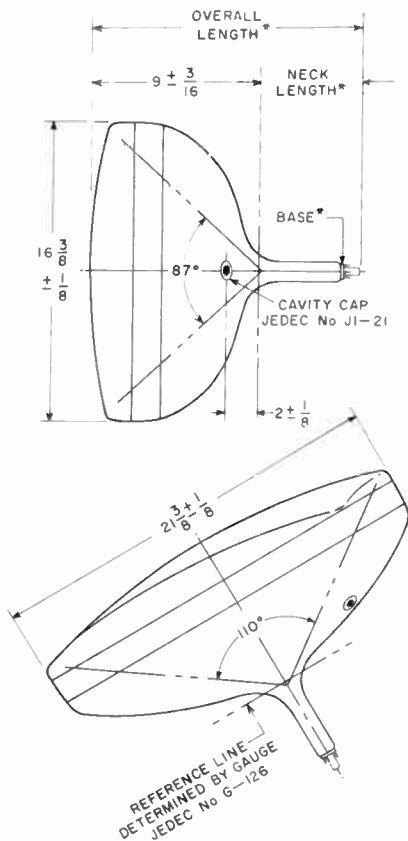
Dimensional Outline

FOR PICTURE TUBES UTILIZING



Bulb J171 H/J

BULB J171 H/J



92CL-11572

DIMENSIONS IN INCHES

*See data for specific tube type.



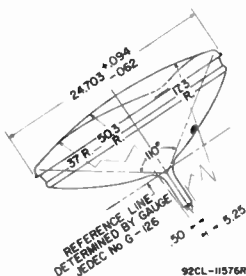
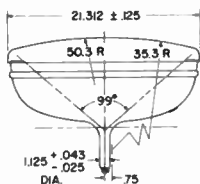
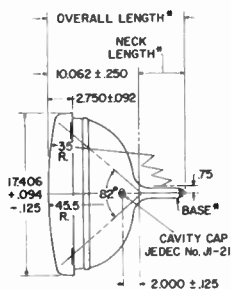
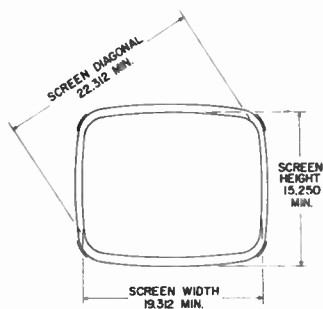
RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.

CRT
OUTLINES 20
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Dimensional Outline

Bulb J187 A

FOR PICTURE TUBES UTILIZING BULB J187A
AND PROTECTIVE PANEL FP198



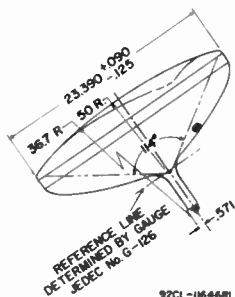
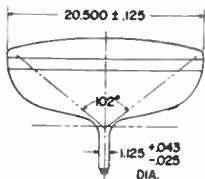
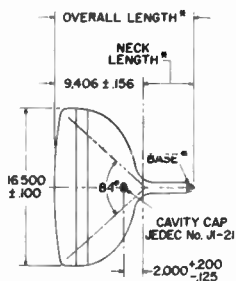
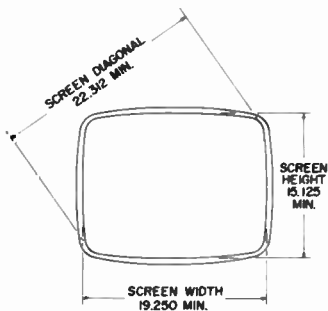
DIMENSIONS IN INCHES

* See data for specific tube type.

Dimensional Outline

Bulb J187 B

FOR PICTURE TUBES UTILIZING BULB J187 B



92CL-11646R1

DIMENSIONS IN INCHES

* See data for specific tube type.

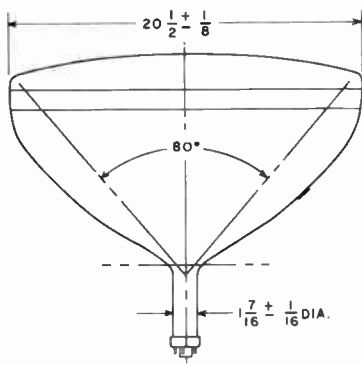
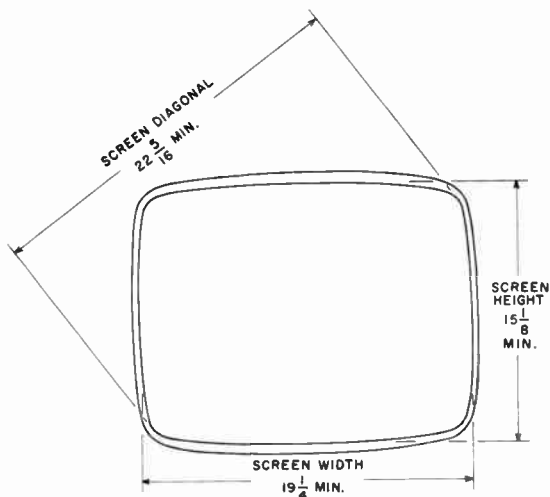


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Harrison, N. J.

CRT
OUTLINES 22
4-65

Dimensional Outline

FOR PICTURE TUBES UTILIZING BULB J187 C/F



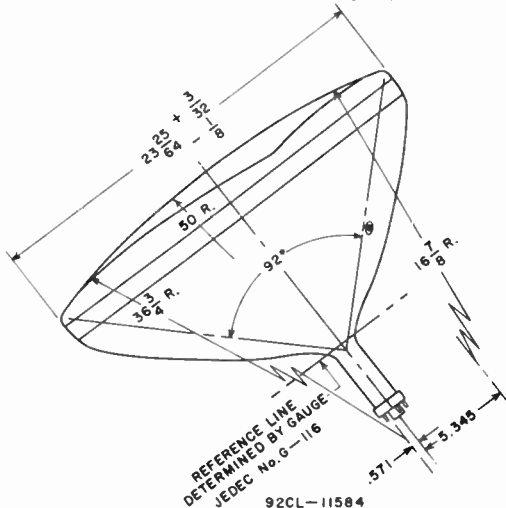
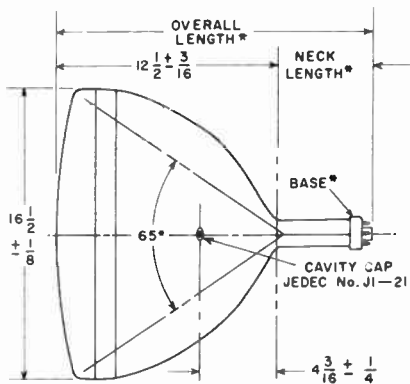
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Bulb J187 C/F

BULB J187 C/F



ALL DIMENSIONS IN INCHES

* See data for specific tube type.



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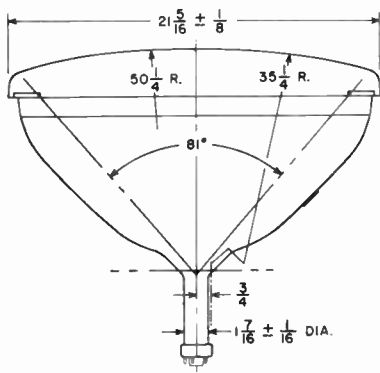
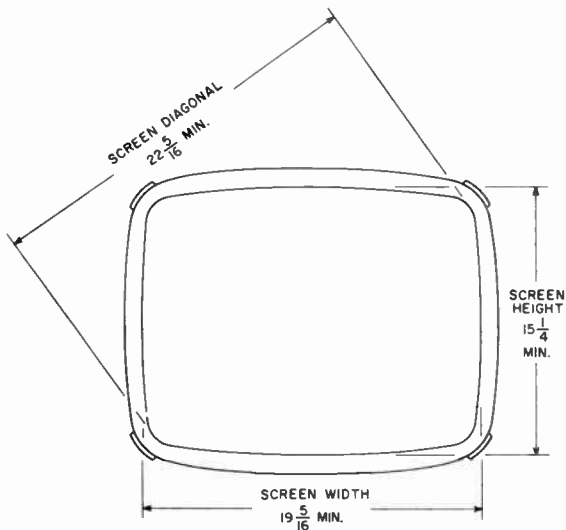
World Radio History

Harrison, N. J.

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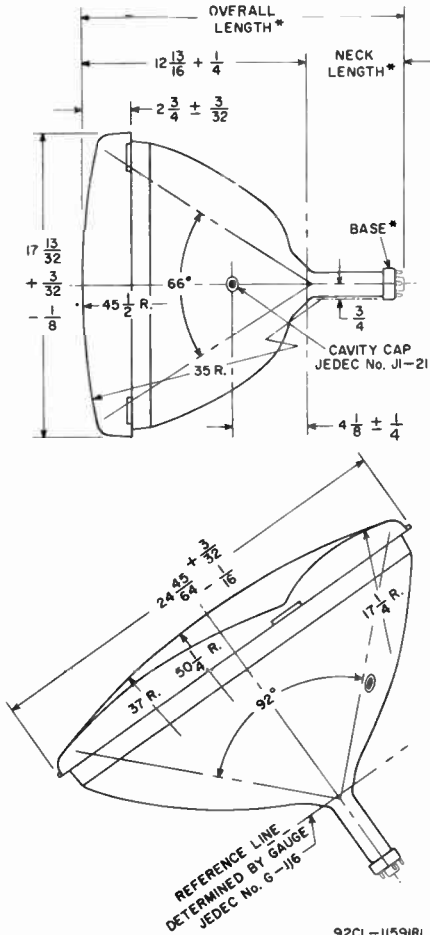
Dimensional Outline

FOR PICTURE TUBES UTILIZING



Bulb J187 D/G

BULB J187 D/G AND PROTECTIVE PANEL



DIMENSIONS IN INCHES

*See data for specific tube type.



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Electronic Components and Devices
World Radio History

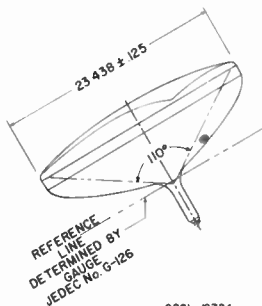
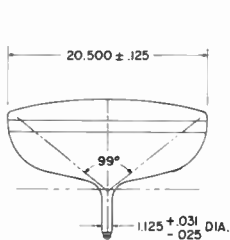
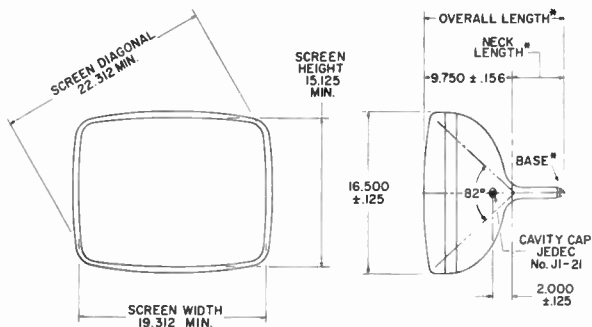
Harrison, N. J.

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8-64

Dimensional Outline

Bulb J187 E

FOR PICTURE TUBES UTILIZING BULB J187 E

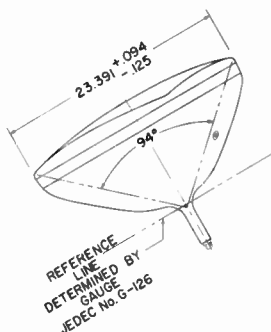
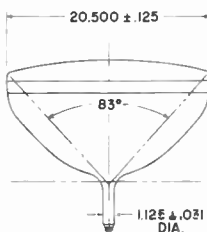
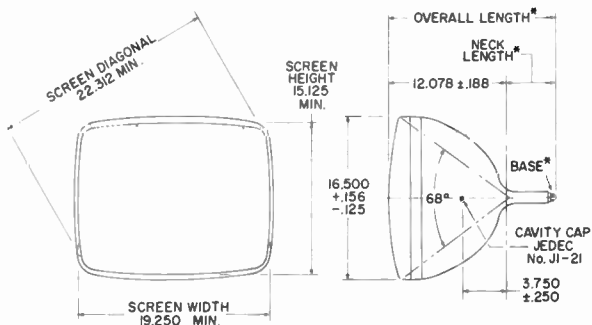


92CL-2724

DIMENSIONS IN INCHES

*See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J187 HI



92CL-12139R1

DIMENSIONS IN INCHES

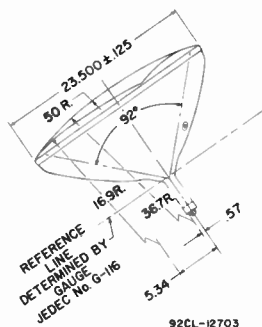
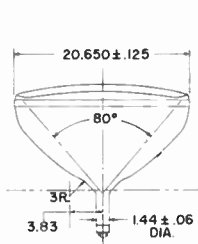
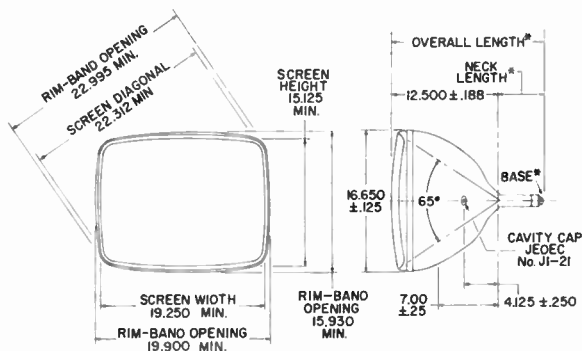
*See data for specific tube type.



Dimensional Outline

Bulb J187 J

FOR PICTURE TUBES UTILIZING BULB J187 J



DIMENSIONS IN INCHES

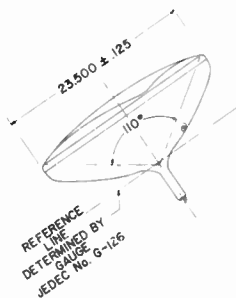
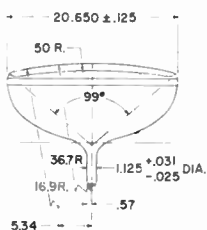
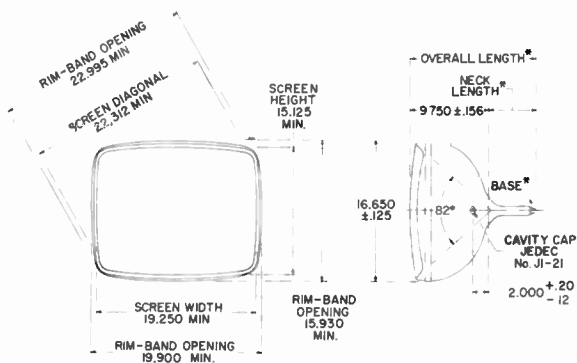
*See data for specific tube type.

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FOR PICTURE TUBES UTILIZING BULB J187 K



92CL-12702

DIMENSIONS IN INCHES

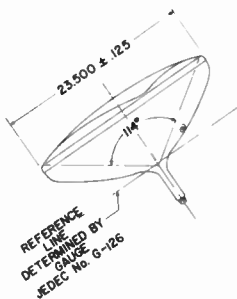
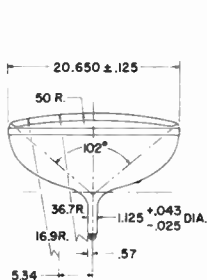
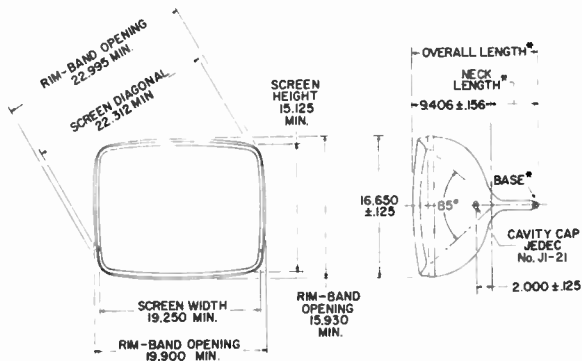
*See data for specific tube type.



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Electronic Components and Devices
Harrison, N. J.

CRT
OUTLINES 26
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FOR PICTURE TUBES UTILIZING BULB J187 L

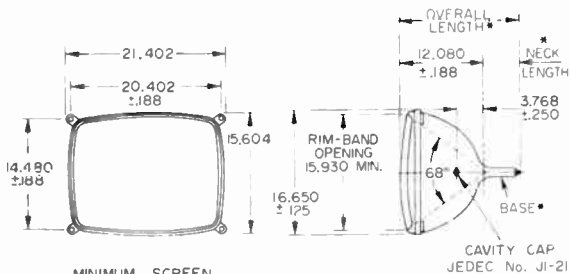


92CL-13019

DIMENSIONS IN INCHES

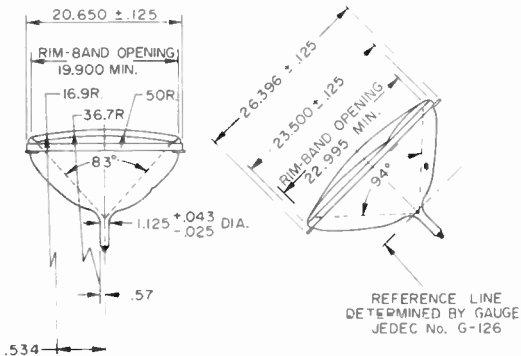
*See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J187 M



MINIMUM SCREEN

DIAGONAL 22.312
 GREATEST WIDTH 19.250
 GREATEST HEIGHT 15.125



92LM-477

DIMENSIONS IN INCHES

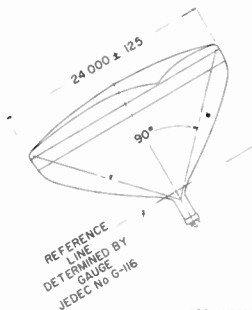
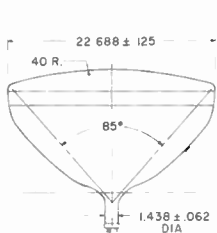
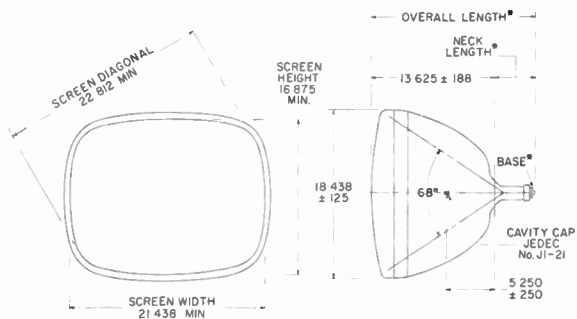
For more information on picture tube tubes, visit our website at www.rca.com



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Dimensional Outline Bulb J192 A/B

FOR PICTURE TUBES UTILIZING BULB J192 A/B



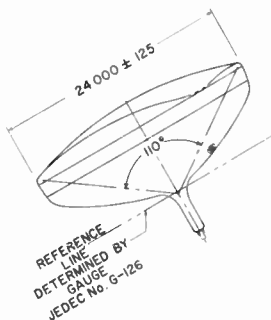
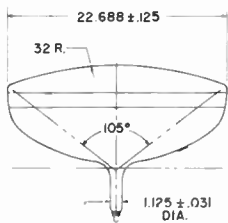
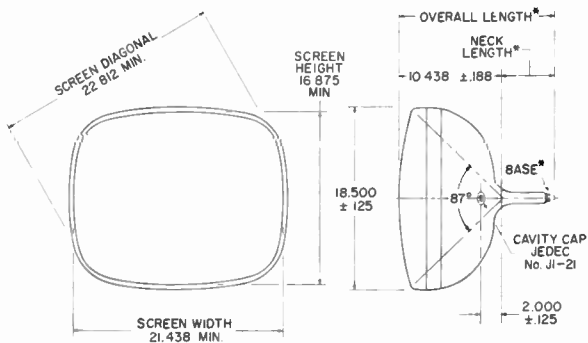
92CL-11583R1

DIMENSIONS IN INCHES



Dimensional Outline Bulb J192 C/D

FOR PICTURE TUBES UTILIZING BULB J192 C/D



92 CL-11587RI

DIMENSIONS IN INCHES

*See data for specific tube type.



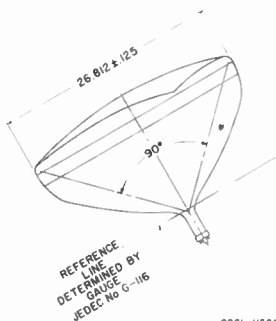
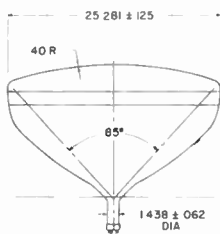
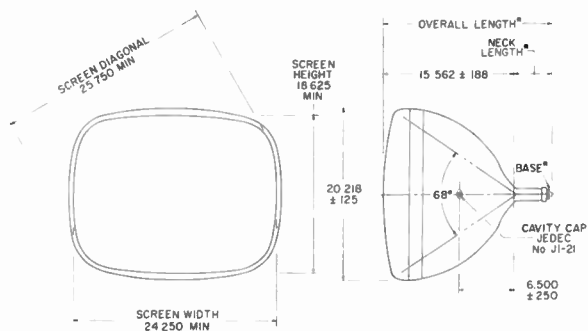
RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.

World Radio History

CRT
OUTLINES 27
8-64

Dimensional Outline Bulb J214-1/2 A

FOR PICTURE TUBES UTILIZING BULB J214-1/2 A



92CL-11586R1

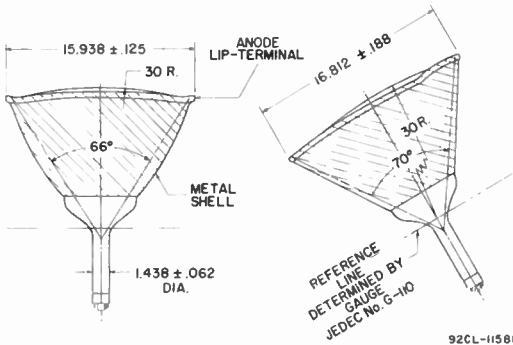
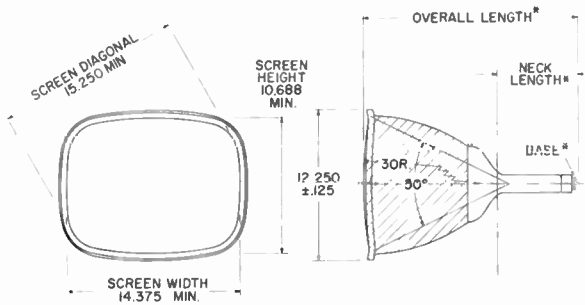
DIMENSIONS IN INCHES

*See data for specific tube type.

Dimensional Outline

Bulb MJ135 A

FOR PICTURE TUBES UTILIZING BULB MJ135 A



DIMENSIONS IN INCHES

*See data for specific tube type.



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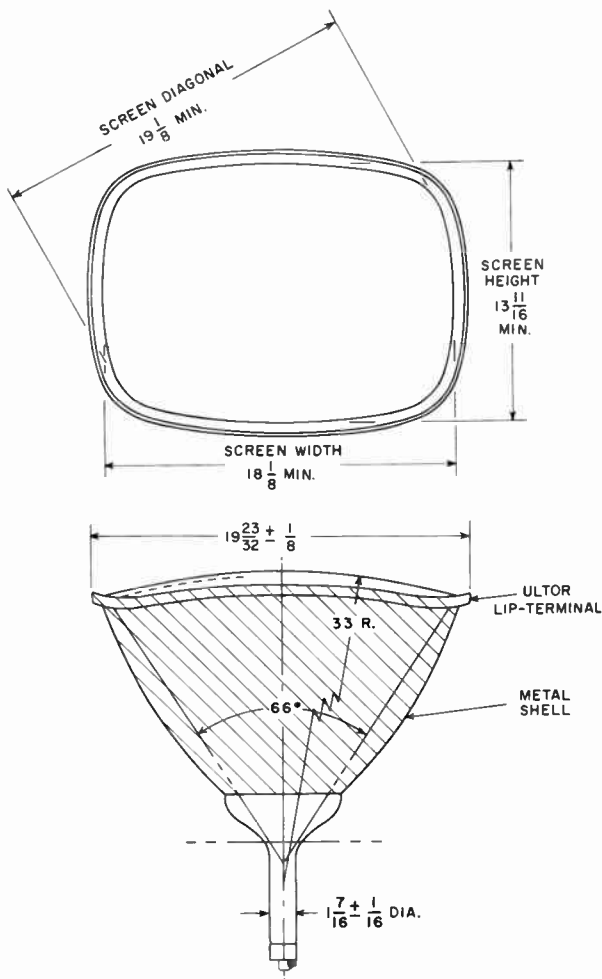
World Radio History

Harrison, N. J.

CRT
OUTLINES 28
8-64

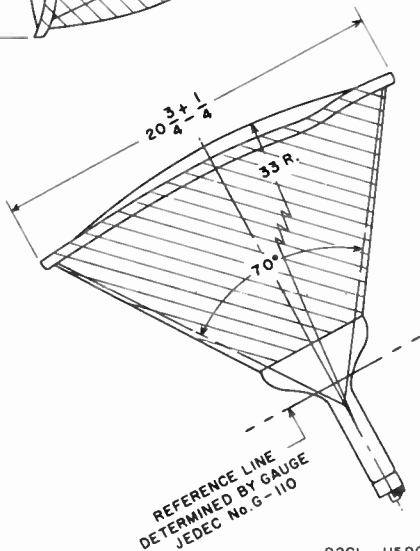
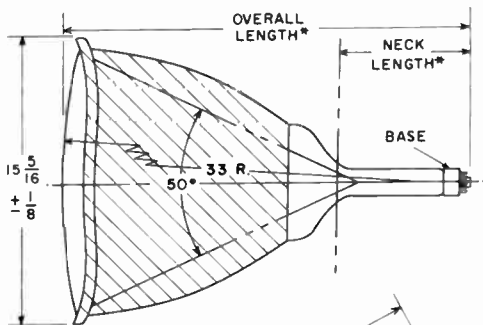
Dimensional Outline

FOR PICTURE TUBES UTILIZING BULB MJ166 A



Bulb MJ166 A

BULB MJ166 A



ALL DIMENSIONS IN INCHES

* See data for specific tube type.

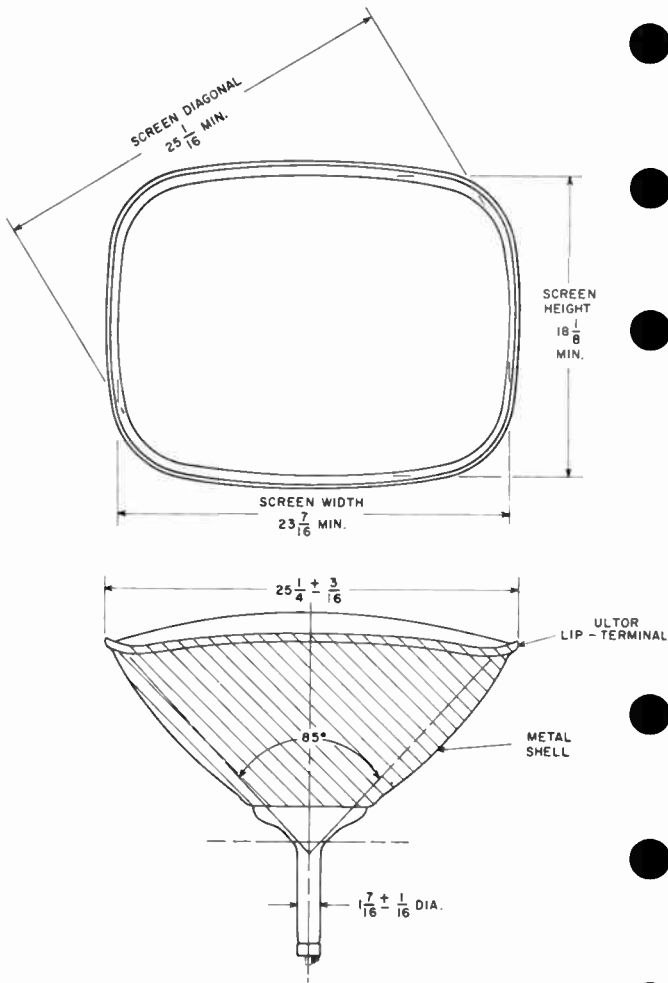


RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.

CRT
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Dimensional Outline

FOR PICTURE TUBES UTILIZING



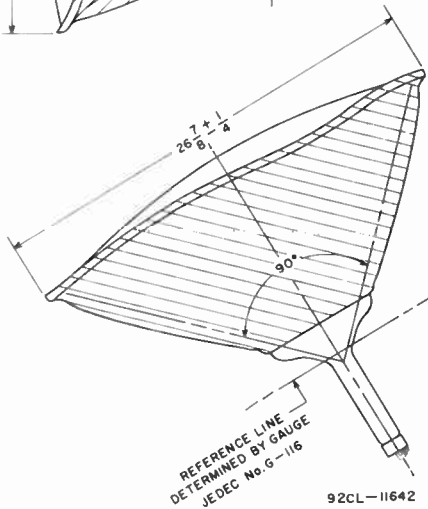
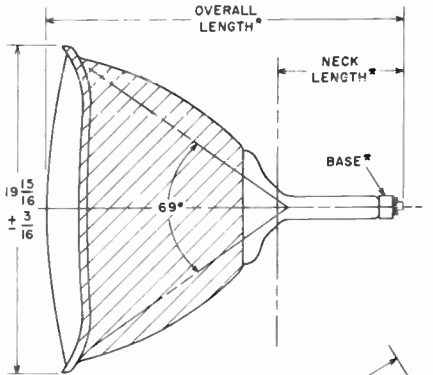
RADIO CORPORATION OF AMERICA
Electron Tube Division

Harrison, N. J.



Bulb MJ214 A

BULB MJ214 A



ALL DIMENSIONS IN INCHES

* See data for specific tube type.



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

World Radio History

CRT
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3-62



X-Radiation Precautions

For Cathode-Ray Tubes

WARNING

All types of cathode-ray tubes may be operated at voltages (where ratings permit) up to 16 kilovolts without personal injury on prolonged exposure at close range.

Above 16 kilovolts, special shielding precautions for X radiation may be necessary.



Definitions

Of Cathode-Ray-Tube Terms

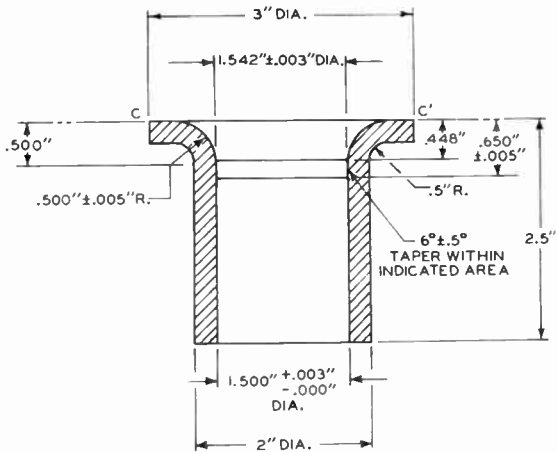
Ultor. The "ultor" in a cathode-ray tube is the element to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection.

Post-Ultor. The "post-ultor" in a cathode-ray tube is the element to which is applied a dc voltage higher than the ultor voltage for accelerating the electrons in the beam after its deflection.





REFERENCE-LINE GAUGE JETEC N^o G-110

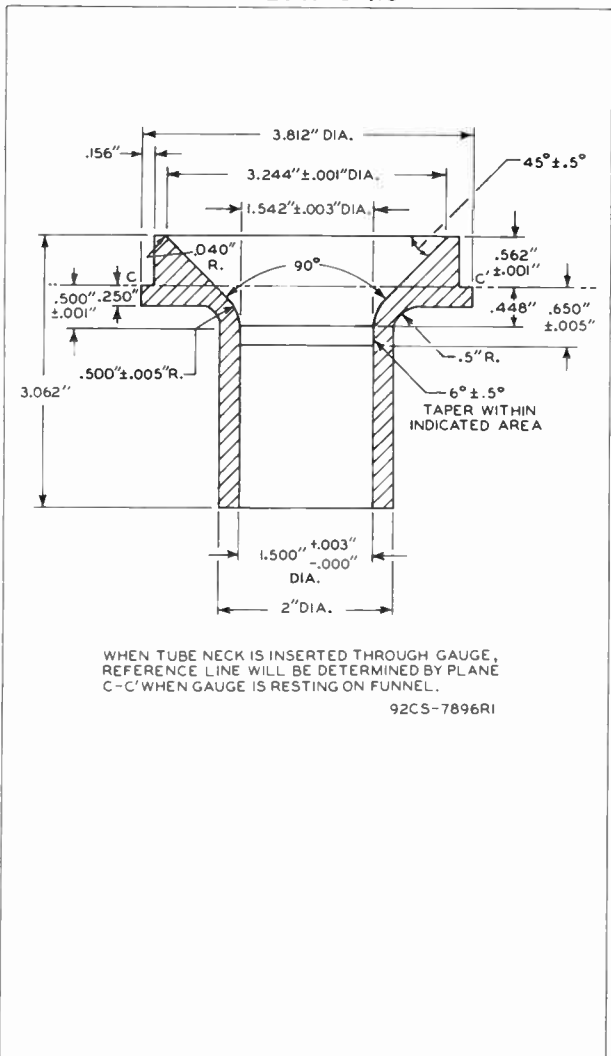


WHEN TUBE NECK IS INSERTED THROUGH GAUGE,
REFERENCE LINE WILL BE DETERMINED BY PLANE
C-C' WHEN GAUGE IS RESTING ON FUNNEL.

92CS-7391R1



REFERENCE-LINE GAUGE JETEC N°G-116

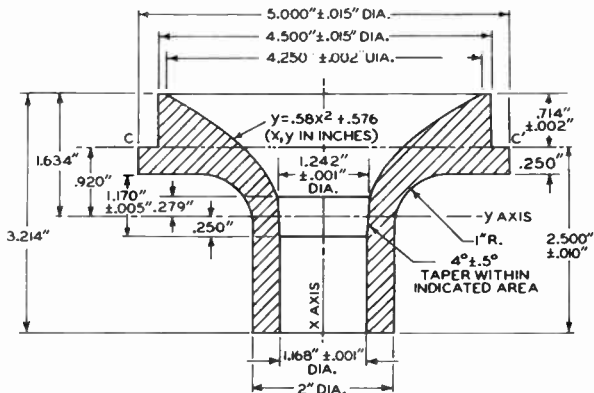


WHEN TUBE NECK IS INSERTED THROUGH GAUGE,
REFERENCE LINE WILL BE DETERMINED BY PLANE
C-C WHEN GAUGE IS RESTING ON FUNNEL.

92CS-7896R1



REFERENCE-LINE GAUGE JETEC N^oG-126



WHEN TUBE NECK IS INSERTED THROUGH GAUGE,
REFERENCE LINE WILL BE DETERMINED BY PLANE
C-C' WHEN GAUGE IS RESTING ON FUNNEL.

"y" VALUES MUST BE HELD TO ±.002."

92CS-9145R1





IEPI

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

IEPI

DATA

General:

Heater, for Unipotential Cathode:

Voltage 6.3 ac or dc volts
Current 0.6 ± 10% amp

Direct Interelectrode Capacitances (Approx.):

Grid No. 1 to all other electrodes	6.5	μf
Deflecting electrode DJ ₁ to deflecting electrode DJ ₂	1.7	μf
Deflecting electrode DJ ₃ to deflecting electrode DJ ₄	0.6	μf
DJ ₁ to all other electrodes	5	μf
DJ ₂ to all other electrodes	5	μf
DJ ₃ to all other electrodes	3.8	μf
DJ ₄ to all other electrodes	3.8	μf

Faceplate, Flat Clear Glass

Phosphor (For Curves, see front of this Section) P1

Fluorescence Green

Phosphorescence Green

Persistence Medium

Focusing Method Electrostatic

Deflection Method Electrostatic

Maximum Overall Length 4-1/16"

Maximum Diameter 1-1/4" ± 1/16"

Minimum Useful Screen Diameter 1-1/16"

Mounting Position Any

Weight (Approx.) 2 oz

Bulb T-10

Base Small-Button Unidekar 11-Pin (JETEC No. E11-22)

Basing Designation for BOTTOM VIEW 11V

- | | |
|--------------------|---------------------|
| Pin 1 - Heater | Pin 8 - U1tor |
| Pin 2 - Heater | (Grid No. 2, |
| Pin 3 - Grid No. 1 | Grid No. 4, |
| Pin 4 - Cathode | Collector) |
| Pin 5 - Grid No. 3 | Pin 9 - Deflecting |
| Pin 6 - Deflecting | Electrode |
| Electrode | DJ ₂ |
| DJ ₄ | Pin 10 - Deflecting |
| Pin 7 - Deflecting | Electrode |
| Electrode | DJ ₁ |
| DJ ₃ | Pin 11 - Internal |
| | Connection- |
| | Do Not Use |



*DJ₁ and DJ₂ are nearer the screen
DJ₃ and DJ₄ are nearer the base*

IEP1



IEP1

OSCILLOGRAPH TUBE

With DJ_2 positive with respect to DJ_1 , the spot is deflected toward the midpoint between pins 6 and 7. With DJ_3 positive with respect to DJ_4 , the spot is deflected toward the midpoint between pins 9 and 10.

The angle between the trace produced by DJ_3 and DJ_4 and its intersection with the plane through the tube axis and the midpoint between pins 9 and 10 does not exceed $\pm 10^\circ$.

The angle between the trace produced by DJ_3 and DJ_4 and the trace produced by DJ_1 and DJ_2 is $90^\circ \pm 3^\circ$.

Maximum Ratings, Design-Center Values:

ULTOR VOLTAGE	1500 max.	volts
GRID-No.3 VOLTAGE	1200 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 recommended minimum* and 1500 volts

Grid-No.3 Voltage for Focus	10% to 30% of E_{c_4}	volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot.	-1.4% to -4.2% of E_{c_4}	volts
Grid-No.3 Current for Any Operating Con- dition.	-15 to +10	μ amp
Deflection Factors:		
DJ_1 & DJ_2	210 to 310 vdc/in./kv of E_{c_4}	
DJ_3 & DJ_4	240 to 350 vac/in./kv of E_{c_4}	
Spot Position	**	

Examples of Use of Design Ranges:

For ultor voltage of	500	1000	volts
Grid-No.3 Voltage for Focus	50 to 150	100 to 300	volts

* Brilliance and definition decrease with decreasing ultor voltage. Recommended minimum for the IEP1 in general service is 500 volts, but a value as low as 300 volts may be used under conditions of low-velocity deflection and low ambient light levels. For operation between 300 and 500 volts, it is essential that the ultor voltage be applied before beam-current flow. Otherwise, a screen charge may develop to block off or distort the scanning pattern.

** See next page.



IEPI

IEPI

OSCILLOGRAPH TUBE

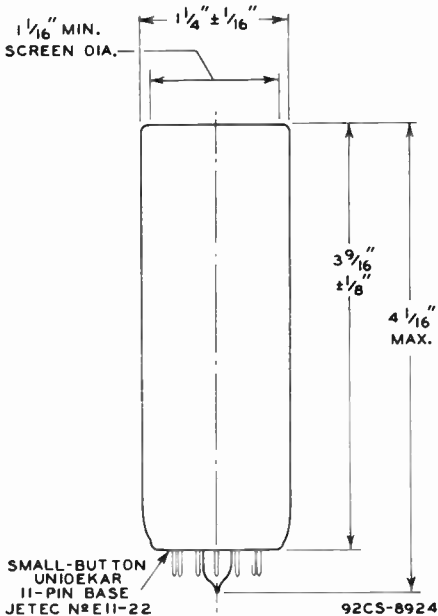
For ultor voltage of	500	1000	volts
Grid-No.1 Voltage for Visual Extinction of Undelected Focused Spot	-7 to -21	-14 to -42	volts
Deflection Factors:			
DJ ₁ & DJ ₂	105 to 155	210 to 310	volts dc/in.
DJ ₃ & DJ ₄	120 to 175	240 to 350	volts dc/in.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting-Electrode Circuit [■]	2.0 max.	megohms

The center of the undelected focused spot will fall within a circle having 2.5-mm radius concentric with the center of the tube face.

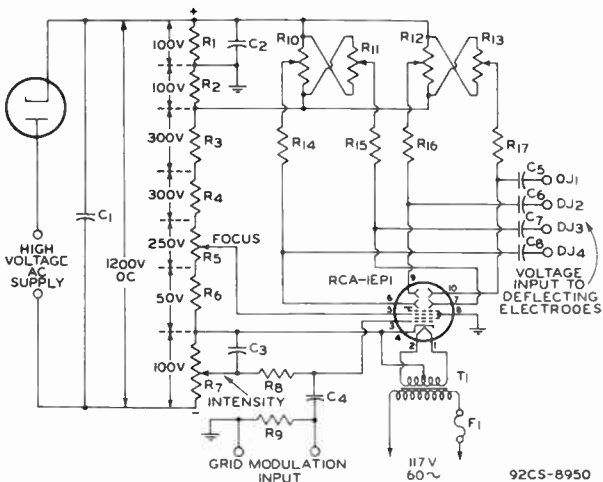
■ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.





OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



C1: 0.5 μ f, 2000 volts
 C2: 1 μ f, 200 volts
 C3: 1 μ f, 200 volts
 C4: 0.05 μ f, 1600 volts
 C5 C6 C7 C8: 0.05 μ f, 600 volts
 R1 R2: 510,000 ohms, 1/2 watt
 R3 R4: 300,000 ohms, 1 watt
 R5: 250,000-ohms, 2-watt po-
 tentiometer
 R6: 51,000 ohms, 1/2 watt
 R7: 100,000-ohms, 1/2-watt po-
 tentiometer
 R8: 510,000 ohms, 1/2 watt

R9: 5 megohms, 1/2 watt
 R10 R11: Dual 1-megohm
 potentiometer
 R12 R13: Dual 1-megohm
 potentiometer
 R14 R15 R16 R17: 1.5 megohms,
 1/2 watt
 T1: Transformer, 6.3 volts
 at 1 ampere, insulated
 for 2000 volts, such as
 Thordarson T21F08
 F1: 1-ampere fuse

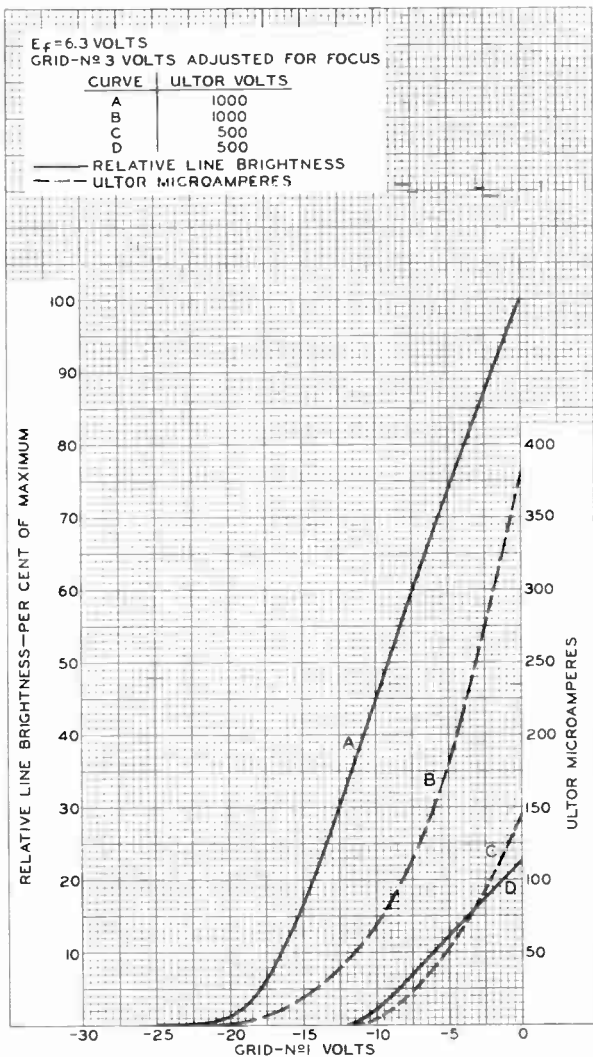
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IEPI

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AVERAGE CHARACTERISTICS



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92CM-8938

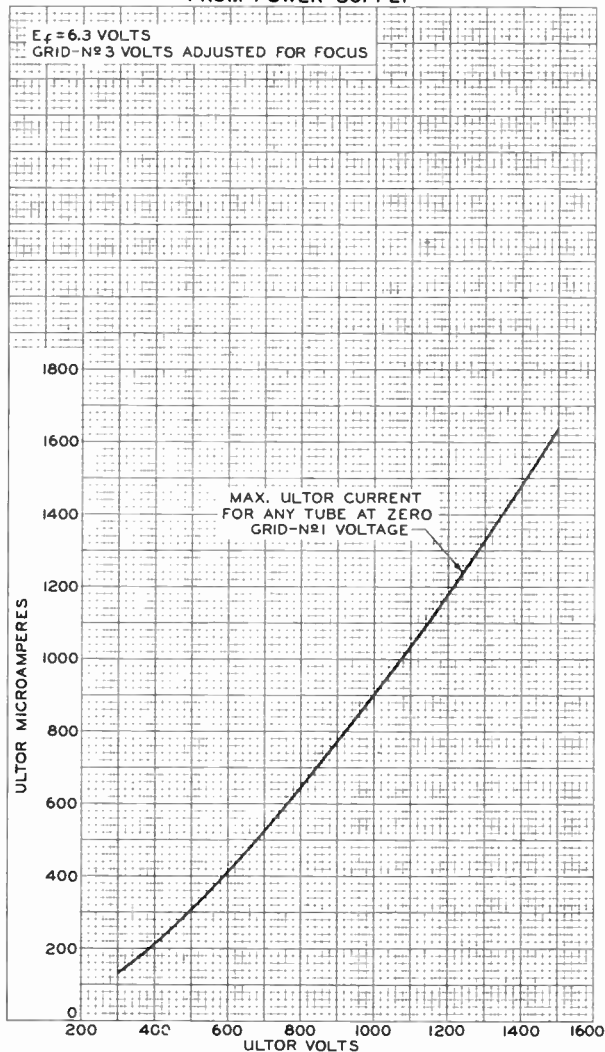
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IEPI



IEPI

MAXIMUM ULTOR-CURRENT REQUIREMENTS FROM POWER SUPPLY



TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8939

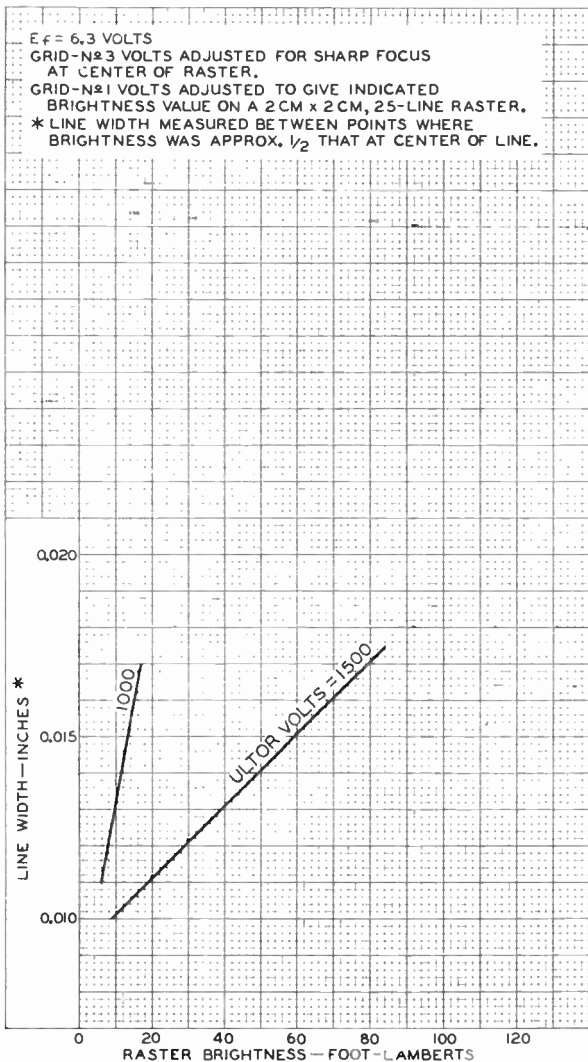


IEPI

IEPI

AVERAGE CHARACTERISTICS

$E_f = 6.3$ VOLTS
 GRID-N \times 3 VOLTS ADJUSTED FOR SHARP FOCUS
 AT CENTER OF RASTER.
 GRID-N \times 1 VOLTS ADJUSTED TO GIVE INDICATED
 BRIGHTNESS VALUE ON A 2 CM x 2 CM, 25-LINE RASTER.
 * LINE WIDTH MEASURED BETWEEN POINTS WHERE
 BRIGHTNESS WAS APPROX. $\frac{1}{2}$ THAT AT CENTER OF LINE.



TUBE DIVISION

92CM-8975R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY





1EP2

1EP2

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

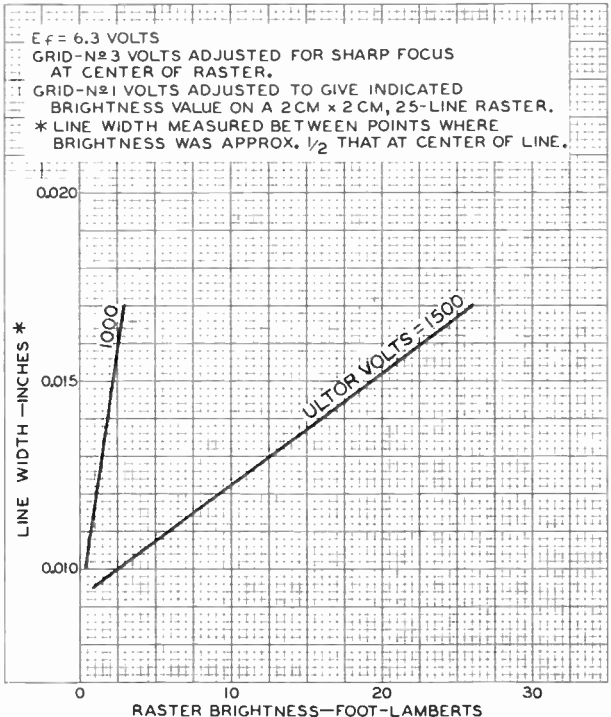
The 1EP2 is the same as the 1EP1 except for the following items:

General:

Phosphor (For Curves, see front of this Section)	P2
Fluorescence	Greenish-Yellow
Phosphorescence	Greenish-Yellow
Persistence	Long

In general, operation of the 1EP2 at an ultor voltage less than 750 volts is not recommended.

AVERAGE CHARACTERISTICS



TUBE DIVISION

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92CM-9189

IEP2

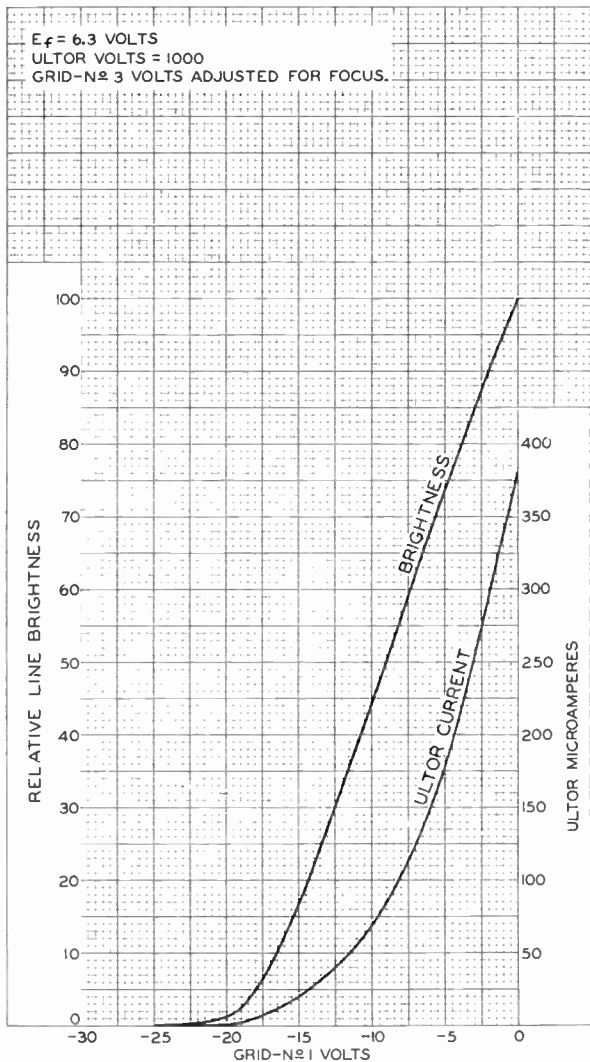


IEP2

AVERAGE CHARACTERISTICS

 $E_f = 6.3$ VOLTS

ULTOR VOLTS = 1000

GRID-N₂ 3 VOLTS ADJUSTED FOR FOCUS.

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9298



1EPII

1EPII

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

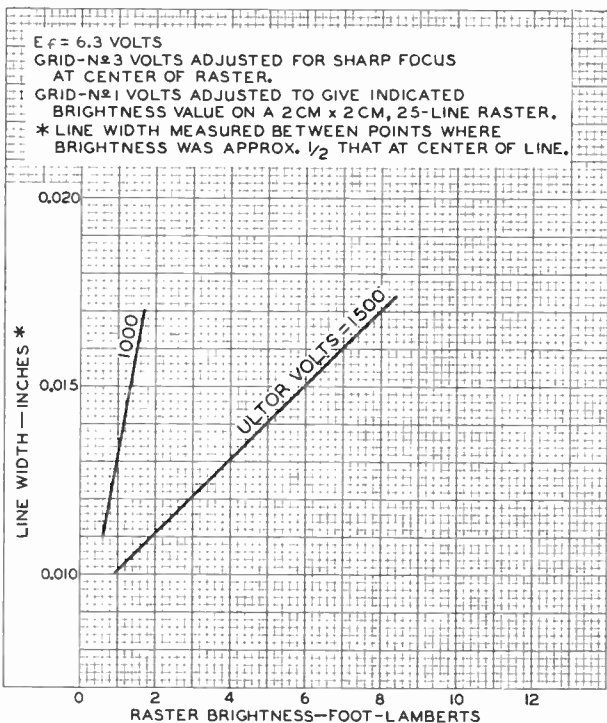
The 1EPII is the same as the 1EP1 except for the following items:

General:

Phosphor (For Curves, see front of this Section)	P11
Fluorescence	Blue
Phosphorescence	Blue
Persistence	Short

In general, operation of the 1EPII at an ultor voltage less than 750 volts is not recommended.

AVERAGE CHARACTERISTICS



TUBE DIVISION

92CM-9188

RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

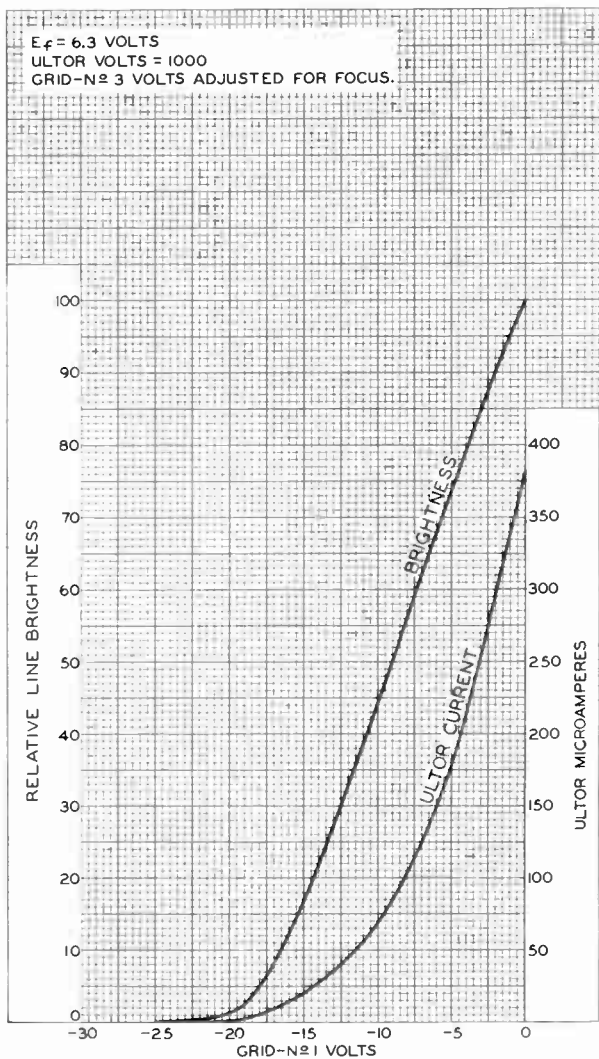
World Radio History

IEPII



IEPII

AVERAGE CHARACTERISTICS



TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9298



2AP1-A

2AP1-A

HIGH-VACUUM CATHODE-RAY TUBE

Supersedes Type 2AP1

General:

Heater, for Unipotential Cathode:

Voltage	6.3 ± 10%	ac or dc volts
Current	0.6	amp.

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to All Other Electrodes	8.0	μf
Cathode to All Other Electrodes	5.5	μf
DJ ₁ to DJ ₂	0.6	μf
DJ ₃ to DJ ₄	1.1	μf
DJ ₁ to All Other Electrodes	8.5	μf
DJ ₃ to All Other Electrodes	9.0	μf
DJ ₁ to All Other Electrodes except DJ ₂	8.0	μf
DJ ₂ to All Other Electrodes except DJ ₁	4.6	μf
DJ ₃ to All Other Electrodes except DJ ₄	7.5	μf
DJ ₄ to All Other Electrodes except DJ ₃	6.0	μf

Phosphor (For Curves, see front of this Section)	No.1
Fluorescence	Green
Persistence	Medium

Focusing Method Electrostatic

Deflection Method Electrostatic

Overall Length 7-7/16" ± 3/16"

Greatest Diameter of Bulb 2" ± 1/16"

Minimum Useful Screen Diameter 1-3/4"

Mounting Position Any

Base Small Shell Magnal 11-Pin

Basing Designation for BOTTOM VIEW 11L

- | | |
|--|--|
| Pin 1-Heater | Pin 8-Deflecting Electrode DJ ₂ |
| Pin 2-Cathode | Pin 9-Deflecting Electrode DJ ₃ |
| Pin 3-Deflecting Electrode DJ ₁ | Pin 10-Grid No.1 |
| Pin 4-Anode No.1 | Pin 11-Heater |
| Pin 5-No Connection | |
| Pin 6-Deflecting Electrode DJ ₄ | |
| Pin 7-Anode No.2, Grid No.2 | |



*DJ₁ and DJ₂ are nearer the screen
 DJ₃ and DJ₄ are nearer the base*

With DJ₁ positive with respect to DJ₂, the spot is deflected toward pin 4. With DJ₃ positive with respect to DJ₄, the spot is deflected toward pin 1.

The angle between the trace produced by DJ₃ and DJ₄ and its intersection with the plane through the tube axis and pin 1 does not exceed 10°.

The angle between the trace produced by DJ₃ and DJ₄ and the trace produced by DJ₁ and DJ₂ is 90° ± 4°.



2API-A

HIGH-VACUUM CATHODE-RAY TUBE

(continued from preceding page)

Maximum Ratings, Absolute Values:

ANODE-No.2 & GRID-No.2 VOLTAGE.	1100 max.	volts
ANODE-No.1 VOLTAGE	550 max.	volts
GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:		
Negative Value :	125 max.	volts
Positive Value :	0 max.	volts
PEAK VOLTAGE BETWEEN ANODE No.2 AND ANY DEFLECTING ELECTRODE	660 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts

Typical Operation:

Anode-No.2 & Grid-No.2 Voltage* . .	500	1000	. . . .	volts
Anode-No.1 Voltage for Focus at 75% of Grid-No.1 Volt- age for Cutoff* . .	125	250	. . . .	volts
Grid-No.1 Volt. for Visual Cutoff#	-30	-60	. . . .	volts
Max. Anode-No.1 Current Range [▲] .	Between -50 and +10 . . μ amp.			
Deflection Sensitivity:				
DJ1 and DJ2.	0.220	0.110	. . .	mm/v dc
DJ3 and DJ4.	0.260	0.130	. . .	mm/v dc
Deflection Factor:**				
DJ1 and DJ2.	115	230	. .	v dc/in.
DJ3 and DJ4.	98	196	. .	v dc/in.

* Brilliance and definition decrease with decreasing anode-No.2 voltage. In general, anode-No.2 voltage should not be less than 500 volts.

● Individual tubes may require between +20% and -45% of the values shown with grid-No.1 voltages between zero and cutoff.

visual extinction of stationary focused spot. Supply should be adjustable to \pm 50% of these values.

▲ See curve for average values.

** Individual tubes may vary from these values by \pm 20%.

Spot Position:

The undeflected focused spot will fall within a 10-mm square centered at the geometric center of the tube face and having one side parallel to the trace produced by DJ1 and DJ2. Suitable test conditions are: anode-No.2 voltage, 1000 volts; anode-No.1 voltage, adjusted for focus; deflecting-electrode resistors, 1 megohm each, connected to anode No.2; the tube shielded from all extraneous fields. To avoid damage to the tube, grid-No.1 voltage should be near cutoff before application of anode voltages.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Impedance of Any Deflecting-Electrode Circuit at Heater-Supply Frequency	1.0 max.	megohm



2AP1-A

2AP1-A

HIGH-VACUUM CATHODE-RAY TUBE

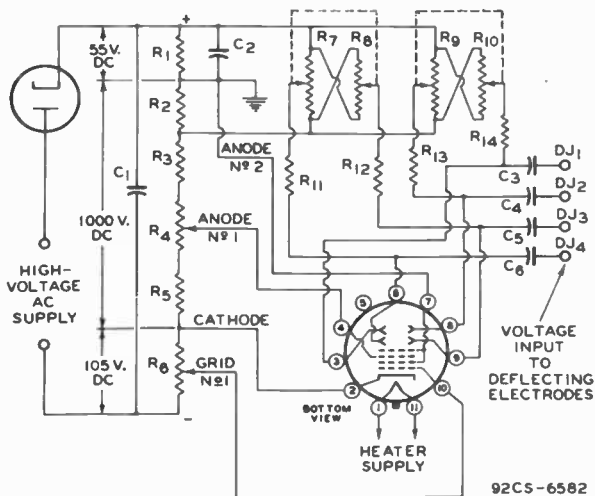
(continued from preceding page)

Resistance in Any Deflecting-

Electrode Circuit^{▲▲} 5.0 max. megohms

^{▲▲} It is recommended that all deflecting-electrode-circuit resistances be approximately equal.

TYPICAL OSCILLOGRAPH CIRCUIT



C1: 0.1 μ f
 C2: 1.0 μ f
 C3 C4 C5 C6: 0.05- μ f Blocking
 Capacitor*

R1 R2: 0.5 Megohm
 R3: 3.0 Megohms

R4: 1.0-Megohm Potentiometer
 R5: 0.5 Megohm
 R6: 0.5-Megohm Potentiometer
 R7 R8: Dual 5-Megohm Potentiometer
 R9 R10: Dual 5-Megohm Potentiometer
 R11 R12 R13 R14: 2 Megohms

* When cathode is grounded, capacitors should have high voltage rating; when anode No.2 is grounded, they may have low voltage rating. For dc amplifier service, deflecting electrodes should be connected direct to amplifier output. In this service, it is preferable usually to remove deflecting-electrode resistors to minimize loading effect on amplifier. In order to minimize spot defocusing, it is essential that anode No.2 be returned to a point in the amplifier system which will give the lowest possible potential difference between anode No.2 and the deflecting electrodes.

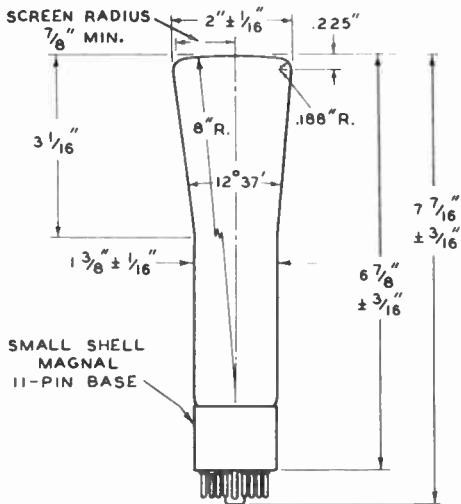
The license extended to the purchaser of tubes appears in the License Notice accompanying them. Information contained herein is furnished without assuming any obligations.

2API-A



2API-A

HIGH-VACUUM CATHODE-RAY TUBE



92CM-6368R2

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



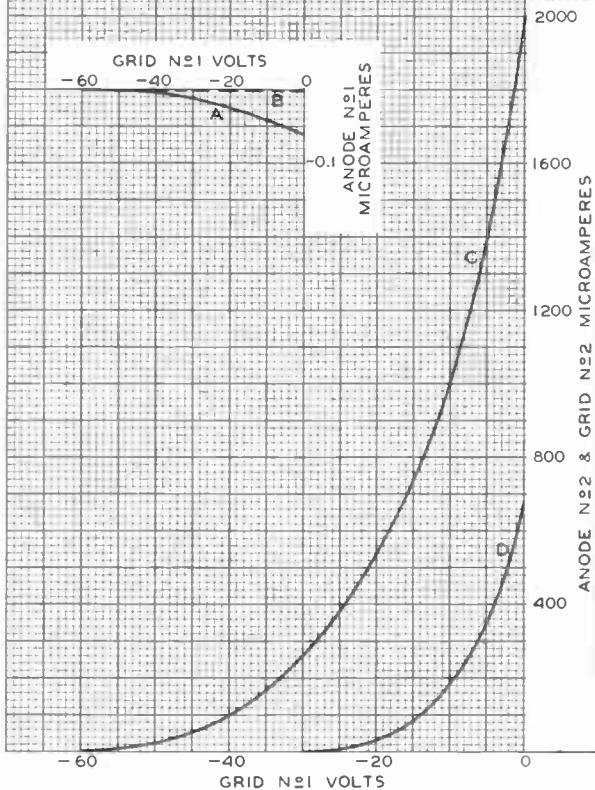
2A1-A

2A1-A

AVERAGE CHARACTERISTICS

 $E_f = 6.3$ VOLTSANODE N^o1 VOLTS ADJUSTED TO GIVE FOCUS

CURVE	ELECTRODE CURRENT	ANODE N ^o 2 & GRID N ^o 2 VOLTS
A	ANODE N ^o 1	1000
B	ANODE N ^o 1	500
C	ANODE N ^o 2 & GRID N ^o 2	1000
D	ANODE N ^o 2 & GRID N ^o 2	500



APR. 17, 1945

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-6410R1





2BPI

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

2BPI

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	8	μ f
DJ ₁ to DJ ₂	2	μ f
DJ ₃ to DJ ₄	2	μ f
DJ ₁ to All Other Electrodes.	11	μ f
DJ ₂ to All Other Electrodes.	8	μ f
DJ ₃ to All Other Electrodes.	7	μ f
DJ ₄ to All Other Electrodes.	8	μ f

Phosphor (For Curves, see front of this Section) No.1

Fluorescence Green

Persistence. Medium

Focusing Method Electrostatic

Deflection Method. Electrostatic

Overall Length 7-5/8" \pm 3/16"

Greatest Diameter of Bulb. 2" \pm 1/16"

Minimum Useful Screen Diameter 1-3/4"

Mounting Position. Any

Base Small-Shell Duodecal 12-Pin

Basing Designation for EOTTOM VIEW 12E

Pin 1 - Heater	Pin 8 - Anode No.2
Pin 2 - Grid No.1	Grid No.2
Pin 3 - Cathode	Pin 9 - Deflecting
Pin 4 - Anode No.1	Electrode
Pin 5 - Internal	DJ ₂
Connection--	Pin 10 - Deflecting
Do Not Use	Electrode
Pin 6 - Deflecting	DJ ₁
Electrode	Pin 11 - Internal
DJ ₂	Connection--
Pin 7 - Deflecting	Do Not Use
Electrode	Pin 12 - Heater
DJ ₄	



DJ₁ and DJ₂ are nearer the screen
DJ₃ and DJ₄ are nearer the base

With DJ₁ positive with respect to DJ₂, the spot is deflected toward pin 4. With DJ₃ positive with respect to DJ₄, the spot is deflected toward pin 1.

The plane through the tube axis and pin No.4 may vary from the trace produced by DJ₁ and DJ₂ by an angular tolerance (measured about the tube axis) of 10°.

The angle between DJ₁ - DJ₂ trace and DJ₃ - DJ₄ trace is 90° \pm 3°.

← Indicates a change.



OSCILLOGRAPH TUBE

Maximum Ratings, Design-Center Values:

ANODE-NO. 2* VOLTAGE	2500 max.	volts
ANODE-NO. 1 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 ANODE NO. 2 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 anode-No. 2 voltage (E_{b2}) between 500 and 2500 volts*

Anode-No. 1 Voltage	15% to 28% of E_{b2}	volts
→ Max. Grid-No. 1 Voltage for Visual Cutoff.	6.75% of E_{b2}	volts
Max. Anode-No. 1 Current Range.	-15 to +10	microamperes
Deflection Factors:		
DJ ₁ & DJ ₂	115 to 155	v dc/in./kv of E_{b2}
DJ ₃ & DJ ₄	74 to 100	v dc/in./kv of E_{b2}
→ Spot Position.	□	

Examples of Use of Design Ranges:

<i>For anode-No. 2 voltage of 1000</i>	<i>2000</i>	<i>volts</i>
Anode-No. 1 Voltage	150 - 280	300 - 560 volts
Max. Grid-No. 1 Voltage for Visual Cutoff.	-67.5	-135 volts
Deflection Factors:		
DJ ₁ & DJ ₂	115 - 155	230 - 310 volts dc/in.
DJ ₃ & DJ ₄	74 - 100	148 - 200 volts dc/in.

Maximum Circuit Values:

Grid-No. 1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting- Electrode Circuit ^o	5.0 max.	megohms

* Brilliance and definition decrease with decreasing anode-No. 2 voltage. A value as low as 500 volts is recommended only for low-velocity deflection and low room-light levels.

o It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

• Anode No. 2 and grid No. 2 which are connected together within tube, are referred to herein as anode No. 2. The product of anode-No. 2 voltage and average anode-No. 2 current should be limited to 6 watts.

□ The center of the undeflected, focused spot will fall within a circle having a 5.0-mm radius concentric with the center of the tube face.

> Indicates a change.

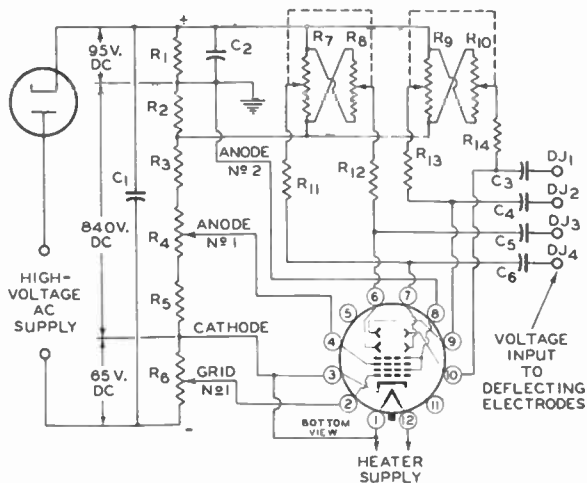


2BP1

OSCILLOGRAPH TUBE

2BP1

TYPICAL OSCILLOGRAPH CIRCUIT



92CM-6777R1

C1: 0.2 μ f
 C2: 1.0 μ f
 C3 C4 C5 C6: 0.05- μ f Blocking
 Capacitors*

R1 R2: 2.5 Megohms, 0.5 watt
 R3: 2.5 Megohms, 1 watt

R4: 1.0-Megohm Potentiometer
 R5: 0.5 megohm, 0.5 watt
 R6: 0.35 Megohm, 0.5 watt
 R7 R8: Dual 5-Megohm potentiometer
 R9 R10: Dual 5-Megohm Potentiometer
 R11 R12 R13 R14: 2 Megohms, 0.5 watt

* when cathode is grounded, capacitors should have high voltage rating; when anode No.2 is grounded, they may have low voltage rating. For dc amplifier service, deflecting electrodes should be connected direct to amplifier output. In this service, it is preferable usually to remove deflecting-electrode resistors to minimize loading effect on amplifier. In order to minimize spot defocusing, it is essential that anode No.2 be returned to a point in the amplifier system which will give the lowest possible potential difference between anode No.2 and the deflecting electrodes.

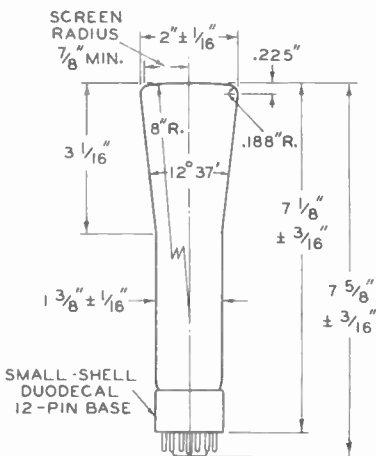
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2BPI



2BPI

OSCILLOGRAPH TUBE



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

92CS-6689

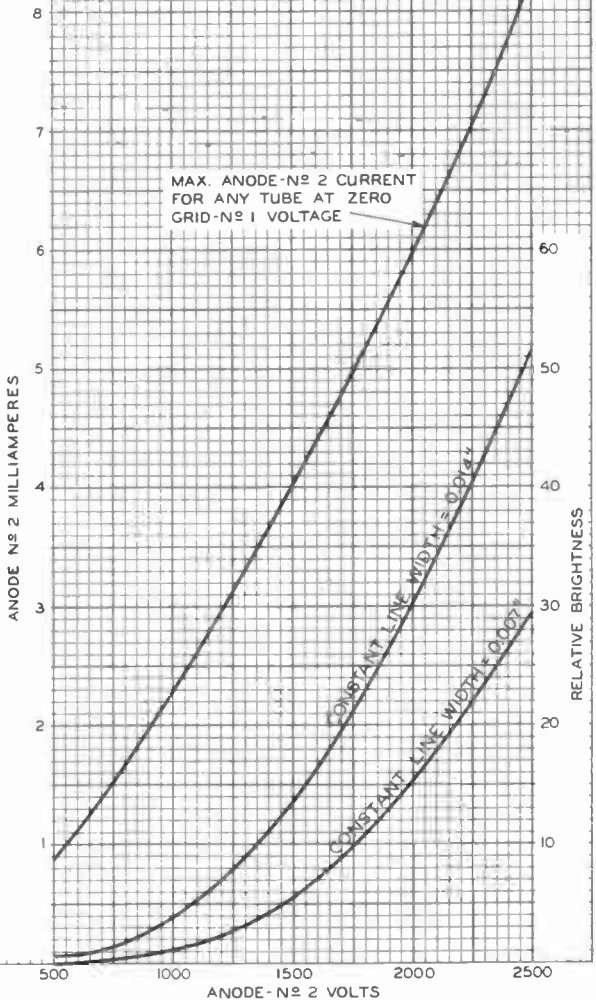


2BPI

CHARACTERISTICS

2BPI

$E_f = 6.3$ VOLTS
ANODE-Nº1 VOLTS ADJUSTED FOR FOCUS



AUGUST 14, 1950

TUBE DEPARTMENT

92CM-6748R1

RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

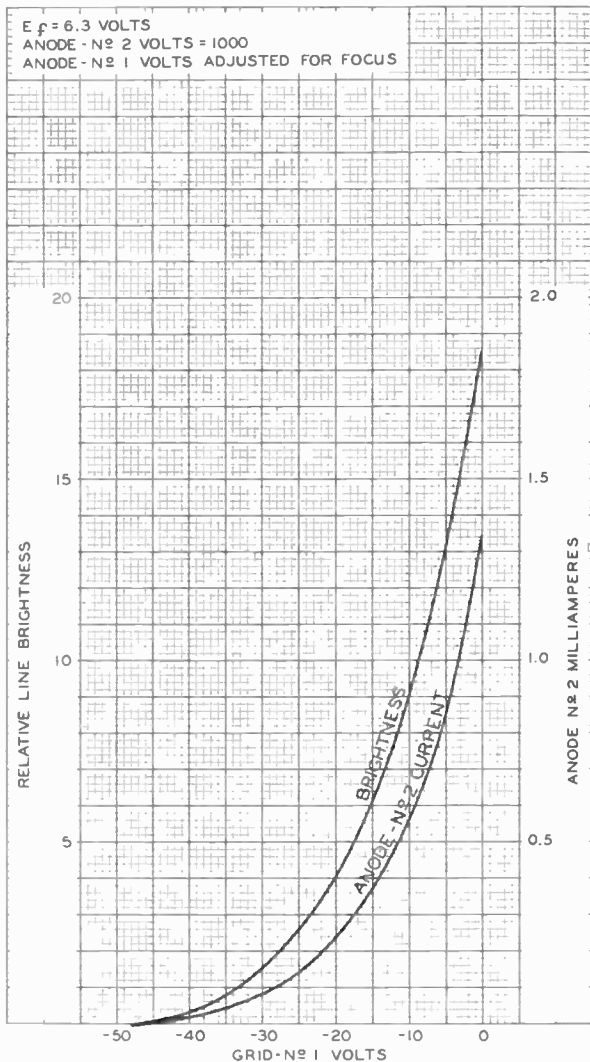
World Radio History

2BP1



2BP1

AVERAGE CHARACTERISTICS



AUGUST 14, 1950

TUBE DEPARTMENT

92CM-6747RI

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History



2BP11

2BP11

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

The 2BP11 is the same as the 2BP1 except that it has a phosphor of the short-persistence, blue-fluorescence type designated P11. The blue radiation of the P11 screen is highly actinic and has sufficiently short persistence to permit use of the 2BP11 in all moving film photographic applications without blurring except in those where film moved at a high speed. The 2BP11 is also quite satisfactory for visual observation of phenomena because its phosphor has unusually high brightness for a blue screen.

In general, operation of the 2BP11 at an anode-No.2 voltage less than 1000 volts is not recommended.

THE SPECTRAL-ENERGY EMISSION CHARACTERISTIC
and the PERSISTENCE CHARACTERISTIC of
the P11 Phosphor are shown at the
front of this Section





2F21

2F21 MONOSCOPE

5-INCH MAGNETIC-DEFLECTION TYPE

Supersedes Type 1899

General:

Heater, for Unipotential Cathode:

Voltage	6.3 ± 10%	. . . . .	ac or dc volts
Current	0.6	. . . . .	amp

Direct Interelectrode Capacitances:

Grid No.1 to All Other Electrodes	7	. . . . .	μf
Pattern Electrode to Grid No.4	5	. . . . .	μf

Pattern:

Type	See illustration on next page
Dimensions (Approx.)	2-5/16" x 3-1/16"
Calibration	Up to 500 lines

Focusing Method Electrostatic

Deflection Method Magnetic

Maximum Solid Deflection Angle 40°

Overall Length 12-7/16" + 1/4" - 7/16"

Greatest Diameter of Bulb 5-1/16" max.

Caps (Two) Recessed Small Ball

Mounting Position Any

Base Long-Shell Medium 6-Pin

Basing Designation for BOTTOM VIEW 6BV

Pin 1 - Heater

Pin 2 - Grid No.2

Pin 3 - Grid No.3

Pin 4 - Grid No.1

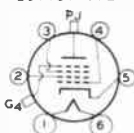
Pin 5 - Cathode

Pin 6 - Heater

End Cap - Pattern

Electrode

Side Cap - Grid No.4



Maximum Ratings, Design-Center Values:

PATTERN-ELECTRODE VOLTAGE 1500 max. volts

GRID-No.4 (COLLECTOR) VOLTAGE 1500 max. volts

GRID-No.3 (FOCUSING ELECTRODE) VOLTAGE 600 max. volts

GRID-No.2 (ACCELERATING ELECTRODE) VOLT. 1600 max. volts

GRID-No.1 (CONTROL ELECTRODE) 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 125 max. volts

Typical Operation: †

Pattern-Electrode Voltage 1000 . . . volts

Grid-No.4 Voltage 1050 . . . volts

Grid-No.3 Voltage for Focus at

0.5 μamp Grid-No.4 Current[‡] 300 approx. volts

Grid-No.2 Voltage 1000 . . . volts

Grid-No.1 Voltage for

Visual Cutoff on Monitor[#] -50 approx. volts

Internal Resistance between

Grid No.4 and Pattern Electrode Greater than 1 meg.

Grid-No.4 Current 0.5 . . . μamp

†, ‡, #: See next page.

JUNE 20, 1946

TUBE DIVISION

TENTATIVE DATA

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

2F21



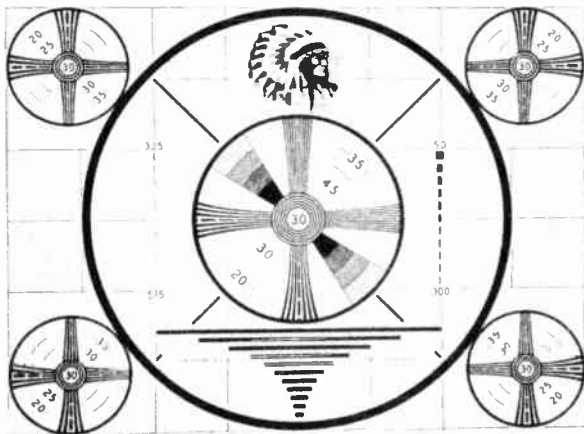
2F21

MONOSCOPE

Pattern-Electrode Signal Current (Peak-to-Peak)	0.5 approx. μ amp
Resolution Capability ^{▲▲}	500 . . . lines
Maximum Circuit Value:	
Grid-No.1-Circuit Resistance	1.5 max. megohms

- ▲ Individual tubes may require between + 20% and - 20% of these values.
- † Deflection must be maintained at all times. when scanned area does not cover entire pattern, the beam current should be reduced accordingly and time of operation limited to prevent damaging the pattern.
- * Supply should be adjustable between + 40% and - 80% of this value.
- ▲▲ with full scanning.

PATTERN



92CS-6685

JUNE 20, 1940

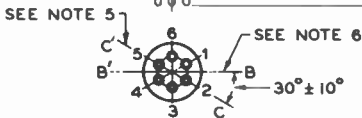
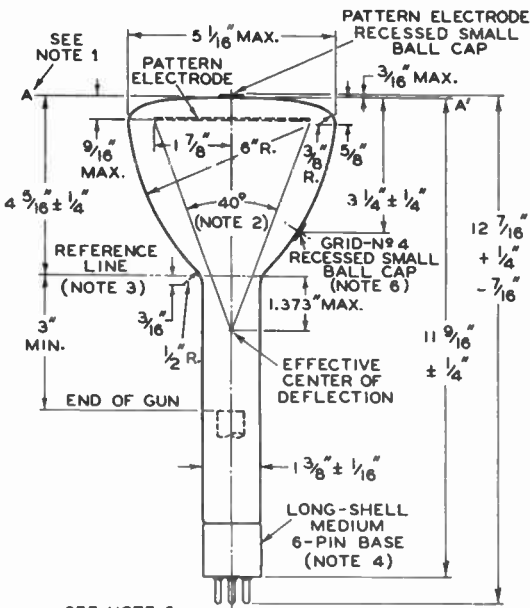
RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE DATA



2F21

2F21 MONOSCOPE



BOTTOM VIEW

9204-6653

NOTE 1: LINE AA' IS PERPENDICULAR TO THE AXIS OF THE TUBE AND INTERSECTS THE FACE CONTOUR $1 \frac{1}{2}$ " FROM THE AXIS OF THE TUBE.

NOTE 2: DEFLECTION ANGLE BETWEEN DIAGONALLY OPPOSITE CORNERS OF PATTERN.

NOTE 3: REFERENCE LINE IS DETERMINED BY POSITION WHERE GAUGE $1.438 \pm .003$ I.D. AND 2 " LONG WILL REST ON BULB CONE.

NOTE 4: ϕ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

NOTE 5: MINOR AXIS OF PATTERN ELECTRODE MAY VARY FROM PLANE CC' THROUGH PIN 2 AND TUBE AXIS BY 10° . TOP EDGE OF PATTERN IS ON SAME SIDE OF TUBE AS PIN 5.

NOTE 6: BB' INDICATES PLANE THROUGH TUBE AXIS AND GRID-No.4 TERMINAL.





3API-A

3API-A OSCILLOGRAPH TUBE

GENERAL DATA

except for those on the phosphor as indicated below,

MAXIMUM RATINGS, TYPICAL OPERATION, OUTLINE,
and

AVERAGE CHARACTERISTICS CURVES

(Anode-No.2 & Grid-No.2 Microamperes vs Grid-No.1 Volts)

for the 3API-A

are the same as those for Type 908-A.

Phosphor (For Curves, see front of this Section) . . .	No.1
Fluorescence	Green
Persistence	Medium

ONLY
FOR
RENEW
USE



Oscillograph Tube

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

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

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to all other electrodes	7.5	μμf
Cathode to all other electrodes	4.3	μμf
Deflecting electrode DJ ₁ to deflecting electrode DJ ₂	5.2	μμf
Deflecting electrode DJ ₃ to deflecting electrode DJ ₄	7	μμf
DJ ₁ to all other electrodes	10.1	μμf
DJ ₂ to all other electrodes	7.5	μμf
DJ ₃ to all other electrodes	8.1	μμf
DJ ₄ to all other electrodes	9.2	μμf

Faceplate, Spherical. Clear Glass

Phosphor (For Curves, see front of this Section). P1

Fluorescence. Yellowish-Green

Phosphorescence Yellowish-Green

Persistence Medium

Focusing Method Electrostatic

Deflection Method Electrostatic

Overall Length. 9-1/8" ± 1/4"

Greatest Diameter of Bulb 3" ± 1/16"

Minimum Useful Screen Diameter. 2-3/4"

Useful Scan (Centered with respect to tube face):

By deflecting electrodes DJ₁ & DJ₂. 2-3/4"

By deflecting electrodes DJ₃ & DJ₄. 2-1/4"

Operating Position. Any

Bulb. J24P1

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

Basing Designation for BOTTOM VIEW. 12E

Pin 1-Heater

Pin 2-Grid No.1

Pin 3-Cathode

Pin 4-Grid No.3

Pin 5-Internal Connection—
Do Not Use

Pin 6-Deflecting Electrode
DJ₃

Pin 7-Deflecting Electrode
DJ₄

Pin 8-Ultor

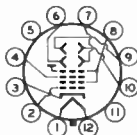
(Grid No.2,
Grid No.4,
Collector)

Pin 9-Deflecting Electrode
DJ₂

Pin 10-Deflecting Electrode
DJ₁

Pin 11-Internal Connection—
Do Not Use

Pin 12-Heater



*DJ₁ and DJ₂ are nearer the screen
DJ₃ and DJ₄ are nearer the base*



3AQPI

Maximum and Minimum Ratings, Design-Center Values:

ULTOR VOLTAGE.	{ 2750 max.	volts
	{ 500 min.	volts
ULTOR INPUT (AVERAGE).	6 max.	watts
GRID-No.3 VOLTAGE.	1100 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	550 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds	410 max.	volts
After equipment warm-up period	125 max.	volts
Heater positive with respect to cathode.	125 max.	volts

Equipment Design Ranges:

For any ultor voltage (E_{c4}) between 500 and 2750 volts

Grid-No.3 Voltage		
for focus.	16.5% to 31% of E_{c4}	volts
Negative Grid-No.1		
Voltage for visual		
extinction of		
undeflected spot	2.8% to 6.7% of E_{c4}	volts
Grid-No.3 Current		
for any operating		
condition.	-15 to +10	μa
Deflection Factors:		
DJ ₁ & DJ ₂	73 to 99	v dc/in./kv of E_{c4}
DJ ₃ & DJ ₄	26 to 35	v dc/in./kv of E_{c4}





3BP1-A

3BP1-A

HIGH-VACUUM CATHODE-RAY TUBE

Supersedes Type 3RP1

General:

Heater, for Unipotential Cathode:

Voltage	6.3 ± 10%	ac or dc volts
Current	0.6	amp.

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to All Other Electrodes	8.5	μf
Cathode to All Other Electrodes	∞	μf
DJ ₁ to DJ ₂	2.0	μf
DJ ₃ to DJ ₄	2.0	μf
DJ ₁ to All Other Electrodes	8.0	μf
DJ ₃ to All Other Electrodes	6.0	μf
DJ ₁ to All Other Electrodes except DJ ₂	6.0	μf
DJ ₂ to All Other Electrodes except DJ ₁	5.0	μf
DJ ₂ to All Other Electrodes except DJ ₄	4.0	μf
DJ ₄ to All Other Electrodes except DJ ₃	6.0	μf

Phosphor (For Curves, see front of this Section)	No.1
Fluorescence	Green
Persistence	Medium

Focusing Method Electrostatic

Deflection Method Electrostatic

Overall Length 10" ± 1/4"

Greatest Diameter of Bulb 3" ± 1/16"

Minimum Useful Screen Diameter 2-3/4"

Mounting Position Any

Base Medium Shell Diheptal 12-Pin

Basing Designation for BOTTOM VIEW 14C

Pin 1- Heater	Pin 9- Anode No.2
Pin 2- Cathode	Grid No.2
Pin 3- Grid No.1	Pin 10- Deflecting Electrode
Pin 4- Internal Con. Do Not Use	DJ ₂
Pin 5- Anode No.1	Pin 11- Deflecting Electrode
Pin 7- Deflecting Electrode DJ ₃	DJ ₁
Pin 8- Deflecting Electrode DJ ₄	Pin 12- No Conn.
	Pin 14- Heater



*DJ₁ and DJ₂ are nearer the screen
 DJ₃ and DJ₄ are nearer the base*

With DJ₁ positive with respect to DJ₂, the spot is deflected toward pin 5. With DJ₃ positive with respect to DJ₄ the spot is deflected toward pin 2.

The angle between the trace produced by DJ₁ and DJ₂ and its intersection with the plane through the tube axis and pin 5 does not exceed 10°.

The angle between the trace produced by DJ₃ and DJ₄ and the trace produced by DJ₁ and DJ₂ is 90° ± 3°.

Maximum Ratings, Absolute Values:

ANODE-NO.2 & GRID-NO.2 VOLTAGE	2200 max.	volts
ANODE-NO.1 VOLTAGE	1100 max.	volts

JULY 1, 1945

3BP1-A



3BP1-A

HIGH-VACUUM CATHODE-RAY TUBE

(continued from preceding page)

GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:		
Negative Value.	200 max.	volts
Positive Value.	0 max.	volts
PEAK VOLTAGE BETWEEN ANODE No.2 AND ANY DEFLECTING ELECTRODE		
	550 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts

Typical Operation:

Anode-No.2 & Grid-No.2 Voltage [■]	1500	2000	volts
Anode No.1 Voltage for Focus at 75% of Grid-No.1 Voltage for Cutoff [●]	430	575	volts
Grid-No.1 Volt. for Visual Cutoff [#]	-45	-60	volts
Max. Anode-No.1 Current Range [▲]	Between	-50 and +10	μamp.
Deflection Sensitivity:			
DJ1 and DJ2	0.169	0.127 . .	mm/v dc
DJ3 and DJ4	0.229	0.172 . .	mm/v dc
Deflection Factor: ^{**}			
DJ1 and DJ2	150	200 . .	v dc/in.
DJ3 and DJ4	111	148 . .	v dc/in.

- Brilliance and definition decrease with decreasing anode-No.2 voltage. In general, anode-No.2 voltage should not be less than 1500 volts.
- Individual tubes may require between +20% and -30% of the values shown with grid-No.1 voltages between zero and cutoff.
- # Visual extinction of stationary focused spot. Supply should be adjustable to ± 50% of these values.
- ▲ See curve for average values.
- ** Individual tubes may vary from these values by ± 20%.

Spot Position:

The undeflected focused spot will fall within a 15-mm square centered at the geometric center of the tube face and having one side parallel to the trace produced by DJ1 and DJ2. Suitable test conditions are: anode-No.2 voltage, 1500 volts; anode-No.1 voltage, adjusted for focus; deflecting-electrode resistors, 1 megohm each, connected to anode No.2; the tube shielded from all extraneous fields. To avoid damage to the tube, grid-No.1 voltage should be near cutoff before application of anode voltages.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Impedance of Any Deflecting-Electrode Circuit at Heater-Supply Frequency	1.0 max.	megohm
Resistance in Any Deflecting-Electrode Circuit ^{▲▲}	5.0 max.	megohms

- ▲▲ It is recommended that all deflecting-electrode-circuit resistances be approximately equal.

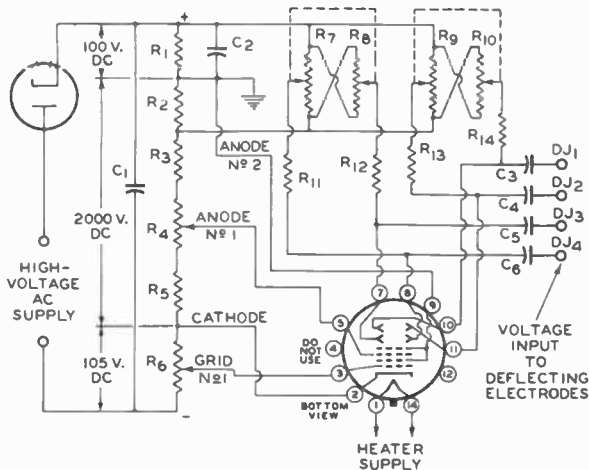


3BP1-A

3BP1-A

HIGH-VACUUM CATHODE-RAY TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



92CS-6514

C1: 0.1 μ f
 C2: 1.0 μ f
 C3 C4 C5 C6: 0.05- μ f Blocking
 Capacitors*

R1 R2: 2 Megohms
 R3: 5.5 Megohms

R4: 2-Megohm Potentiometer
 R5: 1.5 Megohms
 R6: 0.5-Megohm Potentiometer
 R7 R8: Dual 5-Megohm Potentiometer
 R9 R10: Dual 5-Megohm Potentiometer
 R11 R12 R13 R14: 2 Megohms

* When cathode is grounded, capacitors should have high voltage rating; when anode No.2 is grounded, they may have low voltage rating. For dc amplifier service, deflecting electrodes should be connected direct to amplifier output. In this service, it is preferable usually to remove deflecting-electrode resistors to minimize loading effect on amplifier. In order to minimize spot defocusing, it is essential that anode No.2 be returned to a point in the amplifier system which will give the lowest possible potential difference between anode No.2 and the deflecting electrodes.

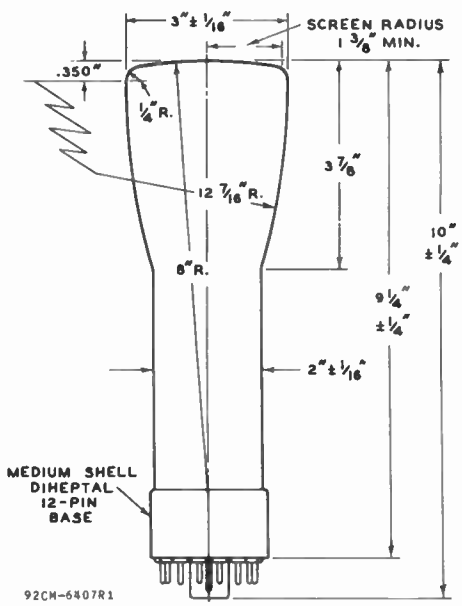
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3BP1-A



3BP1-A

HIGH-VACUUM CATHODE-RAY TUBE



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



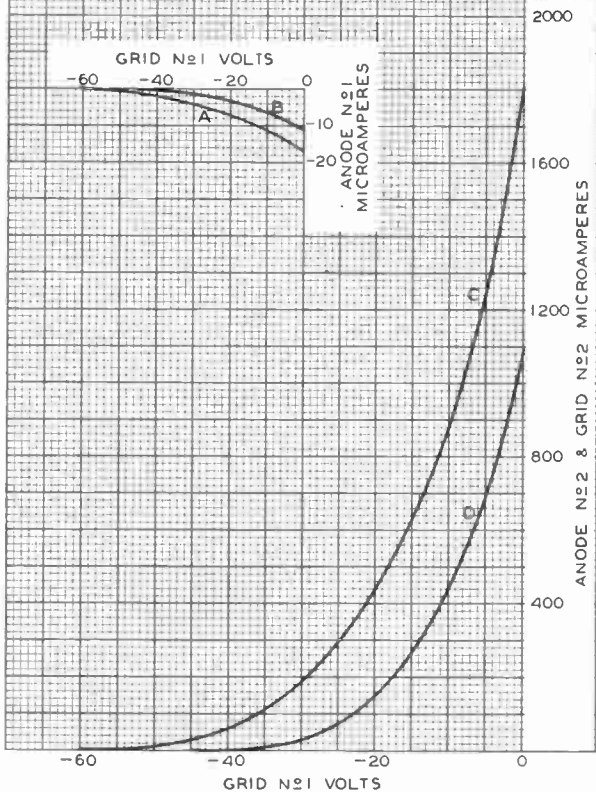
3BP1-A

3BP1-A

AVERAGE CHARACTERISTICS

 $E_f = 6.3$ VOLTSANODE N^o1 VOLTS ADJUSTED TO GIVE FOCUS

CURVE	ELECTRODE CURRENT	ANODE N ^o 2 & GRID N ^o 2 VOLTS
A	ANODE N ^o 1	2000
B	ANODE N ^o 1	1500
C	ANODE N ^o 2 & GRID N ^o 2	2000
D	ANODE N ^o 2 & GRID N ^o 2	1500



APR. 18, 1945

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-6412R1





3JPI

3JPI

OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

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. 8 $\mu\mu\text{f}$

Cathode to All Other Electrodes. 8 $\mu\mu\text{f}$

DJ1 to DJ2 2.5 $\mu\mu\text{f}$

DJ3 to DJ4 2 $\mu\mu\text{f}$

DJ1 to All Other Electrodes. 8 $\mu\mu\text{f}$

DJ2 to All Other Electrodes. 7 $\mu\mu\text{f}$

DJ3 to All Other Electrodes. 7 $\mu\mu\text{f}$

DJ4 to All Other Electrodes. 8 $\mu\mu\text{f}$

Phosphor (For Curves, see front of this Section) P1

Fluorescence and Phosphorescence Green

Persistence of Phosphorescence Medium

Focusing Method. Electrostatic

Deflection Method. Electrostatic

Overall Length 10" \pm 1/4"

Greatest Diameter of Bulb. 3" \pm 1/16"

Minimum Useful Screen Diameter 2-3/4"

Mounting Position. Any

Cap. Recessed Small Ball (JETEC No.J1-22)

Base Medium-Shell Dihedral 12-Pin (JETEC No.B12-37)

Basing Designation for BOTTOM VIEW 14J1

Pin 1-Heater

Pin 2-Cathode

Pin 3-Grid No.1

Pin 4-Internal

Connection-

Do Not Use

Pin 5-Anode No.1

Pin 7-Deflecting

Electrode

DJ3

Pin 8-Deflecting

Electrode DJ4

Pin 9-Anode No.2,

Grid No.2

Pin 10-Deflecting

Electrode

DJ2

Pin 11-Deflecting

Electrode

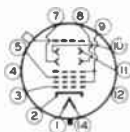
DJ1

Pin 12-No

Connection

Pin 14-Heater

Cap - Anode No.3



DJ1 and DJ2 are nearer the screen

DJ3 and DJ4 are nearer the base

With DJ1 positive with respect to DJ2, the spot is deflected toward pin 5. With DJ3 positive with respect to DJ4, the spot is deflected toward pin 2.

The plane through the tube axis and each of the following items may vary from the trace produced by DJ1 and DJ2 by the following angular tolerances measured about the tube axis: Pin 5, 10°; Cap (on same side of tube as pin 5), 10°.

The angle between DJ1-DJ2 trace and DJ3-DJ4 trace is 90° \pm 3°.

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TUBE DEPARTMENT

DATA 1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

3JPI



3 JPI

OSCILLOGRAPH TUBE

Maximum Ratings, Design-Center Values:

ANODE- <i>No. 3</i> VOLTAGE	4000 max.	volts
ANODE- <i>No. 2</i> ^o VOLTAGE	2000 max.	volts
RATIO OF ANODE- <i>No. 3</i> VOLTAGE TO ANODE- <i>No. 2</i> VOLTAGE	2.3 : 1 max.	
ANODE- <i>No. 1</i> VOLTAGE	1000 max.	volts
GRID- <i>No. 1</i> VOLTAGE:		
Negative bias value	200 max.	volts
Positive bias value [†]	0 max.	volts
Positive peak value	2 max.	volts
PEAK VOLTAGE BETWEEN ANODE <i>No. 2</i> 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 anode-*No. 3* voltage (E_{b3}) between 2000* and 4000 volts
and any anode-*No. 2* voltage (E_{b2}) between 1500** and 2000 volts

Anode- <i>No. 1</i> Voltage	20% to 34.5% of E_{b2}	volts
Grid- <i>No. 1</i> Voltage†	1.5% to 4.5% of E_{b2}	volts
Anode- <i>No. 1</i> Current for any Operating Condition	-50 to +10	μ amp

Deflection Factors:

	<i>When $E_{b3} = 2 \times E_{b2}$</i>	
DJ ₁ & DJ ₂	85 to 115	v dc/in./kv of E_{b2}
DJ ₃ & DJ ₄	62.5 to 85	v dc/in./kv of E_{b2}
	<i>When $E_{b3} = E_{b2}$</i>	
DJ ₁ & DJ ₂	68 to 92	v dc/in./kv of E_{b2}
DJ ₃ & DJ ₄	50 to 68	v dc/in./kv of E_{b2}
Spot Position	#	

□ Anode *No. 2* and grid *No. 2*, which are connected together within tube, and referred to herein as anode *No. 2*.

● At or near this rating, the effective resistance of the anode supply should be adequate to limit the anode-*No. 2* input power to 6 watts.

* It is recommended that anode-*No. 3* voltage be not less than 3000 volts for high-speed transients.

** Recommended minimum value of anode-*No. 2* voltage.

With heater voltage of 6.3 volts, anode-*No. 3* voltage of 3000 volts, anode-*No. 2* voltage of 1500 volts, anode-*No. 1* voltage adjusted for focus, grid-*No. 1* voltage adjusted to give spot that is just visible, each deflecting electrode connected through 1-megohm resistor to anode *No. 2*, and tube shielded from all extraneous fields, the undeflected focused spot will fall within a 15-mm square centered at the geometric center of the tube face and having one side parallel to the trace produced by DJ₁ and DJ₂.

†; See next page.

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TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

DATA 1



3JPI

3JPI

OSCILLOGRAPH TUBE

Examples of Use of Design Ranges:

For anode-No. 3 voltage of	2000	3000	4000	volts
and anode-No. 2 voltage of	2000	1500	2000	volts
Anode-No. 1 Volt.	400 to 690	300 to 515	400 to 690	volts
Grid-No. 1 Volt.†	-30 to -90	22.5 to -67.5	-30 to -90	volts
Deflection Factors:				
DJ ₁ & DJ ₂ . . .	136 to 184	127 to 173	170 to 230	■
DJ ₃ & DJ ₄ . . .	100 to 136	94 to 128	125 to 170	■

Maximum Circuit Values:

Grid-No. 1-Circuit Resistance	1.5 max. megohms
Resistance in Any Deflecting-Electrode Circuit [▲]	5.0 max. megohms

† For visual extinction of undeflected focused spot.

■ volts dc/in.

▲ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

OPERATING NOTES

The 3JPI utilizes a medium-persistence screen having green fluorescence and phosphorescence. The screen has high visual efficiency and exceptionally good brightness contrast between the scanned line and the background. Under conditions of high ambient light, contrast may be maintained by the use of a green filter, such as Wratten No. 58.

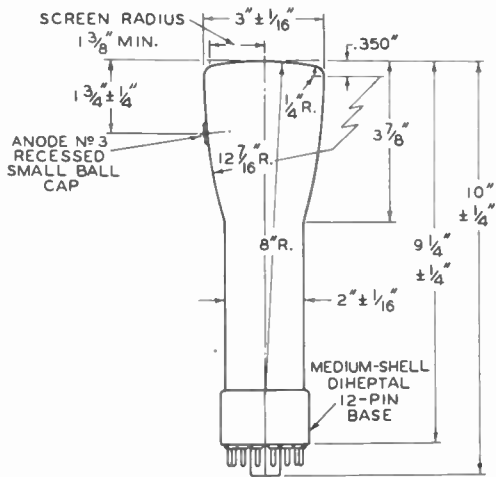
For high-speed scanning, it is recommended that the anode-No. 3 (post-deflection accelerator) voltage be not less than 3000 volts, but for low- and medium-speed scanning, anode No. 3 may be operated at a voltage as low as 2000 volts.

Because of its medium persistence, the 3JPI is particularly useful where either medium-speed non-recurring phenomena or medium- and high-speed recurring phenomena are to be observed. The persistence is such that the 3JPI can be operated with scanning frequencies as low as 20 cycles per second without excessive flicker.

3JPI



3JPI OSCILLOGRAPH TUBE



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

92CM-65B3



3JPI

3JPI

CHARACTERISTICS

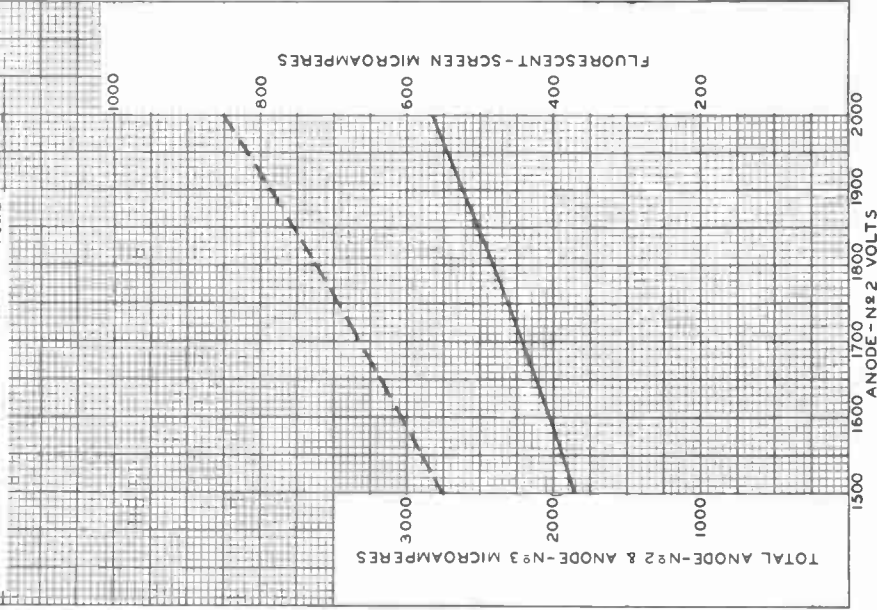
$E_f = 6.3$ VOLTS

ANODE- N_2 1 VOLTS ADJUSTED FOR FOCUS
ANODE- N_3 3 VOLTS GREATER THAN
ANODE- N_2 2 VOLTS

GRID- N_2 1 VOLTS = 0

--- TYPICAL FLUORESCENT-SCREEN
(ANODE- N_3 3) CURRENT

— MAX. TOTAL CURRENT FOR ANY
TUBE



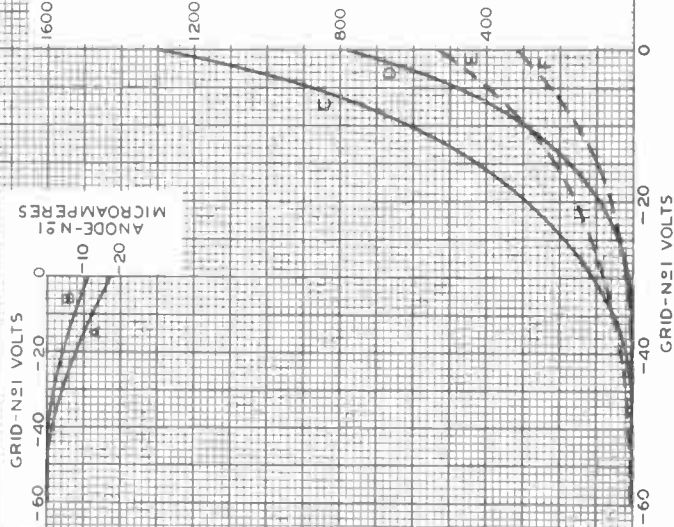


3JPI

AVERAGE CHARACTERISTICS

$E_f = 6.3$ VOLTS
 ANODE-N \circ 1 VOLTS ADJUSTED TO GIVE FOCUS

CURVE	ELECTRODE CURRENT	ANODE-N \circ 2 VOLTS	ANODE-N \circ 3 VOLTS
A	ANODE N \circ 1	2000	4000
B	ANODE N \circ 1	1500	3000
C	ANODE N \circ 2	2000	4000
D	ANODE N \circ 2	1500	3000
E	ANODE N \circ 3	2000	4000
F	ANODE N \circ 3	1500	3000





3JP7

3JP7

OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

The 3JP7 is electrically and mechanically like the 3JP1 but utilizes a long-persistence, cascade (two-layer) screen which exhibits bluish fluorescence of short persistence and greenish-yellow phosphorescence which persists for several minutes under conditions of adequate excitation and low ambient light.

Because of its long persistence, the 3JP7 is particularly useful where either low-speed non-recurring phenomena or high-speed recurring phenomena are to be observed.

The persistence is such that the 3JP7 without filter can be operated with scanning frequencies as low as 30 cycles per second without excessive flicker. When used with a yellow filter, such as Wratten No.15 (G), the 3JP7 can be operated with much lower scanning frequencies.

GENERAL DATA, MAXIMUM RATINGS, AND EQUIPMENT DESIGN RANGES

for the 3JP7 are identical with those for the 3JP1 except that Spot Position is defined as follows:

With heater voltage of 6.3 volts, anode-No.3 voltage of 4000 volts, anode-No.2 voltage of 2000 volts, anode-No.1 voltage adjusted for focus, grid-No.1 voltage adjusted to give spot that is just visible, each deflecting electrode connected through 1-megohm resistor to anode No.2, and tube shielded from all extraneous fields, the undeflected focused spot will fall within a 12-mm square centered at the geometric center of the tube face and having one side parallel to the trace produced by DJ_1 and DJ_2 .

THE SPECTRAL-ENERGY EMISSION CHARACTERISTIC,
BUILDUP CHARACTERISTICS,
and PERSISTENCE CHARACTERISTICS of
the P7 Phosphor are shown at the
front of this Section.





3KPI

3KPI

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

Voltage	6.3	ac or dc volts
Current	0.6 ± 10%	amp

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to all other electrodes	8	μf
Deflecting electrode DJ ₁ to deflecting electrode DJ ₂	2.5	μf
Deflecting electrode DJ ₃ to deflecting electrode DJ ₄	2.5	μf
DJ ₁ to all other electrodes	11	μf
DJ ₂ to all other electrodes	8	μf
DJ ₃ to all other electrodes	7	μf
DJ ₄ to all other electrodes	8	μf

Faceplate Clear Glass

Phosphor (For Curves, see front of this Section) P1

Fluorescence Green

Phosphorescence Green

Persistence Medium

Focusing Method Electrostatic

Deflection Method Electrostatic

Overall Length 11-1/2" ± 1/4"

Greatest Diameter of Eulb 3" ± 1/16"

Minimum Useful Screen Diameter 2-3/4"

Weight (Approx.) 9 oz

Mounting Position Any

Eulb. J-24

Base Medium-Shell Magnal 11-Pin (JETEC No. B11-66)

Basing Designation for BOTTOM VIEW 11M

- | | |
|---|--|
| Pin 1 - Heater | Pin 8 - Deflecting Electrode DJ ₂ |
| Pin 2 - Grid No.1 | Pin 9 - Deflecting Electrode DJ ₁ |
| Pin 3 - Cathode | Pin 10 - Internal Connection- Do Not Use |
| Pin 4 - Grid No.3 | Pin 11 - Heater |
| Pin 5 - Deflecting Electrode DJ ₃ | |
| Pin 6 - Deflecting Electrode DJ ₄ | |
| Pin 7 - Ultor (Grid No.2, Grid No.4, Collector) | |



*DJ₁ and DJ₂ are nearer the screen
 DJ₃ and DJ₄ are nearer the base*

← indicates a change.

3KP1



3KP1

OSCILLOGRAPH TUBE

With DJ_1 positive with respect to DJ_2 , the spot is deflected toward pin 4. With DJ_3 positive with respect to DJ_4 , the spot is deflected toward pin 1.

The plane through the tube axis and pin 1 may vary from the trace produced by DJ_3 and DJ_4 by $\pm 10^\circ$ (measured about the tube axis).

The angle between $DJ_1 - DJ_2$ trace and $DJ_3 - DJ_4$ trace is $90^\circ \pm 3^\circ$.

Maximum Ratings, Design-Center Values:

ULTOR VOLTAGE	2500 max.	volts
ULTOR INPUT (AVERAGE)	6 max.	watts
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_{c4}) between
recommended minimum* and 2500 volts

Grid-No.3 Voltage for Focus	16% to 30% of E_{c4}	volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot.	1.9% to 4.5% of E_{c4}	volts
Grid-No.3 Current for Any Operating Condi- tion.	-15 to +10	μ amp
Deflection Factors:		
DJ_1 & DJ_2	50 to 68	v dc/in./kv of E_{c4}
DJ_3 & DJ_4	38 to 52	v dc/in./kv of E_{c4}
Spot Position	#	

Examples of Use of Design Ranges:

For ultor voltage of 1000 2000 volts

Grid-No.3 Voltage for Focus	160 to 300	320 to 600	volts
--	------------	------------	-------

* Brilliance and definition decrease with decreasing ultor voltage. Recommended minimum for the 3KP1 in general service is 1000 volts but a value as low as 500 volts may be used under conditions of low-velocity deflection and low ambient-light levels.

The center of the undeflected focused spot will fall within a circle having 7.5-mm radius concentric with the center of the tube face.

→ Indicates a change.



3KPI

3KPI

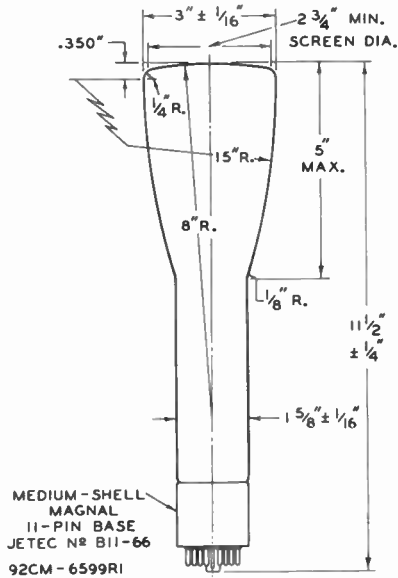
OSCILLOGRAPH TUBE

For ultor voltage of	1000	2000	volts
Grid-No.1 Voltage for Visual Extinction of Undelected Focused Spot	-19 to -45	-38 to -90	volts ←
Deflection Factors:			
DJ ₁ & DJ ₂	50 to 68	100 to 136	volts dc/in.
DJ ₃ & DJ ₄	38 to 52	78 to 104	volts dc/in.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting Electrode Circuit	5 max.	megohms

It is recommended that the deflecting-electrode-circuit resistances be approximately equal.



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

← Indicates a change.

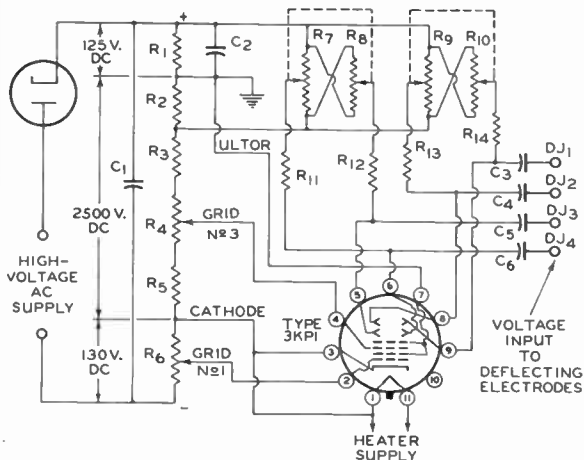
3KPI



3KPI

OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



92CS-669QR2

C1: 0.1 μ f, 3000 VoltsC2: 1.0 μ f, 200 VoltsC3 C4 C5 C6: 0.05- μ f Blocking
Capacitors*

R1 R2: 2 Megohms, 0.5 watt

R3: 6 Megohms, 0.5 watt

R4: 2-Megohm Potentiometer, 0.5 watt

R5: 1.0 Megohm, 0.5 watt

R6: 0.5-Megohm Potentiometer, 0.5 watt
R7 R8: Dual 5-Megohm Potentiometer,
0.5 wattR9 R10: Dual 5-Megohm Potentiometer,
0.5 watt

R11 R12 R13 R14: 2 Megohms, 0.5 watt

- * When cathode is grounded, capacitors should have high voltage rating (3000 volts); when ultor is grounded, they may have low voltage rating (200 volts). For dc amplifier service, deflecting electrodes should be connected direct to amplifier output. In this service, it is preferable usually to remove deflecting-electrode resistors to minimize loading effect on amplifier. In order to minimize spot defocusing, it is essential that ultor be returned to a point in the amplifier system which will give the lowest possible potential difference between ultor and the deflecting electrodes.

Devices and arrangements shown or described herein may use patents of RCA or others. Information contained herein is furnished without responsibility by RCA for its use and without prejudice to RCA's patent rights.

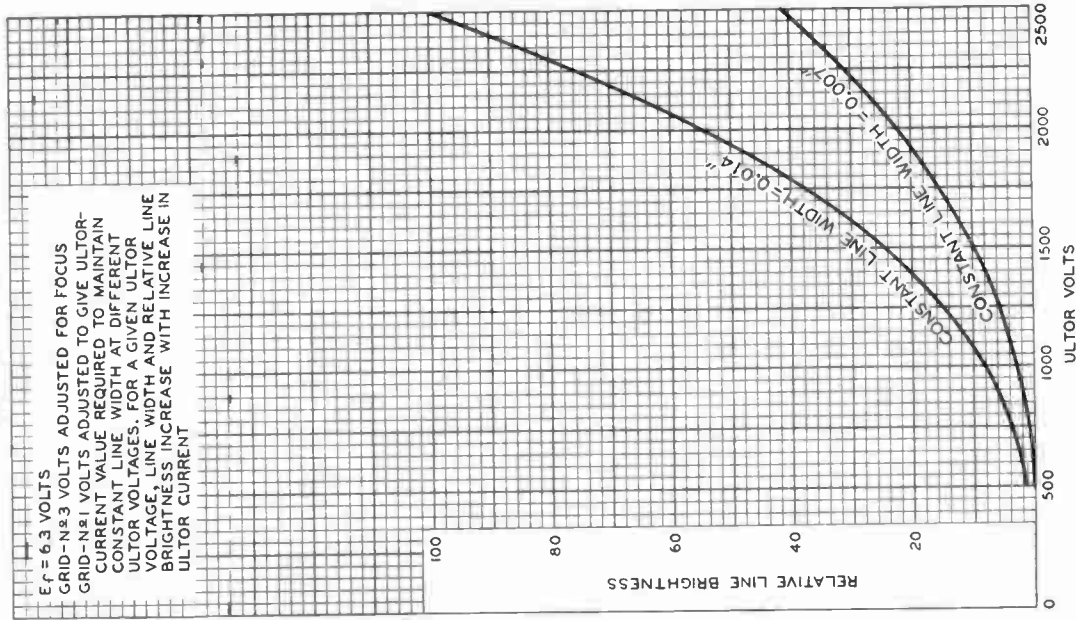


3KPI

CHARACTERISTICS

$E_f = 6.3$ VOLTS

GRID-N₂3 VOLTS ADJUSTED FOR FOCUS
GRID-N₂1 VOLTS ADJUSTED TO GIVE ULTOR-
CURRENT VALUE REQUIRED TO MAINTAIN
CONSTANT LINE WIDTH AT DIFFERENT
ULTOR VOLTAGES. FOR A GIVEN ULTOR
VOLTAGE, LINE WIDTH AND RELATIVE LINE
BRIGHTNESS INCREASE WITH INCREASE IN
ULTOR CURRENT



ULTOR VOLTS

92CM-7191R2

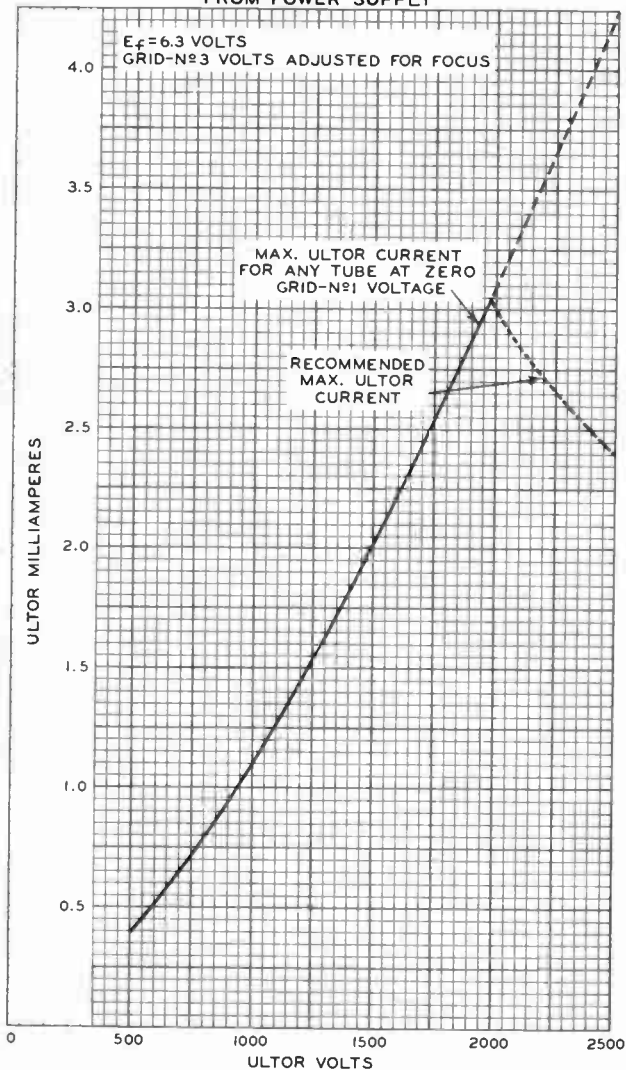
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

3KPI

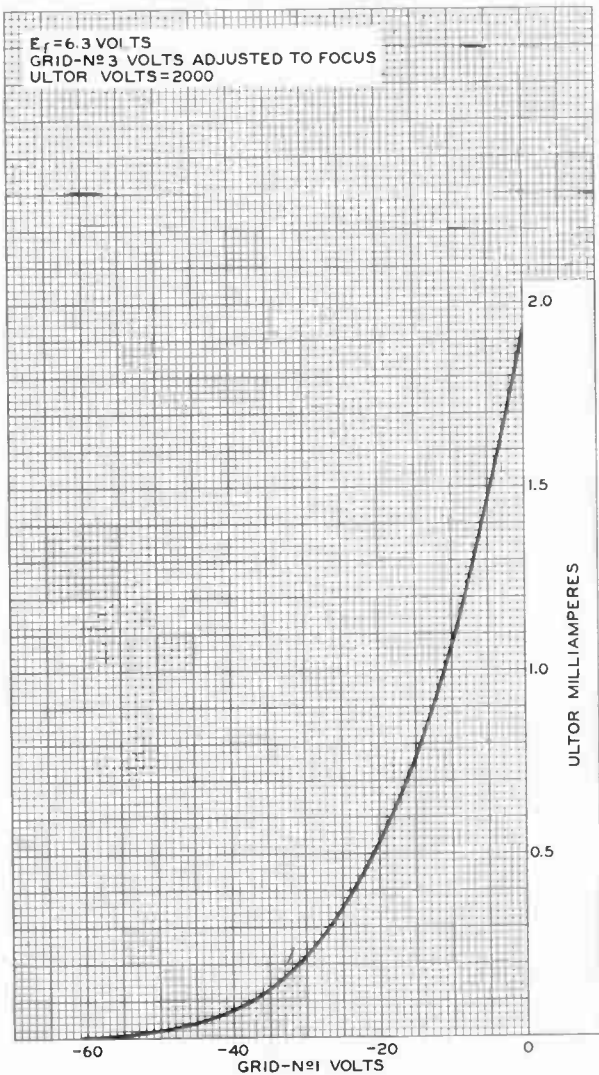


3KPI

MAXIMUM ULTOR-CURRENT REQUIREMENTS FROM POWER SUPPLY



AVERAGE CHARACTERISTIC







3KP4

3KP4
TO
3KP11

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

The 3KP4 is the same as the 3KP1 except for the following items:

General:

Phosphor (For curves, see front of this section) P4—Sulfide Type	
Fluorescence	White
Phosphorescence	White
Persistence	Medium-Short

In general, operation of the 3KP4 at an ultor voltage less than 1500 volts is not recommended.

The PERSISTENCE CHARACTERISTICS of the P4-sulfide phosphor are the same as those shown for the P11 phosphor at the front of this Section

3KP7

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

The 3KP7 is the same as the 3KP1 except for the following items:

General:

Phosphor (For Curves, see front of this Section) P7	
Fluorescence	Purplish-Blue
Persistence	Medium-Short
Phosphorescence	Yellowish-Green
Persistence	Very Long

In general, operation of the 3KP7 at an ultor voltage less than 1500 volts is not recommended.

3KP11

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

The 3KP11 is the same as the 3KP1 except for the following items:

General:

Phosphor (For Curves, see front of this Section) P11	
Fluorescence	Blue
Phosphorescence	Blue
Persistence	Medium-Short

In general, operation of the 3KP11 at an ultor voltage less than 1500 volts is not recommended.

← Indicates a change.

3KP16



3KP16

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

The 3KP16 is the same as the 3KP1 except for the following items:

General:

Phosphor (For Curves, see front of this Section)P16

Fluorescence—

Visible radiation. Violet

Invisible radiation. Near-Ultraviolet

Phosphorescence—

Persistence of visible radiation Very Short

Persistence of invisible radiation Very Short

In general, operation of the 3KP16 at an ultor voltage less than 1500 volts is not recommended.



3KP11

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

3KP11

The 3KP11 is the same as the 3KP1 except that it has a phosphor of the short-persistence, blue-fluorescence type designated P11. The blue radiation of the P11 screen is highly actinic and has sufficiently short persistence to permit use of the 3KP11 in all moving-film photographic applications without blurring except in those where film moves at a high speed. The 3KP11 is also quite satisfactory for visual observation of phenomena because its phosphor has unusually high brightness for a blue screen.

In general, operation of the 3KP11 at an anode-No.2 voltage less than 1500 volts is not recommended.

THE SPECTRAL-ENERGY EMISSION CHARACTERISTIC
and the PERSISTENCE CHARACTERISTIC of
the P11 Phosphor are shown at the
front of this Section

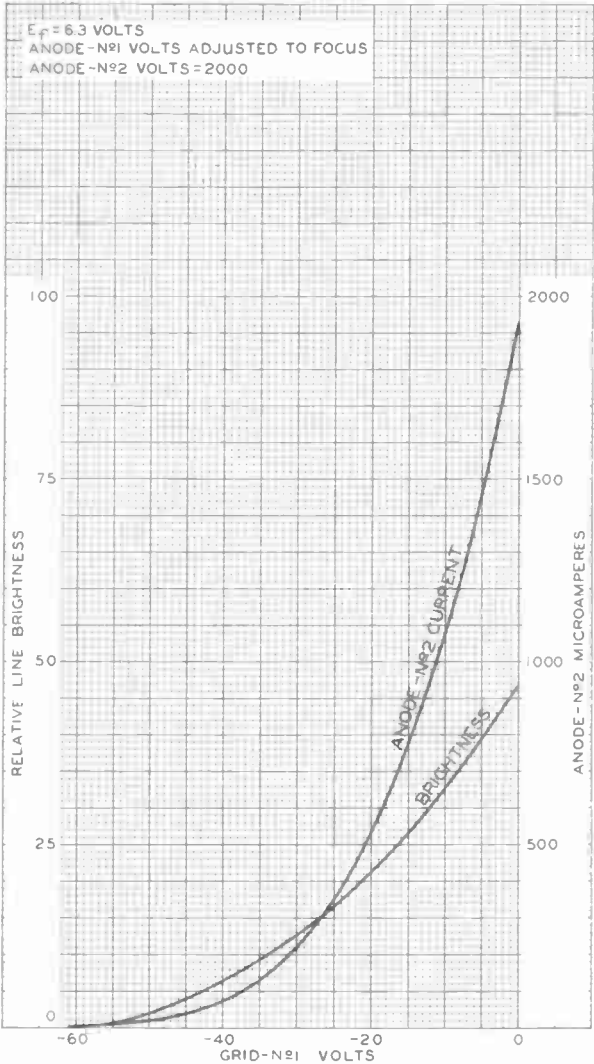
The curve showing MAXIMUM ANODE-No.2 CURRENT
REQUIREMENTS FROM POWER SUPPLY for Type
3KP1 also applies to the 3KP11

3KP11



3KP11

AVERAGE CHARACTERISTICS





3MPI

3MPI

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

Voltage.	6.3	. . . . .	ac or dc volts
Current.	0.6	. . . . .	amp

Direct Interelectrode Capacitances (Approx.):

Cathode to All Other Electrodes.	2.2	
Grid No.1 to All Other Electrodes.	10.3	$\mu\mu\text{f}$
DJ ₁ to DJ ₂	1.3	$\mu\mu\text{f}$
DJ ₃ to DJ ₄	1.2	$\mu\mu\text{f}$
DJ ₁ to All Other Electrodes Except DJ ₂	4.4	$\mu\mu\text{f}$
DJ ₂ to All Other Electrodes Except DJ ₁	5.6	$\mu\mu\text{f}$
DJ ₃ to All Other Electrodes Except DJ ₄	5.0	$\mu\mu\text{f}$
DJ ₄ to All Other Electrodes Except DJ ₃	4.5	$\mu\mu\text{f}$

Phosphor (For Curves, see front of this Section) No.1

Fluorescence	Green
Persistence.	Medium

Focusing Method. Electrostatic

Deflection Method. Electrostatic

Overall Length 8" \pm 1/4"

Greatest Diameter of Bulb. 3" \pm 1/16"

Minimum Useful Screen Diameter 2-3/4"

Mounting Position. Any

Base Small-Shell Duodecal 12-Pin

Basing Designation for Bottom View 12F

Pin 1-Heater		Pin 7-Deflecting Electrode
Pin 2-Grid No.1		DJ ₁
Pin 3-Anode No.1		Pin 8-Deflecting Electrode DJ ₂
Pin 4-Deflecting Electrode DJ ₃		Pin 9-Anode No.2, Grid No.2
Pin 5-Deflecting Electrode DJ ₄		Pin 10-No Connection
Pin 6-No Connection		Pin 11-Cathode
		Pin 12-Heater



DJ₁ and DJ₂ are nearer the screen

DJ₃ and DJ₄ are nearer the base

With DJ₁ positive with respect to DJ₂, the spot is deflected toward pin 4. With DJ₃ positive with respect to DJ₄, the spot is deflected toward pin 1.

The plane through the tube axis and pin 4 may vary from the trace produced by DJ₁ and DJ₂ by an angular tolerance (measured about the tube axis) of 10°.

Maximum Ratings, Design-Center Values:

ANODE-NO.2* VOLTAGE# 2500 max. volts

* Anode No.2 and grid No.2 which are connected together within tube, are referred to herein as anode No.2.

The product of anode-No.2 voltage and average anode-No.2 current should be limited to 6 watts.

3MP1



3MP1

OSCILLOGRAPH TUBE

ANODE- <i>No.1</i> VOLTAGE	1000 max.	volts
GRID- <i>No.1</i> VOLTAGE:		
Negative bias value.	200 max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts
PEAK VOLTAGE BETWEEN ANODE <i>No.2</i> 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 anode-*No.2* voltage (E_{b2}) between
 recommended minimum* and 2500 volts

Anode- <i>No.1</i> Voltage . . .	20% to 35% of E_{b2}	. . . . .	volts
Max. Grid- <i>No.1</i> Voltage for Visual Cutoff	6.3% of E_{b2}	. . . . .	volts
Anode- <i>No.1</i> Cur. for any Operating Condition.	-15 to +10	. . . . .	microamperes
Deflection Factors:			
DJ ₁ & DJ ₂	115 to 145	vdc/in./kv of E_{b2}	
DJ ₃ & DJ ₄	110 to 140	vdc/in./kv of E_{b2}	

Examples of Use of Design Ranges:

For anode- <i>No.2</i> voltage of	1000	2000	volts
Anode- <i>No.1</i> Voltage	200-350	400-700	volts
Max. Grid- <i>No.1</i> Voltage for Visual Cutoff	-63	-126	volts
Deflection Factors:			
DJ ₁ & DJ ₂	115-145	230-290	volts dc/in.
DJ ₃ & DJ ₄	110-140	220-280	volts dc/in.

Maximum Circuit Values:

Grid- <i>No.1</i> -Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting- Electrode Circuit [□]	5.0 max.	megohms

* Brilliance and definition decrease with decreasing anode-*No.2* voltage. Recommended minimum for the 3MP1 in general service is 1000 volts but a value as low as 500 volts may be used under conditions of low-velocity deflection and low ambient-light levels.

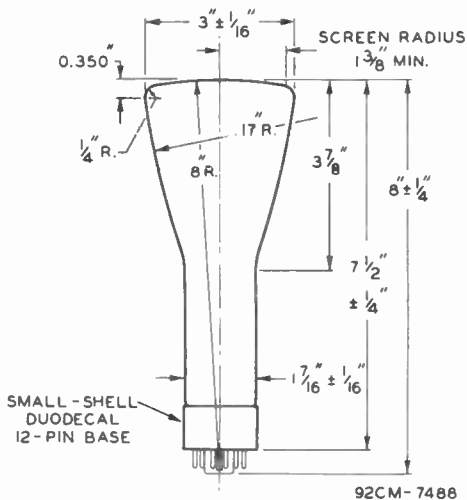
□ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.



3MPI

3MPI

OSCILLOGRAPH TUBE



JULY 3, 1950

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-7488





3RP1

3RP1

OSCILLOGRAPH TUBE

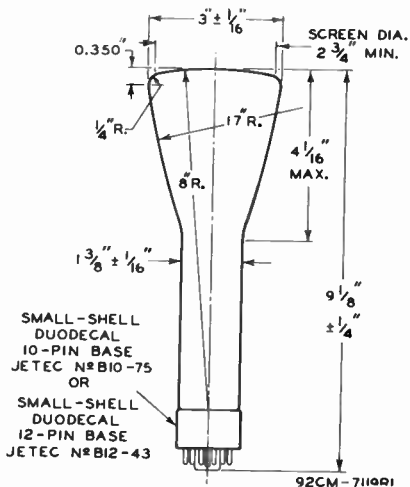
ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

The 3RP1 is the same as the 3RP1-A except for the following items:

General:

Faceplate. Spherical Clear Glass
 Bulb J-24P1
 Weight (Approx.) 7 oz



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

SEPT. 1, 1955

TUBE DIVISION

DATA

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY





3RPI-A

3RPI-A

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

Voltage	6.3	ac or dc volts
Current	0.6 ± 10%	amp

Direct Interelectrode Capacitances (Approx.):

Grid No. 1 to all other electrodes	8	μf
Deflecting electrode DJ ₁ to deflecting electrode DJ ₂	2	μf
Deflecting electrode DJ ₃ to deflecting electrode DJ ₄	2	μf
DJ ₁ to all other electrodes	11	μf
DJ ₂ to all other electrodes	8	μf
DJ ₃ to all other electrodes	7	μf
DJ ₄ to all other electrode	8	μf

Faceplate	Flat Clear Glass
Phosphor (For Curves, see front of this Section).	P1
Fluorescence	Green
Phosphorescence	Green
Persistence	Medium

Focusing Method Electrostatic

Deflection Method Electrostatic

Overall Length 9 1/8" ± 1/4"

Greatest Diameter of Bulb 3" ± 1/16"

Minimum Useful Screen Diameter 2-3/4"

Mounting Position Any

Weight (Approx.) 12 oz

Bulb J-24S1

Base Small Shell Duodecal 10-Pin (JETEC No. B10-75),
or Small Shell Duodecal 12-Pin (JETEC No. B12-43)

Base Designation for POTOM VIEW 12E

Pin 1 - Heater	Pin 8 - Ultron
Pin 2 - Grid No. 1	(Grid No. 2,
Pin 3 - Cathode	Grid No. 4,
Pin 4 - Grid No. 3	Collector)
Pin 5 - Internal connection Do not use	Pin 9 - Deflecting Electrode DJ ₂
Pin 6 - Deflecting Electrode DJ ₃	Pin 10 - Deflecting Electrode DJ ₁
Pin 7 - Deflecting Electrode DJ ₄	Pin 11 - Internal connection- Do Not Use
	Pin 12 - Heater



*DJ₁ and DJ₂ are nearer the screen
DJ₃ and DJ₄ are nearer the base*

▲ Pins 5 and 11 are omitted from the 10-pin base.

3RP1-A



3RP1-A

OSCILLOGRAPH TUBE

With DJ_1 positive with respect to DJ_2 , the spot is deflected toward pin 4. With DJ_3 positive with respect to DJ_4 , the spot is deflected toward pin 1.

The plane through the tube axis and pin 1 may vary from the trace produced by DJ_3 and DJ_4 by 10° (measured about the tube axis).

The angle between $DJ_1 - DJ_2$ trace and $DJ_3 - DJ_4$ trace is $90^\circ \pm 3^\circ$.

Maximum Ratings, Design-Center Values:

ULTOR ^o VOLTAGE	2500 max.	volts
ULTOR INPUT (AVERAGE).	6 max.	watts
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_{c4}) between 500* and 2500 volts

Grid-No.3 Voltage		
for Focus.	16.5% to 21% of E_{c4}	volts
Maximum Grid-No.1 Voltage for Visual Extinction of Un- deflected Focused Spot	-6.75% of E_{c4}	volts
Grid-No.3 Current for Any Operating Con- dition	-15 to +10	μ amp
Deflection Factor:		
DJ_1 & DJ_2	73 to 93	v dc/in./kv of E_{c4}
DJ_3 & DJ_4	52 to 70	v dc/in./kv of E_{c4}
Spot Position.	**	

^o The "ultor" in a cathode-ray 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 3RP1-A, the ultor function is performed by grid No.4. Since grid No.4, grid No.2, and collector are connected together within the 3RP1-A, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.

* Brilliance and definition decrease with decreasing ultor voltage. A value as low as 500 volts is recommended only for low-velocity deflection and low ambient-light levels.

** The center of the undeflected focused spot will fall within a circle having 7.5-mm radius concentric with the center of the tube face.

JULY 1, 1955

TENTATIVE DATA 1

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History



3RPI-A

OSCILLOGRAPH TUBE

3RPI-A

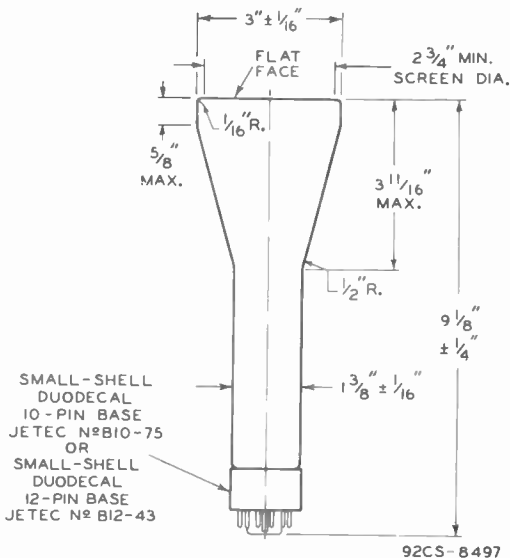
Examples of Use of Design Ranges:

For ultor voltages of	1000	2000	volts
Grid-No.3 Voltage for Focus.	165 to 310	330 to 620	volts
Maximum Grid-No.1 Voltage for Visual Extinction of In- deflected focused Spot	-67.5	-135	volts
Deflection Factors:			
DJ1 & DJ2.	73 to 99	146 to 198	volts dc/in.
DJ3 & DJ4.	52 to 70	104 to 140	volts dc/in.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting- Electrode Circuit	5 max.	megohms

It is recommended that the deflecting-electrode circuit resistances be approximately equal.



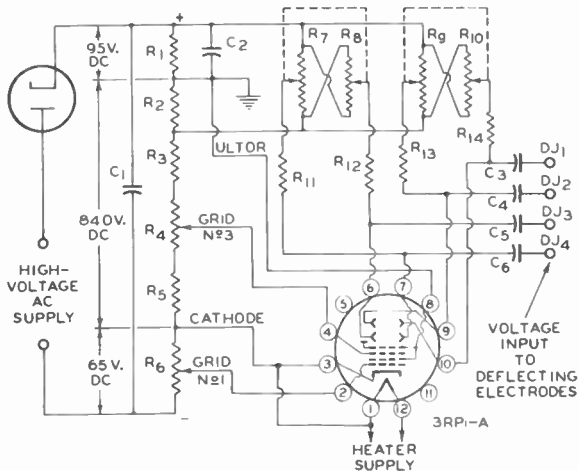
CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE.

3RP1-A



3RP1-A OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



92CS-6777R1

C1: 0.2 μ f
 C2: 1.0 μ f
 C3 C4 C5 C6: 0.05- μ f Blocking
 Capacitors
 R1 R2: 2.5 Megohms, 0.5 watt
 R3: 2.5 Megohms, 1 watt

R4: 1.0-Megohm Potentiometer
 R5: 0.5 Megohm, 0.5 watt
 R6: 0.35 Megohm, 0.5 watt
 R7 R8: Dual 5-Megohm Potentiometer
 R9 R10: Dual 5-Megohm Potentiometer
 R11 R12 R13 R14: 2 Megohms, 0.5 watt

* When cathode is grounded, capacitors should have high voltage ratings; when ultor is grounded, they may have low voltage rating. For dc amplifier service, deflecting electrodes should be connected direct to amplifier output. In this service, it is preferable usually to remove deflecting-electrode resistors to minimize loading effect on amplifier. In order to minimize spot defocusing, it is essential that ultor be returned to a point in the amplifier system which will give the lowest possible potential difference between ultor and the deflecting electrodes.

Devices and arrangements shown or described herein may use patents of RCA or others. Information contained herein is furnished without responsibility by RCA for its use and without prejudice to RCA's patent right.

JULY 1, 1955

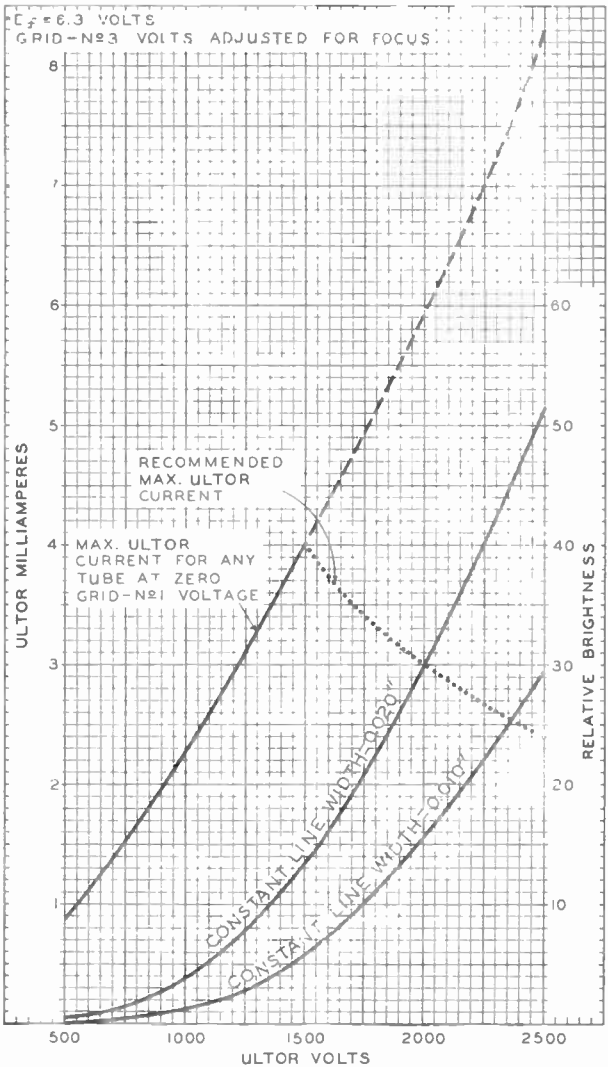
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 RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-6777R1



3RPI-A

3RPI-A CHARACTERISTICS



MAR. 24, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

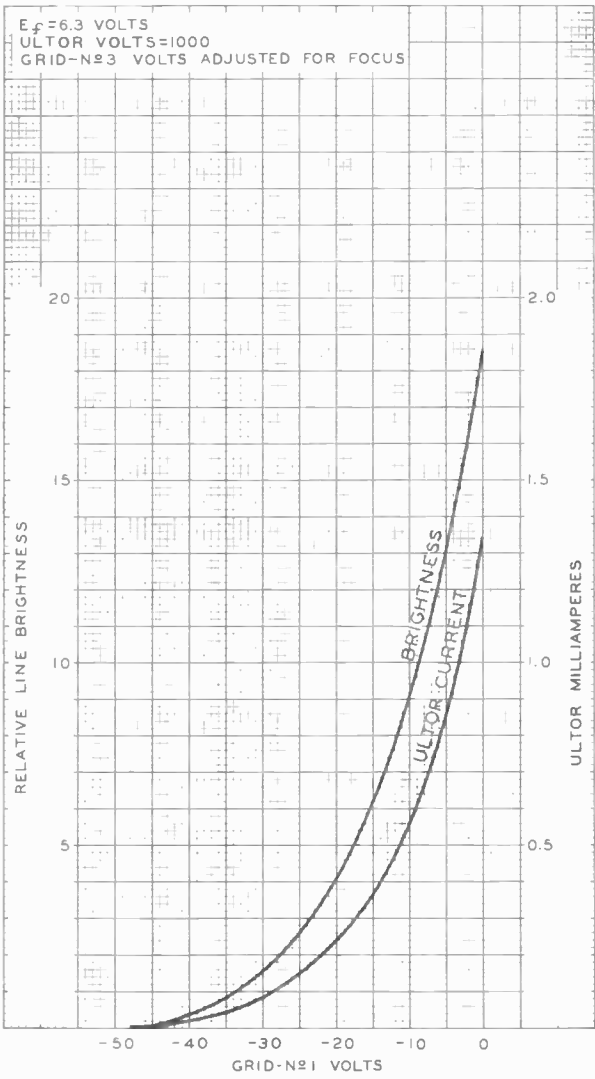
92CM-7143RI

3RPI-A



3RPI-A

AVERAGE CHARACTERISTICS



MAR. 24, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-714IR1



3RP4

3RP4

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

The 3RP4 is the same as the 3RP1 except for the following items:

General:

Phosphor (For curves, see front of this section)	P4—Sulfide Type
Fluorescence	White
Phosphorescence	White
Persistence	Short

In general, operation of the 3RP4 at an ultor voltage less than 1500 volts is not recommended.





3WPI

3WPI

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:
 Voltage 6.3 ac or dc volts
 Current 0.6 ± 10% amp

Direct Interelectrode Capacitances:
 Grid No. 1 to all other electrodes 4.6 to 8.7 μμf
 Cathode to all other electrodes 3 to 5.7 μμf
 Deflecting electrode DJ₁ to
 deflecting electrode DJ₂ 1.7 to 3.3 μμf
 Deflecting electrode DJ₃ to
 deflecting electrode DJ₄ 1 to 2 μμf
 DJ₁ to all other electrodes 5.5 to 10.5 μμf
 DJ₂ to all other electrodes 5.5 to 10.5 μμf
 DJ₃ to all other electrodes 3.5 to 6.8 μμf
 DJ₄ to all other electrodes 3.5 to 6.8 μμf

Faceplate, Flat Clear Glass
 Phosphor (For Curves, see front of this Section) P1
 Fluorescence Green
 Phosphorescence Green
 Persistence Medium

Focusing Method Electrostatic
 Deflection Method Electrostatic
 Deflecting-electrode

arrangement See Dimensional Outline

Overall Length 11-1/2" ± 1/8"

Greatest Diameter of Bulb 3" ± 1/16"

Minimum Useful Screen Diameter 2-3/4"

Minimum Useful Scan (Centered with respect to tube face):

By deflecting electrodes DJ₁ & DJ₂ 2-1/2"

By deflecting electrodes DJ₃ & DJ₄ 2-1/4"

Weight (Approx.) 1 lb

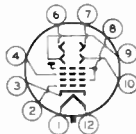
Mounting Position Any

Bulb J24R

Base Small-Shell Duodecal 10-Pin (JETEC No. B10-75),
 or Small-Shell Duodecal 12-Pin (JETEC No. B12-43)

Basing Designation for BOTTOM VIEW 12T

- | | |
|--|---|
| Pin 1 - Heater | Pin 8 - Ultron |
| Pin 2 - Grid No. 1 | (Grid No. 2, |
| Pin 3 - Cathode | Grid No. 4, |
| Pin 4 - Grid No. 3 | Collector) |
| Pin 6 - Deflecting
Electrode
DJ ₁ | Pin 9 - Deflecting
Electrode
DJ ₄ |
| Pin 7 - Deflecting
Electrode
DJ ₂ | Pin 10 - Deflecting
Electrode
DJ ₃ |
| | Pin 12 - Heater |



3WPI



3WPI

OSCILLOGRAPH TUBE

Maximum Ratings, Design-Center Values:

ULTOR VOLTAGE.	2500 max.	volts
ULTOR INPUT (AVERAGE).	6 max.	watts
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.	0 max.	volts
PEAK VOLTAGE BETWEEN ULTOR AND ANY		
DEFLECTING ELECTRODE	500 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	180 max.	volts
Heater positive with respect to cathode.	180 max.	volts

Equipment Design Ranges:

For any ultor voltage (E_{c4}) between recommended minimum* and 2500 volts

Grid-No.3 Voltage for Focus.	16.5% to 31% of E_{c4}	volts
Grid-No.1 Voltage for Visual Ex- tinction of Under- flected Focused Spot	-3% to -5% of E_{c4}	volts
Grid-No.3 Current for Any Operat- ino Condition.	-15 to +10	μa
Deflection Factors: DJ ₁ & DJ ₂	41.5 to 50.5	v dc/in./kv of E_{c4}
DJ ₃ & DJ ₄	28.5 to 35	v dc/in./kv of E_{c4}
Spot Position.	**	

Examples of Use of Design Ranges:

For ultor voltage of	1000	1500	2000	volts
Grid-No.3 Volt- age for Focus.	165 to 310	247 to 465	330 to 620	volts
Grid-No.1 Voltage for Visual Ex- tinction of Unflected Focused Spot	-30 to -50	-45 to -75	-60 to -100	volts
Deflection Factors: DJ ₁ & DJ ₂	41.5 to 50.5	62.3 to 75.8	83 to 101	v dc/in.
DJ ₃ & DJ ₄	28.5 to 35	42.8 to 52.5	57 to 70	v dc/in.

* Brilliance and definition decrease with decreasing ultor voltage. Recommended minimum for the 3WPI in general service is 1000 volts but a value as low as 500 volts may be used under conditions of low-velocity deflection and low ambient-light levels.

** : See next page.



3WPI

3WPI

OSCILLOGRAPH TUBE

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting-Electrode Circuit [■]	5 max.	megohms

SPECIAL PERFORMANCE DATA

For ultor voltage of 1500 volts

Line Width [▲]	0.020 max.	inch
Peak Grid-No.1 Drive from Spot Cutoff [▲]	50 max.	volts
Raster Shape	§	
Deflection Factor Uniformity	♣	

** with grid-no.1 voltage adjusted to give a spot that is just visible, and the tube shielded from all extraneous fields, the center of the undeflected focused spot will fall within a circle of 3/16-inch radius concentric with the center of the tube face.

■ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

▲ Under the following conditions: heater voltage of 6.3 volts, brightness of 7 foot-lamberts measured on a 2" x 2", 49-line raster with high-frequency scanning applied to deflecting electrodes DJ₁ and DJ₂. For line-width measurement, the high-frequency scanning is adjusted to give a raster width of 6.9 cm with the grid-No.3 voltage adjusted to give sharpest focus at center of tube face. Raster height is contracted until the individual scanning lines are just barely distinguishable. Line width is expressed as the quotient of the contracted raster height measured at the center line of the tube face divided by the number of scanning lines (49).

§ Under the following conditions: heater voltage of 6.3 volts, grid-No.3 voltage adjusted for focus, and grid-No.1 voltage adjusted to give visible raster. With 49-line raster centered with respect to the tube face and size adjusted to give mean dimensions of 1.875" in 10J2 direction and 1.688" in 3DJ4 direction, all points on the raster will lie within the area between the two rectangles also centered with respect to the tube face; the one, 1.920" in 10J2 direction by 1.730" in 3DJ4 direction; the other, 1.830" in 10J2 direction and 1.646" in 3DJ4 direction.

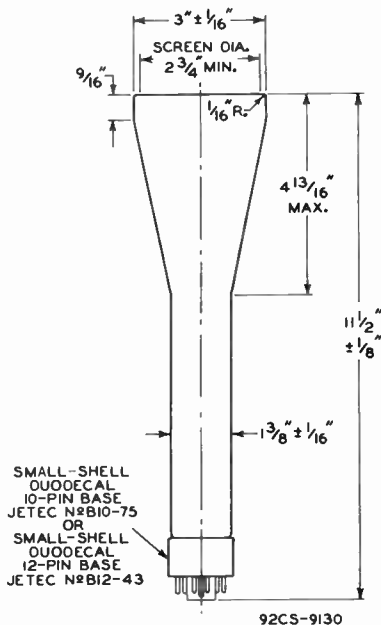
♣ The deflection factor for either DJ₁ and DJ₂ electrodes or DJ₃ and DJ₄ electrodes for a deflection of less than 75 per cent of the respective useful scan will not differ from the deflection factor for the corresponding deflecting electrodes at 25 per cent of the useful scan by more than 2 per cent.

3WP1



3WP1

OSCILLOGRAPH TUBE



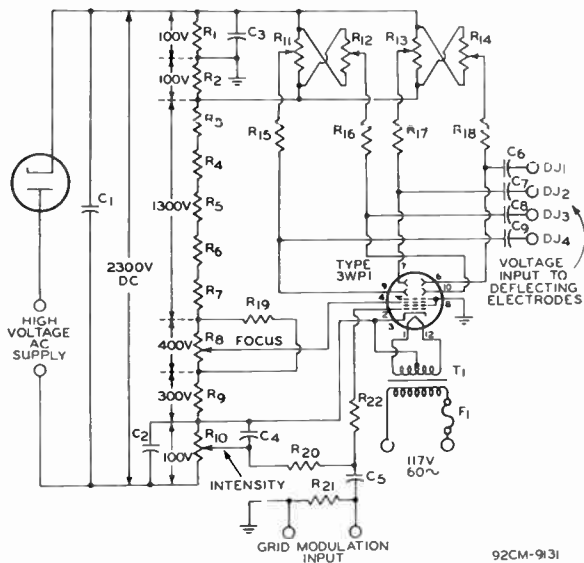
\angle OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE.

THE PLANE THROUGH THE TUBE AXIS AND PIN 3 MAY VARY FROM THE TRACE PRODUCED BY DJ_1 AND DJ_2 BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 10^{\circ}$. ANGLE BETWEEN $DJ_1 - DJ_2$ TRACE AND $DJ_3 - DJ_4$ TRACE IS $90^{\circ} \pm 1^{\circ}$.

DJ_1 AND DJ_2 ARE NEARER THE SCREEN; DJ_3 AND DJ_4 ARE NEARER THE BASE. WITH DJ_1 POSITIVE WITH RESPECT TO DJ_2 , THE SPOT WILL BE DEFLECTED TOWARD PIN 3; LIKewise, WITH DJ_3 POSITIVE WITH RESPECT TO DJ_4 , THE SPOT WILL BE DEFLECTED TOWARD PIN 12.

OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



92CM-9131

- C1: 0.5 μ f, 3000 volts
 C2: 8 μ f, 250 volts
 C3: 1 μ f, 200 volts
 C4: 1 μ f, 200 volts
 C5: 0.05 μ f, 3000 volts
 C6 C7 C8 C9: 0.05 μ f, 600 volts
 R1 R2: 510000 ohms, 1/2 watt
 R3 R4 R5 R6: 270000 ohms, 1/2 watt
 R7: 220000 ohms, 1/2 watt
 R8: 500000-ohm potentiometer, 1/2 watt
 R9: 300000 ohms, 1/2 watt
 R10: 100000-ohm potentiometer, 1/2 watt

- R11 R12: Dual 1-megohm potentiometer, 1/2 watt
 R13 R14: Dual 1-megohm potentiometer, 1/2 watt
 R15 R16 R17 R18: 1.5 megohms, 1/2 watt
 R19: 2 megohms, 1 watt
 R20: 510000 ohms, 1/2 watt
 R21: 5 megohms, 1/2 watt
 R22: 5100 ohms, 1/2 watt
 T1: Transformer, with 6.3-volt/1-ampere secondary, insulated for at least 3000 volts, such as Thordarson T26F65.
 F1: 1-ampere fuse

Devices and arrangements shown or described herein may use patents of RCA or others. Information contained herein is furnished without responsibility by RCA for its use and without prejudice to RCA's patent rights.

3WPI



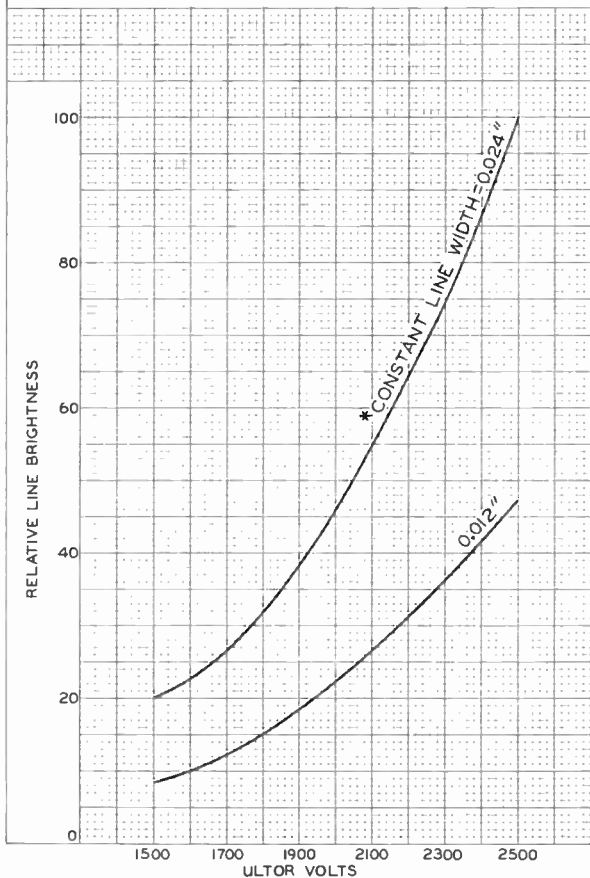
3WPI

AVERAGE CHARACTERISTICS

 $E_f = 6.3$ VOLTSGRID-N₂ 3 VOLTS ADJUSTED FOR FOCUS.

GRID-N₁ 1 VOLTS ADJUSTED TO GIVE ULTOR-CURRENT VALUE REQUIRED TO MAINTAIN CONSTANT LINE WIDTH AT DIFFERENT ULTOR VOLTAGES. FOR A GIVEN ULTOR VOLTAGE, LINE WIDTH AND RELATIVE LINE BRIGHTNESS INCREASE WITH INCREASE IN ULTOR CURRENT.

* LINE WIDTH MEASURED BETWEEN POINTS WHERE BRIGHTNESS WAS APPROX. $\frac{1}{2}$ THAT AT CENTER OF LINE.



TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

92CM-9162

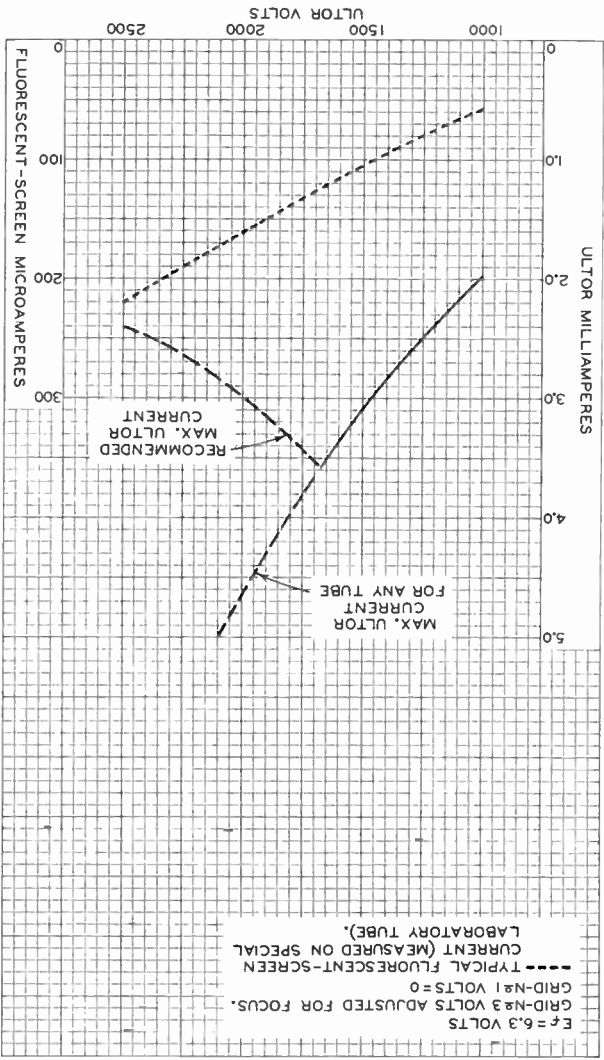
CHARACTERISTICS

3WP1



World Radio History

$E_f = 6.3$ VOLTS
 GRID-#2 3 VOLTS ADJUSTED FOR FOCUS.
 GRID-#1 VOLTS = 0
 ----- TYPICAL FLUORESCENT-SCREEN
 CURRENT (MEASURED ON SPECIAL
 LABORATORY TUBE).



92CM-9158

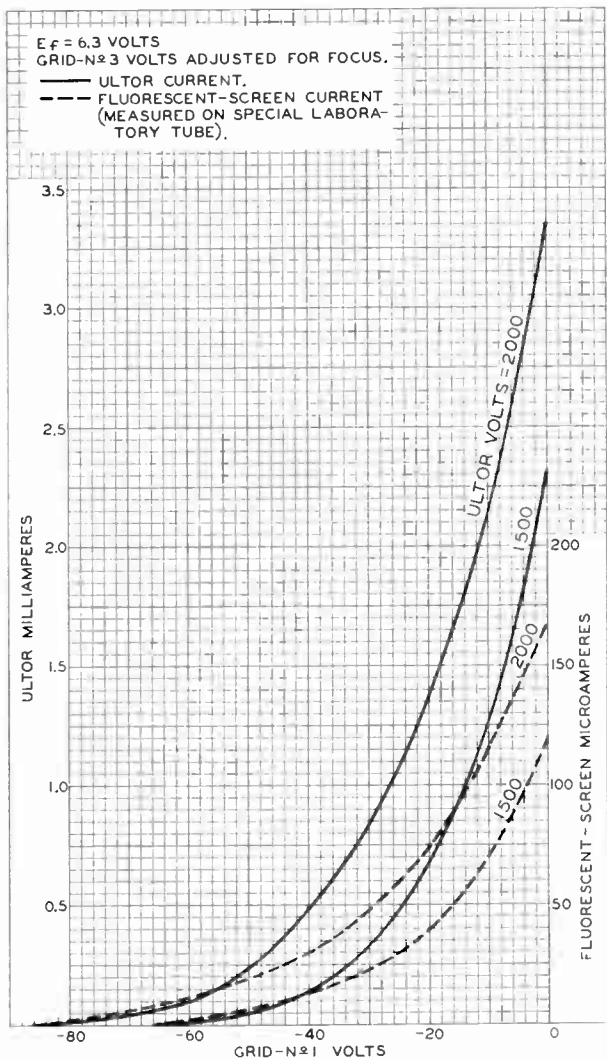
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3WPI



3WPI

AVERAGE CHARACTERISTICS



TUBE DIVISION

92CM-9159

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY



3WP2

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

3WP2
3WP1

The 3WP2 is the same as the 3WP1 except for the following items:

General:

- Phosphor (For Curves, see front of this Section) P2
- Fluorescence Greenish-Yellow
- Phosphorescence Greenish-Yellow
- Persistence Long

Line width and drive values for the 3WP2 are the same as those shown for type 3WP1 under the heading SPECIAL PERFORMANCE DATA and are based upon operation at brightness values calculated from 3WP1 performance.

3WP11

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

The 3WP11 is the same as the 3WP1 except for the following items:

General:

- Phosphor (For Curves, see front of this Section) P11
- Fluorescence Blue
- Phosphorescence Blue
- Persistence Short

Line width and drive values for the 3WP11 are the same as those shown for type 3WP1 under the heading SPECIAL PERFORMANCE DATA and are based upon operation at brightness values calculated from 3WP1 performance.





5ABPI

OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

5ABPI

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 8 μμf
Cathode to All Other Electrodes 5 μμf
DJ1 to DJ2 2.5 μμf
DJ3 to DJ4 1.3 μμf
DJ1 to All Other Electrodes 9 μμf
DJ2 to All Other Electrodes 9 μμf
DJ3 to All Other Electrodes 5 μμf
DJ4 to All Other Electrodes 6 μμf

Faceplate, Flat Clear Glass

Phosphor (For Curves, see front of this Section). P1

Fluorescence and Phosphorescence Green

Persistence of Phosphorescence Medium

Focusing Method Electrostatic

Deflection Method Electrostatic

Overall Length 16-3/4" ± 3/8"

Greatest Diameter of Bulb 5-1/4" ± 3/32"

Minimum Useful Screen Diameter 4-9/16"

Bulb J42

Weight (Approx.) 2-1/2 lbs

Mounting Position Any

Cap Recessed Small Ball (JETEC No.J1-22)

Base Medium-Shell Dihedral 12-Pin (JETEC No.B12-37)

BOTTOM VIEW

Pin 1 - Heater

Pin 2 - Cathode

Pin 3 - Grid No.1

Pin 4 - No Connection - Do Not Use

Pin 5 - Grid No.3

Pin 7 - Deflecting Electrode DJ3

Pin 8 - Deflecting Electrode DJ4

Pin 9 - Ultor

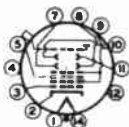
(Grid No.2, Grid No.4)

Pin 10 - Deflecting Electrode DJ2

Pin 11 - Deflecting Electrode DJ1

Pin 12 - No. Conn.

Pin 14 - Heater Cap - Post-Ultor (Grid No.5, Collector)



DJ1 and DJ2 are nearer the screen
DJ3 and DJ4 are nearer the base

With DJ1 positive with respect to DJ2, the spot is deflected toward pin 5. With DJ3 positive with respect to DJ4, the spot is deflected toward pin 2.

The plane through the tube axis and each of the following items may vary from the trace produced by DJ1 and DJ2 by



5ABPI OSCILLOGRAPH TUBE

the following angular tolerances (measured about the tube axis): Pin 5, 10° ; side terminal (on same side of tube as pin 5), 10° . Angle between $DJ_1 - DJ_2$ trace and $DJ_3 - DJ_4$ trace is $90^{\circ} \pm 1.5^{\circ}$.

Maximum Ratings, Design-Center Values:

POST-ULTOR [•] VOLTAGE	6000 max.	volts
ULTOR [▲] VOLTAGE	2600 max.	volts
RATIO OF POST-ULTOR VOLTAGE TO ULTOR VOLTAGE	2.3:1 max.	
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 post-ultor voltage (E_{C5}) between 2000* and 6000 volts
and any ultor voltage (E_{C4}) between 1500** and 2600 volts

Grid-No.3 Voltage for Focus	20% to 34.5% of E_{C4}	volts
Grid-No.1 Voltage for Visual Extinction of Undelected Focused Spot	2.6% to 4.3% of E_{C4}	volts
Grid-No.3 Current for Any Operating Condition	-15 to +10	μ amp

Deflection Factors:

When $E_{C5} = 2 \times E_{C4}$

DJ_1 & DJ_2	26.5 to 36	v dc/in./kvof E_{C4}
DJ_3 & DJ_4	18 to 24	v dc/in./kvof E_{C4}

When $E_{C5} = E_{C4}$

DJ_1 & DJ_2	21.5 to 29	v dc/in./kvof E_{C4}
DJ_3 & DJ_4	14.5 to 19.5	v dc/in./kvof E_{C4}
Spot Position	##	

Examples of Use of Design Ranges:

For post-ultor voltage of	2000	3000	4000	volts
and ultor voltage of	2000	1500	2000	volts
Grid-No.3 Volt. for Focus	400 to 690	300 to 515	400 to 690	volts
Grid-No.1 Volt. [◻]	-52 to -87	-39 to -65	-52 to -87	volts

•, ▲, ◦, *, **, #, ##, ◻: See next page.



5ABPI

SABPI

OSCILLOGRAPH TUBE

Deflection Factors:

DJ ₁ & DJ ₂	43 to 58	40 to 54	53 to 72	v dc/in.
DJ ₃ & DJ ₄	29 to 39	27 to 36	36 to 48	v dc/in.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting- Electrode Circuit [#]	5.0 max.	megohms

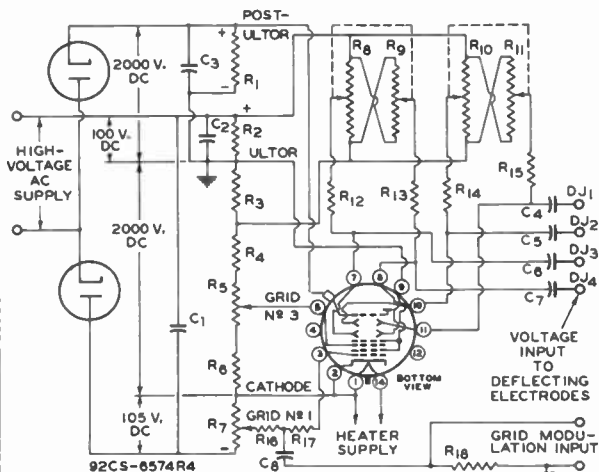
- The "post-ultor" in a cathode-ray tube is the electrode to which is applied a dc voltage higher than the ultor voltage for accelerating the electrons in the beam after its deflection. In the 5AB-types, the post-deflection acceleration function and the collector function are both performed by grid No.5 which is conveniently referred to as "post-ultor".
- ▲ The "ultor" in a cathode-ray 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 5AB-types, the ultor function is performed by grid No.4. Since grid No.4 and grid No.2 are connected together within the 5AB-types, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.
- At or near this rating, the effective resistance of the ultor supply should be adequate to limit the ultor input power to 6 watts.
- ** It is recommended that the post-ultor voltage be not less than 3000 volts for high-speed scanning.
- ** Recommended minimum value of ultor voltage.
- # The deflecting electrodes DJ₃ and DJ₄ are designed to have extra-high deflection sensitivity and consequently produce less than full-screen deflection. With post-deflection acceleration, the length of deflection may be limited to 4 inches; without post-deflection acceleration, deflection to full screen diameter will ordinarily be obtained. These electrodes are, therefore, more suitable for the signal voltage than for the time-base voltage.
- #* With heater voltage of 6.3 volts, post-ultor voltage of 4000 volts, ultor voltage of 2000 volts, grid-No.3 voltage adjusted to give focus, grid-No.1 voltage adjusted to give spot that is just visible, each deflecting electrode connected through a 1-megohm resistor to ultor, and tube shielded from all extraneous fields, the center of the undeflected, focused spot will fall within a circle having a 12.5-mm radius concentric with the center of the tube face.
- For visual cutoff of undeflected focused spot.
- # It is recommended that the deflecting-electrode-circuit resistances be approximately equal.



SABPI

OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



C1: 0.1 μ f, 2500 Volts
 C2: 1.0 μ f, 200 Volts
 C3: 0.1 μ f, 2500 Volts
 C4 C5 C6 C7: 0.05- μ f, Blocking Capacitors^a
 C8: 0.0001 μ f, 2500 Volts
 R1: 50 megohms (Five 10-Meg-ohm, 1-Watt Resistors in Series)
 R2 R3: 2 Megohms, 0.5 watt
 R4: 5.5 Megohms, 2 watts

R5: 2-Megohm Potentiometer
 R6: 1.5 Megohms, 0.5 Watt
 R7: 0.5-Megohm Potentiometer
 R8 R9: 5-Megohm Potentiometer
 R10 R11: Dual 5-Megohm Potentiometer
 R12 R13 R14 R15: 2 Megohms, 0.5 watt
 R16: 0.5 Megohm, 0.5 Watt
 R17: Not less than 2000 ohms per volt of positive signal
 R18: 5 Megohms, 0.5 watt

^a When cathode is grounded, capacitors should have high voltage rating (2500 volts); when ultor is grounded, they may have low voltage rating (200 volts). For dc amplifier service, deflecting electrodes should be connected direct to amplifier output. In this service, it is preferable usually to remove deflecting-electrode resistors to minimize loading effect on amplifier. In order to minimize spot defocusing, it is essential that ultor be returned to a point in the amplifier system which will give the lowest possible potential difference between ultor and the deflecting electrodes.

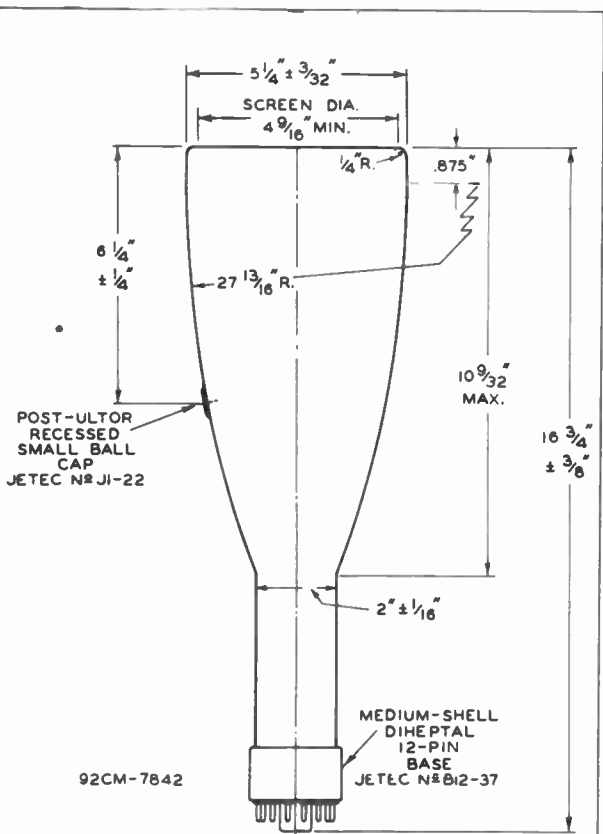
Devices and arrangements shown or described herein may use patents of RCA or others. Information contained herein is furnished without responsibility by RCA for its use and without prejudice to RCA's patent rights.



5ABPI

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OSCILLOGRAPH TUBE



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

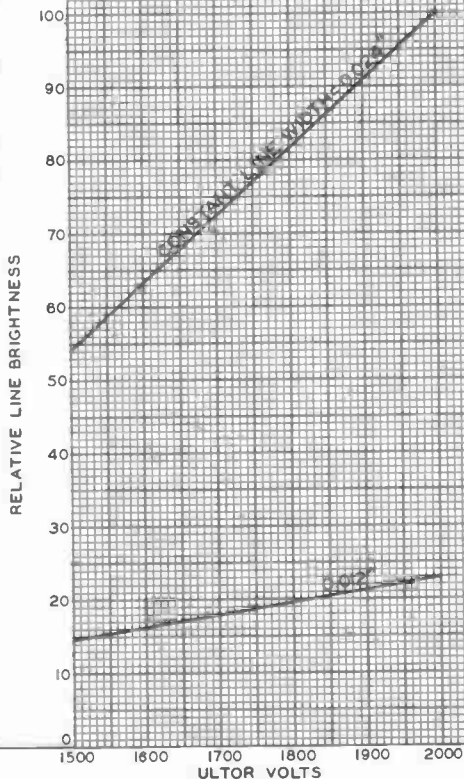
SABPI



5ABPI

TYPICAL CHARACTERISTICS

$E_f = 6.3$ VOLTS
GRID-N & 3 VOLTS ADJUSTED FOR FOCUS
POST-ULTOR VOLTS = 2 x ULTOR VOLTS



FEB. 11, 1953

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6820R1

World Radio History



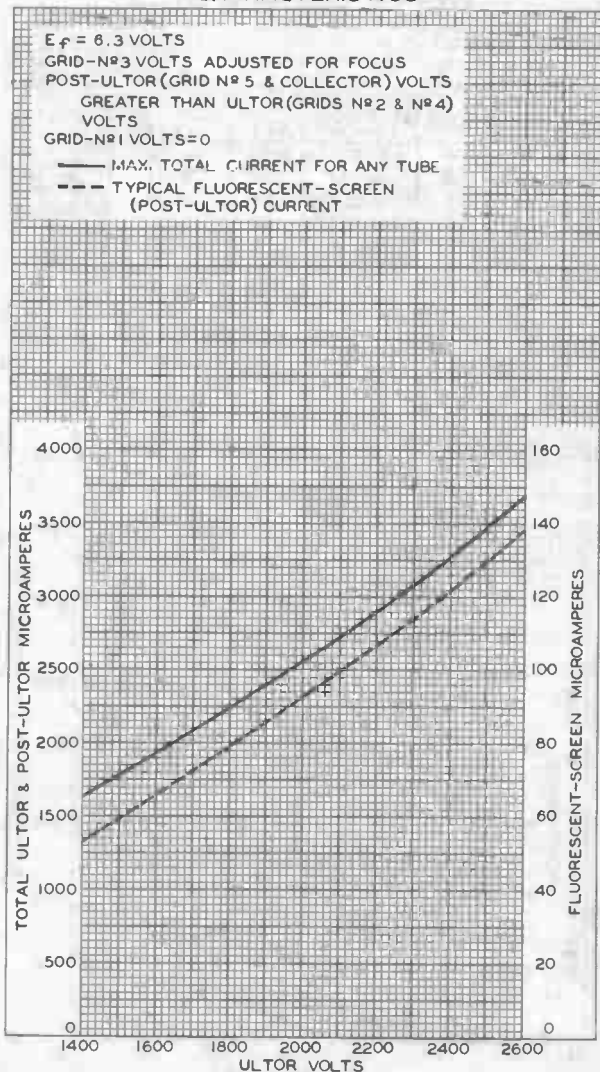
5ABPI

5ABPI

CHARACTERISTICS

$E_f = 8.3$ VOLTS
GRID-№3 VOLTS ADJUSTED FOR FOCUS
POST-ULTOR (GRID № 5 & COLLECTOR) VOLTS
GREATER THAN ULTOR (GRIDS №2 & №4)
VOLTS
GRID-№1 VOLTS=0

— MAX. TOTAL CURRENT FOR ANY TUBE
- - - TYPICAL FLUORESCENT-SCREEN
(POST-ULTOR) CURRENT



FEB. 3, 1953

TUBE DEPARTMENT

92CM-7910

RAD'CO COMPANY, INC. HARRISON, NEW JERSEY

5ABPI

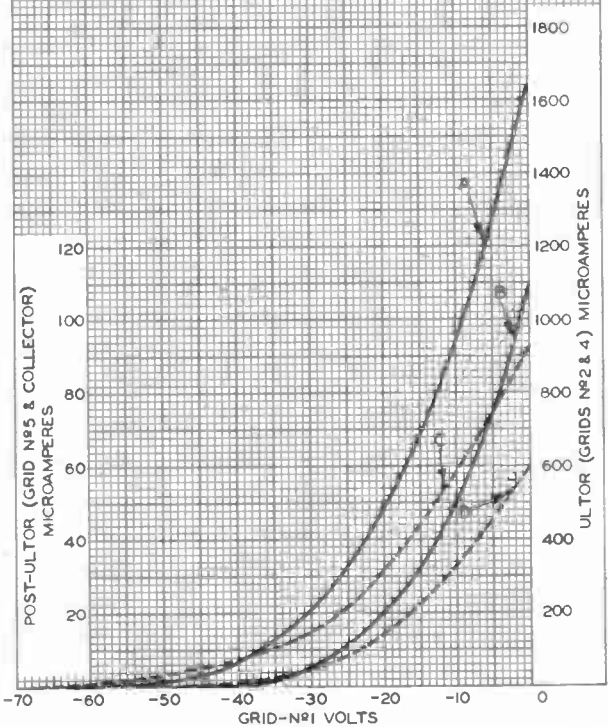


5ABPI

AVERAGE CHARACTERISTICS

$E_f = 6.3$ VOLTS
 GRID-N#3 VOLTS ADJUSTED FOR FOCUS

CURVE	ELECTRODE CURRENT	ULTOR VOLTS	POST-ULTOR VOLTS
A	ULTOR	2000	4000
B	ULTOR	1500	3000
C	POST-ULTOR	2000	4000
D	POST-ULTOR	1500	3000



FEB. 4, 1953

TUBE DEPARTMENT
 RADIO CORPORATION OF AMERICA, HARTFORD, NEW JERSEY

92CM-7911



SABP4
TO
SABP11

5ABP4 OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR
ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

The 5ABP4 is the same as the 5ABP1 except for the following items:

General:

Phosphor (For Curves, see front of this section) . . . P4—Sulfide Type	
Fluorescence	White
Phosphorescence	White
Persistence	Short

THE PERSISTENCE CHARACTERISTICS

of the P4-sulfide phosphor are the same as those shown for the P11 phosphor at the front of this Section

5ABP7 OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR
ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

The 5ABP7 is the same as the 5ABP1 except for the following items:

General:

Phosphor (For Curves, see front of this Section)	P7
Fluorescence	Blue
Persistence	Short
Phosphorescence	Greenish-Yellow
Persistence	Long

5ABP11 OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR
ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

The 5ABP11 is the same as the 5ABP1 except for the following items:

General:

Phosphor (For Curves, see front of this Section)	P11
Fluorescence	Blue
Phosphorescence	Blue
Persistence	Short





SADPI

SADPI OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR
ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

Voltage 6.3 ac or dc volts
Current 0.6 ± 10% amp

Direct Interelectrode Capacitances:

Grid No.1 to all other electrodes. 4.2 to 7.9 μμf
Cathode to all other electrodes. 3.1 to 5.8 μμf
Deflecting electrode DJ₁ to
deflecting electrode DJ₂ 1.7 to 3.1 μμf
Deflecting electrode DJ₃ to
deflecting electrode DJ₄ 0.7 to 1.3 μμf
DJ₁ to all other electrodes. 4.4 to 9.2 μμf
DJ₂ to all other electrodes. 4.4 to 9.2 μμf
DJ₃ to all other electrodes. 2.8 to 5.3 μμf
DJ₄ to all other electrodes. 2.8 to 6.3 μμf

Faceplate, Flat. Clear Glass

Phosphor (For Curves, see front of this Section) P1

Fluorescence Green

Phosphorescence. Green

Persistence. Medium

Focusing Method. Electrostatic

Deflection Method. Electrostatic

Deflecting-electrode
arrangement. See Dimensional Outline

Overall Length 16-3/4" ± 3/16"

Greatest Diameter of Bulb. 5-1/4" ± 3/32"

Minimum Useful Screen Diameter 4-1/2"

Weight (Approx.) 2-1/2 lbs

Mounting Position. Any

Cap. Recessed Small Ball (JETEC No. J1-22)

Bulb J42

Base Medium-Shell Diheptal 12-Pin (JETEC No. B12-37)

Basing Designation for BOTTOM VIEW 14J

Pin 1 - Heater

Pin 2 - Cathode

Pin 3 - Grid No. 1

Pin 4 - No Connection-Do
Not Use

Pin 5 - Grid No. 3

Pin 7 - Deflecting
Electrode
DJ₃

Pin 8 - Deflecting
Electrode
DJ₄

Pin 9 - Ultron

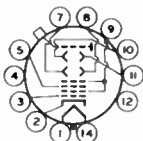
(Grid No. 2,
Grid No. 4)

Pin 10 - Deflecting
Electrode
DJ₂

Pin 11 - Deflecting
Electrode
DJ₁

Pin 12 - No Connection

Pin 14 - Heater
Cap - Post-Ultron
(Grid No. 5,
Collector)





OSCILLOGRAPH TUBE

Maximum Ratings, Design-Center Values:

POST-ULTOR VOLTAGE	6000 max.	volts
ULTOR VOLTAGE.	2600 max.	volts
RATIO OF POST-ULTOR VOLTAGE TO		
ULTOR VOLTAGE.	2.3:1 max.	
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	180 max.	volts
Heater positive with		
respect to cathode	180 max.	volts

Equipment Design Ranges:

With any post-ultor voltage (E_{c_3}) between 2000* and 6000 volts
and any ultor voltage (E_{c_4}) between 1500** and 2600 volts

Grid-No.3 Voltage		
for focus.	20% to 34.5% of E_{c_4}	volts
Grid-No.1 Voltage		
for Visual Ex-		
tinction of Unde-		
flected Focused		
Spot	-2.25% to -3.75% of E_{c_4}	volts
Grid-No.3 Current		
for Any Operating		
Condition.	-15 to .10	μ amp
Deflection Factors:#		
When $E_{c_3} = 2 \times E_{c_4}$:		
DJ ₁ & DJ ₂	26.7 to 33.3	v dc/in./kv of E_{c_4}
DJ ₃ & DJ ₄	20.3 to 25	v dc/in./kv of E_{c_4}
When $E_{c_3} = E_{c_4}$:		
DJ ₁ & DJ ₂	21.5 to 26.5	v dc/in./kv of E_{c_4}
DJ ₃ & DJ ₄	16 to 20	v dc/in./kv of E_{c_4}
Spot Position.	#	

* At or near this rating, the effective resistance of the ultor supply should be adequate to limit the ultor input power to 6 watts.

** It is recommended that the post-ultor voltage be not less than 3000 volts for high-speed scanning.

Recommended minimum value of ultor voltage.

with heater voltage of 6.3 volts, post-ultor voltage of 4000 volts, ultor voltage of 2000 volts, grid-no.3 voltage adjusted to give focus, grid-no.1 voltage adjusted to give spot that is just visible, each deflecting electrode connected through a 1-megohm resistor to ultor, and the tube shielded from all extraneous fields, the center of the undeflected, focused spot will fall within a circle having an 8-mm radius concentric with the center of the tube face.

: See next page.



5ADPI

SADPI

OSCILLOGRAPH TUBE

Examples of Use of Design Ranges:

With post-ultor voltage of	2000	3000	4000	volts
and ultor voltage of	2000	1500	2000	volts
Grid-No.3				
Voltage for Focus	400 to 690	300 to 515	400 to 690	volts
Grid-No.1				
Voltage for Visual Extinction of Undeflected Focused Spot.	-45 to -75	-34 to -56	-45 to -75	volts
Deflection Factors:#				
DJ ₁ & DJ ₂	43 to 53	40 to 50	53.4 to 66.6	v dc/in.
DJ ₃ & DJ ₄	32 to 40	30.5 to 37.5	40.6 to 50	v dc/in.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
Resistance in Any Deflecting-Electrode Circuit	5.0 max.	megohms

SPECIAL PERFORMANCE DATA

With post-ultor voltage of	3000 volts	
and ultor voltage of	1500 volts	
Line Width ^b	0.030 max.	inch
Peak Grid-No.1 Drive from Spot Cutoff ^b	45 max.	volts
Raster Shape.	§	

* The deflecting electrodes in the 5ADPI are designed to have extra-high deflection sensitivity and consequently produce less than full-screen deflection. With post-deflection acceleration, the length of deflection in either horizontal or vertical direction may be limited to 4-1/4 inches; without post-deflection acceleration, deflection to full screen diameter will ordinarily be obtained.

^a It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

^b Under the following conditions: heater voltage of 6.3 volts, brightness of 15 foot-lamberts measured on a 2" x 2", 49-line raster with high-frequency scanning applied to deflecting electrodes DJ₁ and DJ₂. For line-width measurement, the high-frequency scanning is adjusted to give a raster width of 12 cm with the grid-no.3 voltage adjusted to give sharpest focus at center of tube face. Raster height is contracted until individual scanning lines are just barely distinguishable. Line width is expressed as the quotient of the contracted raster height measured at the center line of the tube face divided by the number of scanning lines (49).

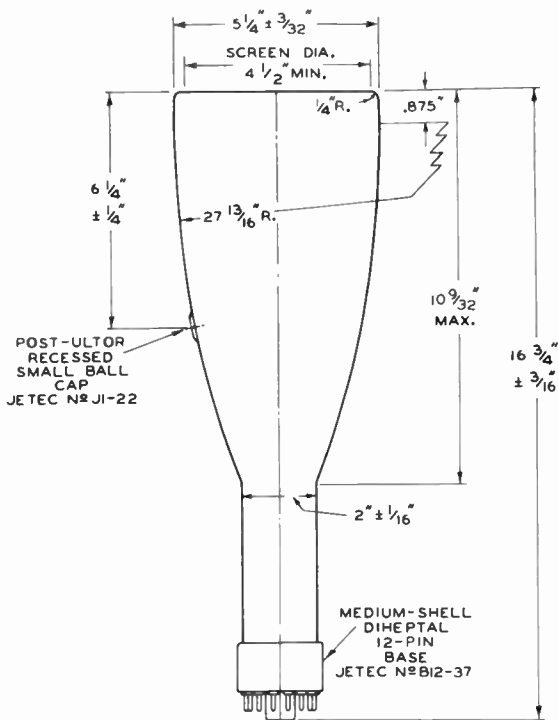
^c Under the following conditions: heater voltage of 6.3 volts, grid-no.3 voltage adjusted for focus, and grid-no.1 voltage adjusted to give visible raster. With 49-line raster, the size of which is adjusted so that the widest points on the raster just touch the sides of a square 3.075" on a side, no point on the raster sides will lie within an inscribed square 2.925" on a side having its sides parallel to the sides of the 3.075" square and its center at the center of the 3.075" square.

5ADPI



5ADPI

OSCILLOGRAPH TUBE



92CM-9098

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

THE PLANE THROUGH TUBE AXIS AND EACH OF THE FOLLOWING ITEMS MAY VARY FROM THE TRACE PRODUCED BY DJ_1 AND DJ_2 BY THE FOLLOWING ANGULAR TOLERANCES (MEASURED ABOUT THE TUBE AXIS): PIN 5, $\pm 10^{\circ}$; SIDE TERMINAL (ON SAME SIDE OF TUBE AS PIN 5), $\pm 10^{\circ}$. ANGLE BETWEEN $DJ_1 - DJ_2$ TRACE AND $DJ_3 - DJ_4$ TRACE IS $90^{\circ} \pm 1^{\circ}$.

DJ_1 AND DJ_2 ARE NEARER THE SCREEN. DJ_3 AND DJ_4 ARE NEARER THE BASE. WITH DJ_1 POSITIVE WITH RESPECT TO DJ_2 , THE SPOT WILL BE DEFLECTED TOWARD PIN 5; LIKewise, WITH DJ_3 POSITIVE WITH RESPECT TO DJ_4 , THE SPOT WILL BE DEFLECTED TOWARD PIN 2.



5ADPI

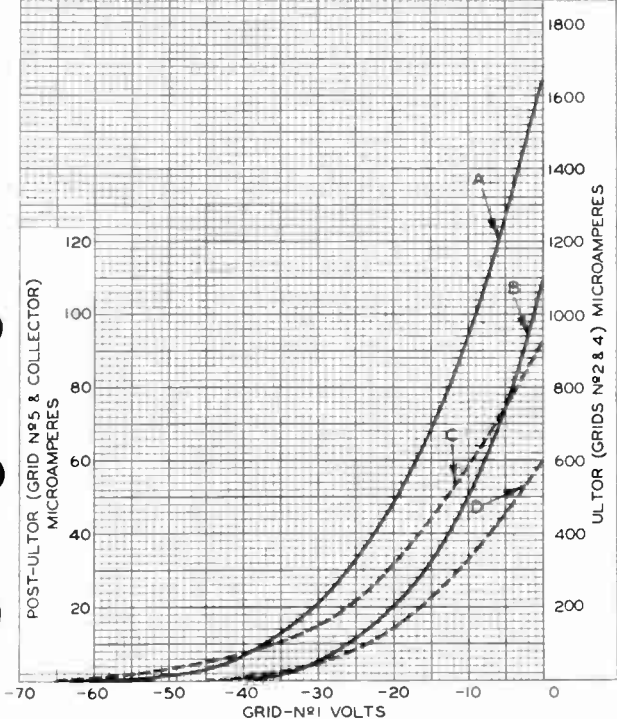
5ADPI

AVERAGE CHARACTERISTICS

$E_f = 6.3$ VOLTS

GRID-N^o3 VOLTS ADJUSTED FOR FOCUS.

CURVE	ELECTRODE CURRENT	ULTOR VOLTS	POST-ULTOR VOLTS
A	ULTOR	2000	4000
B	ULTOR	1500	3000
C	POST-ULTOR	2000	4000
D	POST-ULTOR	1500	3000



TUBE DIVISION

92CM-9099

RADCO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

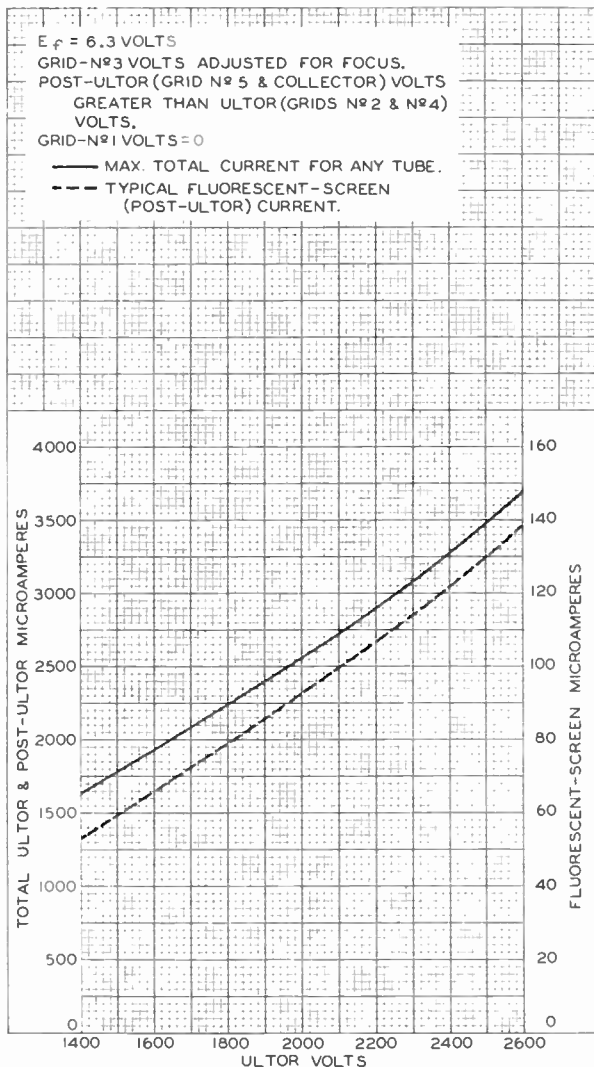
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CHARACTERISTICS



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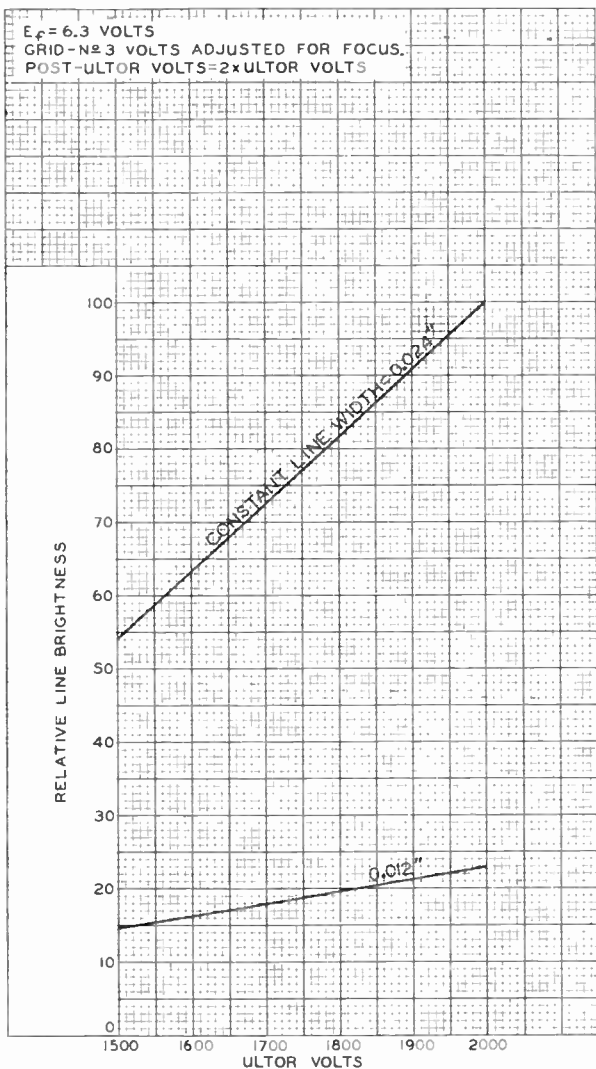
92CM-7910



5ADPI

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TYPICAL CHARACTERISTICS



TUBE DIVISION

92CM-6820R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY





5AUP24

5AUP24

COLOR FLYING-SPOT CATHODE-RAY TUBE

HIGH-RESOLUTION CAPABILITY
ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
MAGNETIC DEFLECTION

For use as flying-spot scanner in color video-signal generators

DATA

General:

Heater, for Unipotential Cathode:

Voltage 6.3 ac or dc volts
Current 0.6 + 10% amp

Direct Interelectrode Capacitance:

Grid No.1 to all other electrodes 8 μ f
Cathode to all other electrodes 5 μ f
External conductive neck coating to ultron { 500 max. μ f
100 min. μ f

Faceplate, Flat Clear Glass

Phosphor P24
Aluminized

Fluorescence Green

Phosphorescence Green

Persistence Short

Focusing Method Electrostatic

Deflection Method Magnetic

Deflection Angle (Approx.) 40°

Overall Length 12-1/2" \pm 3/8"

Greatest Diameter 5" \pm 1.8"

Minimum Useful Screen Diameter 4-1/4"

Operating Position Any

Weight (Approx.) 1.4 lbs

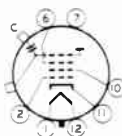
Cap. Recessed Small Cavity (HTEC No. J1-21)

Socket See Operating Considerations

Base Small-Shell Duodecal 7-Pin (HTEC Group 4, No. B7-51)

Basins Designation for BOTTOM VIEW 12C

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 6 - Grid No.3
- Pin 7 - Internal Connection—Do Not Use
- Pin 10 - Grid No.2



- Pin 11 - Cathode
- Pin 12 - Heater
- Cap - Ultron (Grid No.4, Collector)
- C - External Conductive Neck Coating

Maximum Ratings, Design-Center Values:

ULTRON VOLTAGE	27000 max. volts
GRID-NO.3 VOLTAGE	6000 max. volts
GRID-NO.2 VOLTAGE	350 max. volts
GRID-NO.1 VOLTAGE:	
Negative-bias value	150 max. volts
Positive-bias value	0 max. volts
Positive-rak value	2 max. volts

← indicates a change.

5AUP24



5AUP24

COLOR FLYING-SPOT CATHODE-RAY TUBE

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode:

During equipment warm-up period

not exceeding 15 seconds 410 max. volts

After equipment warm-up period 150 max. volts

Heater positive with respect to cathode. 150 max. volts

Characteristics Range Values for Equipment Design:

For any ultor voltage (E_{c4}) between 20000* and 27000 volts

Grid-No.3 Voltage for focus
with ultor current of 200 μ a 17% to 21.5% of E_{c4} volts

Grid-No.2 Voltage when circuit
design utilizes fixed grid-
No.1 voltage (E_{c1}) for visual
extinction of undeflected fo-
cused spot 2 to 5 times E_{c1} volts

Grid-No.1 Voltage for visual
extinction of undeflected fo-
cused spot when circuit design
utilizes grid-No.2 voltage
(E_{c2}) at fixed value 20% to 50% of E_{c2} volts

Maximum Grid-No.3 Current for
ultor current of 200 μ a. 170 μ a

Grid-No.2 Current. -15 to +15 μ a

Examples of Use of Design Ranges:

For ultor voltage of 27000 volts

Grid-No.3 Voltage for focus
with ultor current of 200 μ a 4600 to 5800 volts

Grid-No.2 Voltage when circuit
design utilizes fixed grid-
No.1 voltage of -70 volts for
visual extinction of undeflec-
ted focused spot 140 to 350 volts

Grid-No.1 Voltage for visual
extinction of undeflected fo-
cused spot when circuit design
utilizes grid-No.2 voltage of
200 volts. -40 to -100 volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance 1.5 max. megohms

* Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 20,000 volts.

OPERATING CONSIDERATIONS

X-Ray Warning. X-ray radiation is produced at the face of the 5AUP24 when it is operated at its normal ultor voltage. These rays can constitute a health hazard unless the tube is

→ Indicates a change.



5AUP24

5AUP24

COLOR FLYING-SPOT CATHODE-RAY TUBE

adequately shielded for X-ray radiation. Although relatively simple shielding should prove adequate, make sure that it provides the required protection against personal injury.

The base pins of the 5AUP24 fit the Duodecal 12-contact socket. The socket contacts corresponding to the vacant pin positions should be omitted in order to provide the maximum insulation for the high-voltage pins A and 7. The socket should be made of high-grade, arc-resistant, insulating material and should preferably be designed with baffles.

Heater Protection. Although maximum values of peak heater-cathode voltage are specified in the tabulated data, it is recommended that the mid-tap or one side of the heater transformer winding be connected directly to the cathode to minimize the possibility of heater burnout. This connection will also minimize the possibility of damage due to heater-cathode shorts produced by arcing between heater and cathode when a possible momentary arc causes the voltage between heater and cathode to exceed the maximum heater-cathode ratings.

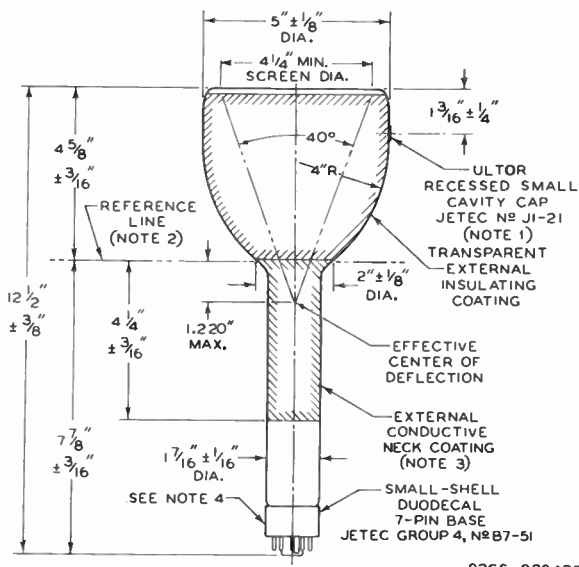
When in some circuit designs, the heater is not connected directly to the cathode, precautions must be taken to hold the peak heater-cathode voltage to the maximum values shown in the tabulated data. It is also recommended that a series limiting resistance of 50,000 ohms be placed in both the ultor and grid-No.3 leads between the tube and any filter capacitors.

Resolution of better than 800 lines at the center of the reproduced picture can be produced by the 5AUP24 when it is operated with 27,000 volts on the ultor. At lower ultor voltages, the resolution capability decreases. To obtain high resolution in the horizontal direction, it is necessary to use a video amplifier having a bandwidth of about 20 megacycles.



5AUP24

COLOR FLYING-SPOT CATHODE-RAY TUBE



92CS-8294R2

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION 3 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 10^\circ$. ULTOR TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION 3.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No. G-110 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY INTERSECTION OF PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: EXTERNAL CONDUCTIVE NECK COATING MUST BE GROUNDED.

NOTE 4: ϕ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

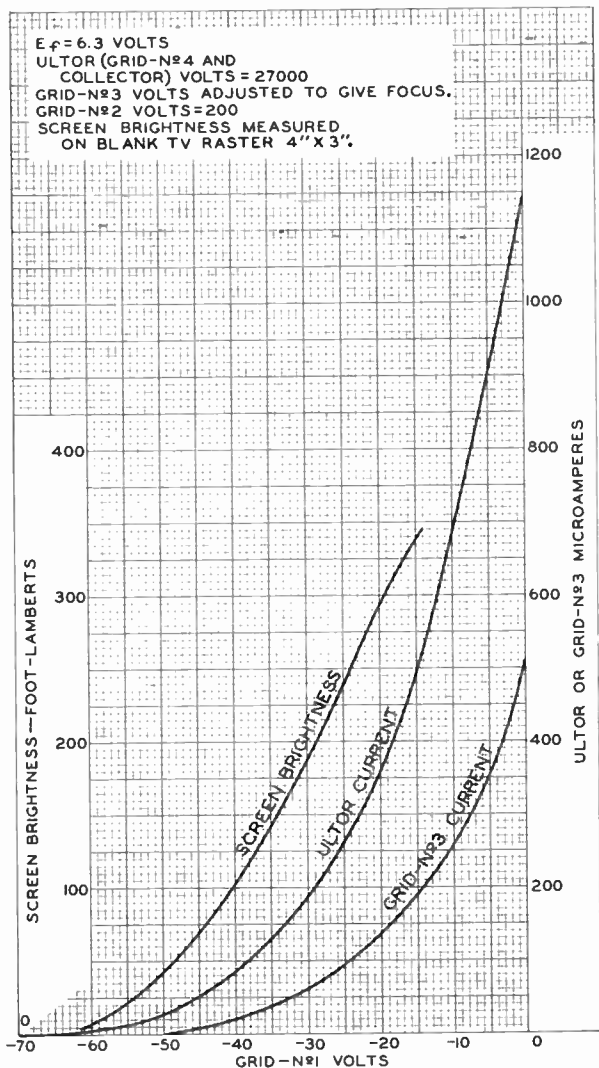


5AUP24

5AUP24

AVERAGE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ULTOR (GRID-N^o4 AND COLLECTOR) VOLTS = 27000
GRID-N^o3 VOLTS ADJUSTED TO GIVE FOCUS.
GRID-N^o2 VOLTS = 200
SCREEN BRIGHTNESS MEASURED ON BLANK TV RASTER 4" X 3".



ELECTRON TUBE DIVISION

92CM-8343RI

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

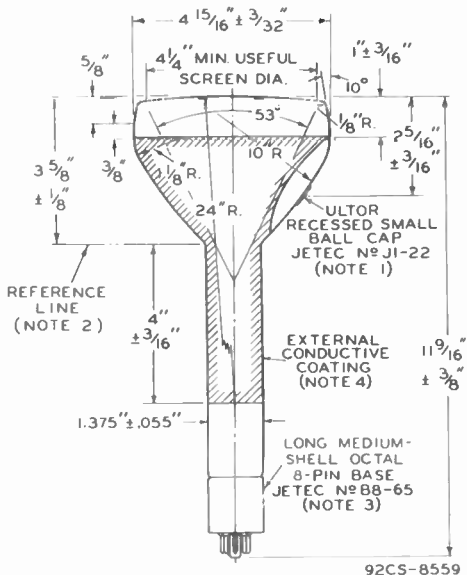




5AYP4

VIEW-FINDER KINESCOPE

5AYP4



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 5 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 10^\circ$. ULTOR TERMINAL IS ON SAME SIDE OF TUBE AS PIN 5.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE GAUGE $1.430'' + 0.003'' - 0.000''$ I.D. AND 2" LONG WILL REST ON BULB CONE.

NOTE 3: CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

MAY 1, 1955

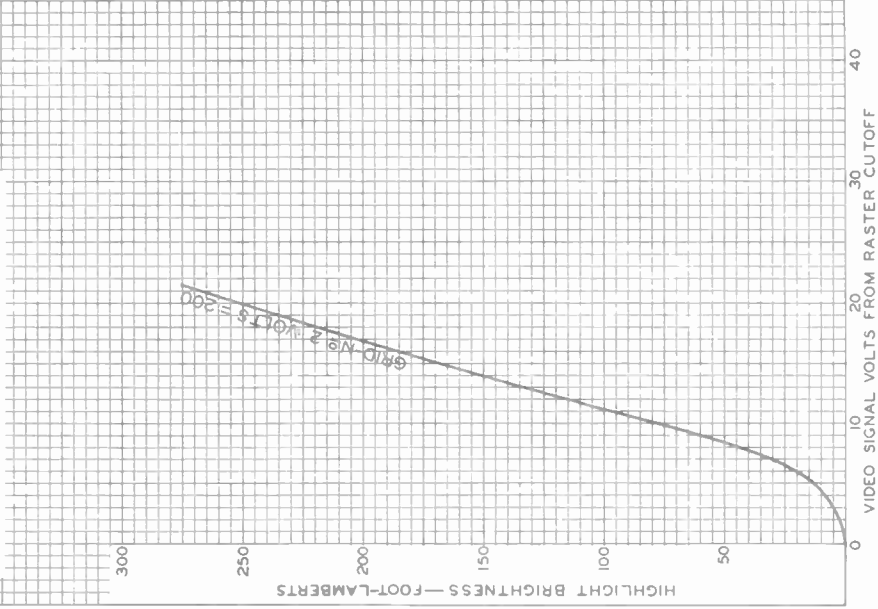
CE-8559



5AYP4

AVERAGE GRID-DRIVE CHARACTERISTIC

$E_f = 6.3$ VOLTS
 ULTOR (GRID N^o 4 AND
 COLLECTOR) VOLTS = 10000
 GRID - N^o 3 VOLTS ADJUSTED TO GIVE FOCUS
 AT AVERAGE RASTER BRIGHTNESS
 GRID N^o 1 BIASED TO CUTOFF OF FOCUSED
 RASTER
 RASTER SIZE = $3 \frac{3}{8}$ " x $2 \frac{1}{2}$ "



5AZP4

Average Anode Power:

Without forced-air cooling of faceplate	9 max. W
With forced-air cooling of faceplate	12 max. W

Air Flow to Face, when Average Anode Power Exceeds 9 Watts:

An air-cooling system is required to cool the face of these tubes when they are operated with an average anode input in excess of 9 watts. The system consists of a suitable blower and an air duct, having an outlet diameter of about 2 inches, directed perpendicularly onto the face of the tube. The air flow must be adequate to limit the faceplate temperature to 100° C. The cooling air must not contain water, dust, or other foreign matter. The air-cooling system should be electrically interconnected with the anode power supply to prevent operation of the tube without cooling.

Cooling of the face by a tangential flow of air across the face is not recommended because the temperature gradient produced across the face may result in immediate or delayed cracking of the face.

Grid-No.3 (Focusing Electrode)

Voltage 9000 max. V

Grid-No.2 Voltage 400 max. V

Grid-No.1 Voltage:

Negative bias value 150 max. V

Positive bias value 0 max. V

Positive peak value 2 max. V

Peak Heater-Cathode Voltage:

Heater negative with respect
to cathode 175 max. V

Heater positive with respect
to cathode 10 max. V

Heater Voltage (ac or dc):

Under operating conditions^b { 6.9 max. V
5.7 min. V

RECOMMENDED OPERATING VALUES

Unless otherwise specified, values are positive with respect to cathode.

Anode Voltage 40,000 V^c

Average Anode Current 300 μ A

Grid-No.3 (Focusing Electrode)

Voltage for an Anode Current
of 300 microamperes 7400 to 9000 V

Grid-No.2 and Grid-No.1
 Voltages for Visual Ex-
 tinction of Focused Spot See accompanying *Cutoff
 Design Chart*

TYPICAL PERFORMANCE DATA

At recommended operating values

Grid-No.3 Current (Total) See accompanying *Typical
 Grid-No.3 Current Characteristic*

Grid-No.2 Current $\pm 15 \mu\text{A}$

Equivalent Passband (N_e) 270

(For sine-wave response, see accompanying
Typical Sine-Wave Response)

Center Resolution^d 900 TV Lines

Drive Characteristics See accompanying *Typical
 Drive Characteristics*

Luminance at 300 μA 1650 fL

Luminance Characteristics See accompanying *Typical
 Luminance Characteristic*

LIMITING CIRCUIT VALUES

(See accompanying *Schematic Diagram of Circuit Showing
 Protective Elements Employed to Prevent Tube Damage*)

HIGH-VOLTAGE CIRCUITS

In order to minimize the possibility of damage to the tubes caused by a momentary internal arc, it is recommended that the high-voltage power supply and the grid-No.3 power supply be of the limited-energy type.

Anode-Circuit Resistance
 (unbypassed) 0.5 min. $\text{M}\Omega$

Grid-No.3 Circuit Resistance
 (unbypassed) 0.1 $\text{M}\Omega$

LOW-VOLTAGE CIRCUITS

Grid-No.2 Circuit Resistance
 (bypassed) 10 $\text{k}\Omega$

Grid-No.1 Circuit Resistance
 (unbypassed) 1 $\text{k}\Omega$

Effective Grid-No.1-to-Cathode
 Circuit Resistance 1.5 max. $\text{M}\Omega$

Cathode Circuit Resistance
 (unbypassed) 1 $\text{k}\Omega$

Heater Circuit Resistance
 (bypassed) to one side of heater 10 $\text{k}\Omega$

^b For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts.

5AZP4

- c Brilliance and definition may change with decreasing anode voltage. In general, the anode voltage should not be less than 30,000 volts.
- d Determined for a 3-inch high TV resolution test pattern with tube operating at an average screen current of 300 microamperes.

HIGH-VOLTAGE PRECAUTIONS

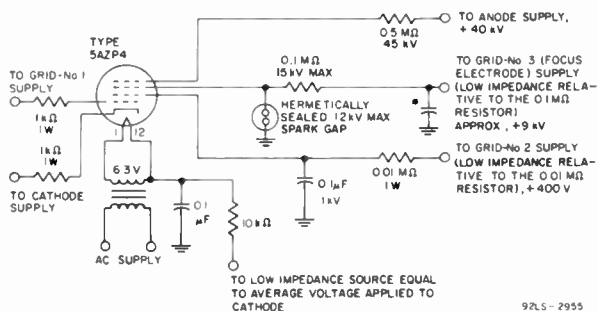
The high voltages at which this type is operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Precautions include the enclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is required.

X-RADIATION WARNING

X-radiation is produced at the face of this tube when it is operated at normal anode voltage.

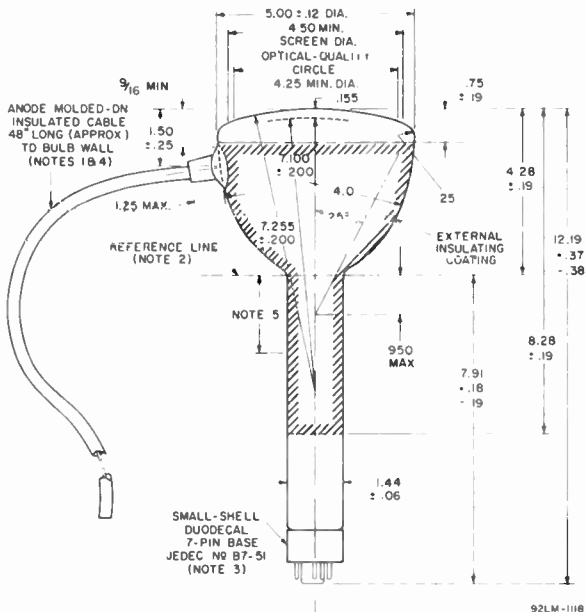
These rays can constitute a health hazard unless the tube is adequately shielded. Make sure that the shielding provides the required protection against personal injury.

SCHEMATIC DIAGRAM OF CIRCUIT SHOWING PROTECTIVE ELEMENTS EMPLOYED TO PREVENT TUBE DAMAGE



- * The value of this capacitor should be such that its charging time constant is at least five times greater than the firing time of the spark gap..

DIMENSIONAL OUTLINE - Dimensions In Inches



Note 1: The plane through the tube axis and vacant pin position No.3 may vary from the plane through the tube axis and anode-cable connection at bulb wall by angular tolerance (measured about the tube axis) of $\pm 20^\circ$. Anode-cable connection is on same side as vacant pin position No.3

Note 2: Reference line is determined by position where gauge 1.500" + 0.003" - 0.000" I.D. and 2" long will rest on bulb cone.

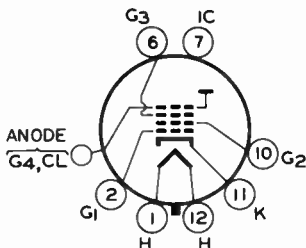
Note 3: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Socket contacts corresponding to vacant pin positions No.3, 4, 5, 8 and 9 should be removed in order to provide maximum insulation for pins No.6 and 7.

Note 4: Anode cable should not be sharply bent within 3" of bulb wall.

Note 5: The windings of the deflecting yoke should not extend more than 2" from the reference line toward the base. They should be insulated to withstand 20 kV and be spaced at least 1/10" from the tube neck.

5AZP4

TERMINAL DIAGRAM (Bottom View)



Pin 1: Heater

Pin 2: Grid No.1

Pin 6: Grid No.3

Pin 7: Internal Connection – Do not use

Pin 10: Grid No.2

Pin 11: Cathode

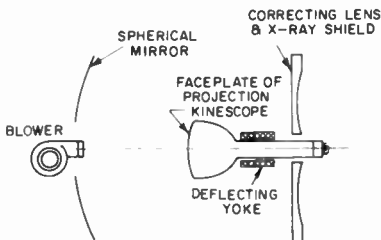
Pin 12: Heater

Flexible Cable: Anode (Grid No.4, Collector)

Note: Socket contacts for vacant pin positions No.3, 4, 5, 8, and 9 should be removed so that maximum insulation is provided for pins No.6 and 7.

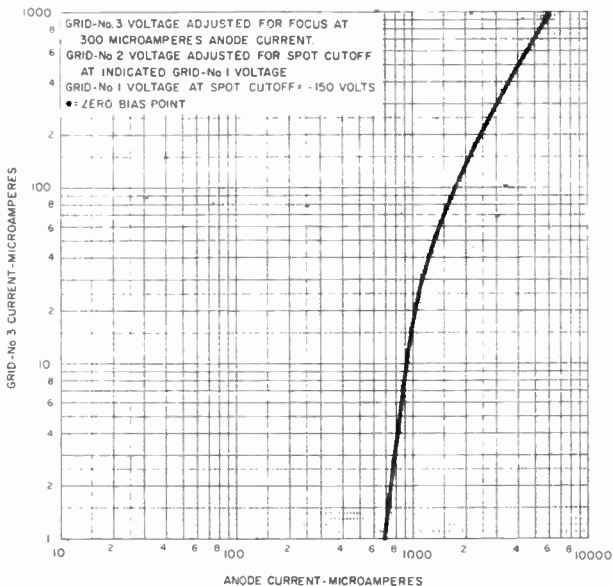
REFLECTIVE OPTICAL SYSTEM

Arrangement of Typical Optical System and Air-Cooling System for Television Projector Using Reflective Optical Principles.



92L S - 2952

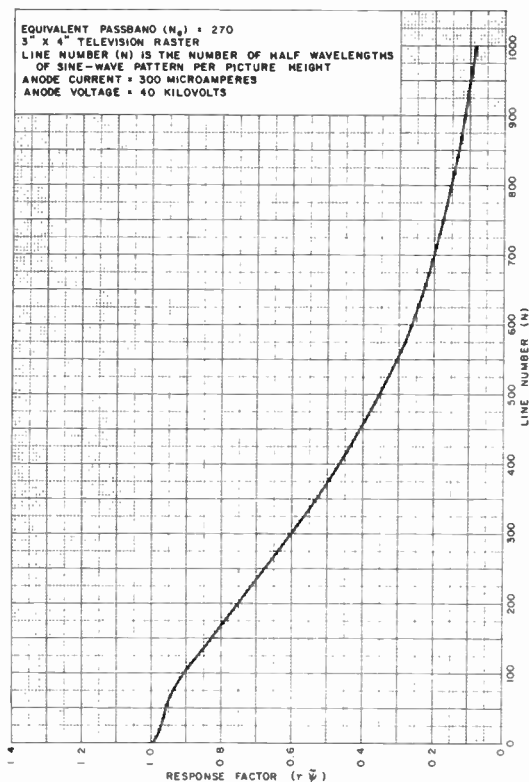
TYPICAL GRID-No.3 CURRENT CHARACTERISTIC



92LM 1111

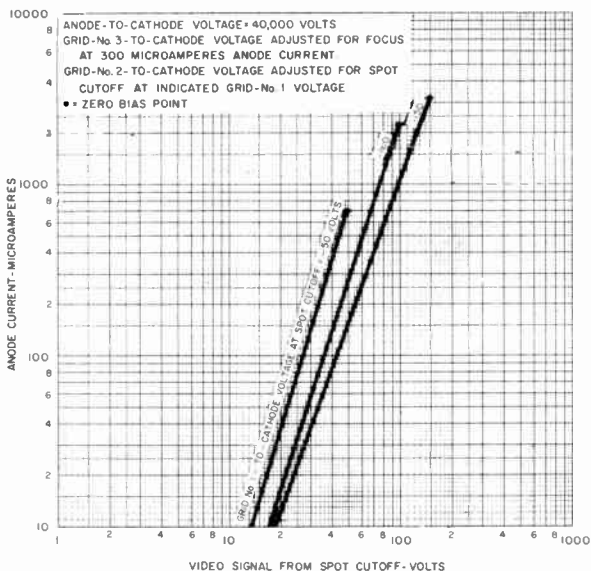
5AZP4

TYPICAL SINE-WAVE RESPONSE



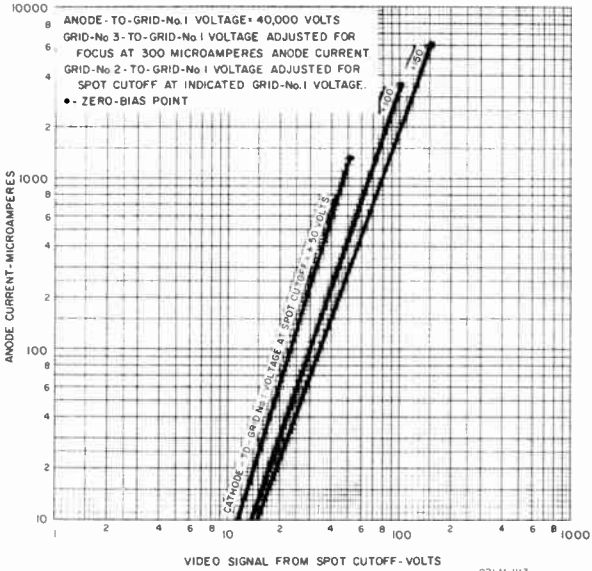
92LS-1107

TYPICAL DRIVE CHARACTERISTICS GRID-DRIVE SERVICE

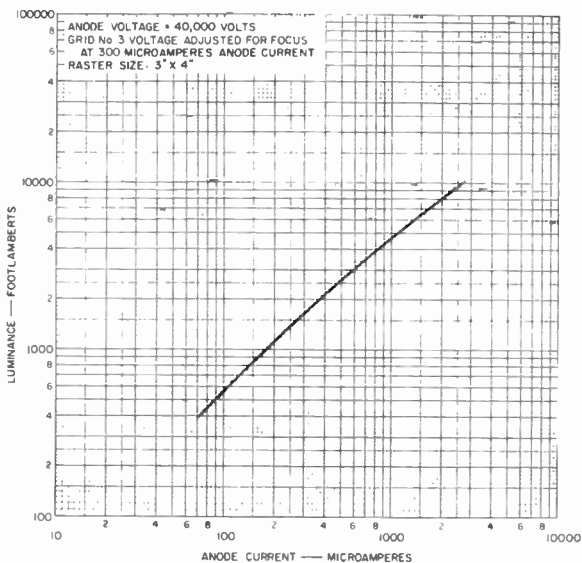


5AZP4

TYPICAL DRIVE CHARACTERISTICS CATHODE-DRIVE SERVICE



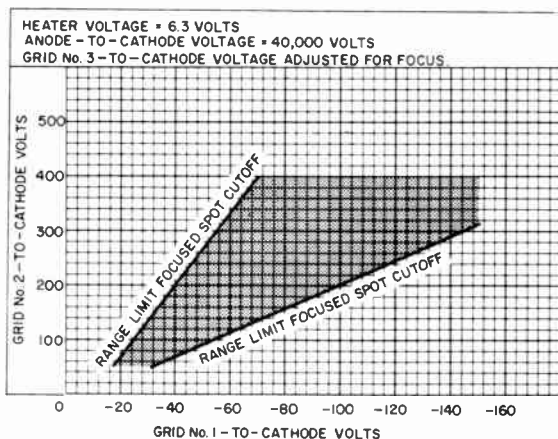
TYPICAL LUMINANCE CHARACTERISTIC



92LS-2554

5AZP4

CUTOFF DESIGN CHART



92LS-2953



5BPI-A

5BPI-A

HIGH-VACUUM CATHODE-RAY TUBE

*Superscans Type 5BP1***General:**

Heater, for Unipotential Cathode:

Voltage 6.3 ± 10% ac or dc volts
Current 0.6 amp.

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to All Other Electrodes.	8.0	. . . . .	μμf
DJ ₁ to DJ ₂	1.3	. . . . .	μμf
DJ ₃ to DJ ₄	1.2	. . . . .	μμf
DJ ₁ to All Other Electrodes.	9.5	. . . . .	μμf
DJ ₃ to All Other Electrodes.	12.0	. . . . .	μμf
DJ ₁ to All Other Electrodes except DJ ₂	8.0	. . . . .	μμf
DJ ₂ to All Other Electrodes except DJ ₁	7.5	. . . . .	μμf
DJ ₃ to All Other Electrodes except DJ ₄	10.0	. . . . .	μμf
DJ ₄ to All Other Electrodes except DJ ₃	7.5	. . . . .	μμf

Phosphor (For Curves, see front of this Section) No.1
Fluorescence Green
Persistence Medium

Focusing Method. Electrostatic

Deflection Method. Electrostatic

Overall Length 16-3/4" ± 3/8"

Greatest Diameter of Bulb. 5-1/4" + 1/16"
- 3/32"

Minimum Useful Screen Diameter 4-1/2"

Mounting Position. Any

Base Medium Shell Magnal 11-Pin

Basing Designation for BOTTOM VIEW 11N

Pin 1—Heater	Pin 7—Anode No.2,
Pin 2—No Connection	Grid No.2
Pin 3—Deflecting Electrode DJ ₁	Pin 8—Deflecting Electr. DJ ₂
Pin 4—Anode No.1	Pin 9—Deflecting Electr. DJ ₃
Pin 5—Internal Con. Do not use	Pin 10—Grid No.1
Pin 6—Deflecting Electrode DJ ₄	Pin 11—Heater, Cathode



*DJ₁ and DJ₂ are nearer the screen
DJ₃ and DJ₄ are nearer the base*

With DJ₁ positive with respect to DJ₂, the spot is deflected toward pin 4. With DJ₃ positive with respect to DJ₄, the spot is deflected toward pin 1.

The angle between the trace produced by DJ₃ and DJ₄ and its intersection with the plane through the tube axis and pin 1 does not exceed 100°.

The angle between the trace produced by DJ₃ and DJ₄ and the trace produced by DJ₁ and DJ₂ is 90° ± 30°.



5BP1-A

HIGH-VACUUM CATHODE-RAY TUBE

(continued from preceding page)

Maximum Ratings, Absolute Values:

ANODE-No.2 & GRID-No.2 VOLTAGE.	2200 max.	volts
ANODE-No.1 VOLTAGE.	1100 max.	volts
GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:		
Negative Value.	125 max.	volts
Positive Value.	0 max.	volts
PEAK VOLTAGE BETWEEN ANODE No.2 AND ANY DEFLECTING ELECTRODE	550 max.	volts

Typical Operation:

Anode-No.2 & Grid-No.2 Voltage*	1500	2000	. . .	volts
Anode-No.1 Volt. for Focus at 75% of Grid-No.1 Volt. for Cutoff#	337	450	. . .	volts
Grid-No.1 Volt. for Visual Cutoff#.	-30	-40	. . .	volts
Max. Anode-No.1 Current Range ^Δ . Between -50 and +10				μamp.
Deflection Sensitivity:				
DJ ₁ and DJ ₂	0.404	0.303	. . .	mm/v dc
DJ ₃ and DJ ₄	0.446	0.334	. . .	mm/v dc
Deflection Factor:**				
DJ ₁ and DJ ₂	63	84	. . .	v dc/in.
DJ ₃ and DJ ₄	57	76	. . .	v dc/in.

* Brilliance and definition decrease with decreasing anode-No.2 voltage. In general, anode-No.2 voltage should not be less than 1500 volts.

● Individual tubes may require between +25% and -30% of the values shown with grid-No.1 voltages between zero and cutoff.

Visual extinction of stationary focused spot. Supply should be adjustable to ± 50% of these values.

Δ See curve for average values.

** Individual tubes may vary from these values by ± 17%.

Spot Position:

The undeflected focused spot will fall within a 15-mm square centered at the geometric center of the tube face and having one side parallel to the trace produced by DJ₁ and DJ₂. Suitable test conditions are: anode-No.2 voltage, 1500 volts; anode-No.1 voltage, adjusted for focus; deflecting-electrode resistors, 1 megohm each, connected to anode-No.2; the tube shielded from all extraneous fields. To avoid damage to the tube, grid-No.1 voltage should be near cutoff before application of anode voltages.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Impedance of Any Deflecting-Electrode Circuit at Heater-Supply Frequency	1.0 max.	megohm
Resistance in Any Deflecting- Electrode Circuit ^{▲▲}	5.0 max.	megohms.

▲▲ It is recommended that all deflecting-electrode-circuit resistances be approximately equal.

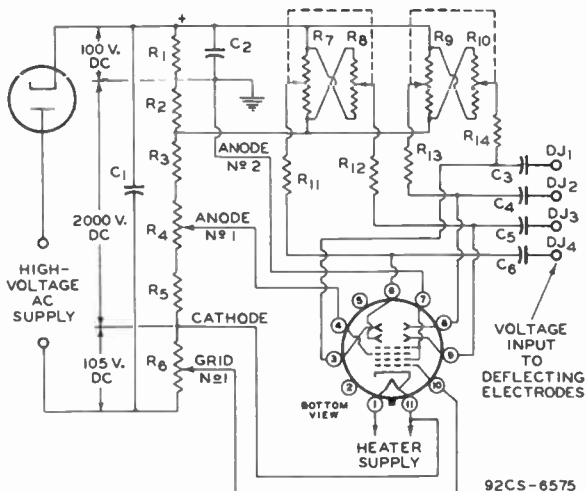


5BP1-A

5BP1-A

HIGH-VACUUM CATHODE-RAY TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



C1: 0.1 μ f
 C2: 1.0 μ f
 C3 C4 C5 C6: 0.05- μ f Blocking
 Capacitors*

R1 R2: 2 Megohms
 R3: 6 Megohms

R4: 2-Megohm Potentiometer
 R5: 1.0 Megohm
 R6: 0.5-Megohm Potentiometer
 R7 R8: Dual 5-Megohm Potentiometer
 R9 R10: Dual 5-Megohm Potentiometer
 R11 R12 R13 R14: 2 Megohms

*When cathode is grounded, capacitors should have high voltage rating; when anode No.2 is grounded, they may have low voltage rating. For dc amplifier service, deflecting electrodes should be connected direct to amplifier output. In this service, it is preferable usually to remove deflecting-electrode resistors to minimize loading effect on amplifier. In order to minimize spot defocusing, it is essential that anode No.2 be returned to a point in the amplifier system which will give the lowest possible potential difference between anode No.2 and the deflecting electrodes.

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

JULY 1, 1945

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

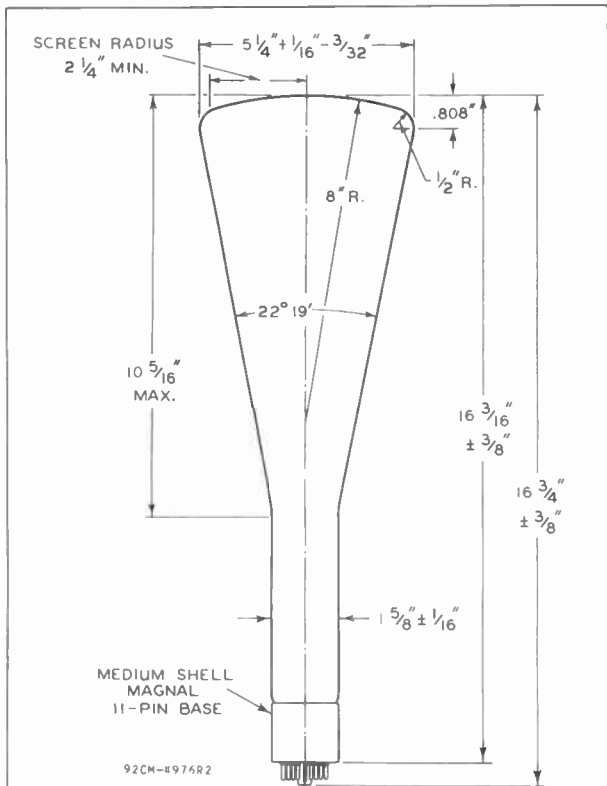
DATA 2

5BPI-A



5BPI-A

HIGH-VACUUM CATHODE-RAY TUBE



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

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DATA 2



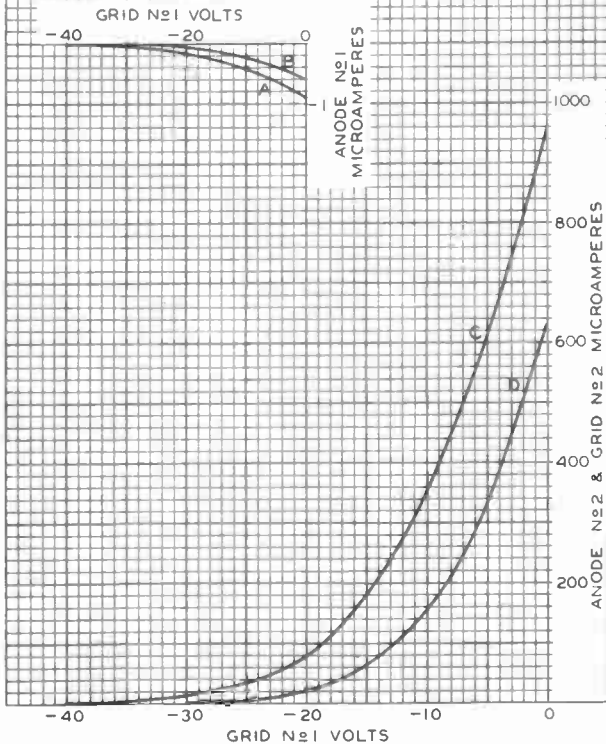
5BP1-A

5BP1-A

AVERAGE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ANODE No 1 VOLTS ADJUSTED TO GIVE FOCUS

CURVE	ELECTRODE CURRENT	ANODE No 2 & GRID No 2 VOLTS
A	ANODE No 1	2000
B	ANODE No 1	1500
C	ANODE No 2 & GRID No 2	2000
D	ANODE No 2 & GRID No 2	1500



FEB. 7, 1945

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
World Radio History

92CM-4984 R3





5CPI-A

5CPI-A OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

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. 8 μf
Cathode to All Other Electrodes. 9 μf
DJ₁ to DJ₂ 2 μf
DJ₃ to DJ₄ 2 μf
DJ₁ to All Other Electrodes. 9 μf
DJ₂ to All Other Electrodes. 9 μf
DJ₃ to All Other Electrodes. 7 μf
DJ₄ to All Other Electrodes. 8 μf

Phosphor (For Curves, see front of this Section) P1

Fluorescence and Phosphorescence Green
Persistence of Phosphorescence Medium

Focusing Method. Electrostatic

Deflection Method Electrostatic

Overall Length 16-3/4" \pm 3/8"Greatest Diameter of Bulb 5-1/4" \pm 3/32"

Minimum Useful Screen Diameter 4-1/2"

Mounting Position. Any

Cap. Recessed Small Ball (JETEC No. J1-22)

Base Medium-Shell Diheptal 12-Pin (JETEC No. B12-37)

Basing Designation for BOTTOM VIEW 14J1

Pin 1 - Heater	Pin 9 - Anode No.2, Grid No.2
Pin 2 - Cathode	Pin 10 - Deflecting Electr. DJ ₂
Pin 3 - Grid No.1	Pin 11 - Deflecting Electr. DJ ₁
Pin 4 - Internal Con. Do not use	Pin 12 - No Con- nection
Pin 5 - Anode No.1	Pin 14 - Heater Cap - Anode No.3
Pin 7 - Deflecting Electrode DJ ₃	
Pin 8 - Deflecting Electrode DJ ₄	



*DJ₁ and DJ₃ are nearer the screen
DJ₂ and DJ₄ are nearer the base*

With DJ₁ positive with respect to DJ₂, the spot is deflected toward pin 5. With DJ₃ positive with respect to DJ₄, the spot is deflected toward pin 2.

The plane through the tube axis and each of the following items may vary from the trace produced by DJ₁ and DJ₂ by the following angular tolerances measured about the tube axis: Pin 5, 10°; Cap (on same side of tube as pin 5), 10°.

The angle between the trace produced by DJ₁ and DJ₂ and the trace produced by DJ₃ and DJ₄ is 90° \pm 3°.

5CPI-A



5CPI-A OSCILLOGRAPH TUBE

Maximum Ratings, Design-Center Values:

ANODE-NO.3 VOLTAGE	4000 max.	volts
ANODE-NO.2* VOLTAGE.	2000 max.	volts
RATIO OF ANODE-NO.3 VOLTAGE TO ANODE-NO.2 VOLTAGE 2.3 : 1		
ANODE-NO.1 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 ANODE NO.2 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 anode-No.3 voltage (E_{b3}) between 2000** and 4000 volts
and any anode-No.2 voltage (E_{b2}) between 1500[▲] and 2000 volts

→ Anode-No.1 Voltage	18.7 to 34.5% of E_{b2} . . .	volts
→ Grid-No.1 Voltage [♠]	1.5% to 4.5% of E_{b2} . . .	volts
Anode-No.1 Current of any Operating Condition	-15 to +10	μ amp

Deflection Factors:

When $E_{b3} = 2 \times E_{b2}$

DJ1 & DJ2	39 to 53 v dc/in./kv of E_{b2}
DJ3 & DJ4	33 to 45 v dc/in./kv of E_{b2}

When $E_{b3} = E_{b2}$

DJ1 & DJ2	31 to 42 v dc/in./kv of E_{b2}
DJ3 & DJ4	27 to 37 v dc/in./kv of E_{b2}

Spot Position. ##

Examples of Use of Design Ranges:

For anode-No.3 voltage of	2000	3000	4000	volts
and anode-No.2 voltage of	2000	1500	2000	volts

→ Anode-No.1 Volt.	375 to 690	280 to 515	375 to 690	volts
→ Grid-No.1 Volt. [♠]	-30 to -90	-22.5 to -67.5	-30 to -90	volts

Deflection Factors:

DJ1 & DJ2	62 to 84	59 to 80	78 to 106	□
DJ3 & DJ4	54 to 74	50 to 68	66 to 90	□

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting-Electrode Circuit [■]	5.0 max.	megohms

•, •, **, ▲, ♠, ##, ■, □: See next page.

→ Indicates a change.

OCTOBER 1, 1951

TUBE DEPARTMENT

DATA 1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History



5CPI-A

5CPI-A OSCILLOGRAPH TUBE

- * Anode No.2 and grid No.2, which are connected together within tube, are referred to herein as anode No.2.
- At or near this rating, the effective resistance of the anode supply should be adequate to limit the anode-No.2 input power to 6 watts.
- ** It is recommended that anode-No.3 voltage be not less than 3000 volts for high-speed scanning.
- ▲ Recommended minimum value of anode-No.2 voltage.
- For visual cutoff of undeflected focused spot.
- Volts dc/in.
- **# With heater voltage of 6.3 volts, anode-No.3 voltage of 4000 volts, anode-No.2 voltage of 2000 volts, anode-No.1 voltage adjusted to focus, grid-No.1 voltage adjusted to give spot that is just visible, each deflecting electrode connected through 1-megohm resistor to anode No.2, and tube shielded from all extraneous fields, the center of the undeflected, focused spot will fall within a circle having a 12.5-mm radius concentric with the center of the tube face.
- It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

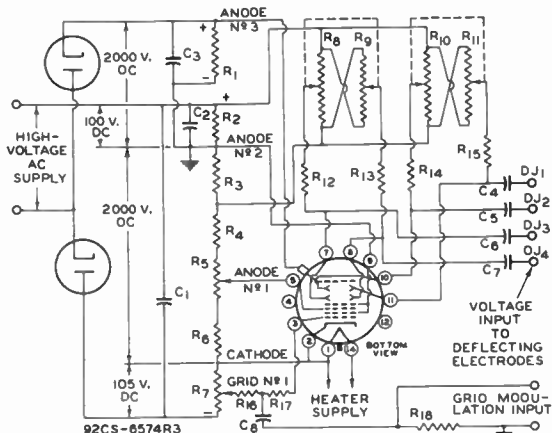
5CPI-A



5CPI-A

OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



C1: 0.1 μ f, 2500 Volts
 C2: 1.0 μ f, 200 Volts
 C3: 0.1 μ f, 2500 Volts
 C4 C5 C6 C7: 0.05- μ f, Blocking Capacitors*
 C8: 0.0001 μ f, 2500 Volts
 R1: 50 Megohms (Five 10-Megohm, 1-watt Resistors in Series)
 R2 R3: 2 Megohms, 0.5 watt
 R4: 5.5 Megohms, 2 Watts

R5: 2-Megohm Potentiometer
 R6: 1.5 Megohms, 0.5 Watt
 R7: 0.5-Megohm Potentiometer
 R8 R9: Dual 5-Megohm Potentiometer
 R10 R11: Dual 5-Megohm Potentiometer
 R12 R13 R14 R15: 2 Megohms, 0.5 Watt
 R16: 0.5 Megohm, 0.5 Watt
 R17: Not less than 2000 ohms per volt of positive signal
 R18: 5 Megohms, 0.5 watt

* when cathode is grounded, capacitors should have high voltage rating (2500 volts); when anode No.2 is grounded, they may have low voltage rating (200 volts). For dc amplifier service, deflecting electrodes should be connected direct to amplifier output. In this service, it is preferable usually to remove deflecting-electrode resistors to minimize loading effect on amplifier. In order to minimize spot defocusing, it is essential that anode No.2 be returned to a point in the amplifier system which will give the lowest possible potential difference between anode No.2 and the deflecting electrodes.

Devices and arrangements shown or described herein may use patents of RCA or others. Information contained herein is furnished without responsibility by RCA for its use and without prejudice to RCA's patent rights.

OCTOBER 1, 1951

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

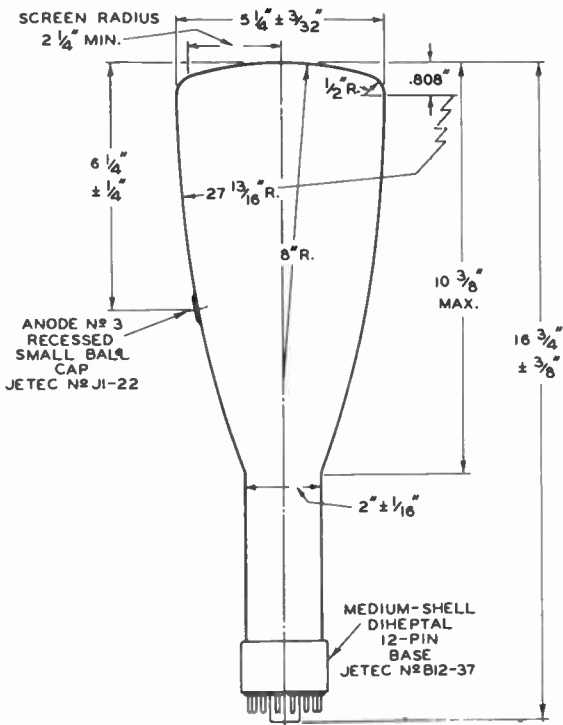
World Radio History

CE-6574R3



5CPI-A

5CPI-A OSCILLOGRAPH TUBE



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

92CM-640BR4

5CPI-A



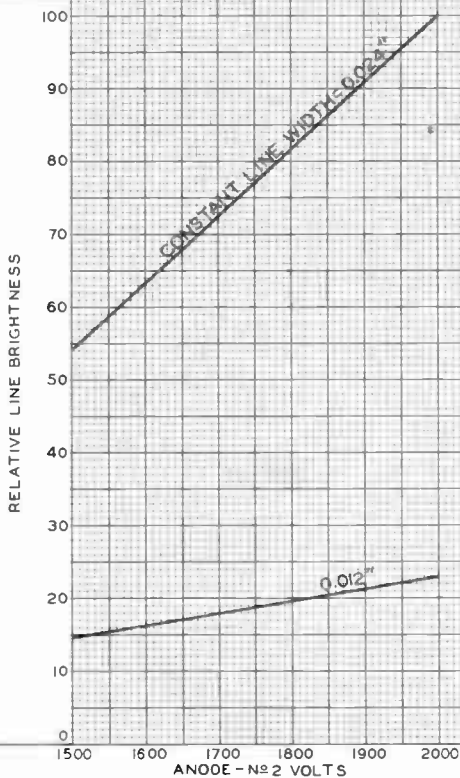
5CPI-A

CHARACTERISTICS

$E_f = 6.3$ VOLTS

ANODE - N^o 1 VOLTS ADJUSTED FOR FOCUS

ANODE - N^o 3 VOLTS = 2 * ANODE - N^o 2 VOLTS

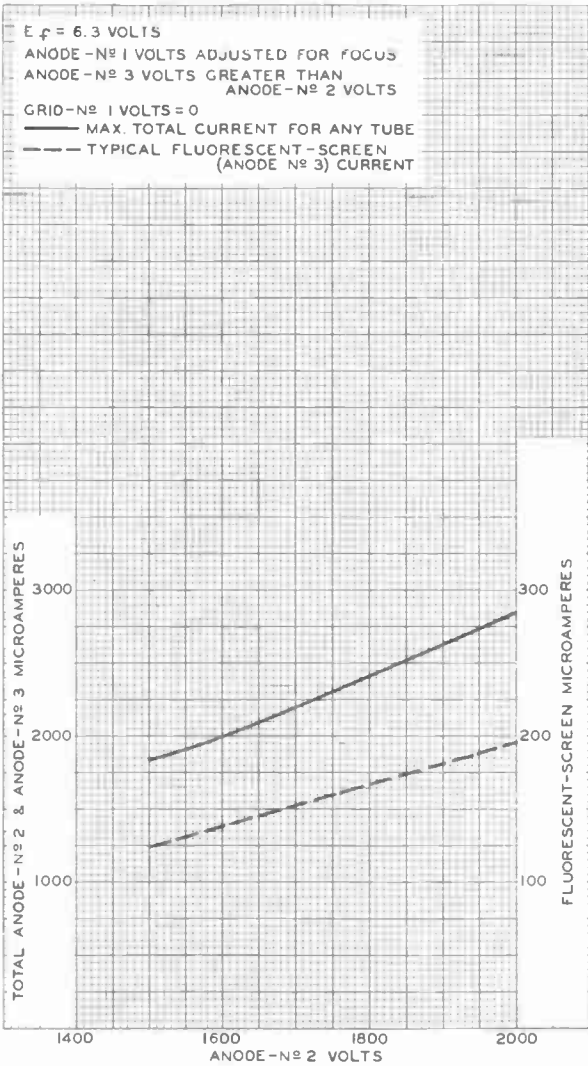




5CPI-A

5CPI-A

CHARACTERISTICS



5CPI-A

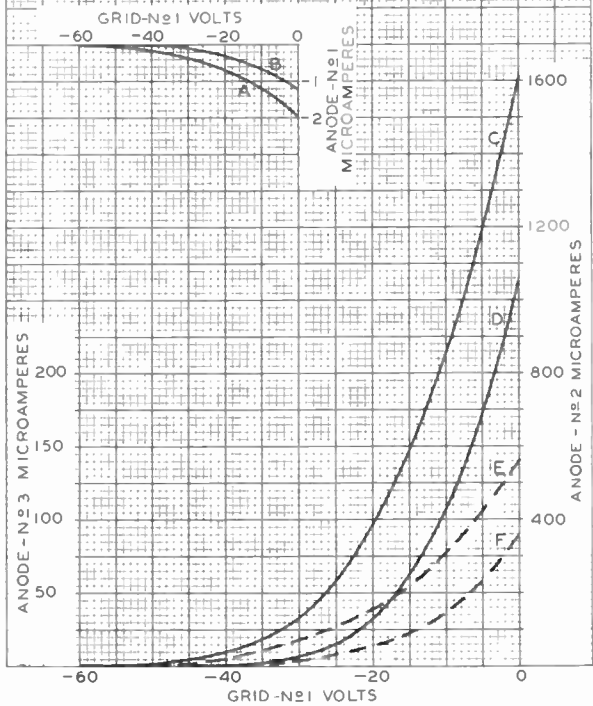


5CPI-A

AVERAGE CHARACTERISTICS

$E_f = 6.3$ VOLTS
 ANODE N°1 VOLTS ADJUSTED TO GIVE FOCUS

CURVE	ELECTRODE CURRENT	ANODE-N°2 VOLTS	ANODE-N°3 VOLTS
A	ANODE N°1	2000	2000-4000
B	ANODE N°1	1500	1500-3000
C	ANODE N°2	2000	4000
D	ANODE N°2	1500	3000
E	ANODE N°3	2000	4000
F	ANODE N°3	1500	3000



DEC. 26, 1946

TUBE DEPARTMENT

92CM-6414R2

RAD O CORPORATION OF AMER CA HARRISON, NEW JERSEY



5CP11-A

5CP11-A OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR
ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

The 5CP11-A is the same as the 5CP1-A, except that it has a screen of the short-persistence, blue-fluorescence type designated P11. Its highly actinic fluorescent spot of unusually high brightness makes the 5CP11-A particularly useful for photographic recording. Because its improved phosphor has exceptional brightness for a blue screen, the 5CP11-A is also quite useful for visual observation of phenomena.

The SPECTRAL-ENERGY EMISSION CHARACTERISTIC,
as well as the PERSISTENCE CHARACTERISTIC
for the P11 PHOSPHOR are shown at the
beginning of this Section.

APRIL 15, 1947

TUBE DEPARTMENT

TENTATIVE DATA

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History



View-Finder Kinescope

MAGNETIC FOCUS

MAGNETIC DEFLECTION

GENERAL DATA

Electrical:

Direct Inter-electrode Capacitances:

Cathode to all other electrodes	5	pf
Grid No. 1 to all other electrodes	5	pf
Heater Current at 6.3 volts	6.0	ma

Optical:

Fluor. (see curve on front of this section)	P4--Sulfide Type
Fluorescence	White
Phosphorescence	White
Persistence	Short
Focusing Method	Magnetic
Deflection Method	Magnetic
Deflection Angle (Approx.)	30°

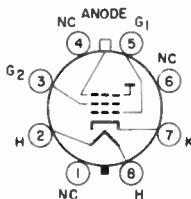
Mechanical:

Overall length	11-1/8" ± 3/8"
Greatest Diameter	4-15/16" ± 3/32"
Minimum Useful screen Diameter	4-1/4"
Cap.	Recessed Small Ball (JEDEC No. J1-22)

Bases (Alternates):

- Long Medium-Shell Octal:
 - 8-Pin (JEDEC Group 1, No. 98-65)
 - 9-Pin (JEDEC Group 1, No. 98-80)
- Medium-Shell Octal 8-Pin:
 - 8-Pin (JEDEC Group 1, No. 85-11)

- Pin 1 - No Internal Connection
- Pin 2 - Heater
- Pin 3 - Grid No. 2
- Pin 4 - Same as Pin 1
- Pin 5 - Grid No. 1



- Pin 6 - Same as Pin 1
- Pin 7 - Cathode
- Pin 8 - Heater
- Cap - Anode (Grid No. 3, Collector)

Maximum Ratings, Design-Center Values:

ANODE VOLTAGE ^a	8000 max.	volts
GRID-NO. 2 VOLTAGE	410 max.	volts
GRID-NO. 1 VOLTAGE:		
negative bias value	125 max.	volts
positive bias value	0 max.	volts
positive peak value	2 max.	volts
PEAK HEATER CATHODE VOLTAGE:		
Heater negative with respect to cathode	150 max.	volts
Heater positive with respect to cathode	150 max.	volts



5FP4A

Typical Operation:

Anode Voltage ^b ,	6000	volts
Grid-No.2 Voltage	250	volts
Grid-No.1 Voltage for Visual Extinction of Undelected Focused Spot	-25 to -70	volts
Focused-Coil Current (DC, approx.) ^c	120 ± 15%	ma

Maximum Circuit Values:

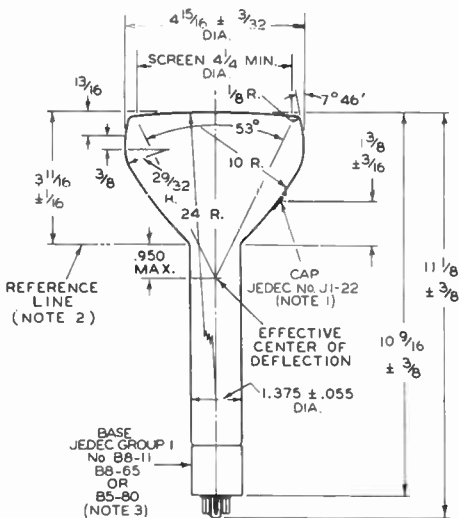
Grid-No.1-Circuit Resistance. 1.5 max. megohms

^a The product of anode voltage and average anode current should be limited to 6 watts.

^b Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 4000 volts.

^c For specimen focusing coil similar to JEDEC Focusing Coil No.106 positioned with air gap toward kinescope screen, and center line of air gap 3-1/4" from Reference Line (see Outline Drawing). The indicated current is for condition with combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 10 foot-lamberts on a 3-7/8" x 2-7/8" picture area sharply focused at center of screen.





92CM-6362R5

DIMENSIONS IN INCHES

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 5 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF 10° . ANODE TERMINAL IS ON SAME SIDE OF TUBE AS PIN 5.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE GAUGE $1.430" + .003" - .000"$ INSIDE DIAMETER AND 2" LONG WILL REST ON BULB CONE.

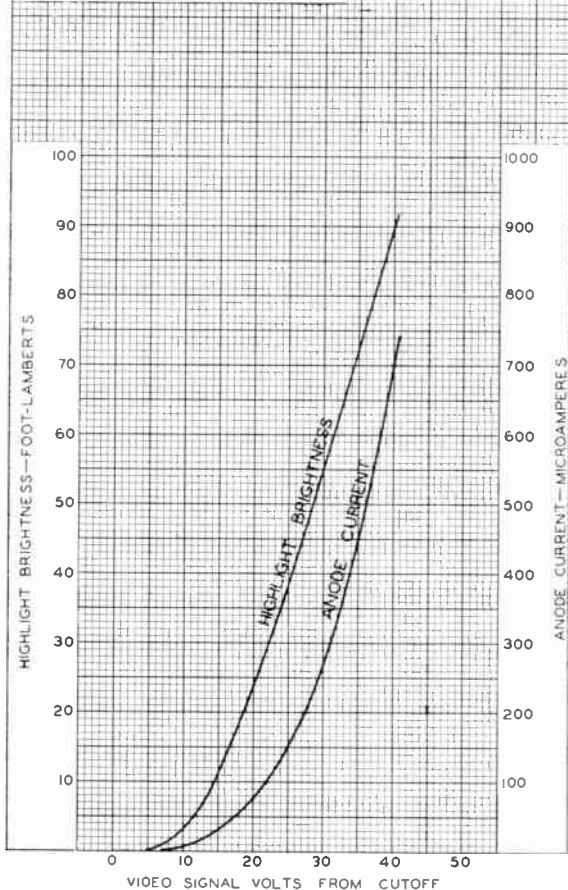
NOTE 3: CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERRECTED AT THE CENTER OF THE BOTTOM OF THE BASE.



5FP4A

AVERAGE GRID-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ANODE VOLTS = 6000
GRID-N^o2 VOLTS = 250
GRID-N^o1 BIASED TO CUTOFF OF UNDEFLECTED FOCUSED SPOT
RASTER SIZE = $3\frac{7}{8}'' \times 2\frac{7}{8}''$ (FOCUSED FOR AVERAGE BRIGHTNESS)



92CM - 6683R1



SFP7-A

SFP7-A

OSCILLOGRAPH TUBE

MAGNETIC FOCUS

MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

Voltage.	6.3	ac or dc volts
Current.	0.6	amp

Direct Interelectrode Capacitances:

Grid No.1 to All Other Electrodes.	8	μmf
Cathode to All Other Electrodes.	5	μmf

Phosphor (For Curves, see front of this Section) P7

Fluorescence Blue

Phosphorescence. Greenish-Yellow

Persistence of Phosphorescence Long

Focusing Method. Magnetic

Deflection Method. Magnetic

Deflection Angle (Approx.) 53°

Overall Length $11\text{-}1/8" \pm 3/8"$

Greatest Diameter of Bulb. $4\text{-}15/16" \pm 3/32"$

Minimum Useful Screen Diameter $4\text{-}1/4"$

Mounting Position. Any

Cap. Recessed Small Ball (JETEC No. J1-22)

Base Long Medium-Shell Octal 8-Pin (JETEC No. B8-65)

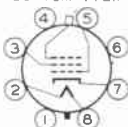
BOTTOM VIEW

Pin 1 - No
Connection

Pin 2 - Heater

Pin 3 - Grid No. 2

Pin 4 - No
Connection



Pin 5 - Grid No. 1

Pin 6 - No
Connection

Pin 7 - Cathode

Pin 8 - Heater
Cap - Anode

Maximum Ratings, Design-Center Values:

ANODE VOLTAGE. 8000 max. volts

GRID-NO. 2 VOLTAGE. 700 max. volts

GRID-NO. 1 VOLTAGE:

Negative bias value. 180 max. volts

Positive bias value*. 0 max. volts

Positive peak value. 2 max. volts

PEAK GRID-NO. 1 DRIVE FROM CUTOFF 65 max. volts

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode. 125 max. volts

Heater positive with respect to cathode. 125 max. volts

Typical Operation:

Anode Voltage**. 4000 7000 volts

Grid-No. 2 Voltage. 250 250 volts

* At or near this rating, the effective resistance of the anode supply should be adequate to limit the anode input power to 6 watts.

** Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 4000 volts.

◀ Indicates a change.

5FP7-A



5FP7-A

OSCILLOGRAPH TUBE

Grid-No.1 Voltage ^o	-25 to -70	-25 to -70	volts
→ Grid-No.2 Current	-15 to +15	-15 to +15	μamp
Focusing-Coil Current			
→ (DC, approx.)*	96 ± 15%	128 ± 15%	ma
Spot Position	**	—	

Maximum Circuit Values:

Grid-No.1-Circuit Resistance 1.5 max. megohms

^o For visual extinction of undeflected focused spot.

* For specimen focusing coil similar to JETEC Focusing Coil No.106 positioned with air gap toward face plate, and center line of airgap 2-3/4 inches from Reference Line (see Outline Drawing), and total anode current of 200 microamperes.

** The center of the undeflected, unfocused spot will fall within a circle having 9-mm radius concentric with center of tube face.

OPERATING NOTES

The 5FP7-A utilizes a long-persistence, cascade (two-layer) screen which exhibits bluish fluorescence of short persistence and greenish-yellow phosphorescence.

Because of its long persistence, the 5FP7-A is particularly useful where either low-speed non-recurring phenomena or high-speed recurring phenomena are to be observed. Furthermore, two or more phenomena can be observed simultaneously on the screen by means of a suitable switching arrangement.

The persistence is such that the 5FP7-A without filter can be operated with scanning frequencies as low as 30 cycles per second without excessive flicker. When used with yellow filter, such as Wratten No.15 (G), the 5FP7-A can be operated with much lower scanning frequencies.

In general, operation of the 5FP7-A at an anode voltage below 4000 volts will not give persistence of useable brightness.

OUTLINE DIMENSIONS for Type 5FP7-A
are the same as those for Type 5FP4-A

AVERAGE CHARACTERISTIC CURVE
for Type 5FP7-A is the same as that shown for
Type 7BP7-A

→Indicates a change.

AUG. 1, 1951

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

DATA



5FP14

5FP14

OSCILLOGRAPH TUBE

MAGNETIC FOCUS

MAGNETIC DEFLECTION

The 5FP14 is the same as the 5FP7-A except that it utilizes a medium-long-persistence, cascade (two-layer) screen which exhibits purple fluorescence of short persistence and orange phosphorescence which persists for a little over a minute under conditions of adequate excitation and low ambient light.

Because of its medium-long persistence, the 5FP14 is particularly useful where either low- and medium-speed non-recurring phenomena or high-speed recurring phenomena are to be observed. Furthermore, two or more phenomena can be observed simultaneously on the screen by means of a suitable switching arrangement.

The persistence is such that the 5FP14 without filter can be operated with scanning frequencies as low as 30 cycles per second without excessive flicker. When used with yellow filter, such as Wratten No. 15 (G), the 5FP14 can be operated with much lower scanning frequencies.

In general, operation of the 5FP14 at an anode voltage below 4000 volts will not give persistence of useable brightness.

THE SPECTRAL-ENERGY EMISSION CHARACTERISTIC
and the PERSISTENCE CHARACTERISTIC of
the P14 Phosphor are shown at the
front of this Section.





SUPI

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

SUPI

General:

Heater, for Unipotential Cathode:

Voltage	6.3 ± 10%	ac or dc volts
Current	0.6	amp

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to All Other Electrodes	8.0	μf
DJ ₁ to DJ ₂	2.5	μf
DJ ₃ to DJ ₄	2.5	μf
DJ ₁ to All Other Electrodes	11.0	μf
DJ ₂ to All Other Electrodes	8.0	μf
DJ ₃ to All Other Electrodes	7.0	μf
DJ ₄ to All Other Electrodes	8.0	μf

Phosphor (For Curves, see front of this Section)	No.1
Fluorescence	Green
Persistence	Medium

Focusing Method. Electrostatic

Deflection Method. Electrostatic

Overall Length 14-3/4" ± 3/8"

Greatest Diameter of Bulb 5-1/4" ± 3/32"

Minimum Useful Screen Diameter 4-1/2"

Mounting Position. Any

Base Small-Shell Duodecal 12-Pin

Basing Designation for BOTTOM VIEW 12E

- | | |
|---|--|
| Pin 1 - Heater | Pin 8 - Anode No.2,
Grid No.2 |
| Pin 2 - Grid No.1 | Pin 9 - Deflecting
Electrode DJ ₂ |
| Pin 3 - Cathode | Pin 10 - Deflecting
Electrode DJ ₁ |
| Pin 4 - Anode No.1 | Pin 11 - Internal Con.
Do Not Use |
| Pin 5 - Internal Con.
Do Not Use | Pin 12 - Heater |
| Pin 6 - Deflecting
Electrode DJ ₃ | |
| Pin 7 - Deflecting
Electrode DJ ₄ | |



*DJ₁ and DJ₂ are nearer the screen
DJ₃ and DJ₄ are nearer the base*

With DJ₁ positive with respect to DJ₂, the spot is deflected toward pin 4. With DJ₃ positive with respect to DJ₄, the spot is deflected toward pin 1.

The angle between the trace produced by DJ₁ and DJ₂ and its intersection with the plane through the tube axis and pin 1 does not exceed 10°.

The angle between the trace produced by DJ₃ and DJ₄ and the trace produced by DJ₁ and DJ₂ is 90° ± 30°.

5U1



5U1

OSCILLOGRAPH TUBE

Maximum Ratings, Design-Center Values:

ANODE-No. 2 [■] VOLTAGE	2500 max.	volts
ANODE-No. 1 VOLTAGE	1000 max.	volts
GRID-No. 1 (CONTROL ELECTRODE) VOLTAGE:		
Negative bias value.	200 max.	volts
Positive bias value.	0 max.	volts
Peak positive value.	2 max.	volts
PEAK VOLTAGE BETWEEN ANODE No. 2 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 anode-No. 2 voltage (E_{b2}) between 1000* and 2500 volts

Anode-No. 1 Voltage . . .	17% to 32% of E_{b2}	. . . volts
Max. Grid-No. 1 Voltage for Visual Cutoff	4.5% of E_{b2}	. . . volts
Anode-No. 1 Current for Any Operating Condition	-15 to +10	. . microamp
Deflection Factors:		
DJ ₁ & DJ ₂	28 to 38.5	v dc/in./kv of E_{b2}
DJ ₃ & DJ ₄	23 to 31	v dc/in./kv of E_{b2}

Examples of Use of Design Ranges:

For anode-No. 2 voltages of	<u>1000</u>	<u>2000</u>	volts
Anode-No. 1 Voltage . . .	170 - 320	340 - 640	. . volts
Max. Grid-No. 1 Voltage for Visual Cutoff	-45	-90	. . volts
Deflection Factors:			
DJ ₁ & DJ ₂	28 - 38.5	56 - 77	volts dc/in.
DJ ₃ & DJ ₄	23 - 31	46 - 62	volts dc/in.

Maximum Circuit Values:

Grid-No. 1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting Electrode Circuit [□] . . .	5.0 max.	megohms

* Recommended minimum value.

□ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

□ Anode No. 2 and grid No. 2, which are connected together within tube, are referred to herein as anode No. 2.

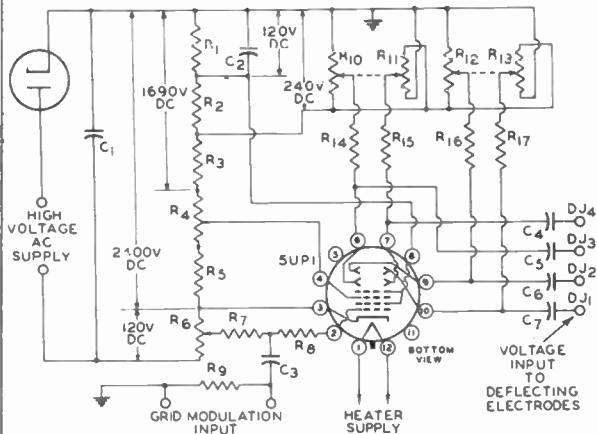


5U1I

OSCILLOGRAPH TUBE

5U1I

TYPICAL CIRCUIT



92CM-6819

R1 R2: 2.5 Megohms, 0.5 Watt
 R3: 6 Megohms, 3 watts
 R4: 2-Megohm Potentiometer
 R5: 1 Megohm, 0.5 Watt
 R6: 0.5-Megohm Potentiometer
 R7: 0.5-Megohm, 0.5 Watt
 R8: Not less than 2000 Ohms per
 volt of positive signal
 R9: 5-Megohms, 0.5 Watt

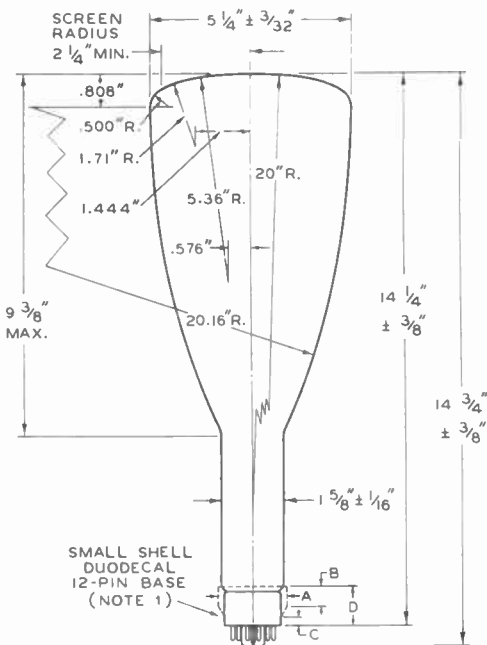
R10 - R11, R12 - R13: Dual Potentiometers, R10, R11, R12, R13: 0.5 Megohm
 R14 R15 R16 R17: 2.2 Megohms, 0.5 Watt
 C1: 0.1 μ f, 2500 Volts
 C2: 1 μ f, 200 Volts
 C3: 0.0001 μ f, 2500 Volts
 C4 C5 C6 C7: 0.1 μ f, 600 Volts

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

5U1



5U1 OSCILLOGRAPH TUBE



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

NOTE 1: THIS BASE MAY BE SUPERSEDED BY AN ALTERNATE BASE WHICH WILL FIT THE SAME SOCKET BUT WHICH WILL HAVE A FLARED SHELL INDICATED BY THE DASHED LINES AND DIMENSIONED APPROXIMATELY AS FOLLOWS:

A = 1.85" MAX., B = 0.500", C = 0.200" MIN., D = 0.925".

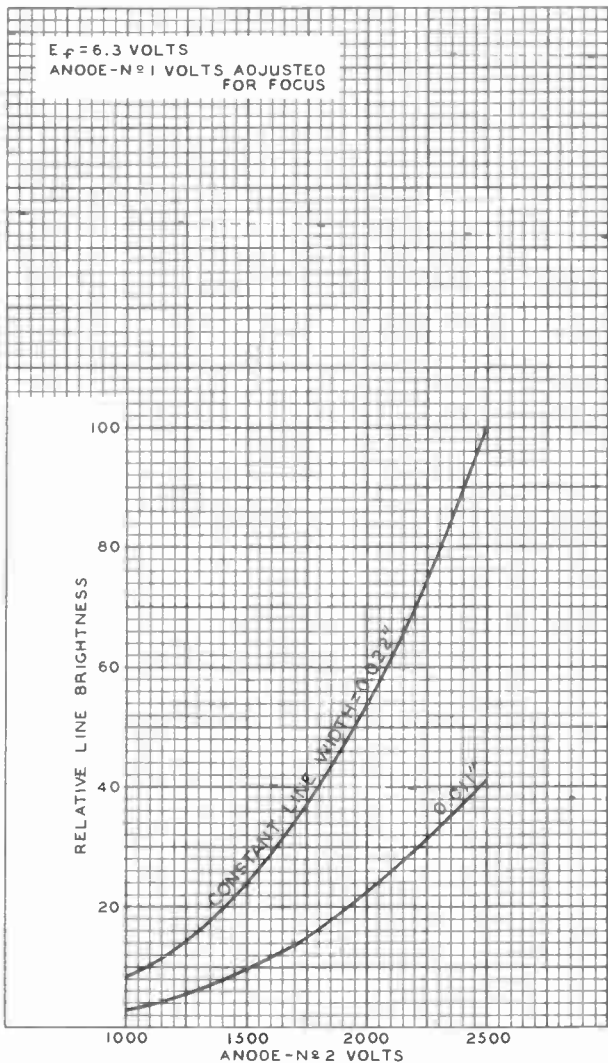
92CM-6763



5U1

5U1

AVERAGE CHARACTERISTICS



NOV. 7, 1946

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RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

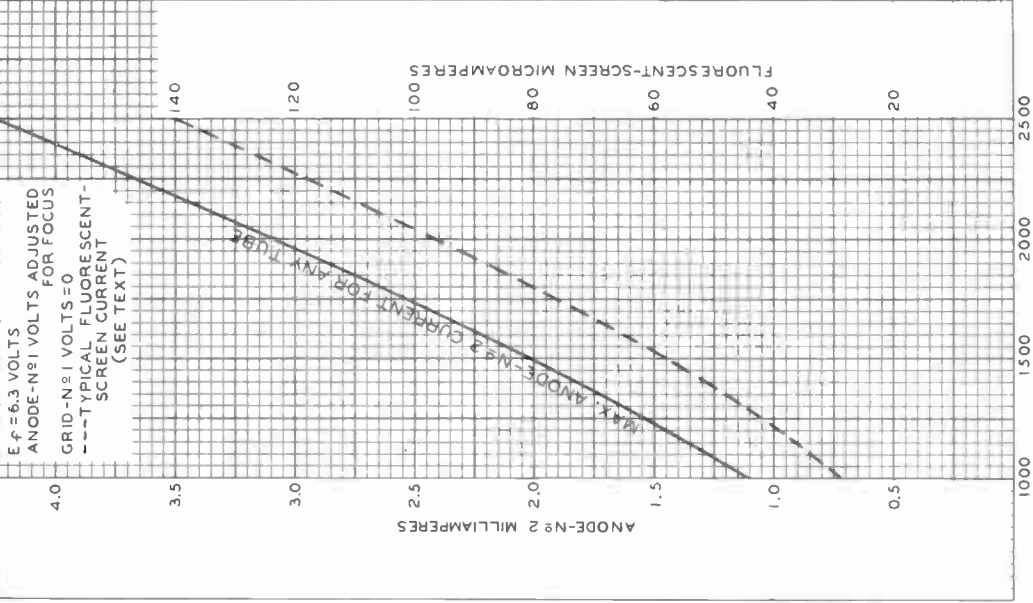
92CM-6808

5U1



5U1

CHARACTERISTICS



OCT. 21, 1949

 TUBE DEPARTMENT
 RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

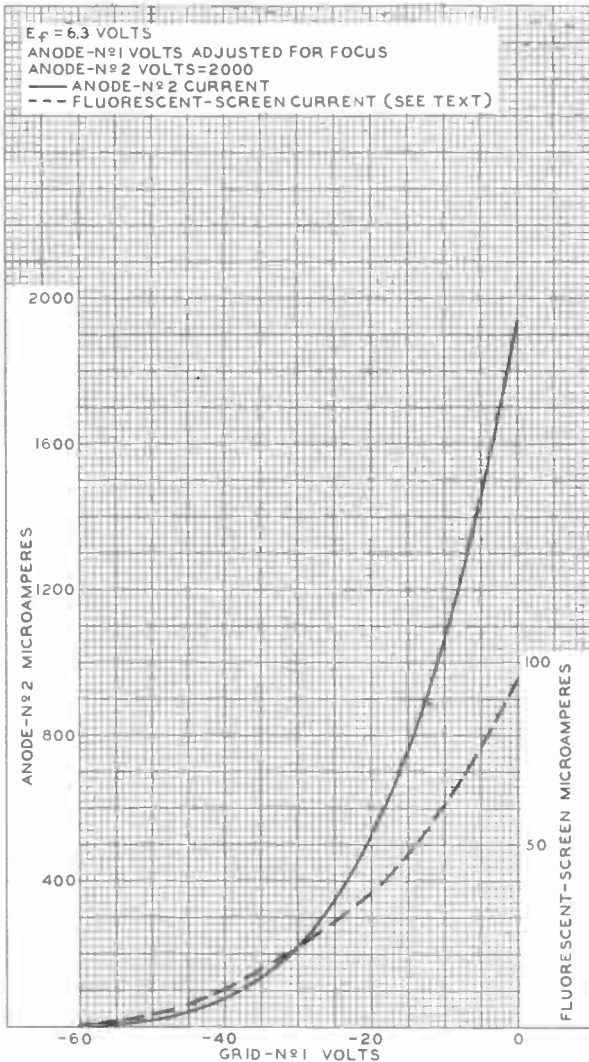
92CM-6811R1



5U1

5U1

AVERAGE CHARACTERISTICS



NOV. 11, 1946

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

92CM-6810



Oscillograph Tube

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

For Extremely Low-Speed Recurrent, or Medium-Speed Non-Recurrent Image Displays

The 5UP7 is the same as the 5UP1 except for the following items

GENERAL

Phosphor (For curves, see front of this section)	P7
Fluorescence	White
Phosphorescence	Yellowish-Green
Persistence ^{a, b}	Very-Long

5UP11

Oscillograph Tube

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

For Photographic Recording and Visual Observations

The 5UP11 is the same as the 5UP1 except for the following items

GENERAL

Phosphor (For curves, see front of this section)	P11
Fluorescence	Actinic-Blue
Phosphorescence	Actinic-Blue
Persistence ^{a, b}	Medium-Short

5UP31

Oscillograph Tube

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

For Low- or Medium-Speed Non-Recurring Image Displays

The 5UP31 is the same as the 5UP1 except for the following items.

GENERAL

Phosphor (For curves see type 7VP31)	P31
Fluorescence	Green
Phosphorescence	Green
Persistence ^b	Medium-Short ^c (Approx. 38 μ sec)

^a Persistence of useable brightness can be obtained with an anode-No. 2 voltage of as low as 1500 volts.

^b Time for initial brightness to decay to 10% point.

^c Phosphorescence may have a useful brightness for over a minute under conditions of adequate excitation and low-ambient illumination.







5WPII

5WPII

TRANSCRIBER KINESCOPE

ELECTROSTATIC FOCUS

MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

Voltage 6.3 ac or dc volts

Current 0.6 amp

Direct Interelectrode Capacitances:

Grid No.1 to All Other Electrodes 7.5 μmf

Cathode to All Other Electrodes 5 μmf

External Conductive Coating to Anode No.2 $\left. \begin{array}{l} 500 \text{ max.} \\ 100 \text{ min.} \end{array} \right\}$ μmf

Phosphor (For Curves, see front of this Section) P11

Fluorescence Blue

Persistence Short

Focusing Method Electrostatic

Deflection Method Magnetic

Deflection Angle (Approx.) 50°

Overall Length $11-7/16" \pm 3/8"$

Greatest Diameter of Bulb $5" \pm 1/8"$

Minimum Useful Screen Diameter $4-1/4"$

Raster Size (Approx.) $2-1/2" \times 3-3/8"$

Mounting Position Any

Cap. Recessed Small Cavity

Base Small-Shell Duodecal 7-Pin

Basing Designation for BOTTOM VIEW 12C

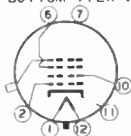
Pin 1-Heater

Pin 2-Grid No.1

Pin 6-Anode No.1

Pin 7-Internal Con.-

Do Not Use



Pin 10-Grid No.2

Pin 11-Cathode

Pin 12-Heater

Cap - Anode No.2

Maximum Ratings, Design-Center Values:

ANODE-No.2 VOLTAGE 27000 max. volts

ANODE-No.1 VOLTAGE 6000 max. volts

GRID-No.2 VOLTAGE 350 max. volts

GRID-No.1 VOLTAGE:

Negative bias value 150 max. volts

Positive bias value 0 max. volts

Positive peak value 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode:

During equipment warm-up period not exceeding 15 seconds 410 max. volts

After equipment warm-up period 125 max. volts

Heater positive with respect to cathode. 125 max. volts

Typical Operation:

Anode-No.2 Voltage* 27000 volts

*: See next page.

5WP11



5WP11

TRANSCRIBER KINESCOPE

Anode-No.1 Voltage Range for		
Anode-No.2 Current of 20 μ amp.	4200 to 5400	volts
Grid-No.2 Voltage**	200	volts
Grid-No.1 Voltage for Visual Cutoff . . .	-42 to -98	volts
Anode-No.2 Current	20	μ amp
Max. Anode-No.1 Current.	25	μ amp
Grid-No.2 Current Range.	-15 to +15	μ amp

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
--	----------	---------

Minimum Circuit Values:

When the output capacitor of the power supply is capable of storing more than 250 microcoulombs, and when the inherent regulation of the power supply permits the instantaneous short-circuit current to exceed 1 ampere, the effective resistance in circuit between indicated electrode and the output capacitor should be as follows:

Grid-No.1-Circuit Resistance	180 min.	ohms
Grid-No.2-Circuit Resistance	390 min.	ohms
Anode-No.1-Circuit Resistance.	6800 min.	ohms
Anode-No.2-Circuit Resistance.	30000 min.	ohms

The resistors used should be capable of withstanding the voltages involved.

Components:

Deflecting Yoke. RCA Type No. 201D11

Hor. Deflection Output Transformer:

For use with 6AS7-G booster scanning tube
and separate high-voltage supply RCA Type No. 204T1

For use with single high-voltage tripler
supply employing 3 1B3-GT/8016's RCA Type No. 211T2

Ver. Deflection Output Transformer RCA Type No. 204T2

* Brilliance and definition decrease with decreasing anode voltages. In general, anode-No.2 voltage should not be less than 15000 volts.

** Subject variation of $\pm 40\%$ when grid-No.1 voltage cutoff is desired at -70 volts.

OPERATING NOTES

Soft x-rays are produced when the 5WP11 is operated with an anode-No.2 voltage above approximately 20000 volts. These rays can constitute a health hazard unless the tube is adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.

Resolution of better than 700 lines at the center of the reproduced picture can be produced by the 5WP11. To utilize such resolution capability in the horizontal direction with the standard scanning rate of 525 lines, it is necessary to use a video amplifier having a band-width of at least 10 megacycles.

FEB. 1, 1949

TUBE DEPARTMENT

TENTATIVE DATA 1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History



5WP11

5WP11

TRANSCRIBER KINESCOPE

The screen of the 5WP11 has highly actinic blue radiation, and is particularly effective for photography. The persistence of the radiation is sufficiently short to prevent "carry over" from one frame to the next. The persistence is dependent to some extent on the current density in the focused spot, and decreases with current density.

Operation of the 5WP11 results in gradual browning of the face. The rate of browning increases markedly with increase in anode-No.2 voltage, is proportional to beam current, and is inversely proportional to the scanned area. The browning is most noticeable during initial operation; thereafter, a gradual increase in the amount of browning will be observed during the life of the tube.

OUTLINE DIMENSIONS for the 5WP11 are the same
as those for the 5WP15

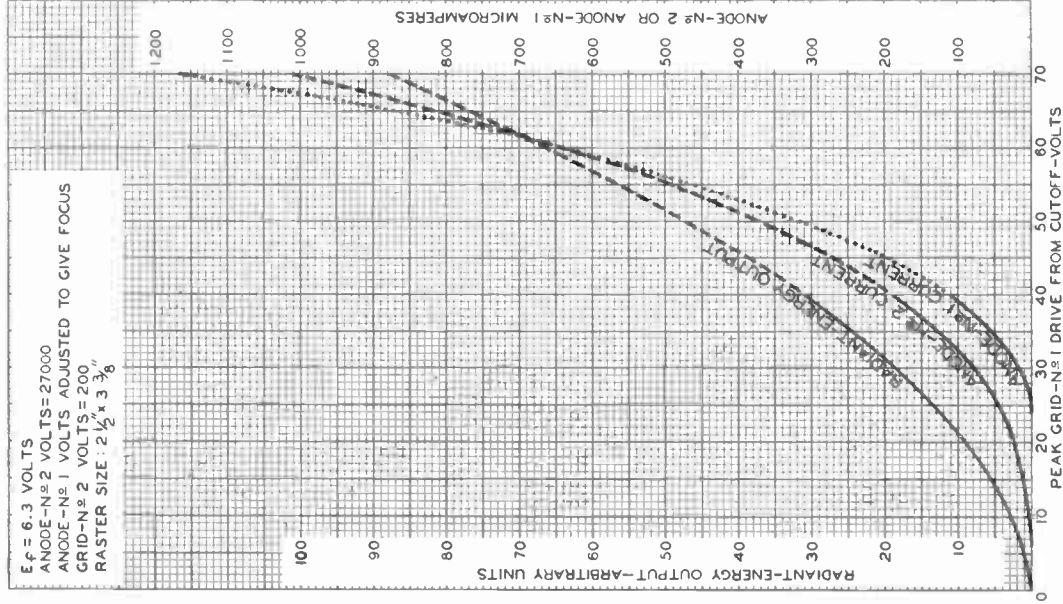
5WP11



5WP11

AVERAGE CHARACTERISTICS

$E_f = 6.3$ VOLTS
 ANODE-N^o 2 VOLTS = 27000
 ANODE-N^o 1 VOLTS ADJUSTED TO GIVE FOCUS
 GRID-N^o 2 VOLTS = 200
 RASTER SIZE: $2\frac{1}{2}'' \times 3\frac{3}{8}''$



OCTOBER 28, 1948

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7105



5ZP16

5ZP16

FLYING-SPOT CATHODE-RAY TUBE

HIGH RESOLUTION CAPABILITY

ALUMINIZED SCREEN

ELECTROSTATIC FOCUS

MAGNETIC DEFLECTION

For use as scanner in high-quality flying-spot video-signal generators

DATA

General:

Heater, for Unipotential Cathode:

Voltage 6.3 ac or dc volts

Current 0.6 ± 10% amp

Direct Interelectrode Capacitances:

Grid No.1 to all other electrodes. 8 μmf

Cathode to all other electrodes. 5 μmf

External conductive neck coating to ultor. { 500 max. μmf
100 min. μmf

Faceplate, Flat. Clear Glass

Phosphor (For curves, see front of this section) P16
Aluminized

Fluorescence—

Visible radiation. Violet

Invisible radiation. Near Ultraviolet

Phosphorescence—

Persistence of visible radiation Very Short

Persistence of invisible radiation Very Short

Focusing Method. Electrostatic

Deflection Method. Magnetic

Deflection Angle (Approx.) 40°

Tube Dimensions:

Overall length 14-3/8" ± 3/8"

Greatest diameter of bulb. 5" ± 1/8"

Minimum Useful Screen Diameter 4-1/4"

Weight (Approx.) 1-1/2 lbs

Operating Position Any

Cap. Recessed Small Cavity (JETEC No. J1-21)

Socket See Operating Considerations

Base Small-Shell Duodecal 7-Pin (JETEC No. B7-51)

Basing Designation for BOTTOM VIEW 12C

Pin 1—Heater

Pin 2—Grid No.1

Pin 6—Grid No.3

Pin 7—Internal

Connection—

Do Not Use

Pin 10—Grid No.2

Pin 11—Cathode

Pin 12—Heater

Cap—Ultor

(Grid No.4,

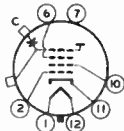
Collector)

C—External

Conductive

Neck Coat-

ing



Maximum Ratings, Design-Center Values:

ULTOR VOLTAGE. 27000 max. volts

GRID—No.3 VOLTAGE. 7000 max. volts

GRID—No.2 VOLTAGE. 350 max. volts

← Indicates a change.

5ZP16



5ZP16

FLYING-SPOT CATHODE-RAY TUBE

GRID-No.1 VOLTAGE:		
Negative bias value.	150 max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	410 max.	volts
After equipment warm-up period	150 max.	volts
Heater positive with respect to cathode.	150 max.	volts

→ Equipment Design Ranges:

For any ultor voltage (E_{C4}) between 20000* and 27000 volts

Grid-No.3 Voltage for focus with ultor current of 25 μ a or less.	20.5% to 26.5% of E_{C4}	volts
Grid-No.2 Voltage for visual extinction of undeflected focused spot when circuit design utilizes fixed grid-No.1 voltage.	2 to 5 times E_{C1}	volts
Grid-No.1 Voltage for visual extinction of undeflected focused spot when circuit design utilizes fixed grid-No.2 voltage.	-20% to -50% of E_{C2}	volts
Grid-No.2 Current.	-15 to +15	μ a

→ Examples of Use of Design Ranges:

For ultor voltage of	20000	27000	volts
Grid-No.3 Voltage for focus with ultor current as indicated.	4100 to 5300	5500 to 7100	volts
Grid-No.2 Voltage for visual extinction of undeflected focused spot when circuit design utilizes fixed grid-No.1 voltage of -70 volts.	140 to 350	140 to 350	volts
Grid-No.1 Voltage for visual extinction of undeflected focused spot when circuit design utilizes fixed grid-No.2 voltage of 200 volts.	-40 to -100	-40 to -100	volts
Ultor Current.	25	15	μ a

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
--	----------	---------

* Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 20,000 volts.

→ Indicates a change.



5ZP16

5ZP16

FLYING-SPOT CATHODE-RAY TUBE

OPERATING CONSIDERATIONS

X-Ray Warning. X-ray radiation is produced at the face of the 5ZP16 when it is operated at its normal ultor voltage. 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 that it provides the required protection against personal injury.

The base pins of the 5ZP16 fit the Duodecal 12-contact socket. The socket contacts corresponding to the vacant pin positions (pin positions 3, 4, 5, 8, and 9) should be removed in order to provide the maximum insulation for the high-voltage pins 6 and 7. The socket should be made of high-grade, arc-resistant, insulating material and should preferably be designed with baffles.

Resolution of better than 1000 lines at the center of the reproduced picture can be produced by the 5ZP16 when it is operated with 27,000 volts on the ultor. At lower ultor voltages, the resolution capability decreases. To obtain high resolution in the horizontal direction, it is necessary to use a video amplifier having a bandwidth of about 20 megacycles.

The ultraviolet output of the 5ZP16 is a linear function of the ultor current. For any particular value of ultor current, the ultraviolet output is approximately 50 per cent higher when the 5ZP16 is operated with 27,000 volts on the ultor than when operated with 20,000 volts.

Underscanning over a protracted period should be avoided because an underscanned area of the screen will be burned and thus give diminished radiation when the raster is again scanned to full size and be slightly noticeable in the reproduced picture. Furthermore, it is inadvisable to permit a modulated stationary pattern to remain more than a few minutes on the face of the tube. If it remains for a longer time, the phosphor will be burned unevenly over the pattern area.

Never allow the beam to remain stationary, even momentarily, because the high peak energy in the beam will seriously damage the screen. Provision should be made to prevent such a possibility. Provision should also be made in equipment design to insure that the ultor voltage will drop as fast as the scanning current when the equipment is turned off; or to bias grid No. 1 to beam-current cutoff when the equipment is turned off.

← Indicates a change.

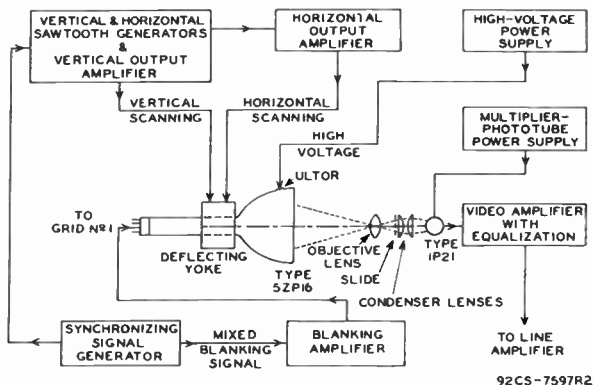
5ZP16



5ZP16

FLYING-SPOT CATHODE-RAY TUBE

BLOCK DIAGRAM OF FLYING-SPOT VIDEO-SIGNAL GENERATOR SYSTEM FOR SLIDE TRANSPARENTS



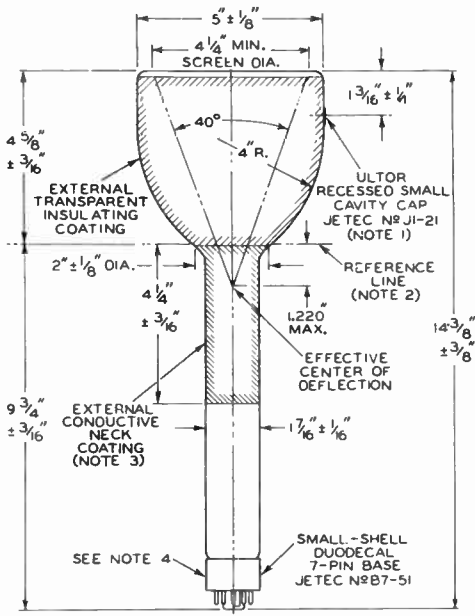
Devices and arrangements shown or described herein may use patents of RCA or others. Information contained herein is furnished without responsibility by RCA for its use and without prejudice to RCA's patent rights.



5ZP16

5ZP16

FLYING-SPOT CATHODE-RAY TUBE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION 3 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 10^\circ$. THE ULTOR TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION 3.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No. 110 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY INTERSECTION ON PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: EXTERNAL CONDUCTIVE NECK COATING MUST BE GROUNDED.

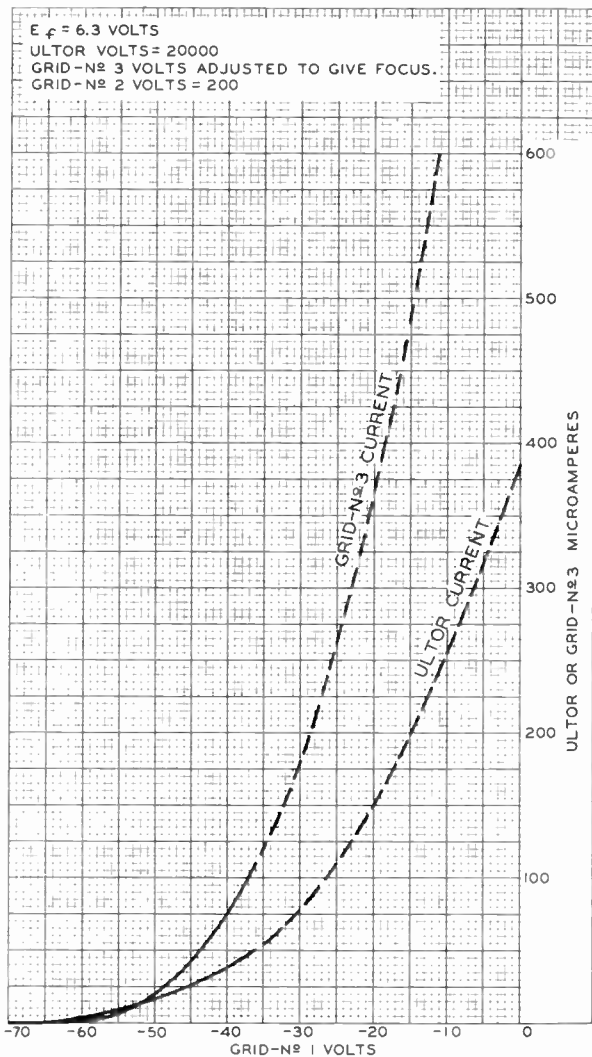
NOTE 4: \angle OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERRECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

5ZP16



5ZP16

AVERAGE CHARACTERISTICS



ELECTRON TUBE DIVISION

92CM-7575R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

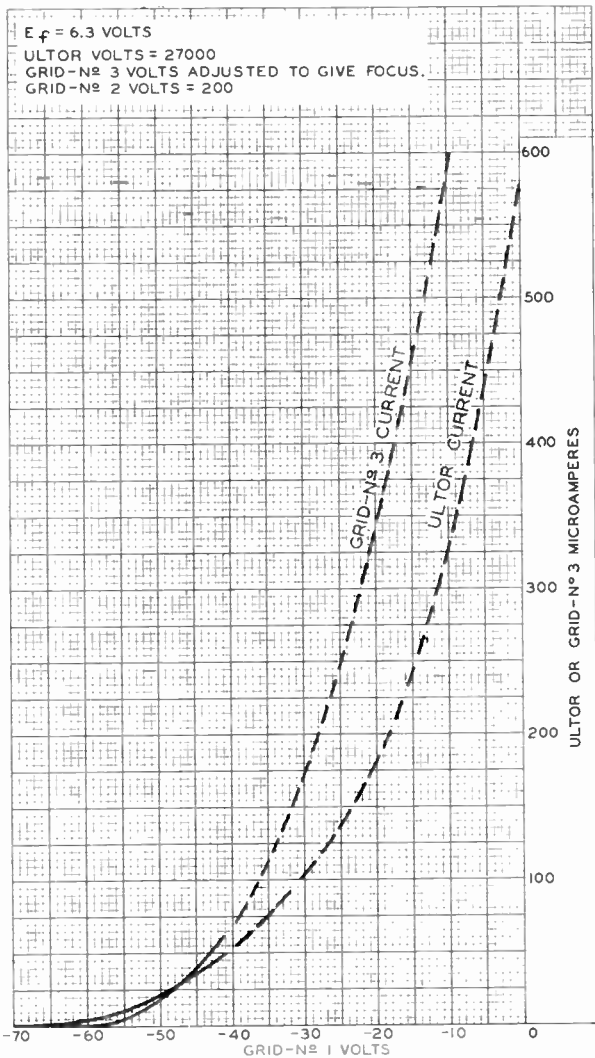
World Radio History



5ZP16

5ZP16

AVERAGE CHARACTERISTICS



ELECTRON TUBE DIVISION

92CM-7576R1

RADIO CORPORATION OF AMERICA HARRISON NEW JERSEY





7BP7-A

7BP7-A

OSCILLOGRAPH TUBE

MAGNETIC FOCUS

MAGNETIC DEFLECTION

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	8.5	μf
Grid No.2 to All Other Electrodes	7	μf
Cathode to All Other Electrodes	5	μf

Phosphor (For Curves, see front of this Section) No.7

Fluorescence Blue

Phosphorescence Greenish-Yellow

Persistence of Phosphorescence Long

Focusing Method Magnetic

Deflection Method Magnetic

Deflection Angle (Approx.) 53°

Overall Length $13\text{-}1/4" \pm 3/8"$

Greatest Diameter of Bulb $7" \pm 1/8"$

Maximum Useful Screen Diameter $6"$

Mounting Position Any

Cap. Recessed Small Ball

Base Long Medium-Shell Octal 8-Pin

BOTTOM VIEW

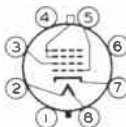
Pin 1 - No
Connection

Pin 2 - Heater

Pin 3 - Grid No.2

Pin 4 - No
Connection

Pin 5 - Grid No.1



Pin 6 - No
Connection

Pin 7 - Cathode

Pin 8 - Heater

Cap - Anode,
Grid No.3

Maximum Ratings, Design-Center Values:

ANODE* VOLTAGE 8000 max. volts

GRID-No.2 VOLTAGE 700 max. volts

GRID-No.1 VOLTAGE:

Negative bias value 125 max. volts

Positive bias value^o 0 max. volts

Positive peak value 2 max. volts

PEAK GRID-No.1 DRIVE FROM CUTOFF 65 max. volts

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode. 125 max. volts

Heater positive with respect to cathode. 125 max. volts

Typical Operation:

Anode Voltage* 4000 7000 volts

Grid-No.2 Voltage 250 250 volts

Grid-No.1 Voltage Range^o -25 to -70 -25 to -70 volts

Focusing-Coil Current[^] 75 to 102 99 to 135 ma

Spot Position #

* , ^o , [^] , # : See next page.

7BP7-A



7BP7-A

OSCILLOGRAPH TUBE

Maximum Circuit Values:

Grid-No.1-Circuit Resistance 1.5 max. megohms

Minimum Circuit Values:

When the output capacitor of the power supply is capable of storing more than 250 microcoulombs, and when the inherent regulation of the power supply permits the instantaneous short-circuit current to exceed 1 ampere, the effective resistance in circuit between indicated electrode and the output capacitor should be as follows:

Grid-No.1-Circuit Resistance 150 min. ohms

Grid-No.2-Circuit Resistance 820 min. ohms

Anode-Circuit Resistance 9100 min. ohms

The resistors used should be capable of withstanding the voltages involved.

Components:

RCA Focusing Coil. RCA Type No. 202D1

- Anode and grid No.3, which are connected together within tube, are referred to herein as anode.
- At or near this rating, the effective resistance of the anode supply should be adequate to limit the anode input power to 6 watts.
- * Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 4000 volts.
- For visual extinction of undeflected focused spot.
- ▲ For JETEC Focusing Coil No.106, or equivalent, with center line of air gap approximately 2-3/4" from reference line (see Outline Drawing), and total anode current of 200 microamperes.
- # The center of the undeflected, unfocused spot will fall within a circle having 12 mm radius concentric with the center of the tube face.

JUNE 15, 1948

TUBE DEPARTMENT

TENTATIVE DATA

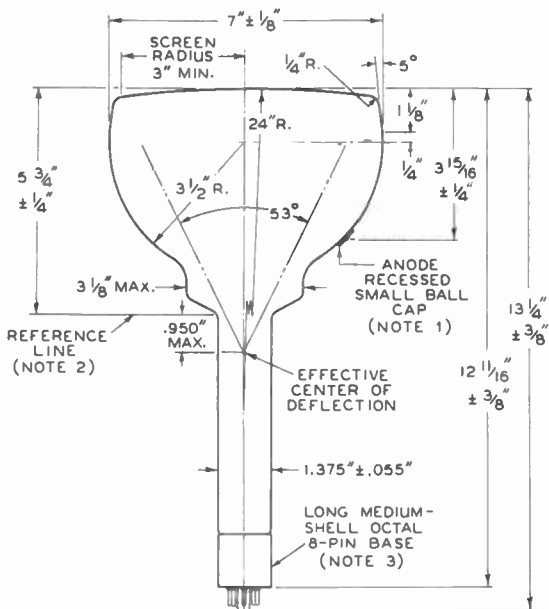
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History



7BP7-A

7BP7-A OSCILLOGRAPH TUBE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN NO. 5 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF 10° . ANODE TERMINAL IS ON SAME SIDE OF TUBE AS PIN NO. 5.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE GAUGE $1.430'' + .003'' - .000''$ I.D. AND $2''$ LONG WILL REST ON BULB CONE.

NOTE 3: ϕ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

92CM-6367R3

JUNE 15, 1948

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

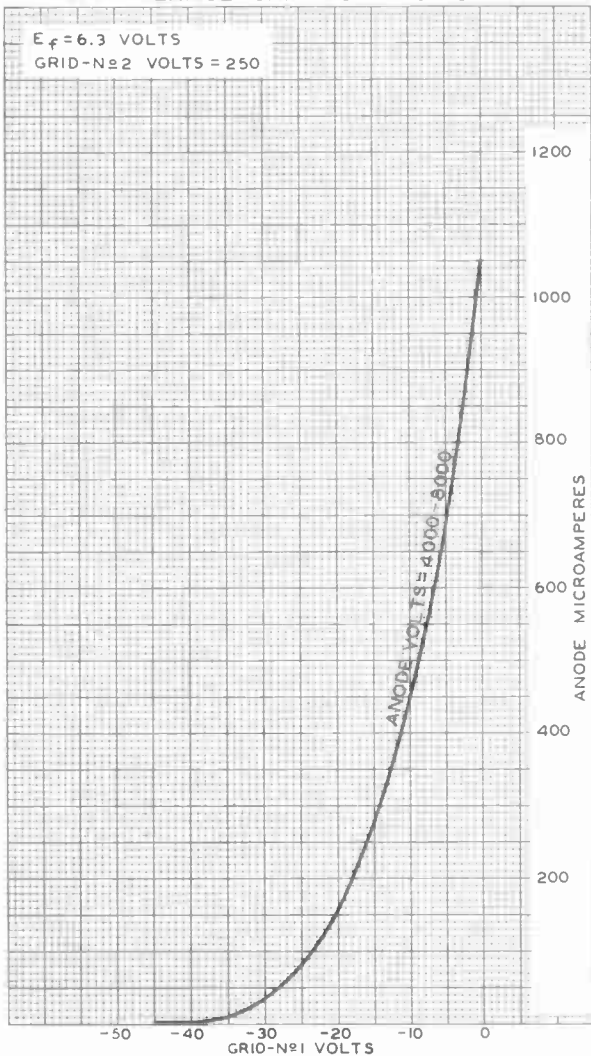
CE-6367R3

7BP7-A



7BP7-A

AVERAGE CHARACTERISTIC



MAR. 22, 1948

TUBE DEPARTMENT

92CM-6373R1

RADIO CORPORATION OF AMERICA HARTFORD, NEW HAVEN

World Radio History



7CPI

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS, MAGNETIC DEFLECTION

7CPI

General:

Heater, for Unipotential Cathode:

Voltage 6.3 ± 10% ac or dc volts
Current 0.6 amp

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to All Other Electrodes 8.0 μf
Cathode to All Other Electrodes 6.5 μf

Phosphor (For Curves, see front of this Section) No.1
Fluorescence Green

Persistence Medium

Focusing Method Electrostatic

Deflection Method Magnetic

Solid Deflection Angle (Approx.) 57°

Overall Length 13-7/16" ± 3/8"

Greatest Diameter of Bulb 7" ± 1/8"

Minimum Useful Screen Diameter 6-1/2"

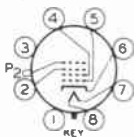
Cap. Recessed Small Ball

Mounting Position Any

Base Long Medium-Shell Octal 8-Pin

Basing Designation for BOTTOM VIEW 6AZ

- Pin 1 - No Connection
- Pin 2 - Anode No.1
- Pin 3 - No Connection
- Pin 4 - Grid No.2
- Pin 5 - Grid No.1
- Pin 6 - Cathode
- Pin 7 - Heater
- Pin 8 - Heater
- Cap - Anode No.2



Maximum Ratings, Design-Center Values:

ANODE-No.2 VOLTAGE 8000 max. volts

ANODE-No.1 VOLTAGE 2400 max. volts

GRID-No.2 VOLTAGE 300 max. volts

GRID-No.1 VOLTAGE:

Negative bias value 125 max. volts

Positive bias value 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode. 125 max. volts

Heater positive with respect to cathode. 125 max. volts

Typical Operation:

Anode-No.2 Voltage* 4000 7000 . . volts

Anode-No.1 Voltage for

Focus at 75% of Grid-No.1

Voltage for Cutoff⁰ 780 1365 . . volts

Grid-No.2 Voltage 250 250 . . volts

Grid-No.1 Voltage for

Visual Cutoff** -45 -45 . . volts

* , 0 , ** : See next page.

7CPI



7CPI

OSCILLOGRAPH TUBE

- Brilliance and definition decrease with decreasing anode-No.2 voltage. In general, the anode-No.2 voltage should not be less than 4000 volts.
- Individual tubes may require between -30% and +20% of the values shown with grid-No.1 voltages between zero and cutoff.
- Visual extinction of undeflected focused spot. Supply should be adjustable to $\pm 50\%$ of indicated value.

Maximum Circuit Values:

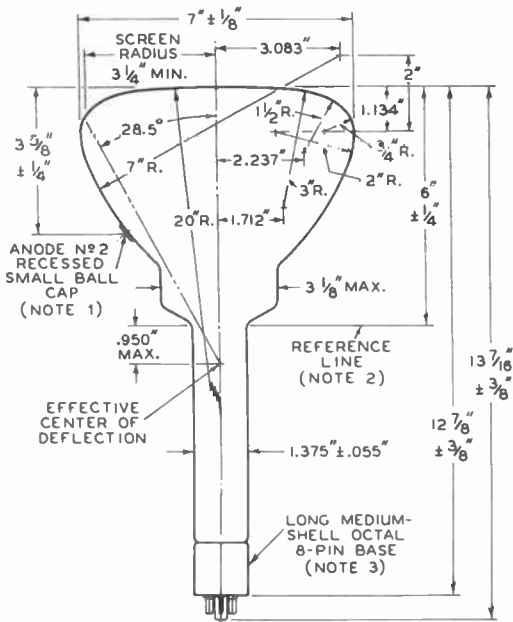
Grid-No.1-Circuit Resistance. 1.5 max. megohms



7CPI

7CPI

OSCILLOGRAPH TUBE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN No. 2 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE No. 2 TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF 10° . ANODE No. 2 TERMINAL IS ON SAME SIDE OF TUBE AS PIN No. 2.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE GAUGE $1.430" + .003" - .000"$ I.D. AND $2"$ LONG WILL REST ON BULB CONE.

NOTE 3: \angle OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERRECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

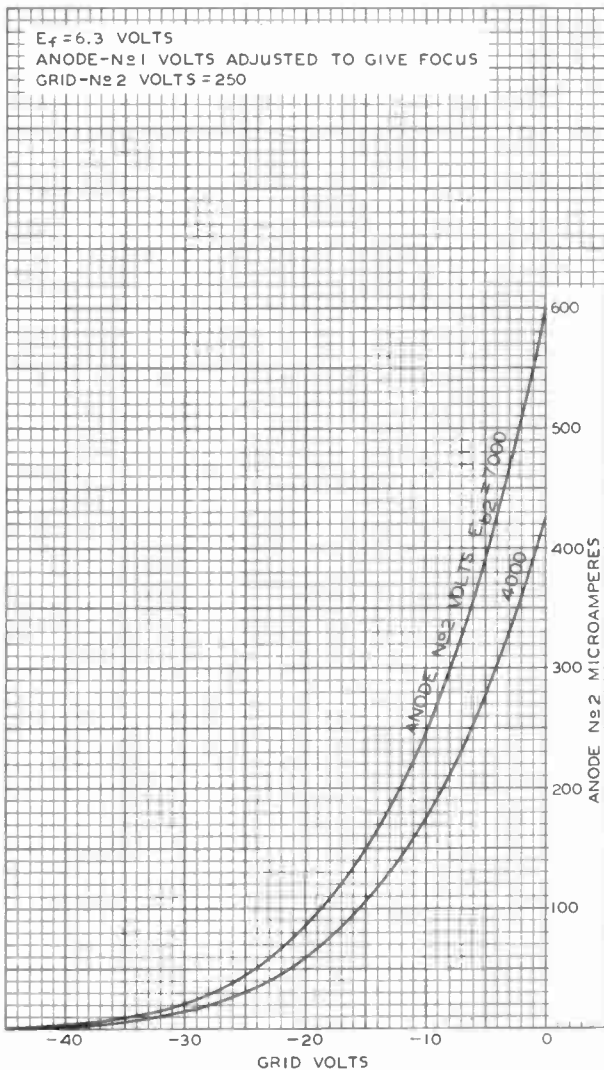
92CM-6364R2

7CPI



7CPI

AVERAGE CHARACTERISTICS



AUG. 23, 1946

TUBE DEPARTMENT

92C-6424

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History



7DP4

KINESCOPE

ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

7DP4

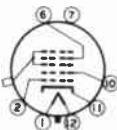
DATA

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 μmf
Cathode to All Other Electrodes	5 μmf
External Conductive Coating to Anode No.2	{ 1500 max. μmf
	{ 400 min. μmf
Phosphor (For Curves, see front of this Section)	No.4
Fluorescence and Phosphorescence	White
Persistence of Phosphorescence	Medium
Focusing Method	Electrostatic
Deflection Method	Magnetic
Deflection Angle (Approx.)	50°
Ion Trap	Magnetic
External Coating	Conductive
Overall Length	14-1/16" \pm 3/8"
Greatest Diameter of Bulb	7-3/16" \pm 1/8"
Minimum Useful Screen Diameter	6"
Raster Size (Approx.)	4" x 5-1/2"
Mounting Position	Any
Cap.	Recessed Small Cavity
Base	Small-Shell Duodecal 7-Pin

BOTTOM VIEW

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 6 - Anode No.1
- Pin 7 - Internal Con. -
Do Not Use



- Pin 10 - Grid No.2
- Pin 11 - Cathode
- Pin 12 - Heater
- Cap - Anode No.2,
Grid No.3

Maximum Ratings, Design-Center Values:

ANODE-No.2 [•] VOLTAGE [•]	8000 max. volts
ANODE-No.1 VOLTAGE	2400 max. volts
GRID-No.2 VOLTAGE	410 max. volts
GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:	
Negative bias value	125 max. volts
Positive bias value	0 max. volts
Positive peak value	2 max. volts
PEAK HEATER-CATHODE VOLTAGE:	
Heater negative with respect to cathode:	
During equipment warm-up period not exceeding 15 seconds	410 max. volts
After equipment warm-up period	150 max. volts
Heater positive with respect to cathode	150 max. volts

[•], [•]: See next page.
← Indicates a change.

7DP4



7DP4 KINESCOPE

Typical Operation:

Anode-No.2 Voltage ^o	6000	volts
Anode-No.1 Voltage for Focus ^o	1215 to 1645	volts
Grid-No.2 Voltage.	250	volts
Grid-No.1 Voltage for Visual Cutoff ^{**}	-27 to -63	volts
Max. Anode-No.1 Current Range.	-15 to +10	μ amp

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
--	----------	---------

→ Minimum Circuit Values:

The power supply should be of the limited-energy type with inherent regulation to limit the continuous short-circuit current to 5 ma. If the supply permits the instantaneous short-circuit current to exceed 1 ampere, or is capable of storing more than 250 microcoulombs, the effective resistance in circuit between indicated electrode and the output capacitor should be as follows:

Grid-No.1-Circuit Resistance	150 min.	ohms
Grid-No.2-Circuit Resistance	470 min.	ohms
Anode-No.1-Circuit Resistance.	2700 min.	ohms
Anode-No.2-Circuit Resistance.	9100 min.	ohms

The resistors used should be capable of withstanding the voltages involved.

Components:

Ion-Trap Magnet [#]	RCA Type No.203D1
→ Deflecting Yoke [*]	RCA Type No.201D12

- Anode No.2 and grid No.3, which are connected together within tube, are referred to herein as anode No.2.
- The product of anode-No.2 voltage and average anode-No.2 current should never exceed 6 watts.
- Brilliance and definition decrease with decreasing anode-No.2 voltage. In general, anode-No.2 voltage should not be less than 5000 volts.
- With the combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 12 foot-lamberts on a 4" x 5-1/2" picture area.
- ** Visual extinction of undeflected focused spot.
- # The dc current required by this magnet is approx. 70 ma. for the typical operating conditions shown.
- * The horizontal deflecting-coil current required by this yoke to produce 5-1/2" picture width is approx. 410 ma. peak-to-peak under the typical operating conditions shown. The current varies directly as the square root of the anode-No.2 voltage.

→ Indicates a change.

NOV. 15, 1949

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

DATA

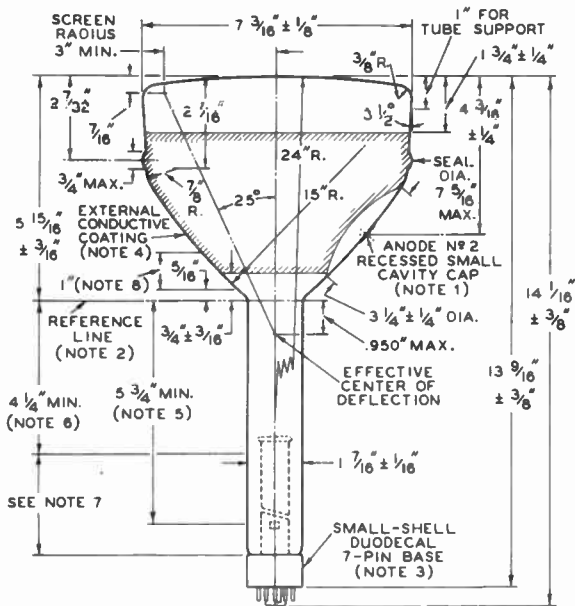
World Radio History



7DP4

KINESCOPE

7DP4



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No. 3 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE No. 2 TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF 10°. ANODE No. 2 TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION No. 3.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE HINGED GAUGE 1.500" + .003" - .000" I.D. AND 2" LONG WILL REST ON BULB CONE.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING DIAMETER OF 1-7/8".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: DISTANCE TO INTERNAL POLE PIECES. PLANE THROUGH

OCTOBER 15, 1947

TUBE DEPARTMENT

CE-6664R1A

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

7DP4



7DP4 KINESCOPE

(continued from preceding page)

PIN No. 6 AND TUBE AXIS PASSES THROUGH LINE JOINING CENTERS OF POLE PIECES. DIRECTION OF PRINCIPAL FIELD OF ION-TRAP MAGNET SHOULD BE SUCH THAT NORTH POLE IS ADJACENT TO PIN No. 6 AND SOUTH POLE TO PIN No. 12.

NOTE 6: LOCATION OF DEFLECTING YOKE MUST BE WITHIN THIS SPACE.

NOTE 7: KEEP THIS SPACE CLEAR FOR ION-TRAP MAGNET.

NOTE 8: FOR TUBE SUPPORT WHICH MUST NOT COVER SPECIFIED CLEAR AREA AROUND ANODE CAP.

92CM-6664R1

OCTOBER 15, 1947

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-6664R1B

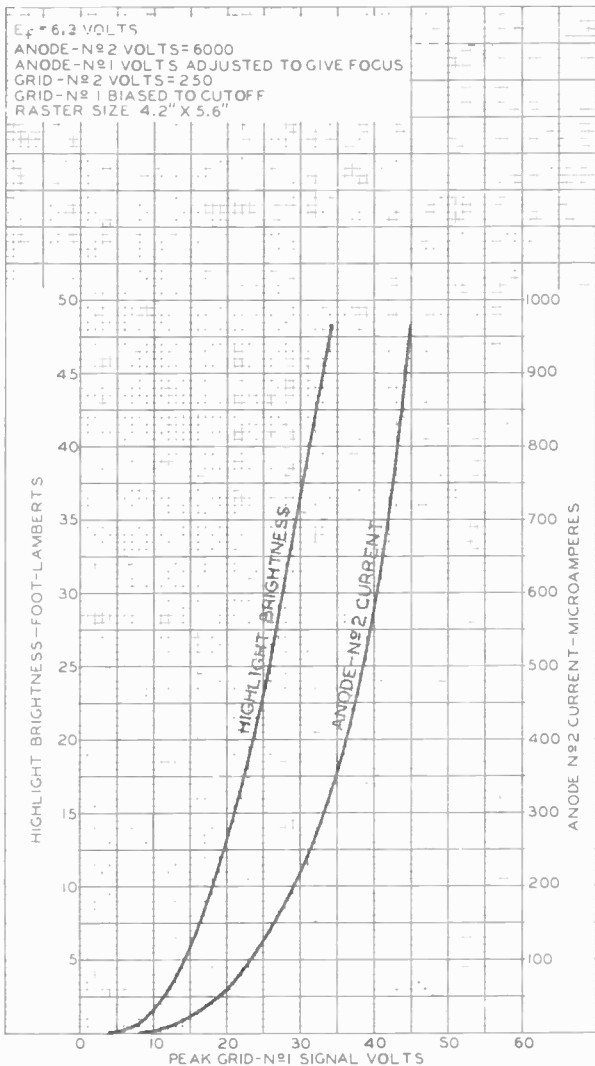
World Radio History



7DP4

7DP4

AVERAGE CHARACTERISTICS



OCT. 14, 1947

TUBE DEPARTMENT

92CM-6674R1

RADIO CORPORATION OF AMERICA HARTFORD, CONNECTICUT

World Radio History





7JPI

7JPI

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

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 $\mu\mu\text{f}$
 DJ₁ to DJ₂ 3 $\mu\mu\text{f}$
 DJ₃ to DJ₄ 2 $\mu\mu\text{f}$
 DJ₁ to All Other Electrodes. 9 $\mu\mu\text{f}$
 DJ₂ to All Other Electrodes. 9 $\mu\mu\text{f}$
 DJ₃ to All Other Electrodes. 7 $\mu\mu\text{f}$
 DJ₄ to All Other Electrodes. 7 $\mu\mu\text{f}$

Phosphor (For Curves, see front of this Section) No.1

Fluorescence and Phosphorescence Green

Persistence of Phosphorescence Medium

Focusing Method. Electrostatic

Deflection Method. Electrostatic

Deflecting-Electrode Arrangement . . . See Outline Drawing

Overall Length 14-1/2" \pm 3/8"Greatest Diameter of Bulb. 7" \pm 1/8"

Minimum Useful Screen Diameter 6"

Mounting Position. Any

Base Medium-Shell Diheptal 12-Pin

Basing Designation for BOTTOM VIEW 14G1

Pin 1 - Heater

Pin 2 - Cathode

Pin 3 - Grid No.1

Pin 4 - No

Connection

Pin 5 - Anode No.1

Pin 7 - Deflecting

Electrode

DJ₃

Pin 8 - Deflecting

Electrode

DJ₁

Pin 9 - Anode No.2,

Grid No.2

Pin 10 - Deflecting

Electrode

DJ₂

Pin 11 - Deflecting

Electrode

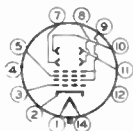
DJ₁

Pin 12 - Internal

Connection-

Do Not Use

Pin 14 - Heater

*DJ₁ and DJ₂ are nearer the screen**DJ₃ and DJ₄ are nearer the base*

With DJ₁ positive with respect to DJ₂, the spot is deflected toward pin 5. With DJ₃ positive with respect to DJ₄, the spot is deflected toward pin 2.

The plane through the tube axis and pin 5 may vary from the trace produced by DJ₁ and DJ₂ by an angular tolerance (measured about the tube axis) of 10°. Angle between DJ₁ - DJ₂ trace and DJ₃ - DJ₄ trace is 90° \pm 3°.

7JPI



7JPI

OSCILLOGRAPH TUBE

Maximum Ratings, Design-Center Values:

ANODE-No.2 [•] VOLTAGE [□]	6000 max.	volts
ANODE-No.1 VOLTAGE	2800 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 ANODE No.2 AND ANY DEFLECTING ELECTRODE . . .	750 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 anode-No.2 voltage (E_{b2}) between 1000* and 6000 volts

Anode-No.1 Voltage	27% to 40% of E_{b2}	volts
Max. Grid-No.1 Voltage for Visual Cutoff	2.8% of E_{b2}	volts
Anode-No.1 Current for any Operating Condition.	-15 to +10	microamp
Deflection Factors:		
DJ1 & DJ2.	31 to 41 v dc/in./kv of E_{b2}	
DJ3 & DJ4.	25 to 34 v dc/in./kv of E_{b2}	
Spot Position.	#	

Examples of Use of Design Ranges:

For anode-No.2 voltage of	2000	4000	volts
Anode-No.1 Voltage	540-800	1080-1600	volts
Max. Grid-No.1 Voltage for Visual Cutoff	-56	-112	volts
Deflection Factors:			
DJ1 & DJ2.	62-82	124-164	volts dc/in.
DJ3 & DJ4.	50-68	100-136	volts dc/in.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting- Electrode Circuit [○]	5.0 max.	megohms

Minimum Circuit Values:

The power supply should be of the limited-energy type with inherent regulation to limit the continuous short-circuit current to 5 milliamperes. If the supply permits the instantaneous short-circuit current to exceed 1 ampere, or is capable of storing more than 250 microcoulombs, the effective resistance in circuit between indicated electrode and the output capacitor should be as follows:

Grid-No.1-Circuit Resistance	220 min.	ohms
--	----------	------

•, □, *, #, ○: See next page.

JAN. 1, 1951

TUBE DEPARTMENT

TENTATIVE DATA 1

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7JPI

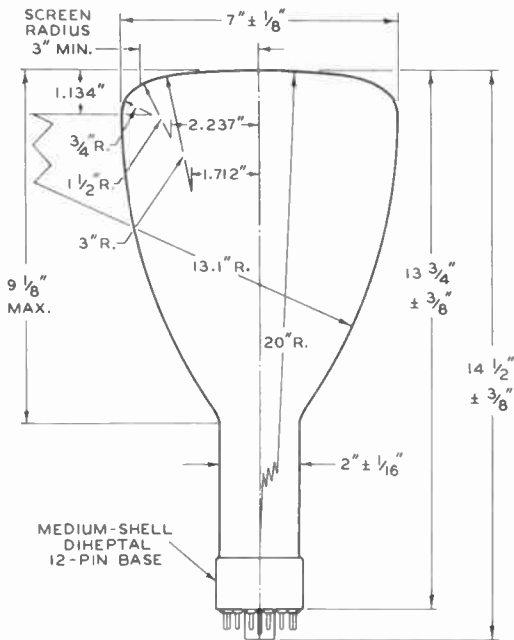
7JPI

OSCILLOGRAPH TUBE

Anode-No.1-Circuit Resistance, 3000 min. ohms
 Anode-No.2-Circuit Resistance, 6800 min. ohms

The resistors used should be capable of withstanding the applied voltage.

- Anode No.2 and grid No.2, which are connected together within tube, are referred to herein as anode No.2.
- For operation at or near 0 volts on grid No.1 and with 4000 to 6000 volts on anode No.2, it is essential that the effective resistance of the anode-No.2 supply be adequate to limit the anode-No.2 input power to 6 watts.
- * Brilliance and definition decrease with decreasing anode-No.2 voltage. A value as low as 1000 volts is recommended only for low-velocity deflection and low ambient-light levels.
- # The center of the undeflected, focused spot will fall within a circle having a 10-mm radius concentric with the center of the tube face.
- o It is recommended that the deflecting-electrode-circuit resistances be approximately equal.



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

JAN. 1, 1951

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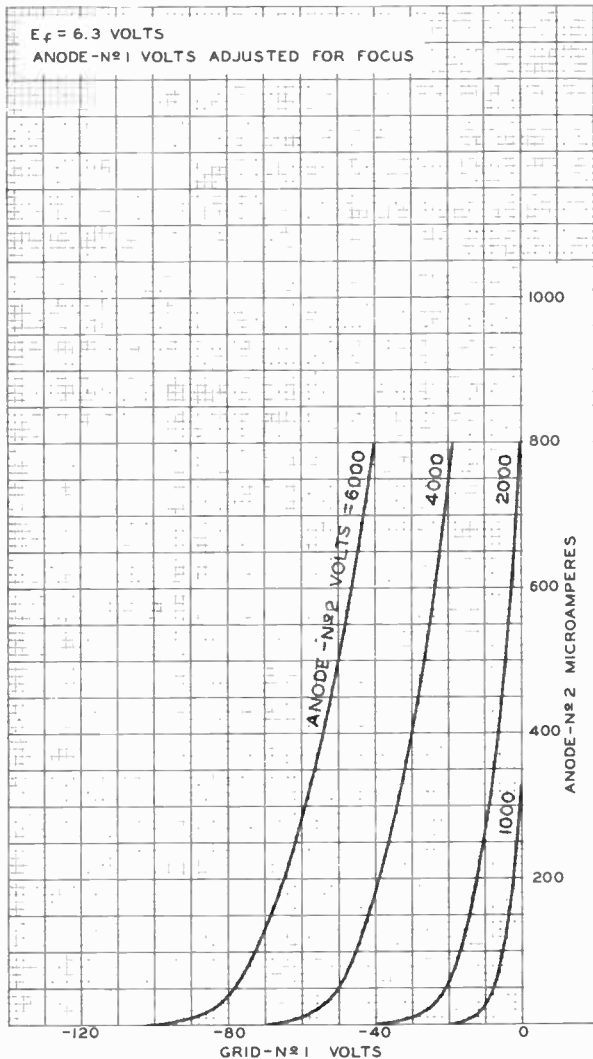
TENTATIVE DATA 2

7JPI



7JPI

AVERAGE CHARACTERISTICS



AUGUST 4, 1950

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7521



7MP7

7MP7

OSCILLOGRAPH TUBE

MAGNETIC FOCUS

MAGNETIC DEFLECTION

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	μ f
Cathode to All Other Electrodes	5	μ f

Phosphor (For Curves, see front of this Section) P7

Fluorescence Blue

Phosphorescence Greenish-Yellow

Persistence Long

Focusing Method Magnetic

Deflection Method Magnetic

Deflection Angle (Approx.) 50°

Overall Length 12-3/4" \pm 3/8"

Greatest Diameter of Bulb 7-3/16" \pm 1/8"

Minimum Useful Screen Diameter 6"

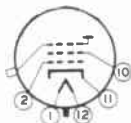
Mounting Position Any

Cap. Recessed Small Cavity (JETEC No. J1-21)

Base Small-Shell Duodecal 5-Pin (JETEC No. B5-57)

BOTTOM VIEW

Pin 1 - Heater
 Pin 2 - Grid No.1
 Pin 10 - Grid No.2



Pin 11 - Cathode
 Pin 12 - Heater
 Cap - Grid No.3,
 Collector

Maximum Ratings, Design-Center Values:

ULTOR* VOLTAGE 8000 max. volts

GRID-NO.2 VOLTAGE:

Positive Value (DC or Peak AC) 700 max. volts

Negative Value (DC or Peak AC) 180 max. volts

GRID-NO.1 VOLTAGE:

Negative bias value 180 max. volts

Positive bias value# 0 max. volts

Positive peak value 2 max. volts

PEAK GRID-NO.1 DRIVE FROM CUTOFF 65 max. volts

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode. 125 max. volts

Heater positive with respect to cathode. 125 max. volts

* In the 7M-types, grid No.3 which has the ultor function, and collector are connected together within the tube and are conveniently referred to collectively as "ultor". The "ultor" in a cathode-ray tube is the electrode, or the electrode in combination with one or more additional electrodes connected within the tube to it, to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection.

At or near this rating, the effective resistance of the ultor supply should be adequate to limit the ultor input power to 6 watts.

7MP7



7MP7 OSCILLOGRAPH TUBE

Typical Operation:

Ultror Voltage*	4000	7000	volts
Grid-No.2 Voltage	250	250	volts
Grid-No.1 Voltage °	-27 to -63	-27 to -63	volts
→ Grid-No.2 Current	-15 to +15	-15 to +15	μamp
→ Focusing-Coil Current (DC Approx.)**	64 ± 15%	85 ± 15%	ma
→ Spot Position	-	**	

Maximum Circuit Values:

Grid-No.1-Circuit Resistance. 1.5 max. megohms

* Brilliance and definition decrease with decreasing ultror voltage. In general, the ultror voltage should not be less than 4000 volts.

° For visual extinction of undeflected, focused spot.

** For specimen focusing coil similar to JETEC Focusing Coil No.109 positioned with air gap toward faceplate and center line of air gap 2-3/4" from Reference Line (see Outline Drawing) and ultror current of 200 microamperes.

The center of the undeflected, unfocused spot will fall within a circle having 12-mm radius concentric with the center of the tube face.

→ Indicates a change

OCTOBER 1, 1951

TUBE DEPARTMENT

DATA

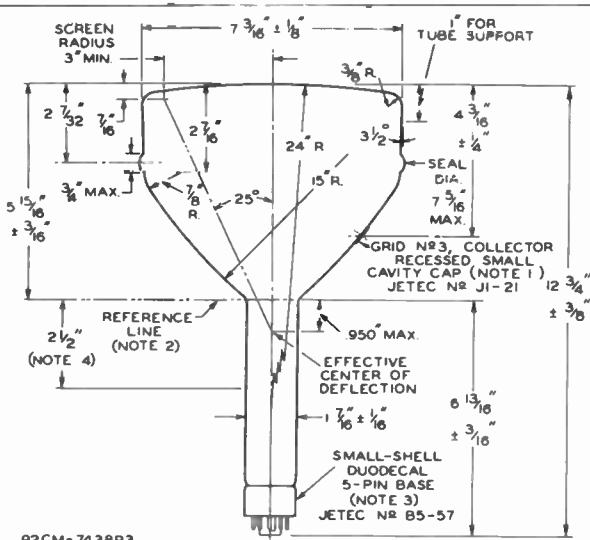
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World Radio History



7MP7

7MP7 OSCILLOGRAPH TUBE



92CM-7438R3

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No. 3 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND BULB TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 10^\circ$. BULB TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION No. 3.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE REFERENCE-LINE GAUGE (JETEC No. 112) 1.500 + .003" - .000" I. O. AND 2" LONG WILL REST ON BULB CONE.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING DIAMETER OF 1-7/8".

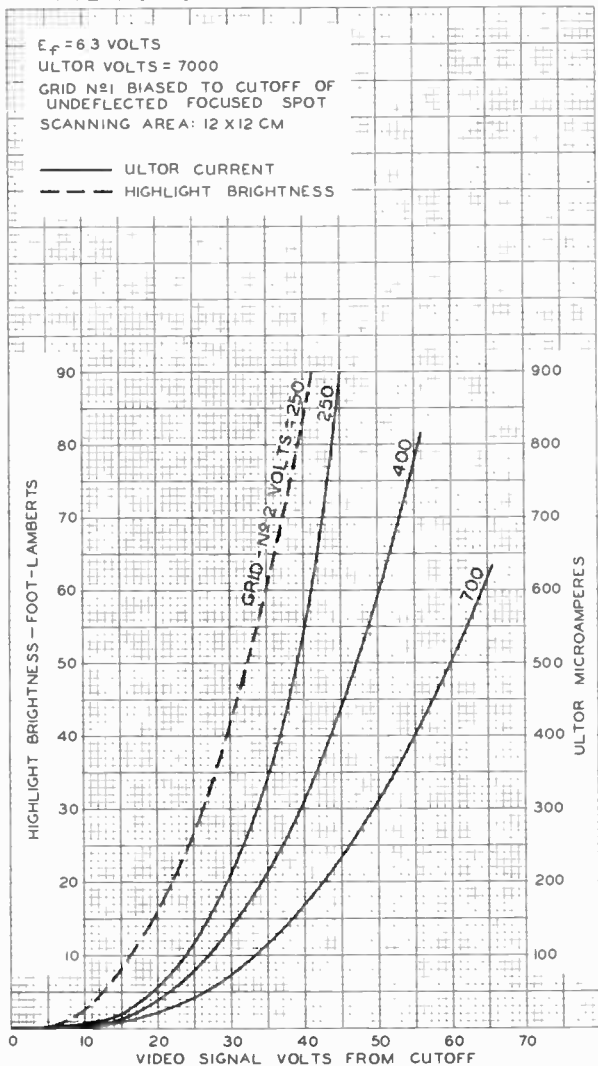
NOTE 4: LOCATION OF DEFLECTING YOKE MUST BE WITHIN THIS SPACE.

7MP7



7MP7

AVERAGE GRID-DRIVE CHARACTERISTICS



JULY 18, 1951

TUBE DEPARTMENT

92CM-7450RI

RADIO CORPORATION OF AMERICA HARTSON NEW JERSEY

World Radio History



7MP14

7MP14

OSCILLOGRAPH TUBE

MAGNETIC FOCUS

MAGNETIC DEFLECTION

The 7MP14 is the same as the 7MP7 except that it utilizes a medium-long-persistence, cascade (two-layer) screen which exhibits purple fluorescence of short persistence and orange phosphorescence which persists for a little over a minute under conditions of adequate excitation and ambient light.

Because of its medium-long-persistence, the 7MP14 is particularly useful where either low- and medium-speed non-recurring phenomena or high-speed recurring phenomena are to be observed. Furthermore, two or more phenomena can be observed simultaneously on the screen by means of a suitable switching arrangement.

The persistence is such that the 7MP14 without filter can be operated with scanning frequencies as low as 30 cycles per second without excessive flicker. When used with yellow filter, such as Wratten No.15 (G), the 7MP14 can be operated with much lower scanning frequencies.

In general, operation of the 7MP14 at an anode voltage below 4000 volts will not give persistence of useable brightness.

THE SPECTRAL-ENERGY EMISSION CHARACTERISTIC
and the PERSISTENCE CHARACTERISTIC of
the P14 Phosphor are shown at the
front of this Section



Projection Kinescopes

FORCED-AIR COOLED
ELECTROSTATIC FOCUSMAGNETIC DEFLECTION
20 FT. x 15 FT. PROJECTED PICTURES*For Black-and-White Projection Systems in Theater and Closed-Circuit Television Applications*

ELECTRICAL

Heater, for Unipotential Cathode

Voltage (AC or DC) 6.6 ± 5% V
Current 0.62 A

Focusing Method. Electrostatic

Deflection Method. Magnetic

Deflection Angle (Approx.) 35°

Direct Interelectrode Capacitances (Approx.)

Grid to all other electrodes 12 pF

Cathode to all other electrodes 6 pF

OPTICAL

Faceplate. Spherical, Non-Browning Glass

Quality Rectangle of Faceplate

(See Dimensional Outline) 5 x 3-3/4 in

Refractive Index of Faceplate. 1.469

Projection-Throw Distance for

20 ft x 15 ft Picture 60 feet

Phosphor Aluminized P4-Silicate-Sulfide Type

Luminescence White

Persistence. Medium

MECHANICAL

Air Flow to Face 40 cfm

The specified air flow should be delivered perpendicularly from a nozzle having a diameter of about 2 inches onto the face of the tube while it is in operation. See REFLECTIVE OPTICAL SYSTEM. In a typical system with air filter, the total system static pressure is approximately 0.25 inch of water. The cooling air must not contain water, dust, or other foreign matter. The air-cooling system should be electrically interconnected with the anode power supply to prevent operation of the tube without cooling.

Cooling of the tube by a tangential flow of air across its face is not recommended because the temperature gradient produced across the face may result in immediate or delayed cracking of the face.

Operating Position Any

Tube Dimensions

Overall Length 19-1/2 ± 5/8 in

Greatest Diameter of Bolt

(Including insulation) 7 ± 3/16 in

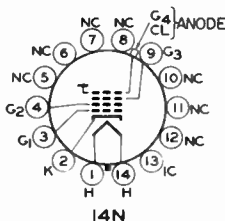
Cap Medium (JEDEC No. C1-5)

Base Plastic Filled, Small-Shell Diheptal 14-Pin,
(JEDEC No. B14-15)

7NP4

TERMINAL DIAGRAM (Bottom View)

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



Note: Socket contacts for Pins No.5, 6, 7, 8, 10, 11, 12, and 13 should be removed so that maximum insulation is provided for Pin No.9.

CATHODE-DRIVE^a SERVICE

Absolute-Maximum Ratings

Anode-to-Grid-No.1 Voltage ^b	80000	V
Grid-No.3-to-Grid-No.1 Voltage	20000	V
Grid-No.2-to-Grid-No.1 Voltage	1300	V
Cathode-to-Grid-No.1 Voltage		
Positive bias value.	250	V
Negative bias value.	0	V
Peak negative value.	2	V
Average Anode Current ^b	2	mA
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period not		
exceeding 15 seconds	410	V
After equipment warm-up period	150	V
Heater positive with respect to cathode	150	V

Equipment Design Ranges

With any anode-to-grid-No.1 voltage (E_{c4g1}) between 70000^c and 80000 volts and grid-No.2-to-grid-No.1 voltage (E_{c2g1}) between 400 and 850 volts

Grid-No.3-to-Grid-No.1		
Voltage for Focus	20% to 22.6% of E_{c4g1}	V
Grid-No.2-to-Grid-No.1 Voltage		
for Visual Extinction of Focused		
Raster when Circuit Design		
Utilizes Fixed Cathode-to-Grid-		
No.1 Voltage (E_{kg1})	2.58 to 3.87 times E_{kg1}	V
	plus E_{kg1} voltage	
Cathode-to-Grid-No.1 Video Drive		
from Raster Cutoff (Black Level)		
to White-Level Value.	Same values as fixed cathode-	
	to-grid-No.1 voltage except video	
	drive is a negative voltage	

→ Indicates a change.



Grid-No.3 Current.	See footnote ^d	
Grid-No.2 Current.	-15 to +15	μ A

Examples of Use of Design Ranges

For anode-to-grid-No.1 voltage of	75000	V
Grid-No.3-to-Grid-No.1 Voltage for Focus	15000 to 17000	V
Grid-No.2-to-Grid-No.1 Voltage for Visual Extinction of Focused Raster when Circuit Design Utilizes Fixed Cathode-to-Grid-No.1 Voltage (E_{kg1}) of 125 V.	447 to 609	V
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level) to White Level Value	-125	V
Maximum Circuit Value		
Grid No.1 Circuit Resistance	1.5	megohms

GRID-DRIVE^e SERVICE

Absolute-Maximum Ratings

Anode-to-Cathode Voltage ^b	80000	V
Grid-No.3-to-Cathode Voltage	20000	V
Grid-No.2-to-Cathode Voltage	1050	V
Grid-No.1-to-Cathode Voltage		
Negative bias value	250	V
Positive bias value	0	V
Peak positive value	2	V
Average Anode Current ^b	2	mA
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period: not exceeding 15 seconds.	410	V
After equipment warm-up period.	150	V
Heater positive with respect to cathode.	150	V

Equipment Design Ranges

With any anode voltage (E_{c4k}) between 70000^c and 80000 volts and grid-No.2 voltage (E_{c2k}) between 400 and 600 volts

Grid-No.3 Voltage for Focus.	20% to 22.6% of E_{c4k}	V
Grid-No.2 Voltage for Visual Extinction of Focused Raster when Circuit Design Utilizes Fixed Grid-No.1 Voltage (E_{c1k}).	2.58 to 3.87 times E_{c1k}	V
Grid-No.1 Video Drive from Raster Cutoff (Black Level) to White-Level Value	Same value as fixed grid-No.1 voltage except video drive is a positive voltage	
Grid-No.3 Current.	See footnote ^d	
Grid-No.2 Current.	-15 to +15	μ A

← Indicates a change.



7NP4

Examples of Use of Design Ranges

For anode voltage	75000	V
Grid-No.3 Voltage for Focus.	15000 to 17000	V
Grid-No.2 Voltage for Visual Extinction of Focused Raster when Circuit Design Utilizes Fixed		
Grid-No.1 Voltage (E_{c1k}) of -155 V.	400 to 600	V
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level) to White- Level Value	155	V
Maximum Circuit Value		
Grid-No.1 Circuit Resistance	1.5	megohms

- a Cathode drive is the operating condition in which the video signal varies the cathode potential.
- b The product of anode-to-grid-No.1 voltage, or anode-to-cathode voltage, and average anode current should be limited to 100 watts.
- c Brilliance and definition decrease with decreasing anode-to-grid-No.1 voltage or anode-to-cathode voltage. In general, the anode-to-grid-No.1 voltage or the anode-to-rathode voltage should not be less than 70000 volts.
- d Grid-No.3 current will be approximately 10% to 5%, or less, of anode current. However, a grid-No.3 leakage current of up to 15 μ A may be present.
- e Grid drive is the operating condition in which the video signal varies the grid-No.1 potential.

GENERAL CONSIDERATIONS

The high voltages at which this type is operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Precautions include the enclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is required.

In the use of this tube, it should always be remembered that high voltages may appear at normally low-potential points in the circuit because of capacitor breakdown or incorrect circuit connections, and that the tube surface maintains a static charge for some time after the power has been turned off. Therefore, before any part of the circuit or the tube is touched, the power-supply switch should be turned off, both terminals of high-voltage capacitors should be grounded, and the terminals of the high-voltage power supply should be grounded. After these steps have been taken and before touching the tube, discharge the anode terminal, the surface of the faceplate, and the coated surface of the cone by use of a suitable wand which is connected to ground. It is to be noted that the entire surface of the cone and of the faceplate will not be discharged by touching the wand to a single point on either surface, because the surfaces have high resistance. Therefore, to discharge each surface, it will be necessary to sweep over the entire surface with the wand.

The fluorescent screen, utilizing phosphor No. 4 of the silicate-sulfide type, is aluminized. The white fluorescence of the screen has a color temperature of approximately 6300° K.



The spectral energy emission characteristic is shown in *Spectral-Energy Emission Characteristic of Phosphor No. 4*. The persistence of the phosphorescence is such that its brightness does not exceed 7 per cent of the peak value in 33 milliseconds after excitation is removed.

Darkening of face occurs during normal operation of the tubes with resulting decrease in the light transmitted by the face. The rate of darkening increases rapidly with increase in anode voltage, is proportional to the beam current, and is inversely proportional to the scanned area. The darkening develops rapidly during initial operation; thereafter, a gradual increase in the amount of darkening will be observed during the life of the tube.

The *anode connection* is made to the medium cap on the side of the bulb. The anode connector should have a ball-type corona shield with a diameter of about 1-1/2 inches in order to prevent corona.

OPERATING HINTS

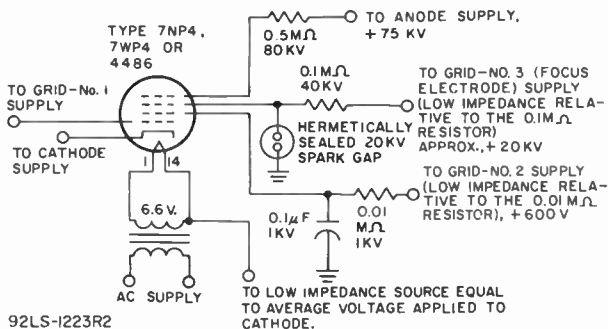
1. Never apply power input to the screen suddenly because immediate or delayed cracking of the face may result. Always increase or decrease the anode current gradually.
2. Never exceed the rated maximum anode current of 2 milliamperes.
3. Never overscan the screen because the beam will strike the neck and liberate occluded gas which may cause internal arcing.
4. Never fail to operate this tube in its equipment at intervals of about 2 months to keep the tube in condition.

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

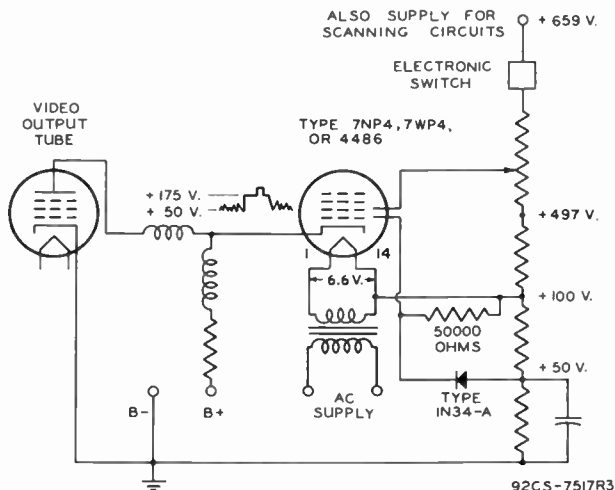


7NP4

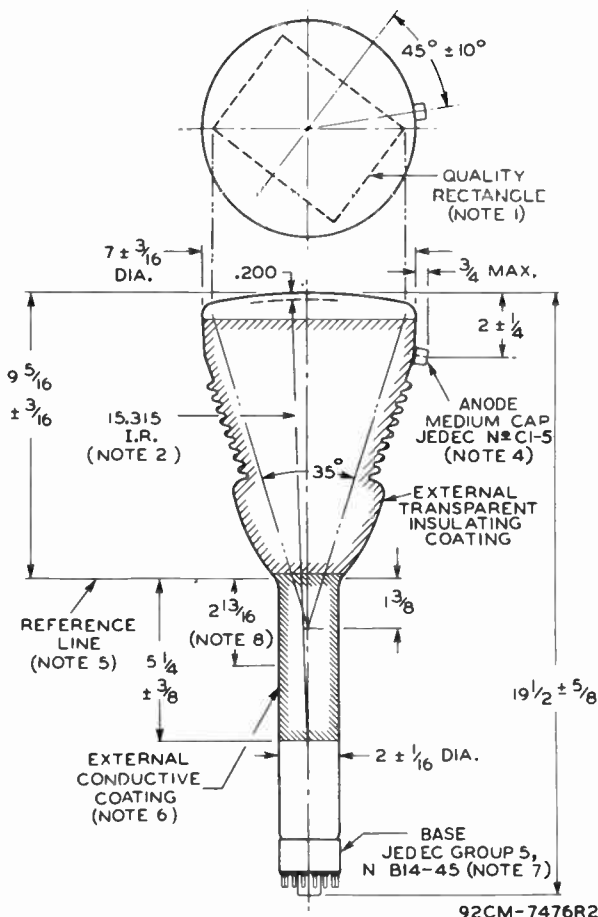
SCHEMATIC DIAGRAM OF CIRCUIT SHOWING PROTECTIVE ELEMENTS EMPLOYED TO PREVENT TUBE DAMAGE



SCHEMATIC DIAGRAM SHOWING PRINCIPLES OF CATHODE DRIVE AS WELL AS METHOD FOR AUTOMATICALLY PROTECTING THE TUBE AGAINST OVERDRIVE AND SCANNING FAILURE



DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

See Notes on next page.



RADIO CORPORATION OF AMERICA
Electronic Components and Devices

Harrison, N. J.

ATA 1

1-11

7NP4

Note 1: When viewed from the face of the tube, the minor axis of the 5 x 3-3/4 inch quality rectangle is located $45^\circ \pm 10^\circ$ in a counter-clockwise direction from a plane through the anode terminal and the tube axis.

Note 2: Inside surface of faceplate within the quality rectangle may vary ± 0.006 " from the spherical surface having a 15.315 inch radius.

Note 3: Inside surface of faceplate within the quality rectangle may vary ± 0.006 inch from the spherical surface having a 20.3 inch radius (Type 7WP4 only).

Note 4: The plane through Base Pin No.9 and the tube axis may vary from the plane through the anode terminal and the tube axis by an angular tolerance (measured about the tube axis) of $\pm 10^\circ$. The anode terminal is on same side as Pin No.9.

Note 5: Reference line is determined by position where gauge 2.100 \pm 0.001 inch I.D. and 3 inches long will rest on bulb cone.

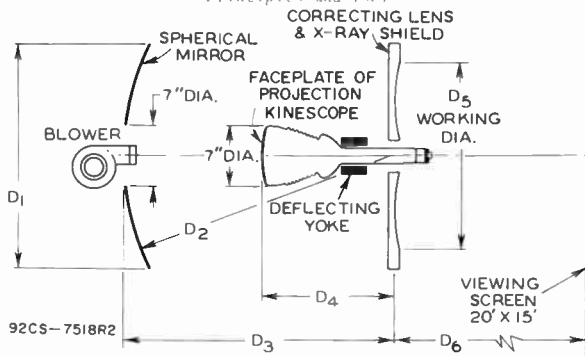
Note 6: External conductive coating must be grounded.

Note 7: Socket for this base should not be rigidly mounted, it should have flexible leads and be allowed to move freely. Socket contacts for Pins 5, 6, 7, 8, 10, 11, 12, and 13 should be removed in order to provide maximum insulation for Pin No.9.

Note 8: Effective deflecting field must be within this space.

REFLECTIVE OPTICAL SYSTEM

Arrangement of Typical Optical System and Air-Cooling System for Theater-Television Projector Using Reflective Optical Principles and 7NP7



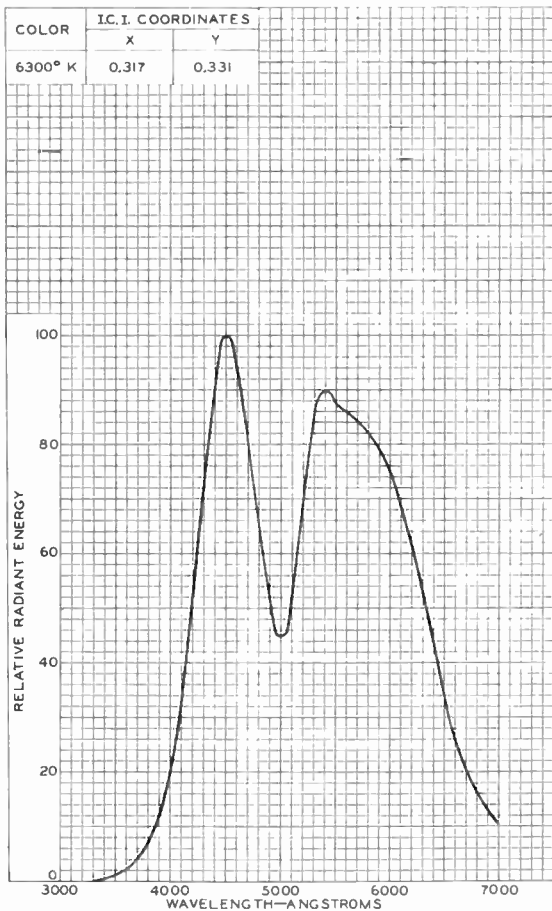
DIMENSIONS (APPROX.)

D_1	26 inch Diameter	D_4	15 inches
D_2	30 inch Radius	D_5	21.5 inches
D_3	30 inches	D_6	60 feet



Spectral-Energy Emission Characteristic of Phosphor No.6

SILICATE-SULFIDE TYPE



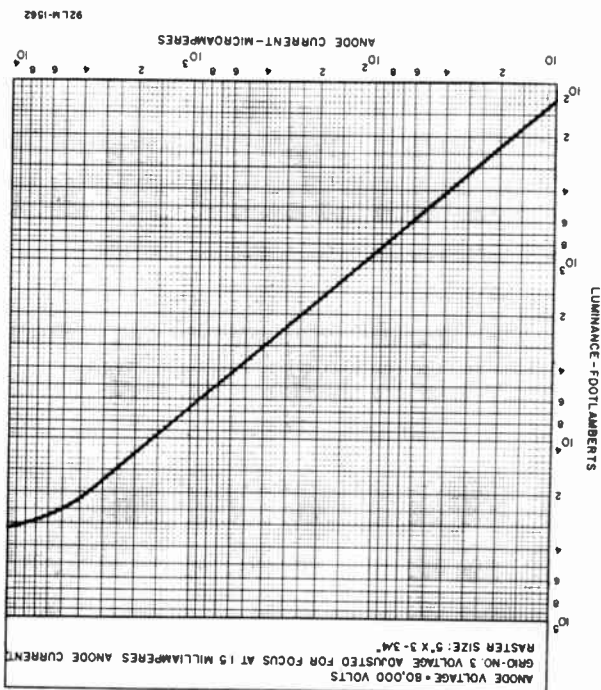
92CM-7458R1



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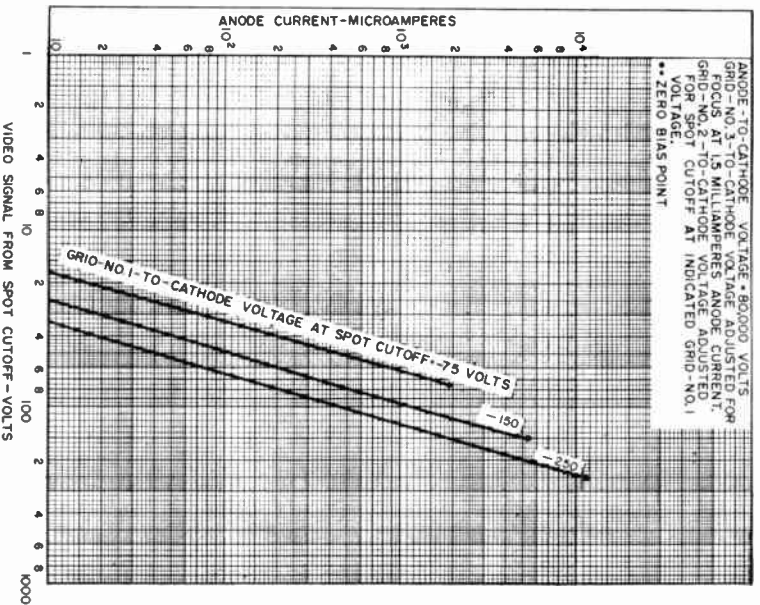
Typical Luminance Characteristic



7NP4

Typical Drive Characteristics

GRID-DRIVE SERVICE



92LM-1564

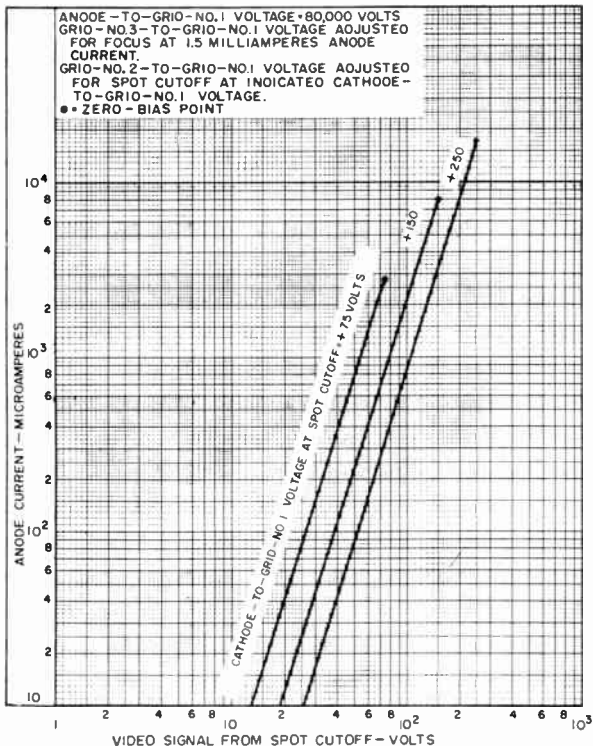


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4-6
 12-66

Typical Drive Characteristics

CATHODE-DRIVE SERVICE





7QP4

7QP4

MONITOR KINESCOPE

MAGNETIC FOCUS

MAGNETIC DEFLECTION

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 $\mu\mu\text{f}$

Cathode to All Other Electrodes 5 $\mu\mu\text{f}$

Phosphor (For Curves, See front of this Section). No.4-Sulfide Type

Fluorescence White

Phosphorescence White

Persistence Short

Focusing Method Magnetic

Deflection Method Magnetic

Deflection Angle (Approx.) 52°

Ion-Trap Gun Requires External, Single-Field Magnet

Overall Length $12-7/8" \pm 3/8"$

Greatest Diameter of Bulb $7-3/16" \pm 1/8"$

Screen Diameter $6-1/4"$

Mounting Position Any

Cap. Recessed Small Cavity

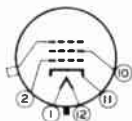
Base Small-Shell Duodecal 5-Pin

BOTTOM VIEW

Pin 1 - Heater

Pin 2 - Grid No.1

Pin 10 - Grid No.2



Pin 11 - Cathode

Pin 12 - Heater

Cap - Anode

Maximum Ratings, Design-Center Values:

ANODE VOLTAGE* 10000 max. volts

GRID-No.2 VOLTAGE 410 max. volts

GRID-No.1 VOLTAGE:

Negative bias value 125 max. volts

Positive bias value 0 max. volts

Positive peak value 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode:

During equipment warm-up period

not exceeding 15 seconds 410 max. volts

After equipment warm-up period 150 max. volts

Heater positive with respect to cathode. 150 max. volts

Typical Operation:

Anode Voltage** 8000 . . volts

* The product of anode voltage and average anode current should be limited to 6 watts.

** Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 6000 volts.

7QP4



MONITOR KINESCOPE

Grid-No.2 Voltage.	300	volts
Grid-No.1 Voltage for Visual Extinction of Undelected Focused Spot . . .	-33 to -77	volts
Focusing-Coil Current (DC, approx.)# . . .	80	ma
Field Strength of Single-Field Ion-Trap Magnet ^o	35	gausses

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
--	----------	---------

Minimum Circuit Values:

The power supply should be of the limited-energy type with inherent regulation to limit the continuous short-circuit current to 5 milliamperes. If the supply permits the instantaneous short-circuit current to exceed 1 ampere, or is capable of storing more than 250 microcoulombs, the effective resistance in circuit between indicated electrode and the output capacitor should be as follows:

Grid-No.1-Circuit Resistance	150 min.	ohms
Grid-No.2-Circuit Resistance	470 min.	ohms
Anode-Circuit Resistance	11000 min.	ohms

The resistors used should be capable of withstanding the applied voltage.

* For specimen focusing coil similar to JETEC Focusing Coil No.109, positioned with air gap toward kinescope screen, and center line of air gap 3 inches from Reference Line (see *Outline Drawing*). The indicated current is for condition with combined grid-no.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 40 foot-lamberts on a 5-3/8" x 4" picture area sharply focused at center of screen.

^o Measured at center of field with General Electric Gauss Meter, Cat. No. 409X51.

7QP4



7QP4

MONITOR KINESCOPE

NOTE 5: LOCATION OF DEFLECTING YOKE MUST BE WITHIN THIS SPACE.

NOTE 6: KEEP THIS SPACE CLEAR FOR SINGLE-FIELD, ION-TRAP MAGNET.

NOTE 7: FOR TUBE SUPPORT WHICH MUST BE KEPT AT LEAST 2" AWAY FROM ANODE CAVITY CAP.

JAN. 1, 1951

TUBE DEPARTMENT

6F-75048

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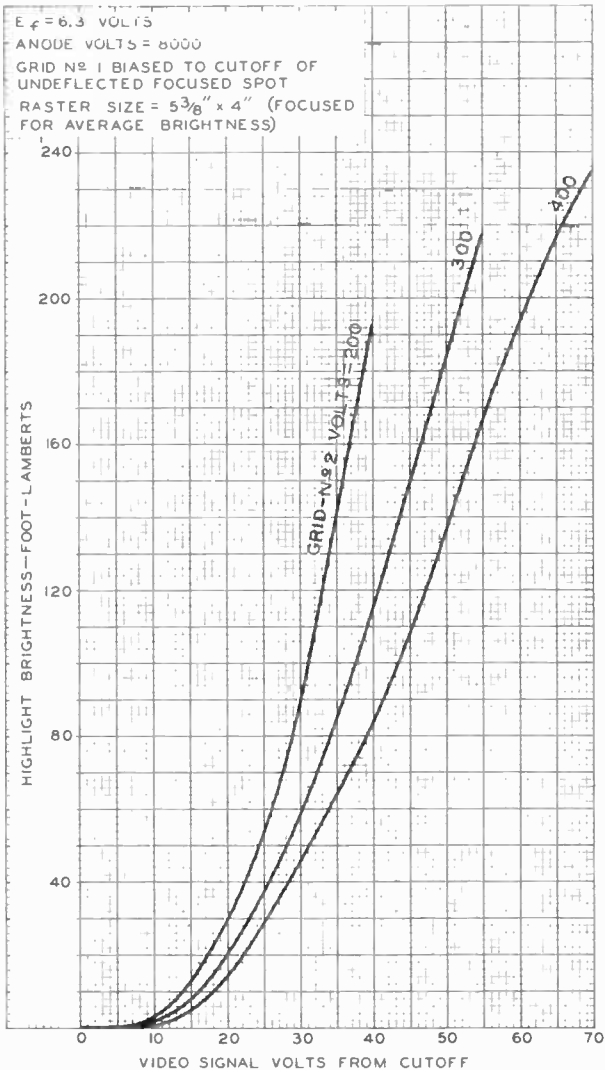
World Radio History



7QP4

7QP4

AVERAGE GRID-DRIVE CHARACTERISTICS



AUGUST 22, 1950

TUBE DEPARTMENT

92CM-7529

RAD O CORPORATION OF AMERICA HARRISON NEW JERSEY

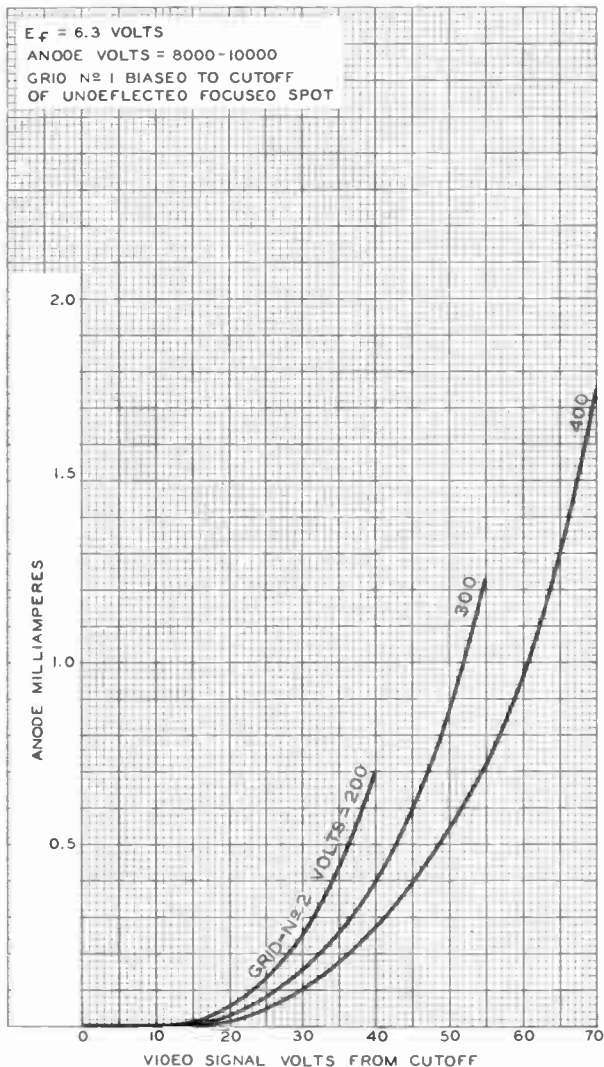
World Radio History

7QP4



7QP4

AVERAGE GRID-DRIVE CHARACTERISTICS



AUGUST 22, 1950

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92CM-7530

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World Radio History



7TP4

7TP4 MONITOR KINESCOPE

METAL-BACKED SCREEN

ELECTROSTATIC FOCUS

MAGNETIC DEFLECTION

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	μf
Cathode to All Other Electrodes	5	μf

Faceplate Clear Glass

Phosphor, Metal-Backed^o P4—Sulfide Type

Fluorescence and Phosphorescence White

Persistence of Phosphorescence Short

Focusing Method Electrostatic

Deflection Method Magnetic

Deflection Angle (Approx.) 50°

Overall Length 13-1/8" ± 3/8"

Greatest Diameter of Bulb 7-3/16" ± 1/8"

Minimum Useful Screen Diameter 6"

Picture Size (Within minimum-useful-screen area) 5-3/8" x 4"

Cap Recessed Small Cavity (JETEC No. J1-21)

Base Small-Shell Duodecal 6-Pin (JETEC No. E6-63)

BOTTOM VIEW

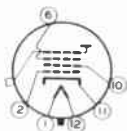
Pin 1 — Heater

Pin 2 — Grid No.1

Pin 6 — Grid No.3

Pin 10 — Grid No.2

Pin 11 — Cathode



Pin 12 — Heater

Cap — Grid No.4,
Collector
(Ultror)

Maximum Ratings, Design-Center Values:

ULTOR^o VOLTAGE 12000 max. volts

GRID-No.3 VOLTAGE 2000 max. volts

GRID-No.2 VOLTAGE 410 max. volts

GRID-No.1 VOLTAGE:

Negative bias value 125 max. volts

Positive bias value 0 max. volts

Positive peak value 2 max. volts

^o For curves, see front of this Section.

In the 7TP4, grid No.4 which has the ultror function, and collector are connected together within the tube and are conveniently referred to collectively as "ultor". The "ultor" in a cathode-ray tube is the electrode, or the electrode in combination with one or more additional electrodes connected within the tube to it, to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection.

FEB. 1, 1952

TUBE DEPARTMENT

TENTATIVE DATA

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7TP4



7TP4 MONITOR KINESCOPE

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode:

During equipment warm-up period	not exceeding 15 seconds	410 max. volts
After equipment warm-up period. . .		180 max. volts
Heater positive with respect to cathode.		180 max. volts

Equipment Design Ranges:

For any ultor voltage (E_U) between 10000* and 12000 volts
and grid-No.2 voltage (E_{C2}) between 150 and 410 volts

Grid-No.3 Voltage for Focus with Ultor Current of 100 μ amp. . .	11.6% to 15.8% of E_U	volts
Grid-No.1 Voltage for Visual Extinction of Undelected Focused Spot.	11% to 25.7% of E_{C2}	volts
Grid-No.3 Current**	See Curves	
Grid-No.2 Current.	-15 to +15	μ amp
Field Strength of Adjustable Centering Magnet.	0 to 8	gausses

Examples of Use of Design Ranges:

For ultor voltage of 10000 volts
and grid-No.2 voltage of 200 volts

Grid-No.3 Voltage for Focus with Ultor Current of 100 μ amp . .	1160 to 1580	volts
Grid-No.1 Voltage for Visual Extinction of Undelected Focused Spot	-22 to -52	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
---------------------------------------	----------	---------

* Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 10000 volts.

** Grid-No.3 Current increases as the ultor voltage is decreased.

FEB. 1, 1952

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

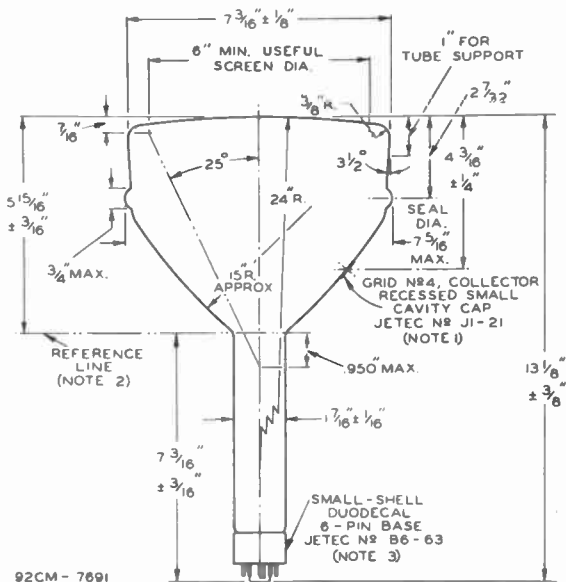
TENTATIVE DATA



7TP4

7TP4

MONITOR KINESCOPE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN No. 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND BULB TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 10^\circ$. BULB TERMINAL IS ON SAME SIDE AS PIN No. 6.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE REFERENCE-LINE GAUGE (JETEC No. 112) 1.500" + 0.003" - 0.000" I.D. AND 2" LONG WILL REST ON BULB CONE.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING DIAMETER OF 1-7/8".



7TP4

AVERAGE GRID-DRIVE CHARACTERISTICS

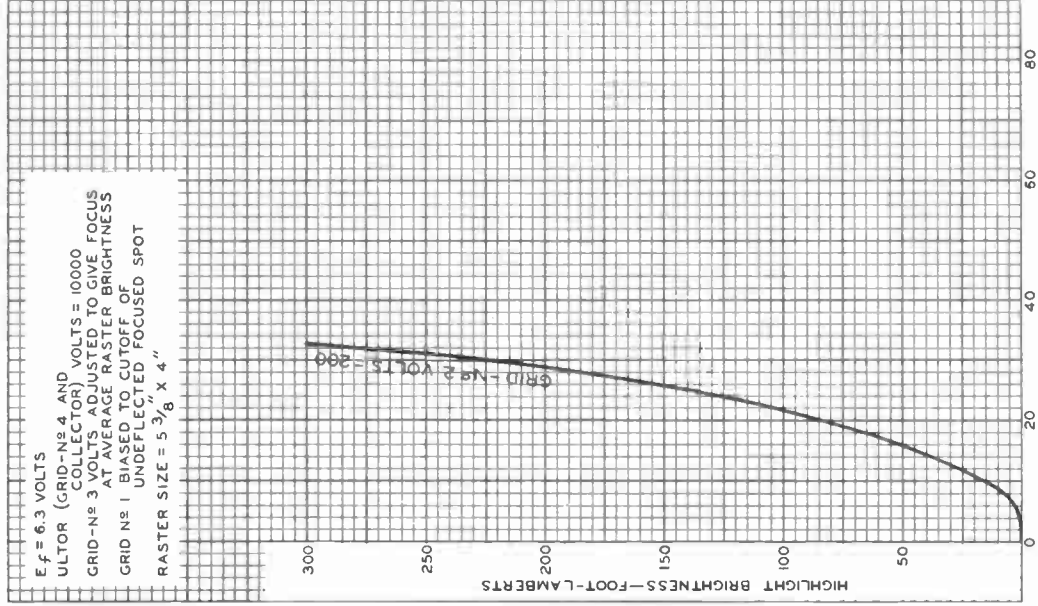
E_f = 6.3 VOLTSULTOR (GRID-N^o 4 AND COLLECTOR) VOLTS = 10000GRID-N^o 3 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESSGRID N^o 1 BIASED TO CUTOFF OF UNDEFLECTED FOCUSED SPOT

RASTER SIZE = 5 3/8" X 4"

GRID-N^o 2 VOLTS = 200

HIGHLIGHT BRIGHTNESS—FOOT-LAMBERTS

VIDEO SIGNAL VOLTS FROM CUTOFF



OCT. 3, 1951

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA - HARTFORD - NEW JERSEY

92CM-7667

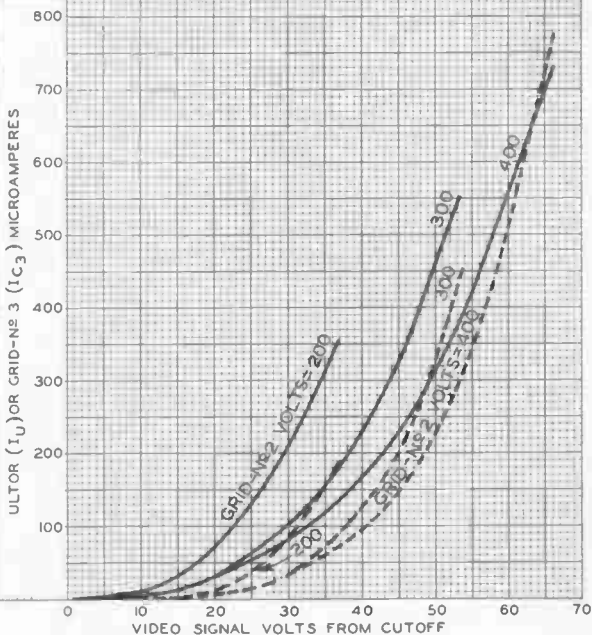


7TP4

7TP4

AVERAGE GRID-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS
 ULTOR (GRID-N^o 4 AND COLLECTOR) VOLTS = 10 000
 GRID-N^o 3 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS
 GRID N^o 1 BIASED TO CUTOFF OF UNDEFLECTED FOCUSED SPOT
 ——— = I_U
 - - - = I_{C_3}



OCT. 3, 1951

TUBE DEPARTMENT

92CM-7688

RAD CO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History





7VPI

7VPI

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

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 $\mu\mu\text{f}$

DJ₁ to DJ₂ 3 $\mu\mu\text{f}$

DJ₃ to DJ₄ 2 $\mu\mu\text{f}$

DJ₁ to All Other Electrodes 9 $\mu\mu\text{f}$

DJ₂ to All Other Electrodes 9 $\mu\mu\text{f}$

DJ₃ to All Other Electrodes 7 $\mu\mu\text{f}$

DJ₄ to All Other Electrodes 7 $\mu\mu\text{f}$

Faceplate Clear Glass

Phosphor (For Curves, see front of this Section) P1

Fluorescence and Phosphorescence Green

Persistence of Phosphorescence Medium

Focusing Method Electrostatic

Deflection Method Electrostatic

Overall Length 14-1/2" \pm 3/8"

Greatest Diameter of Bulb 7" \pm 1/8"

Minimum Useful Screen Diameter 6"

Mounting Position Any

Bulb J56H

Base Medium-Shell Diheptal 12-Pin (JETEC No.B12-37)

BOTTOM VIEW

Pin 1 - Heater

Pin 2 - Cathode

Pin 3 - Grid No.1

Pin 4 - No

Connection

Pin 5 - Grid No.3

Pin 7 - Deflecting

Electrode

DJ₃

Pin 8 - Deflecting

Electrode

DJ₄

Pin 9 - Ultor*

(Grid No.2,

Grid No.4,

Collector)

Pin 10 - Deflecting

Elect. DJ₂

Pin 11 - Deflecting

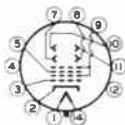
Elect. DJ₁

Pin 12 - Internal

Connection-

Do Not Use

Pin 14 - Heater



DJ₁ and DJ₂ are nearer the screen

DJ₃ and DJ₄ are nearer the base

With DJ₁ positive with respect to DJ₂, the spot is deflected toward pin 5. With DJ₃ positive with respect to DJ₄, the spot is deflected toward pin 2.

The plane through the tube axis and pin 5 may vary from the trace produced by DJ₁ and DJ₂ by an angular tolerance (measured about the tube axis) of $\pm 10^\circ$. Angle between DJ₁-DJ₂ trace and DJ₃-DJ₄ trace is $90^\circ \pm 3^\circ$.

*: See next page.

7VP1



7VP1

OSCILLOGRAPH TUBE

Maximum Ratings, Design-Center Values:

ULTOR® VOLTAGE	4000 max.	volts
GRID-No.3 VOLTAGE	2000 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	750 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_U) between 1000 and 4000 volts*

Grid-No.3 Voltage for Focus	27% to 40% of E_U	volts
Maximum Grid-No.1 Voltage		
for Visual Extinction of		
Undelected Focused Spot	2.8% of E_U	volts
Grid-No.3 Current	-15 to +10	μ amp
Deflection Factors:		
DJ ₁ & DJ ₂	31 to 41	v dc/in./kv of E_U
DJ ₃ & DJ ₄	25 to 34	v dc/in./kv of E_U
Spot Position	##	

Examples of Use of Design Ranges:

<i>For ultor voltage of</i>	<i>1500</i>	<i>3000</i>	<i>volts</i>
Grid-No.3 Voltage			
for Focus	400 to 600	800 to 1200	volts
Maximum Grid-No.1 Volt-			
age for Visual Extinc-			
tion of Undelected			
Focused Spot	-42	-84	volts
Deflection Factors:			
DJ ₁ & DJ ₂	47 to 62	93 to 123	volts dc/in.
DJ ₃ & DJ ₄	38 to 51	75 to 102	volts dc/in.

Maximum Circuit Values:

Grid No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting-		
Electrode Circuit ^o	5.0 max.	megohms

* In the 7VP1, grid no.4 which has the ultor function, grid no.2, and collector are connected together within the tube and are conveniently referred to collectively as "ultor." The "ultor" in a cathode-ray tube is the electrode, or the electrode in combination with one or more additional electrodes connected within the tube to it, to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection.

^o At or near this rating, the effective resistance of the ultor supply should be adequate to limit the ultor input power to 6 watts.

#, ##, ^o: See next page.

NOV. 1, 1952

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

TENTATIVE DATA 1



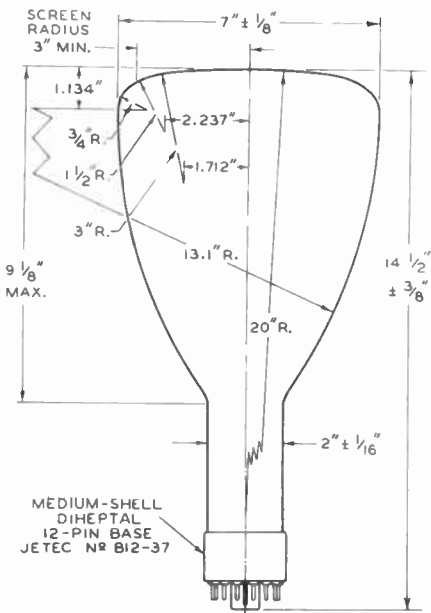
7VP1

7VP1

OSCILLOGRAPH TUBE

- # Brilliance and definition decrease with decreasing ultor voltage. A value as low as 1000 volts is recommended only for low-velocity deflection and low ambient-light levels.
- ## With ultor voltage of 1500 volts, the center of the undeflected focused spot will fall within a circle having a 10-mm radius concentric with the center of the tube face.
- o It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

The 7VP1 can be used as a direct replacement for the 7JP1 in all equipment where the high-voltage supply does not provide more than 4000 volts.



92CM-6667R1

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

NOV. 1, 1952

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

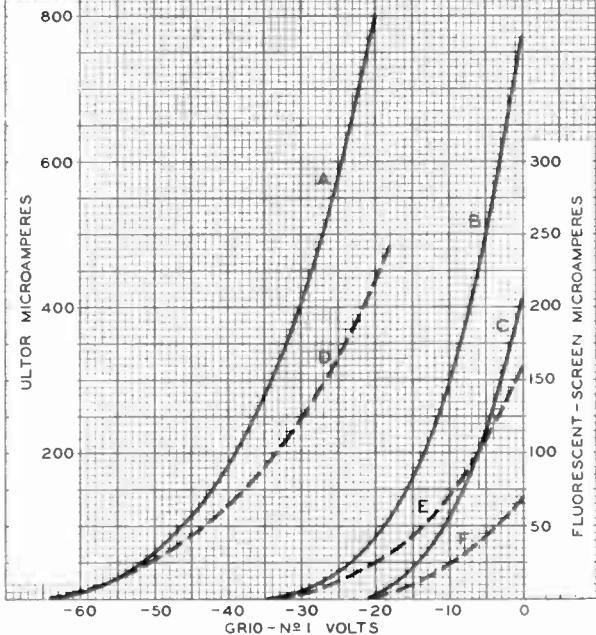
TENTATIVE DATA 2



AVERAGE CHARACTERISTICS

 $E_f = 6.3$ VOLTS
GRID - N^o 3 VOLTS ADJUSTED FOR FOCUS

CURVE	CURRENT	ULTOR VOLTS
A	ULTOR	3000
B	ULTOR	1500
C	ULTOR	1000
D	FLUORESCENT SCREEN	3000
E	FLUORESCENT SCREEN	1500
F	FLUORESCENT SCREEN	1000



Oscillograph Tube

ELECTROSTATIC FOCUS
ELECTROSTATIC DEFLECTION

MEDIUM-SHORT-PERSISTENCE SCREEN
HIGH DEFLECTION SENSITIVITY

The 7VP31 is the same as the 7VP1 except for the following items:

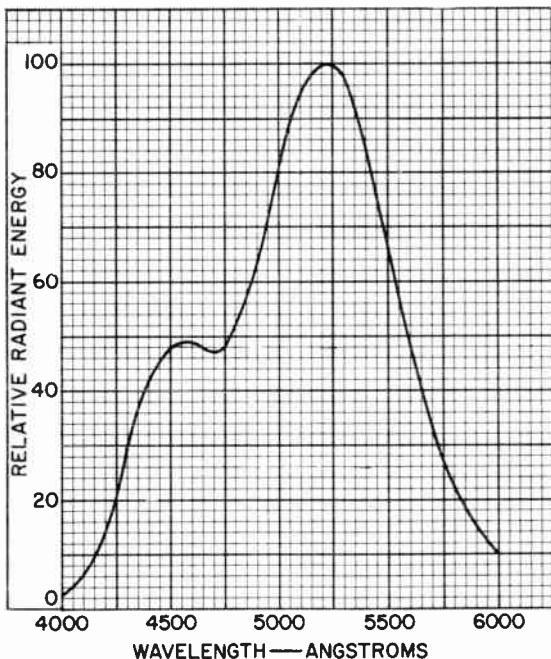
General:

Phosphor (See accompanying curve) P31
Fluorescence Green
Phosphorescence Green
Persistence^a Medium short^b (After 20 μ s: 0.7)

^a Time to initial brightness (fade) to 10% point.

^b Phosphore can maintain useful brightness for over a minute under condition of adequate excitation and low ambient illumination.

SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P31



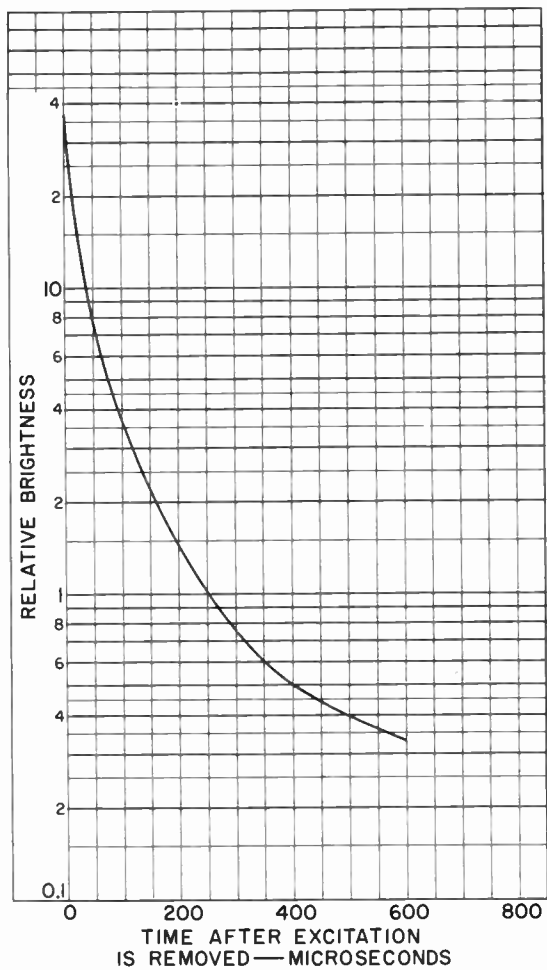
92CM-11261



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DATA
4-6E

PERSISTENCE CHARACTERISTIC
OF PHOSPHOR P31

92CM-11277



Projection Kinescope

FORCED-AIR COOLED
ELECTROSTATIC FOCUSMAGNETIC DEFLECTION
20 FT. x 15 FT. PROJECTED PICTURES*For Black-and-White Projection Systems in Theater and
Closed-Circuit Television Applications**The 7WP4 is the same as the 7NP4 except for the following items:*

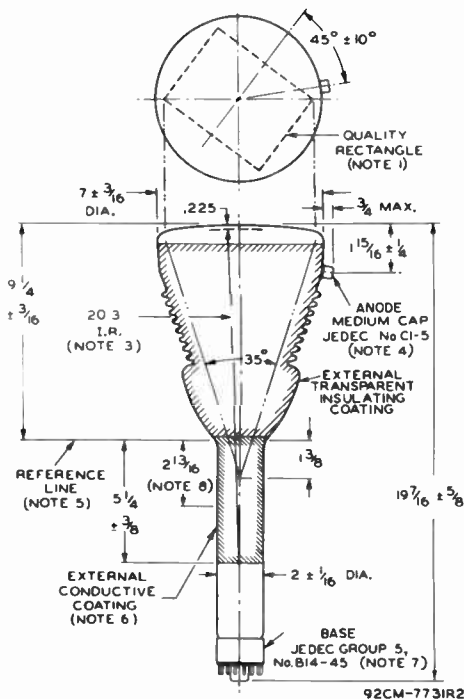
OPTICAL

Projection-Throw Distance for 20 ft x 15 ft Picture.80 ft

MECHANICAL

Overall length19-7/16 + 5/8 in

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

See notes on
other side.RADIO CORPORATION OF AMERICA
Electronic Components and Devices

Harrison, N. J.

DATA
12-66

7WP4

Note 1: When viewed from the face of the tube, the minor axis of the 5 inch x 3-3/4 inch quality rectangle is located $15^{\circ} \pm 10^{\circ}$ in a counter-clockwise direction from a plane through the anode terminal and the tube axis.

Note 2: Inside surface of faceplate within the quality rectangle may vary ± 0.006 inch from the spherical surface having a 15.315 inch radius (Type 7NP4 only).

Note 3: Inside surface of faceplate within the quality rectangle may vary ± 0.006 inch from the spherical surface having a 20.3 inch radius.

Note 4: The plane through base Pin No.9 and the tube axis may vary from the plane through the anode terminal and the tube axis by an angular tolerance (measured about the tube axis) of $\pm 70^{\circ}$. The anode terminal is on same side as Pin No.9.

Note 5: Reference line is determined by position where gauge 2.100 inch \pm 0.001 inch I.D. and 3 inch long will rest on bulb cone.

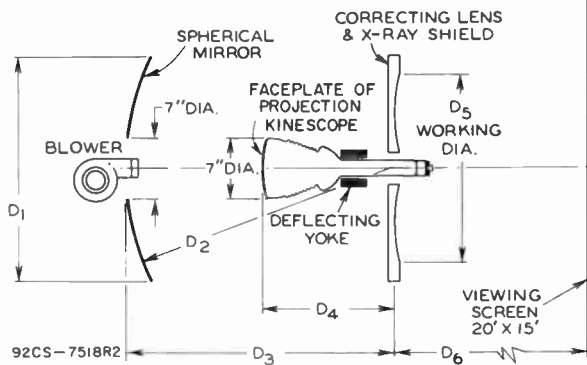
Note 6: External conductive coating must be grounded.

Note 7: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Socket contacts for Pins 5, 6, 7, 8, 10, 11, 12, and 13 should be removed in order to provide maximum insulation for Pin No.9.

Note 8: Effective deflecting field must be within this space.

REFLECTIVE OPTICAL SYSTEM

Arrangement of Typical Optical System and Air-Cooling System for Theater-Television Projector Using Reflective Optical Principles and 7WP4



DIMENSIONS (APPROX.)

D ₁ 27 inch Diameter	D ₄ 20 inches
D ₂ 40 inch Radius	D ₅ 24.5 inches
D ₃ 40 inches	D ₆ 80 feet



8DP4

PICTURE TUBE

SMALL, COMPACT, RECTANGULAR GLASS TYPE

LOW-VOLTAGE ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

8DP4

DATA

General:

Heater, for Unipotential Cathode:

Voltage	6.3	ac or dc volts
Current	0.6 ± 10%	amp

Capacitance between External Conductive Coating and Ultor	{ 350 max. μμf { 250 min. μμf
Faceplate, Spherical . . . . .		Filterglass

Phosphor (For curves, see front of this section)	P4—Sulfide Type
--	-----------------

Deflection Angles (Approx.):

Diagonal	90°
Horizontal	85°
Vertical	68°

Electron Gun	Ion-Trap Type	Requiring External Single-Field Magnet
------------------------	---------------	--

Tube Dimensions:

Overall length	10-7/16" ± 5/16"
Greatest width	7-7/8" + 1/16" - 1/32"
Greatest height	6-1/16" + 1/16" - 1/32"
Diagonal	8-7/16" + 1/16" - 1/32"
Neck length	6-1/2" ± 3/16"
Radius of curvature of faceplate (External surface)	27"

Screen Dimensions (Minimum):

Greatest width	7-3/16"
Greatest height	5-3/8"
Diagonal	7-13/16"
Projected area	35.5 sq. in.

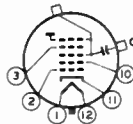
Operating Position Any

Cap. Recessed Small Cavity (JETEC No. J1-21)

Base Dwarf-Shell Duodecal 6-Pin (JETEC Group 4, No. B6-158)

Basing Designation for BOTTOM VIEW 12AB

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 3—Grid No.4
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater



- Cap—Ultor (Grid No.3, Grid No.5, Collector)
- C—External Conductive Coating

Maximum Ratings, Design-Center Values:

ULTOR VOLTAGE	8000 max. volts
GRID-No.4 (FOCUSING) VOLTAGE:	
Positive value	500 max. volts
Negative value	500 max. volts
GRID-No.2 VOLTAGE	300 max. volts

← Indicates a change.

8DP4



8DP4

PICTURE TUBE

GRID-No.1 VOLTAGE:

Negative-peak value.	130 max.	volts
Negative-bias value.	100 max.	volts
Positive-bias value.	0 max.	volts
Positive-peak value.	2 max.	volts

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode.	180 max.	volts
Heater positive with respect to cathode.	180 max.	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
--	----------	---------

Monitor Kinescope

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE ALUMINIZED SCREEN
 LOW-VOLTAGE ELECTROSTATIC FOCUS 90° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes.	5	pf
Grid No.1 to all other electrodes.	9	pf
External conductive coating to anode	$\left\{ \begin{array}{l} 350 \text{ max.} \\ 250 \text{ min.} \end{array} \right.$	pf
		rf

Heater Current at 6.3 volts. 600 ± 60 ma
 Electron Gun Type Requiring No Ion-Trap Magnet

Optical:

Phosphor (For Curves, see front of this Section) P4—Sulfide Type,
 Aluminized
 Faceplate. Filterglass
 Light transmission (Approx.) 80%

Mechanical:

Weight (Approx.) 2.5 lbs
 Overall Length 9.94" ± .31"
 Neck Length. 6.00" ± .19"
 Projected Area of Screen 36 sq. in.
 External Conductive Coating:

Type Regular-Band
 Contact area for grounding Near Reference Line

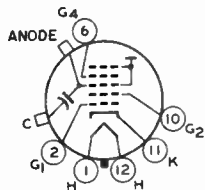
For Additional Information on Coatings and Dimensions:

See *Picture-Tube Dimensional-Outlines and Bulb J67-1/2A* sheets at front of this section

Cap. Recessed Small Cavity (JEDEC No. J1-21)
 Base Small-Shell Duodecal 6-Pin
 (JEDEC Group 4, B6-63)

Basing Designation for BOTTOM VIEW. 12L

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 6—Grid No.4
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater
- Cap—Anode (Grid No.3,
 Grid No.5, Screen,
 Collector)
- C—External Conductive
 Coating



8HP4

Maximum and Minimum Ratings, Absolute-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage.	14000 max.	volts
Grid-No.4 (Focusing) Voltage:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
Grid-No.2 Voltage.	550 max.	volts
Grid-No.1 Voltage:		
Negative peak value.	220 max.	volts
Negative bias value.	155 max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts
Heater Voltage	{ 6.9 max. 5.7 min.	volts volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	180 max.	volts
Heater positive with respect to cathode	180 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage.	11000	volts
Grid-No.4 Voltage.	0 to 300	volts
Grid-No.2 Voltage.	300	volts
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
--	----------	---------

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section



Monitor Kinescope

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
90° MAGNETIC DEFLECTION

Electrical:

Operating Voltage (Nominal) 200 V.
Operating Voltage Range 180-220 V.
Operating Current (Nominal) 1.2 A.
Operating Current Range (Average) 1.0-1.4 A.
Maximum Anode Current (Average) 1.2 A.
Maximum Anode Current (Peak) 1.4 A.

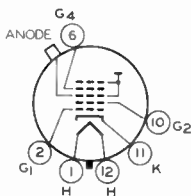
Optical:

Beam Current (Nominal) 1.2 mA.
Beam Current Range 1.0-1.4 mA.
Beam Spot Diameter (Nominal) 1.2 mm.
Beam Spot Diameter Range 1.0-1.4 mm.
Beam Deflection (Nominal) 90°.

Mechanical:

Weight (Nominal) 1.2 lb.
Weight Range 1.0-1.4 lb.
Dimensions (Nominal) 1.2" x 1.2" x 1.2".
Dimensions Range 1.0" x 1.0" x 1.0".
External Insulating Coating None.
Base Bolt #7-1/2 A. (See front view Section).
Base Mounting Small Circular Disc, 1.2" Dia.
Base Mounting Large Circular Disc, 1.2" Dia.
Base Insulation for BOTTOM VIEW 12V

Fig. 2 - Heater
Pin 1 - Grid No. 1
Pin 6 - Grid No. 2
Pin 10 - Grid No. 2
Pin 11 - Cathode
Pin 12 - Heater



Grid - Anode
Grid - Anode
Grid - Anode
Grid - Anode
Grid - Anode

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	22000 max.	volts
Grid No. 1 Voltage:		
Positive value	1100 max.	volts
Negative value	150 max.	volts
Grid No. 2 Voltage:		
Positive value	150 max.	volts
Negative value	200 min.	volts
Grid No. 1 Voltage:		
Negative bias value	270 max.	volts
Negative bias value	150 max.	volts



8NP4

Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage	{ 6.2 max.	volts
	{ 5.7 min.	volts

Peak Heater-Cathode Voltage:

Heater negative with respect to cathode:

During equipment warm-up period

not exceeding 15 seconds 450 max. volts

After equipment warm-up period 200 max. volts

Heater positive with respect to cathode:

Combined AC and DC Voltage 200 max. volts

DC Component 100 max. volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	16000	volts
Grid-No.4 Voltage ^a	200	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1 Circuit Resistance	1.5 max.	megohms
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^a The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 to +400 volts.

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section



Test Picture Tube

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE
ELECTROSTATIC SELF FOCUS

ALUMINIZED SCREEN
90° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes.	5	pf
Grid No.1 to all other electrodes.	6	pf
Heater Current at 6.3 volts.	600	ma
Electron Gun.	Type Requiring No Ion-Trap Magnet	

Optical:

Phosphor (For Curves, see front of this Section) . . . . .	.P4—Sulfide Type, Aluminized
Faceplate.	Filterglass
Light transmission (Approx.)	80%

Mechanical:

Weight (Approx.)	3 lbs
Overall Length	11.44" ± .31"
Neck Length.	7.50" ± .19"
Projected Area of Screen	36 sq. in.
External Conductive Coating.	None

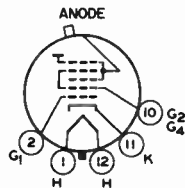
For Additional Information on Dimensions:

See *Picture-Tube Dimensional-Outlines and Bulb J67-1/2A* sheets at front of this section

Cap	Recessed Small Cavity (JEDEC No.J1-21)
Base.	Small-Shell Duodecal 5-Pin (JEDEC Group 4, No.B5-57)

Basing Designation for BOTTOM VIEW. 12S

- Pin 1 -Heater
- Pin 2 -Grid No.1
- Pin 10 -Grid No.2,
Grid No.4
- Pin 11 -Cathode
- Pin 12 -Heater
- Cap -Anode
(Grid No.3,
Grid No.5,
Screen,
Collector)



Maximum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage.	22000 max.	volts
Grid-No.2 and Grid-No.4 Voltage.	550 max.	volts
Grid-No.1 Voltage:		
Negative peak value.	220 max.	volts
Negative bias value.	155 max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts



8XP4

Peak Heater-Cathode Voltage:

Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment-warm-up period.	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to Grid No. 1

Anode Voltage	16000	volts
Grid-No.2 and Grid-No.4 Voltage	400	volts
Cathode Voltage for visual extinction of focused raster.	36 to 78	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section



Test Picture Tube

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE
ELECTROSTATIC SELF FOCUSALUMINIZED SCREEN
110° MAGNETIC DEFLECTION**Electrical:**

Direct Interelectrode Capacitances:

Cathode to all other electrodes.	4	pf
Grid No.1 to all other electrodes.	6	pf
Heater Current at 6.3 volts.	600	ma
Electron Gun	Type Requiring No Ion-Trap Magnet	

Optical:

Phosphor (For curves, see front of this section)	P4—Sulfide Type, Aluminized
Faceplate.	Filterglass
Light transmission (Approx.)	80%

Mechanical:

Weight (Approx.)	2 lbs
Overall Length	8.69" ± .31"
Neck Length.	5.19" ± .19"
Projected Area of Screen	39 sq. in.
External Conductive Coating.	None

For Additional Information on Dimensions:

See *Picture-Tube Dimensional-Outlines and Bulb J67-1/2 B*
sheets at front of this section

Cap. Recessed Small Cavity (JEDEC No. J1-21)

Bases (Alternates):

Special 6-Pin (JEDEC No. B6-185)

Special 6-Pin (JEDEC No. B6-214)

Basing Designation for RQTTQM V1FW 7FG

Pin 2—Cathode

Pin 3—Heater

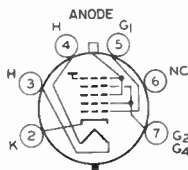
Pin 4—Heater

Pin 5—Grid No.1

Pin 6—No Internal Connection

Pin 7—Grid No.2, Grid No.4

Cap—Anode

(Grid No.3, Grid No.5,
Screen, Collector)**Maximum Ratings, Design-Maximum Values:***Unless otherwise specified, voltage values
are positive with respect to cathode*

Anode Voltage.	22000	volts
Grid-No.2 and Grid-No.4 Voltage.	550	volts
Grid-No.1 Voltage:		
Negative peak value.	220	volts
Negative bias value.	155	volts
Positive bias value.	0	volts
Positive peak value.	2	volts



8YP4

Peak Heater-Cathode Voltage:

heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds	450	volts
After equipment-warm-up period	200	volts
Heater positive with respect to cathode	200	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to Grid No. 1

Anode Voltage	16000	volts
Grid-No. 2 and Grid-No. 4 Voltage	400	volts
Cathode voltage for visual extinction of focused raster	42 to 78	volts

Maximum Circuit Value:

Grid-No. 1-Circuit Resistance	1.5	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section





9AP4

9AP4/1804-P4

KINESCOPE

Heater	Coated Unipotential Cathode	
Voltage	2.5	a-c or d-c volts
Current	2.1	amp.
Focus		Electrostatic
Deflection		Magnetic
Phosphor		No.4
Fluorescence		White
Persistence		Medium
Direct Interelectrode Capacitance:		
Grid No.1 to All Other Electrodes	9	μf
Overall Length	21"	$\pm 3/8"$
Diameter	9"	$\pm 1/8"$
Bulb		J-72
Cap		Medium Metal
Base		Medium 6-Pin

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

Maximum Ratings Are Based on a Line-Voltage Design Center of 117 Volts

High-Voltage Electrode (Anode No.2) Volt.	7000 max.	volts
Focusing Electrode (Anode No.1) Volt.	2000 max.	volts
Accelerating Electrode (Grid No.2) Volt.	250 max.	volts
Control Electrode (Grid No.1) Volt.	Never positive	
Fluorescent Screen Input Power/sq cm :		
Fixed Pattern	2.5 max.	mw
Moving Pattern	5.0 max.	mw
Grid Circuit Resistance	1.5 max.	megohms
Typical Operation:		
Cathode	{Should be connected to one side or to mid-tap of heater winding	
Anode No.2 Voltage	5000 7000	volts
Anode No.1 Voltage \square	1225 1425	approx. volts
Grid No.2 Voltage	250 250	volts
Grid No.1 Voltage \circ	Adjusted to give suitable luminous spot	
Grid No.1 Signal-Swing Volt. \blacktriangle	25 25	approx. volts

NOTE: Brilliance and definition decrease with decreasing anode voltages. In general the anode No.2 voltage should not be less than 5000 volts.

\square Supply should be adjustable to $\pm 20\%$ of the value shown.

\circ Approximately 35% of Grid No.2 voltage is required for current cut-off when, in some applications, it is necessary to use the maximum permissible grid-circuit resistance.

\blacktriangle Peak-to-peak value for good brilliance with good resolution. For greater brilliance, up to twice this value should be available.

The Characteristic Curves for the 9AP4 are the same as those for the 12AP4.

← Indicates a change.

Jan. 30, 1942

RCA RADOTRON DIVISION
RCA MANUFACTURING COMPANY INC

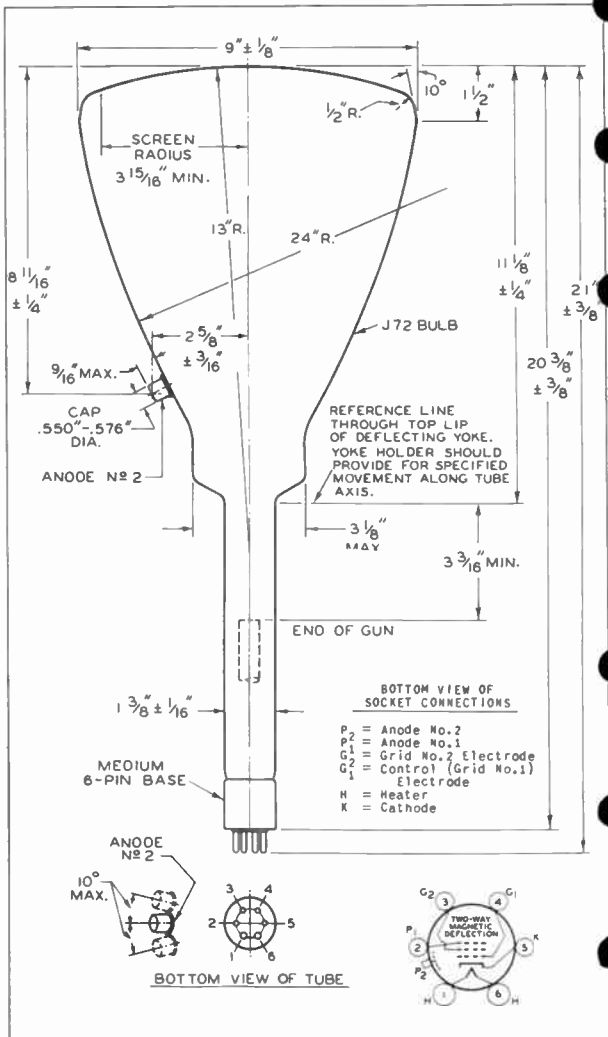
DATA

9AP4



9AP4/1804-P4

KINESCOPE



Jan. 30, 1942

RCA RADITRON DIVISION
RCA MANUFACTURING COMPANY INC

92C-6015R1

Picture Tube

PAN-O-PLY TYPE
 90° MAGNETIC DEFLECTION LOW-GRID-NO.2 VOLTAGE

ELECTRICAL

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid No. 1 to all other electrodes	6	pF
External conductive coating to anode	300 min—750 max	pF
Heater Current at 12V.	75 ± 7	mA
Heater Warm-Up Time (Average).	11	s

Electron Gun Type Requiring No Ion-Trap Magnet

OPTICAL

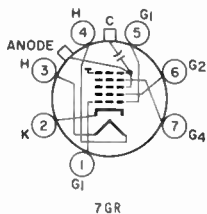
Phosphor	P4—Sulfide Type, Aluminized
For curve, see front of this section	
Faceplate.	Filterglass
Light transmission at center (Approx.) 49.5%	

MECHANICAL

Weight (Approx.)	3.1 lb
Overall Length	8.28 max in
Neck Length.	3.55 max in
Projected Area of Screen	38 sq in
External Conductive Coating ^a	
Type (See CRT OUTLINES 1 at front of this section). Regular-Band	
Content lines for mounting Near Reference Line	
Cap.	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Special Miniature 7-Pin (JEDEC No. E7-91)

TERMINAL DIAGRAM (Bottom View)

- Pin 1—Grid No. 1
- Pin 2—Anode
- Pin 3—Heater
- Pin 4—Heater
- Pin 5—Grid No. 2
- Pin 6—Grid No. 3
- Pin 7—Grid No. 4
- 10—Grid No. 5, Grid No. 5, Screen, Collector
- 11—External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage.	8000 min—12000 max	V
Grid-No.4 Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage.	75 min—250 max	V



9WP4

Grid-No.1 Voltage

Negative peak value.	220 max	V
Negative bias value.	155 max	V
Positive bias value.	0 max	V
Positive peak value.	2 max	V

Heater Voltage 10.8 min—13.2 max V

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:		
During equipment warm-up period ≤ 15 s	450 max	V
After equipment warm-up period . . .	200 max	V
Heater positive with respect to cathode:		
Combined AC & DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage.	9000	V
Grid-No.4 Voltage.	0 to 300	V
Grid-No.2 Voltage.	100	V
Cathode Voltage.	32 to 50	V

For visual extinction of focused raster

Field Strength 0 to 8 G

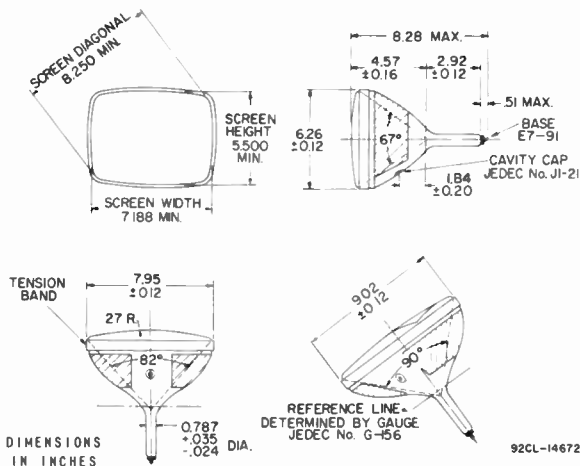
Of required adjustable centering magnet

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance 1.5 max M Ω

^a includes implosion protection hardware.

DIMENSIONAL OUTLINE (8ULB J71-1/2 B1)





IOBP4

KINESCOPE

MAGNETIC FOCUS

MAGNETIC DEFLECTION

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 $\mu\mu\text{f}$
Cathode to All Other Electrodes 5.0 $\mu\mu\text{f}$
External Conductive Coating to Anode No.2 { 2500 max. $\mu\mu\text{f}$
500 min. $\mu\mu\text{f}$

Phosphor (For Curves, see front of this Section) No. 4
Fluorescence and Phosphorescence White
Persistence of Phosphorescence Medium

Focusing Method Magnetic

Deflection Method Magnetic

Deflection Angle (Approx.) 50°

Ion Trap Magnetic

External Coating Conductive

Overall Length 17-5/8" ± 3/8"

Greatest Diameter of Bulb 10-1/2" ± 1/8"

Minimum Useful Screen Diameter 9"

Raster Size (Approx.) 6" x 8"

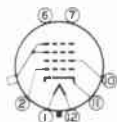
Mounting Position Any

Cap. Recessed Small Cavity

Base Small-Shell Duodecal 7-Pin

BOTTOM VIEW

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 6 - No Connection
- Pin 7 - No Connection



- Pin 10 - Grid No.2
- Pin 11 - Cathode
- Pin 12 - Heater
- Cap - Anode, Grid No.3

Maximum Ratings, Design-Center Values:

ANODE VOLTAGE ■ 10000 max. volts

GRID-No.2 VOLTAGE 410 max. volts

GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:

Negative bias value 125 max. volts

Positive bias value 0 max. volts ←

Positive peak value 2 max. volts ←

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode:

During equipment warm-up period not exceeding 15 seconds 410 max. volts ←

After equipment warm-up period 125 max. volts ←

Heater positive with respect to cathode. 125 max. volts

■ See next page.

← indicates a change.

10BP4



10BP4 KINESCOPE

→ Typical Operation:

Anode Voltage*	9000	..	volts
Grid-No.2 Voltage.	250	..	volts
Grid-No.1 Voltage ^o	-27 to -63		volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
--	----------	---------

→ Minimum Circuit Values:

When the output capacitor of the power supply is capable of storing more than 250 microcoulombs, and when the inherent regulation of the power supply permits the instantaneous short-circuit current to exceed 1 ampere, the effective resistance in circuit between indicated electrode and the output capacitor should be as follows:

Grid-No.1-Circuit Resistance	150 min.	ohms
Grid-No.2-Circuit Resistance	470 min.	ohms
Anode-Circuit Resistance	11000 min.	ohms

The resistors used should be capable of withstanding the voltages involved.

Components:

Ion-Trap Magnet [#]	RCA Type No.203D1
Deflection Yoke ^a	RCA Type No.201D1
Focusing Coil ^{**}	RCA Type No.202D1

■ The anode and grid No.3 which are connected together within tube are referred to herein as anode.

▪ Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 8000 volts.

○ Visual extinction of undeflected focused spot.

♯ The dc current required by this magnet is approx. 109 ma. for the typical operating conditions shown.

▲ The horizontal deflecting-coil current required by this yoke to produce 8" picture width is approx. 470 ma. peak-to-peak under the typical operating conditions shown. The current varies directly as the square root of the anode voltage.

*** The dc current required by this coil is approx. 115 ma. for the typical operating conditions shown and using combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 20 foot-lamberts on a 6" x 8" picture area. Distance from reference line (see Outline Drawing) to center line of air gap is approx. 3-1/4".

→ Indicates a change.

MAR. 15, 1948

TUBE DEPARTMENT

DATA

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

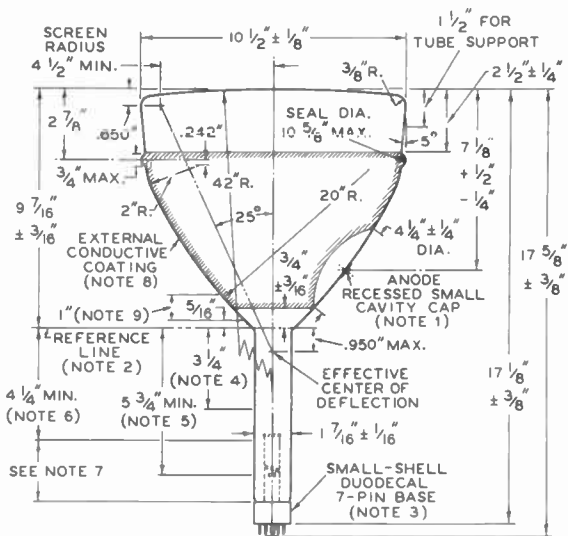
World Radio History



IOBP4

KINESCOPE

IOBP4



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No. 3 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF 10° . ANODE TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION No. 3.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE HINGED GAUGE $1.500" + .003" - .000"$ I.D. AND 2" LONG WILL REST ON BULB CONE.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING DIAMETER OF $1-7/8"$.

NOTE 4: APPROX. DISTANCE TO CENTER OF FOCUSING-COIL AIR GAP.

NOTE 5: DISTANCE TO INTERNAL POLE PIECES. PLANE THROUGH PIN No. 6 AND TUBE AXIS PASSES THROUGH LINE JOINING CENTERS OF POLE PIECES. DIRECTION OF PRINCIPAL FIELD OF ION-TRAP MAGNET SHOULD BE SUCH THAT NORTH POLE IS ADJACENT TO PIN No. 6 AND SOUTH POLE TO PIN No. 12.

OCTOBER 15, 1947

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-6663R2A

10BP4



10BP4
KINESCOPE

(continued from preceding page)

NOTE 6: LOCATION OF DEFLECTING YOKE AND FOCUSING-COIL AIR GAP MUST BE WITHIN THIS SPACE.

NOTE 7: KEEP THIS SPACE CLEAR FOR ION-TRAP MAGNET.

NOTE 8: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 9: FOR TUBE SUPPORT WHICH MUST NOT COVER SPECIFIED AREA AROUND ANODE CAP.

92CM-6663R2

OCTOBER 15, 1947

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-6663R2B

World Radio History

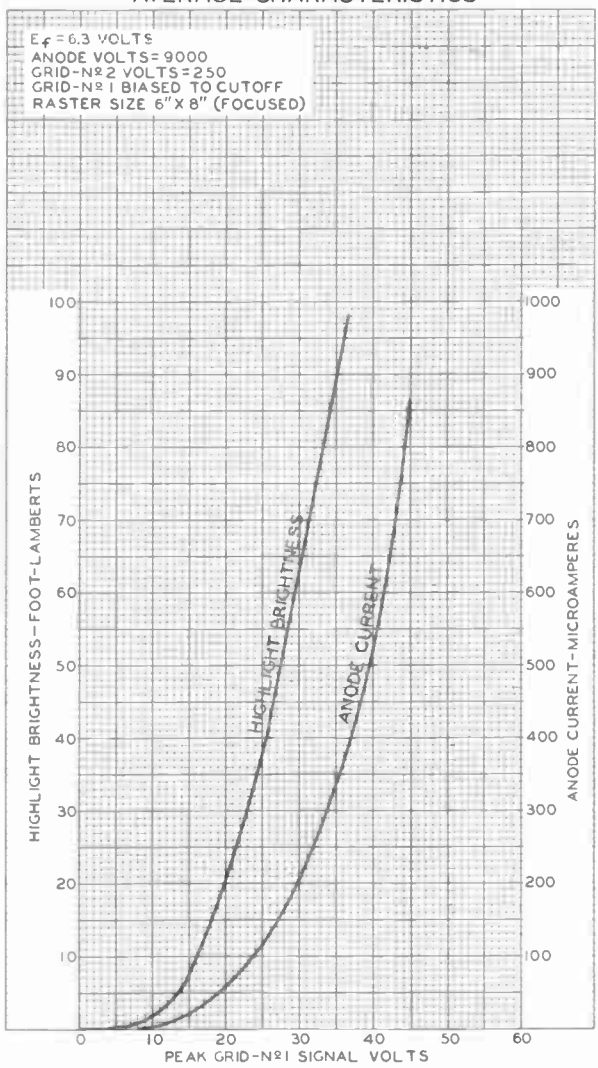


10BP4

10BP4

AVERAGE CHARACTERISTICS

$E_f = 6.3$ VOLTS
 ANODE VOLTS = 9000
 GRID-N^o2 VOLTS = 250
 GRID-N^o1 BIASED TO CUTOFF
 RASTER SIZE 6" X 8" (FOCUSED)



OCT. 9, 1947

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

92CM-6675R2





10SP4

10SP4

MONITOR KINESCOPE

ALUMINIZED SCREEN

ELECTROSTATIC FOCUS

MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

Voltage	6.3	ac or dc volts
Current	0.6	amp

Direct Interelectrode Capacitances:

Grid No.1 to all other electrodes	6	$\mu\mu\text{f}$
Cathode to all other electrodes	5	$\mu\mu\text{f}$

Faceplate, Spherical Filterglass

Light transmission (Approx.) 76% ←

Phosphor (For Curves, see front of this section) . . . P4—Sulfide Type
Aluminized

Fluorescence White

Phosphorescence White

Persistence Short

Focusing Method Electrostatic

Deflection Method Magnetic

Deflection Angle (Approx.) 50°

Overall Length 16-5/8" ± 3/8" ←

Greatest Diameter of Bulb 10-1/2" ± 1/16" ←

Minimum Useful Screen Diameter 9-1/8"

Picture Size (Within minimum useful screen area) . . 8" x 6"

Weight (Approx.) 10 lbs ←

Operating Position Any ←

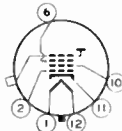
Cap. Recessed Small Cavity (JETEC No. J1-21)

Bulb J84 ←

Base Small-Shell Duodecal 6-Pin (JETEC No. B6-63) ←

Basins Designation for BOTTOM VIEW 12Q ←

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 6—Grid No.3
- Pin 10—Grid No.2
- Pin 11—Cathode



- Pin 12—Heater
- Cap—Ultror
- (Grid No.4, Collector)

Maximum Ratings, Design-Center Values:

ULTOR VOLTAGE 2000 max. volts ←

GRID—No.3 VOLTAGE 3000 max. volts ←

GRID—No.2 VOLTAGE 410 max. volts ←

GRID—No.1 VOLTAGE:

Negative bias value 125 max. volts

Positive bias value 0 max. volts

Positive peak value 2 max. volts

PEAK HEATER—CATHODE VOLTAGE:

Heater negative with respect to cathode:

During equipment warm-up period

not exceeding 15 seconds 410 max. volts

After equipment warm-up period 180 max. volts

Heater positive with respect to cathode. 180 max. volts

← Indicates a change.

10SP4



10SP4

MONITOR KINESCOPE

Equipment Design Ranges:

For any ultor voltage (E_{c4}) between 10000* and 20000 volts and grid-No.2 voltage (E_{c2}) between 150 and 410 volts

Grid-No.3 Voltage for focus with ultor current of 100 μ a.	11.7% to 15.9% of E_{c4}	volts
Grid-No.1 Voltage for visual extinction of 8" x 6" raster	9% to 24% of E_{c2}	volts
Maximum Grid-No.3 Current**	See Curves	
Grid-No.2 Current	-15 to +15	μ a
Field Strength of Adjustable Centering Magnet	0 to 8	gausses

Examples of Use of Design Ranges:

For ultor voltage of	12000	14000	volts
and grid-No.2 voltage of	200	200	volts

Grid-No.3 Voltage for focus with ultor current of 100 μ a.	1400 to 1900	1640 to 2225	volts
Grid-No.1 Voltage for visual extinction of 8" x 6" raster	-18 to -46	-18 to -46	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
--	----------	---------

- * Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 10,000 volts.
- ** Grid-No.3 current increases as the ultor voltage is decreased.

For X-ray shielding considerations, see sheet
 X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES
 at front of this Section

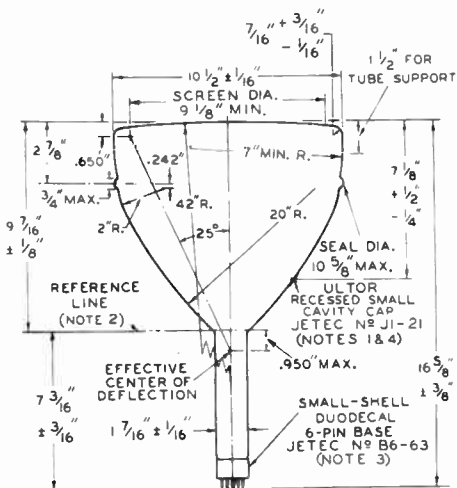
→ Indicates a change.



IOSPA

IOSPA

MONITOR KINESCOPE



92CM-7729R1

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTRON TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 10^\circ$. ULTRON TERMINAL IS ON SAME SIDE AS PIN 6.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE REFERENCE-LINE GAUGE (JETEC No. 112) $1.500'' + 0.003'' - 0.000''$ I.D. AND $2''$ LONG WILL REST ON BULB CONE.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING DIAMETER OF $1-7/8''$.

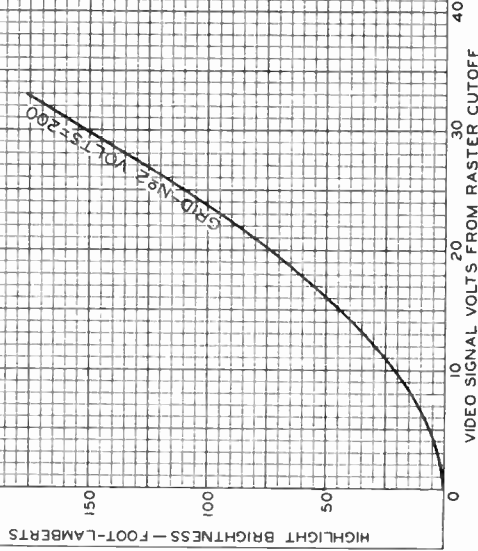
NOTE 4: TUBE SUPPORT MUST BE KEPT AT LEAST $2''$ AWAY FROM BULB TERMINAL.



10SP4

AVERAGE GRID-DRIVE CHARACTERISTIC

$E_f = 6.3$ VOLTS
 ULTOR (GRID-Nº 4-AND-COLLECTOR) VOLTS = 12000
 GRID-Nº 3 VOLTS ADJUSTED TO GIVE FOCUS
 AT AVERAGE RASTER BRIGHTNESS.
 GRID Nº 1 BIASED TO RASTER CUTOFF.
 RASTER SIZE = 8" x 6"



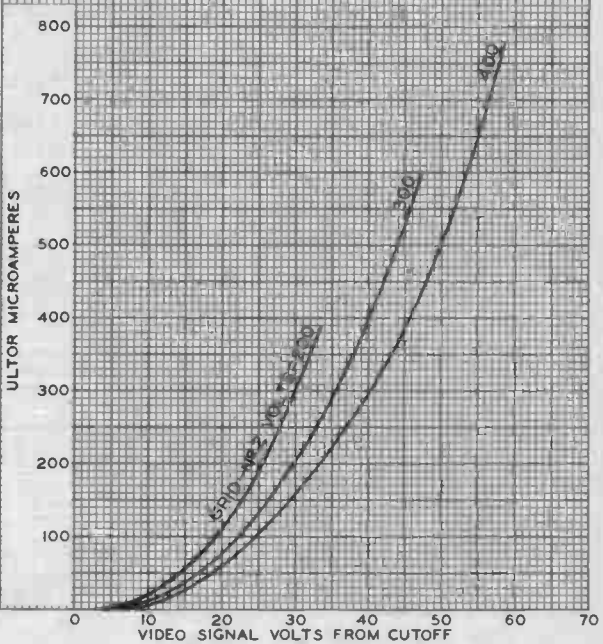


10SP4

10SP4

AVERAGE GRID-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS
 ULTOR (GRID-Nº 4 AND COLLECTOR) VOLTS = 12000
 GRID-Nº 3 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS
 GRID Nº 1 BIASED TO CUTOFF OF RASTER
 RASTER SIZE = 8" x 8"



MAR. 21, 1952

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7773

10SP4



10SP4

GRID-DRIVE CHARACTERISTICS

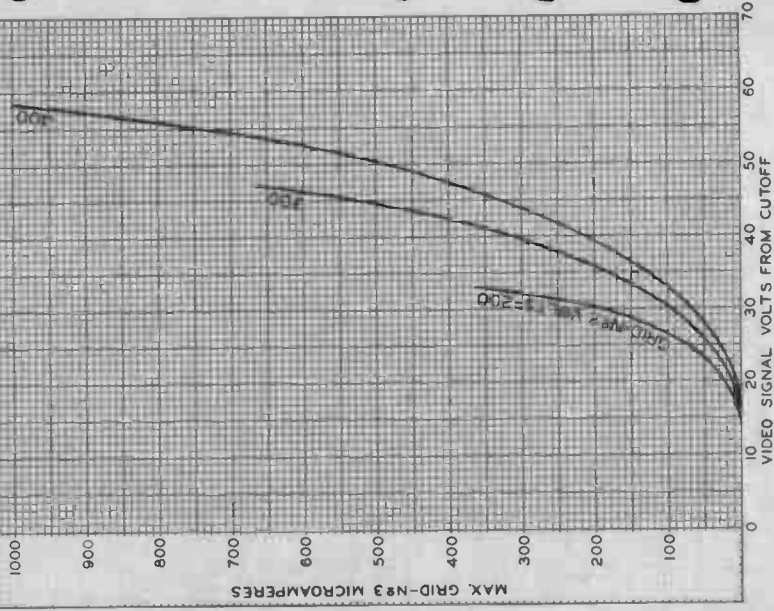
 $E_f = 6.3$ VOLTS

ULTOR (GRID-Nº 4 AND COLLECTOR) VOLTS = 12000

GRID-Nº 3 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS

GRID Nº 1 BIASED TO CUTOFF OF RASTER

RASTER SIZE = 8" x 6"



MAR. 21, 1952

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARTFORD, NEW JERSEY

92CM-7775

Picture Tube

PAN-O-PLY TYPE

110° MAGNETIC DEFLECTION LOW-VOLTAGE ELECTROSTATIC FOCUS

Direct Interelectrode Capacitances

Cathode to all other electrodes.	5	pF
Grid No.1 to all other electrodes.	6	pF
External conductive coating to anode	500 min—750 max	pF
Heater Current at 6.3 V	450 ± 20	mA
Heater Warm-Up Time (Average).	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

Phosphor	P4—Sulfide Type, Aluminized
For curves, see front of this section	
Faceplate.	Filterglass
Light transmission at center (approx.)	79%

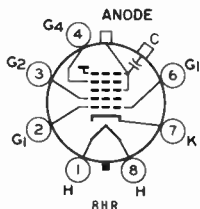
MECHANICAL

Weight (Approx.)	4 lb
Overall Length	8.785 ± .250 in
Neck Length.	4.125 ± .125 in
Projected Area of Screen	60 sq in
External Conductive Coating ^a	

Type (See CRT OUTLINES I at front of this section)	Regular-Band
Contact area for grounding	Near Reference Line
Cap.	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement I, (JEDEC No. B7-208)

TERMINAL DIAGRAM (Bottom View)

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 3—Grid No.2
- Pin 4—Grid No.4
- Pin 6—Grid No.1
- Pin 7—Cathode
- Pin 8—Heater
- Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)
- C—External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage.	8000 min—15000 max	V
Grid-No.4 Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage.	200 min—550 max	V
Grid-No.1 Voltage		
Negative peak value.	220 max	V
Negative bias value.	155 max	V
Positive bias value.	0 max	V
Positive peak value.	2 max	V
Heater Voltage	5.7 min—6.9 max	V



Peak Heater-Cathode Voltage

Heater negative with respect to cathode:

During equipment warm-up period ≤ 15 s.	450 max V
After equipment warm-up period	300 max V

Heater positive with respect to cathode:

Combined AC & DC voltage	200 max V
DC component	100 max V

TYPICAL OPERATING CONDITIONS FOR GRID-DRIVE SERVICE

Voltages are positive with respect to cathode

Anode Voltage.	12000 V
Grid-No.4 Voltage.	0 to 400 V
Grid-No.2 Voltage.	400 V
Grid-No.1 Voltage.	-39 to -94 V

For visual extinction of focused raster

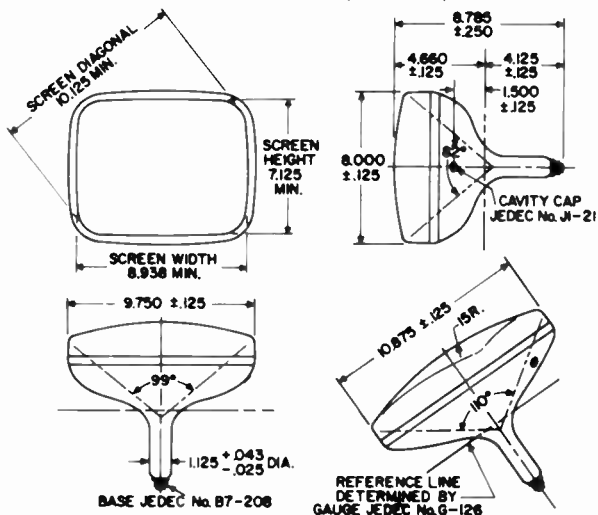
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max M Ω
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^a Includes implosion protection hardware.

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES at
 front of this section

DIMENSIONAL OUTLINE (BULB J87A)



92CS-14055

DIMENSIONS IN INCHES



Picture Tube

FILLED-RIM TYPE
 110° MAGNETIC DEFLECTION INTERMEDIATE-GRID-No.2 VOLTAGE

Direct Interelectrode Capacitances

Cathode to all other electrodes.	5	pF
Grid No.1 to all other electrodes.	6	pF
External conductive coating to anode ^a	500 min—750 max	pF
Heater Current at 6.3 V.	450 ± 20	mA
Heater Warm-Up Time (Average).	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

Phosphor	P4—Sulfide Type, Aluminized
<i>For curves, see front of this section</i>	
Faceplate.	Filterglass
Light transmission at center (Approx.)	52 %

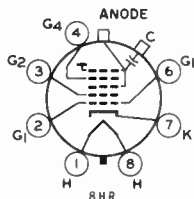
MECHANICAL

Weight (Approx.)	5 lb
Overall Length	8.785 ± .250 in
Neck Length	4.125 ± .125 in
Projected Area of Screen	60 sq in
External Conductive Coating	

Type (See CRT OUTLINES 1 at front of this section)	Regular-Band
Contact area for grounding	Near Reference Line
Cap.	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No. B7-208)

TERMINAL DIAGRAM (Bottom View)

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 3—Grid No.2
- Pin 4—Grid No.4
- Pin 6—Grid No.1
- Pin 7—Cathode
- Pin 8—Heater
- Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)
- C—External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage.	8000 min—15000 max	V
Grid-No.4 Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage.	100 min—250 max	V
Cathode Voltage		
Negative peak value.	220 max	V
Negative bias value.	155 max	V
Positive bias value.	0 max	V
Positive peak value.	2 max	V
Heater Voltage	5.7 min—6.9 max	V



11GP4

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:

During equipment warm-up period ≤ 15 s. 450 max V

After equipment warm-up period 300 max V

Heater positive with respect to cathode:

Combined AC & DC voltage. 200 max V

DC component. 100 max V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No. 1

Anode Voltage	11000	V
Grid-No.4 Voltage	0	V
Grid-No.2 Voltage	150	V
Cathode Voltage . . . . .	.31 to 49	V

For visual extinction of focused raster

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance. 1.5 max M Ω

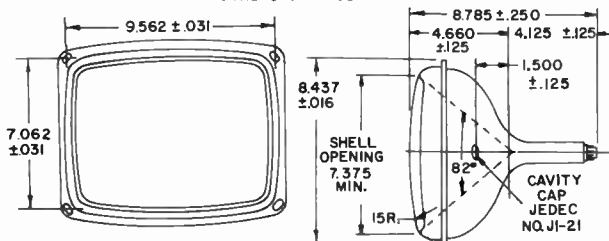
^a Includes implosion protection hardware.

For X-radiation shielding considerations, see sheet

X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES

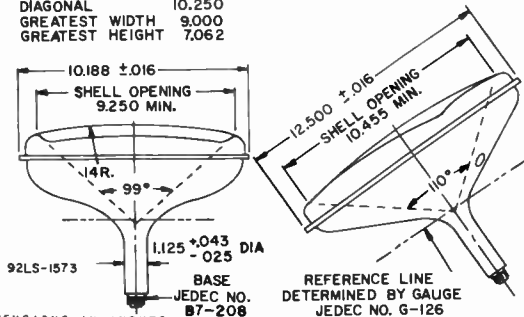
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DIMENSIONAL OUTLINE



MINIMUM SCREEN

DIAGONAL	10.250
GREATEST WIDTH	9.000
GREATEST HEIGHT	7.062



DIMENSIONS IN INCHES



Picture Tube

PAN-O-PLY TYPE

110° MAGNETIC DEFLECTION LOW-VOLTAGE ELECTROSTATIC FOCUS

Direct Interelectrode Capacitances

Control to all other electrodes	5	pF
Grid-No.2 to all other electrodes	6	pF
External inductive coating to anode	500 min—750 max	pF
Heater Current at 6.3 V.	450 ± 20	mA
Heater Warm-Up Time (Average).	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

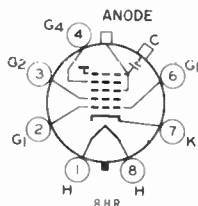
Phosphor	P4—Sulfide Type, Aluminized
For curve, see front of this section	
Faceplate.	Filterglass
Light transmission at center (approx.).	52%

MECHANICAL

Weight (Approx.)	4 lb
Overall Length	8.785 ± .250 in
Neck Length.	4.125 ± .125 in
Projected Area of Screen	60 sq in
External Conductive Coating ^a	
Type (See CE TABLE 1) at top of neck	Regular-Band
Contact type for ground terminal	Near Reference Line
Cap.	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Noveightar 7-Pin, Arrangement 1. (JEDEC No. B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1—Heater
 Pin 2—Grid No. 1
 Pin 3—Grid No. 2
 Pin 4—Grid No. 3
 Pin 5—Grid No. 4
 Pin 6—Anode
 Pin 7—Heater
 Pin 8—Heater
 Pin 9—Anode (Grid No. 1, Grid No. 2, heater, collector)
 Pin 10—External inductive coating



MAXIMUM AND MINIMUM RATINGS. DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage.	9000 min—15000 max	V
Grid-No.4 Voltage		
Positive bias voltage	1100 max	V
Negative bias voltage	550 max	V
Grid-No.2 Voltage.	100 min—250 max	V
Grid-No.1 Voltage		
Positive peak-to-peak voltage	220 max	V
Negative bias voltage	155 max	V
Positive bias voltage	0 max	V
Positive peak-to-peak voltage	2 max	V
Heater Voltage	5.7 min—6.9 max	V



11HP4A

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:	
During equipment warm-up periods	450 max V
After equipment warm-up period	300 max V
Heater positive with respect to cathode:	
Combined AC & DC voltage	200 max V
DC component	100 max V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No. 1

Anode Voltage	11000 V
Grid-No. 4 Voltage	0 V
Grid-No. 2 Voltage	150 V
Cathode Voltage	31 to 49 V

For visual extinction of focused raster

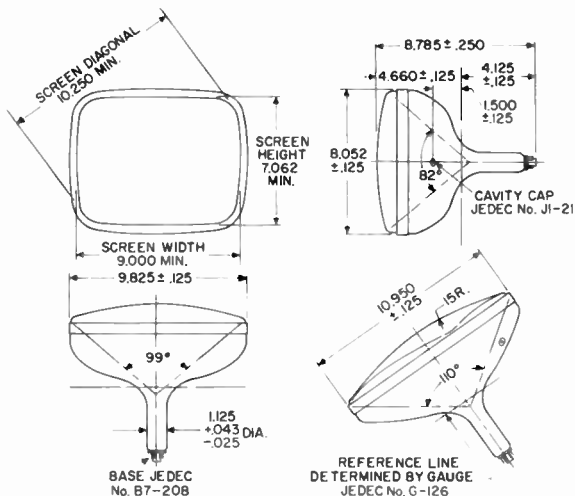
MAXIMUM CIRCUIT VALUE

Grid-No. 1 Circuit Resistance	1.5 max M Ω
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^a Includes implosion protection hardware.

For information regarding conditions, see front
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
 front of this section

DIMENSIONAL OUTLINE (BULB J87B)



92CS 4J44

DIMENSIONS IN INCHES





12AP4

12AP4/1803-P4

KINESCOPE

Heater	Coated Unipotential Cathode	
Voltage	2.5	a-c or d-c volts
Current	2.1	amp.
Focus		Electrostatic
Deflection		Magnetic
Phosphor		No.4
Fluorescence		White
Persistence		Medium
Direct Interelectrode Capacitance:		
Grid No.1 to All Other Electrodes		9 μ f
Overall Length	} Refer to drawings of tube and sleeve	
Maximum Diameter		
Bulb		J-96
Cap		Medium Metal
Base		Medium 6-Pin

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

Maximum Ratings Are Based on a Line-Voltage Design Center of 117 Volts

High-Voltage Electrode (Anode No.2) Volt.	7000 max.	volts
Focusing Electrode (Anode No.1) Volt.	2000 max.	volts
Accelerating Electrode (Grid No.2) Volt.	250 max.	volts
Control Electrode (Grid No.1) Volt.	Never positive	
Fluorescent-Screen Input Power/so cm:		
Fixed Pattern	2.5 max.	mw
Moving Pattern	5.0 max.	mw
Grid Circuit Resistance	1.5 max.	megohms

Typical Operation:

Cathode	{ Should be connected to one side or to mid-tap of heater winding	
Anode No.2 Voltage	6000	7000 volts
Anode No.1 Voltage \square	1240	1460 <u>approx. volts</u>
Grid No.2 Voltage	250	250 volts
Grid No.1 Voltage \circ	Adjusted to give suitable luminous spot	
Grid No.1 Signal-Swing Volt. \blacktriangle	25	25 <u>approx. volts</u>

NOTE: Brilliance and definition decrease with decreasing anode voltages. In general the anode No.2 voltage should not be less than 6000 volts.

\square Supply should be adjustable to $\pm 20\%$ of the value shown.
 \circ Approximately 35% of Grid No.2 voltage is required for current cut-off when, in some applications, it is necessary to use the maximum permissible grid-circuit resistance.

\blacktriangle Peak-to-peak value for good brilliance with good resolution. For greater brilliance, up to twice this value should be available.

Characteristic Curves of phosphor No.4 are shown at the beginning of this section.

\leftarrow Indicates a change.

Jan. 30, 1942

DATA

RCA RADOTRON DIVISION
 RCA MANUFACTURING COMPANY, INC.

World Radio History

12AP4

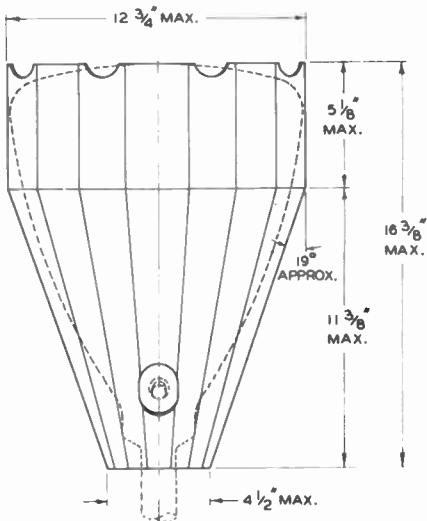


12AP4/1803-P4

KINESCOPE

PROTECTIVE SLEEVE

DO NOT REMOVE SLEEVE
FROM KINESCOPE



Jan. 30, 1942

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY INC

World Radio History

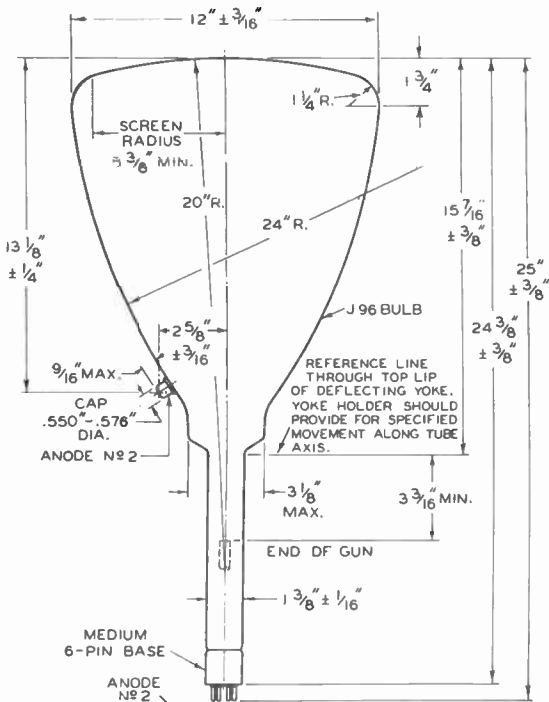
92C-6018



12AP4

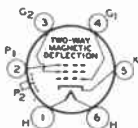
12AP4/1803-P4

KINESCOPE



BOTTOM VIEW OF TUBE

BOTTOM VIEW OF SOCKET CONNECTIONS



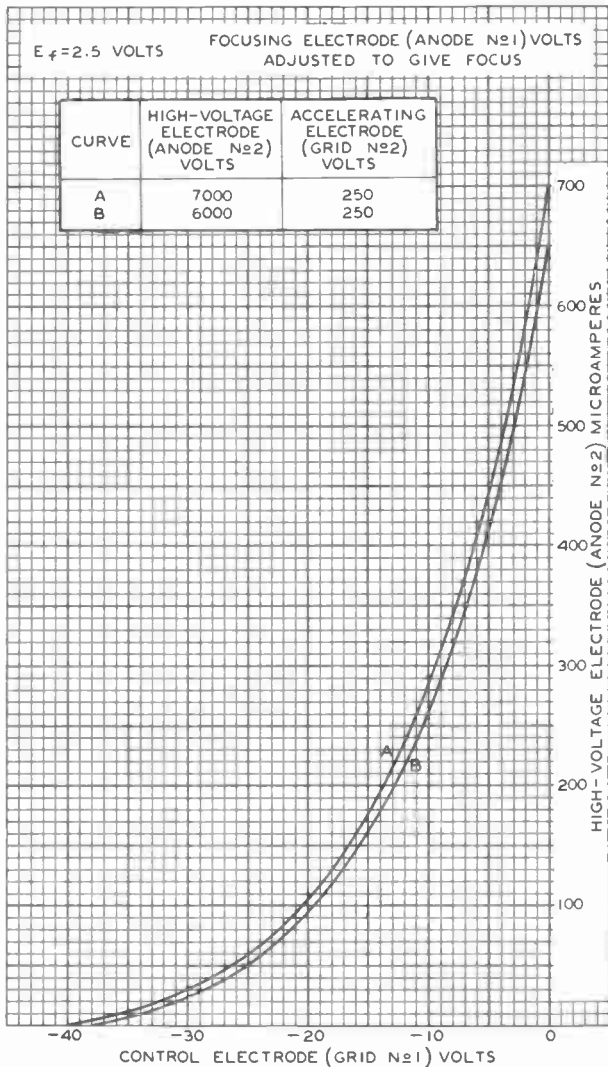
- P2 = Anode No. 2
- P1 = Anode No. 1
- G2 = Grid No. 2 Electrode
- G1 = Control (Grid No. 1) Electrode
- H = Heater
- K = Cathode

12AP4



12AP4/1803-P4

AVERAGE CHARACTERISTICS



12BNP4A

Picture Tube

PAN-O-PLY TYPE
NO ION-TRAP MAGNET REQUIRED

LOW-VOLTAGE ELECTROSTATIC FOCUS
110° MAGNETIC DEFLECTION

Direct Interelectrode Capacitances

Grid-No.4 to all other electrodes	5	pF
Grid-No.2 to all other electrodes	6	pF
Grid-No.1 to all other electrodes	550 min - 850 max	pF
Heater Current at 6.3 V	450 ± 20	mA
Heater Warm-up Time (Average)	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

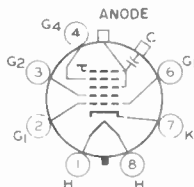
OPTICAL

Phosphor	P4—Sulfide Type, Aluminized
Faceplate	Filterglass
Light transmission at center of screen	49%

MECHANICAL

Weight (Approx.)	5 lb
Overall Length	9.348 ± .250 in
Neck Length	4.375 ± .125 in
Projected Area of Screen . . . . .	.74 sq in
External Conductive Coating	Regular-Band
Capacitor mounting	Near Reference Line
Base	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No. B7-208)
Basing Designation for BOTTOM VIEW	8HR

- Pin 1—Heater
- Pin 2—Grid-No.2
- Pin 3—Grid-No.2
- Pin 4—Grid-No.4
- Pin 5—Grid-No.1
- Pin 6—Anode
- Pin 7—Heater



- C₁—Anode
- C₂—Grid-No.2
- C₃—Grid-No.2
- C₄—Grid-No.4
- C₅—Grid-No.1
- C₆—Anode
- C₇—Heater
- C₈—Heater

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage	9000 min - 15000 max	V
Grid-No.4 Voltage		
Positive bias value	1100 max	V
Negative bias value	550 max	V
Grid-No.2 Voltage	125 min - 550 max	V
Grid-No.1 Voltage		
Positive bias value	220 max	V
Negative bias value	155 max	V
Positive bias value	0 max	V
Positive bias value	2 max	V



RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison N J

12BNP4A

Heater Voltage. 5.7 min - 6.9 max V

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:
 During equipment warm-up period \leq 15 sec. 450 max V
 After equipment warm-up period 300 max V
 Heater positive with respect to cathode:
 Combined AC & DC voltage. 200 max V
 DC component. 100 max V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No. 1

Anode Voltage 13000 V
 Grid-No. 4 Voltage^b. 100 V
 Grid-No. 2 Voltage 140 V
 Cathode Voltage 22 to 42 V
 (for visual distinction of focused raster)
 Field Strength. 0 to 12 G
 (if required, adjustable centering magnet)

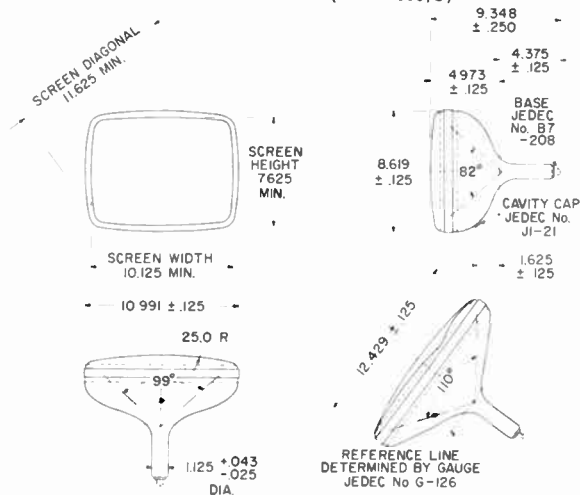
MAXIMUM CIRCUIT VALUE

Grid-No. 1 Circuit Resistance. 1.5 max M Ω

^a Includes implosion protection hardware.

^b The grid-No. 4 voltage required for optimum focus of any individual tube will have a value anywhere between -100 and +300 volts with the combined cathode voltage and video-signal voltage adjusted to give an anode current of 75 microamperes on a 6-3/4-inch by 9-inch pattern from an RCA-2F21 monoscope, or equivalent.

DIMENSIONAL OUTLINE (BULB J99C/E)



92CL-13275

DIMENSIONS IN INCHES





12LP4

KINESCOPE

MAGNETIC FOCUS

MAGNETIC DEFLECTION

12LP4

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 μμf
Cathode to All Other Electrodes 5 μμf
External Conductive Coating to Anode { 3000 max. 14μf
750 min. 4μf

Phosphor (For Curves, see front of this Section) No.4

Fluorescence White

Phosphorescence White

Persistence Medium

Focusing Method Magnetic

Deflection Method Magnetic

Deflection Angle (Approx.) 57°

Ion-Trap Gun Requires External Double-Field Magnet

Overall Length 18-3/4 ± 3/8"

Greatest Diameter of Bulb 12-7/16 ± 1/8"

Screen Diameter 11-3/8"

Raster Size (Approx.) 7-1/2" x 10"

Mounting Position Any

Cap. Recessed Small Cavity

Base Small-Shell Duodecal 7-Pin

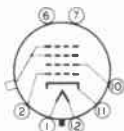
Basing Designation for BOTTOM VIEW 12D

Pin 1-Heater

Pin 2-Grid No.1

Pin 6-No Connection

Pin 7-No Connection



Pin 10-Grid No.2

Pin 11-Cathode

Pin 12-Heater

Cap -Anode, Grid No.3

Maximum Ratings, Design-Center Values:

ANODE VOLTAGE 12000 max. volts

GRID-No.2 VOLTAGE 410 max. volts

GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:

Negative bias value 125 max. volts

Positive bias value 0 max. volts

Positive peak value 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode:

During equipment warm-up period not exceeding 15 seconds 410 max. volts

After equipment warm-up period 150 max. volts

Heater positive with respect to cathode. 150 max. volts

Anode and grid No.3, which are connected together within tube, are referred to herein as anode.

12LP4



12LP4 KINESCOPE

Typical Operation:

Anode Voltage*	9000	11000	volts
Grid-No.2 Voltage.	250	250	volts
Grid-No.1 Voltage for Visual Extinction of Undelected Focused Spot	-27 to -63	-27 to -63	volts
Focusing-Coil Current (DC, Approx.)**.	115	125	ma
Ion-Trap Magnet Current (DC)#.	155	180	ma

Maximum Circuit Values:

Grid-No.1 -Circuit Resistance. 1.5 max. megohms

Minimum Circuit Values:

The power supply should be of the limited-energy type with inherent regulation to limit the continuous short-circuit current to 5 milliamperes. If the supply permits the instantaneous short-circuit current to exceed 1 ampere, or is capable of storing more than 250 microcoulombs, the effective resistance in circuit between indicated electrode and the output capacitor should be as follows:

Grid-No.1 -Circuit Resistance.	150 min.	ohms
Grid-No.2 -Circuit Resistance.	470 min.	ohms
Anode-Circuit Resistance	15000 min.	ohms

The resistors should be capable of withstanding the applied voltages.

- * Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 9000 volts.
- ** For JETEC Focusing Coil No.106, or equivalent, positioned with center line of air gap approximately 3-1/4" from Reference Line (See Outline Drawing). The indicated currents are for the condition with the combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 25 foot-lamberts for 9000 volts, or 30 foot-lamberts for 11000 volts, on a 7-1/2" x 10" picture area.
- # For JETEC Ion-Trap Magnet No.108, or equivalent, located with main pole pieces longitudinally opposite internal pole pieces, and rotated to give good line focus with maximum brightness.

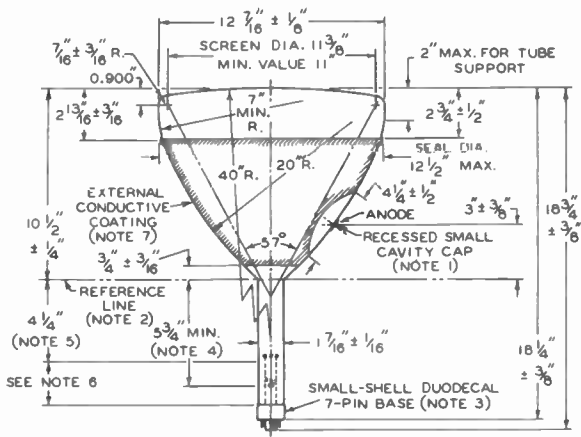
CURVES

The following Grid-Drive Characteristics Curves are for the condition with grid No.1 biased to give visual extinction of the undeflected, focused spot. In viewing television pictures, it will be found that the actual cutoff voltage corresponding to black in the picture is approximately 5 volts less negative than shown on the curves; similarly, the grid-No.1 drive to obtain a given anode current or light output is also about 5 volts less negative.



12LP4 KINESCOPE

12LP4



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No.3 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF 10° . ANODE TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION No.3.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE HINGED GAUGE $1.500" + .003" - .000"$ I.D. AND 2" LONG WILL REST ON BULB CONE.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING DIAMETER OF $1-7/8"$.

NOTE 4: DISTANCE OF INTERNAL POLE PIECES. PLANE THROUGH PIN No.6 AND TUBE AXIS PASSES THROUGH LINE JOINING CENTERS OF POLE PIECES. DIRECTION OF PRINCIPAL FIELD OF ION-TRAP MAGNET SHOULD BE SUCH THAT NORTH POLE IS ADJACENT TO PIN No.6 AND SOUTH POLE TO PIN No.12.

NOTE 5: LOCATION OF DEFLECTING YOKE AND FOCUSING-COIL MUST BE WITHIN THIS SPACE.

NOTE 6: KEEP THIS SPACE CLEAR FOR ION-TRAP MAGNET.

NOTE 7: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDLED.

92CM-7276

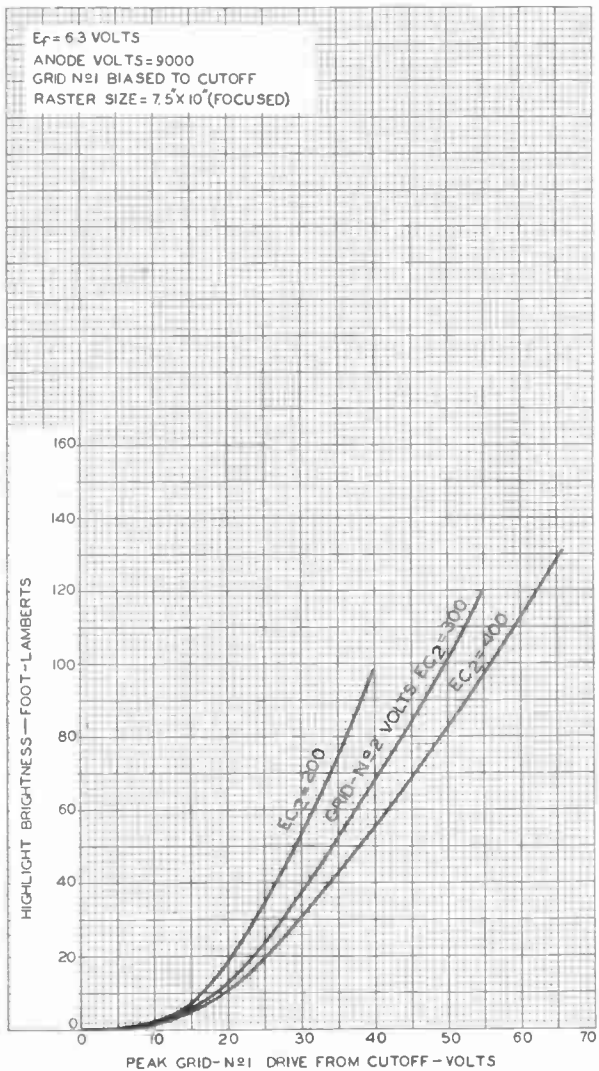
12LP4



12LP4

AVERAGE GRID-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS
 ANODE VOLTS = 9000
 GRID N₂ BIASED TO CUTOFF
 RASTER SIZE = 7.5×10^{-6} (FOCUSED)



JUNE 28, 1949

TUBE DEPARTMENT

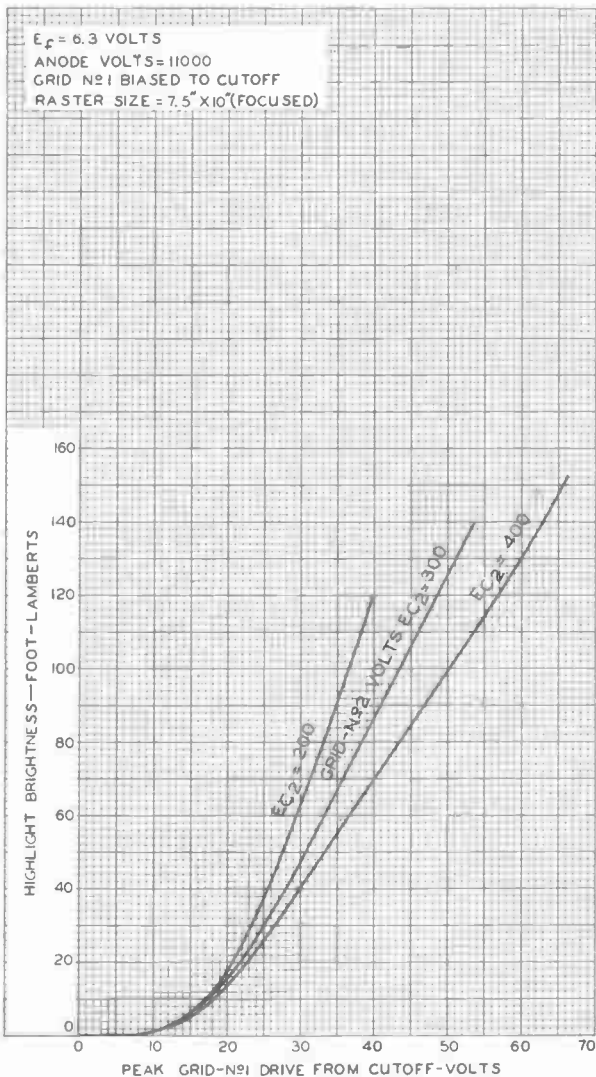
92CM-7309



12LP4

12LP4

AVERAGE GRID-DRIVE CHARACTERISTICS



JUNE 30, 1949

TUBE DEPARTMENT

92CM - 7310

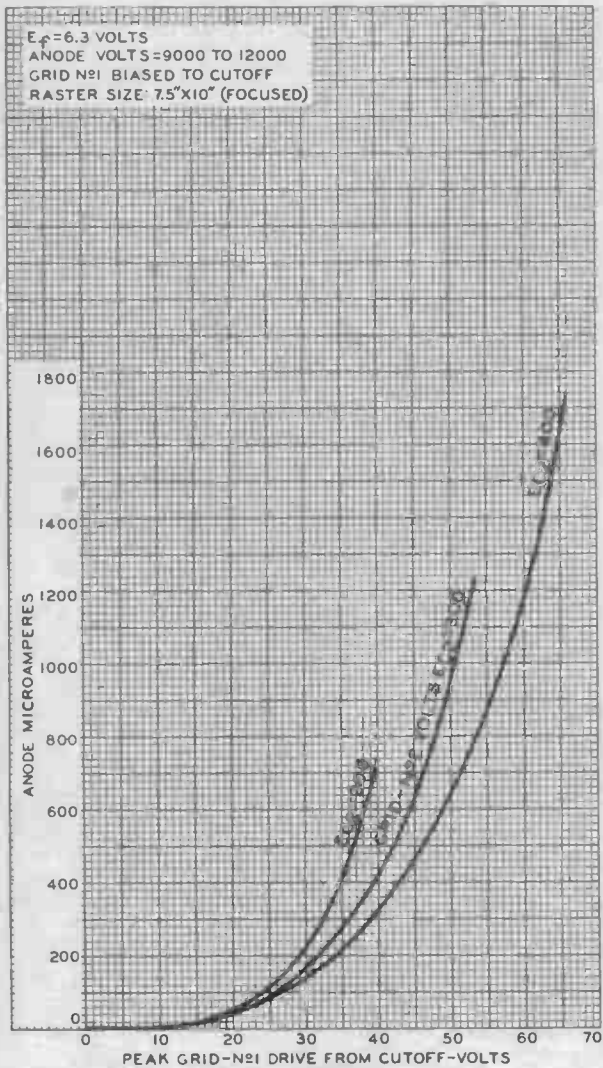
12LP4



12LP4

AVERAGE GRID-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS
 ANODE VOLTS = 9000 TO 12000
 GRID N₂ BIASED TO CUTOFF
 RASTER SIZE: 7.5" X 10" (FOCUSED)



JUNE 23, 1949

TUBE DEPARTMENT

92CM-7306

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History



12SP7

12SP7

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

MAGNETIC DEFLECTION

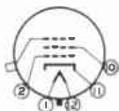
DATA

General:

Heater, for Unipotential Cathode:			
Voltage.	6.3	. . . . .	ac or dc volts
Current.	0.6	. . . . .	amp
Direct Interelectrode Capacitances:			
Grid No.1 to All Other Electrodes.	6		$\mu\mu\text{f}$
Cathode to All Other Electrodes.	5		$\mu\mu\text{f}$
Phosphor			P7
Fluorescence			Blue
Phosphorescence.			Greenish-Yellow
Persistence.			Long
Focusing Method.			Magnetic
Deflection Method.			Magnetic
Deflection Angle (Approx.)			54°
Overall Length	18-3/4"	±	3/8"
Greatest Diameter of Bulb.	12-7/16"	±	1/8"
Minimum Useful Screen Diameter			11"
Mounting Position.			Any
Cap.	Recessed Small Cavity (JETEC No. J1-21)		
Base	Small-Shell Duodecal 5-Pin (JETEC No. B5-57)		

BOTTOM VIEW

Pin 1 - Heater
 Pin 2 - Grid No.1
 Pin 10 - Grid No.2



Pin 11 - Cathode
 Pin 12 - Heater
 Cap - Anode

Maximum Ratings, Design-Center Values:

ANODE VOLTAGE.	10000 max.	volts
GRID-No.2 VOLTAGE:		
Positive value (DC or Peak AC)	410 max.	volts
Negative value (DC or Peak AC)	180 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value.	180 max.	volts
Positive bias value*	0 max.	volts
Positive peak value.	2 max.	volts
PEAK GRID-No.1 DRIVE FROM CUTOFF	65 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	125 max.	volts

Typical Operation:

Anode Voltage*	9000	volts
Grid-No.2 Voltage.	250	volts

* At or near this rating, the effective resistance of the anode supply should be adequate to limit the anode input power to 6 watts.
 * Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 8000 volts.

12SP7



12SP7

OSCILLOGRAPH TUBE

Grid-No.1 Voltage for Visual Extinction of Undelected Focused Spot.	-27 to -63	volts
Grid-No.2 Current.	-15 to +15	μ amp
Focusing-Coil Current (DC)**	107 \pm 10%	ma
Spot Position.	**	

Maximum Circuit Values:

Grid-No.1-Circuit Resistance 1.5 max. megohms

** For specimen focusing coil similar to JETEC No.106 with air gap toward tube face, center line of air gap 3-1/4" from Reference Line (see Outline Drawing), and total anode current of 200 microamperes.

** The center of the undeflected, unfocused spot will fall within a circle having 18-mm radius concentric with the center of the tube face.

OPERATING NOTES

X-Ray Warning. When operated at or below the maximum ratings shown in the tabulated data, the 12SP7 does not produce any harmful x-ray radiation. All types of cathode-ray tubes may be operated at voltages (if ratings permit) up to 16 kilovolts (absolute value) without personal injury on prolonged exposure at close range. Above 16 kilovolts, special shielding precautions for x-ray radiation may be necessary.

AUG. 1, 1951

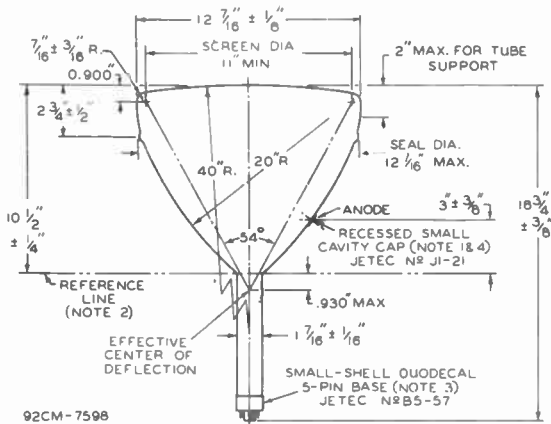
TENTATIVE DATA



12SP7

12SP7

OSCILLOGRAPH TUBE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No.3 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 10^\circ$. ANODE TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION No.3.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE REFERENCE-LINE GAUGE (JETEC No. 112) $1.500" + .003" - .000"$ I.D. AND 2" LONG WILL REST ON BULB CONE.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING DIAMETER OF $1-\frac{7}{8}$ ".

NOTE 4: TUBE SUPPORT MUST BE KEPT AT LEAST 2" AWAY FROM ANODE CAP.

12SP7

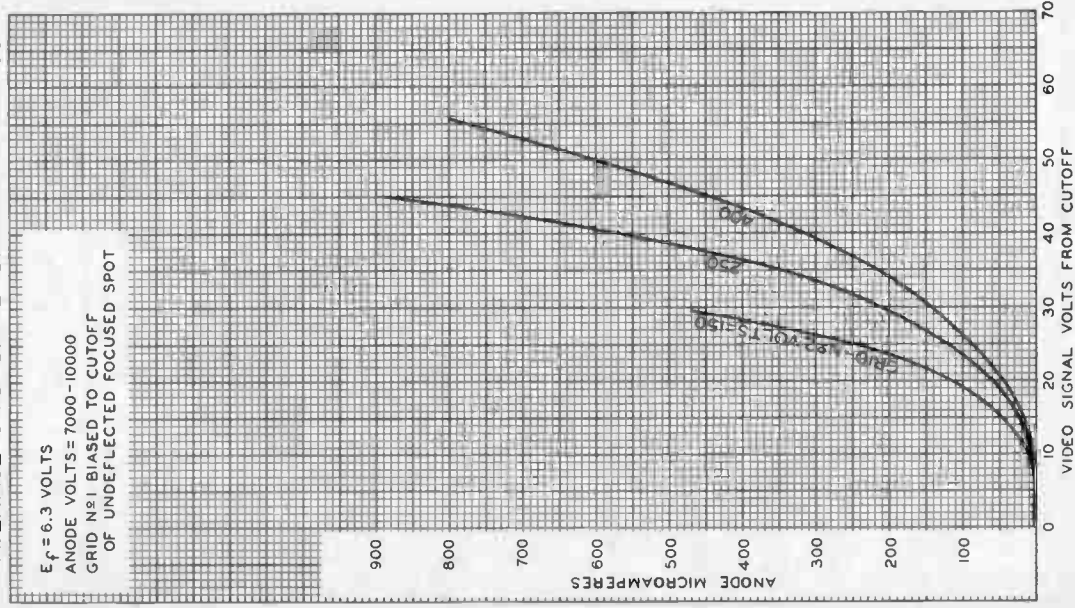


12SP7

AVERAGE GRID-DRIVE CHARACTERISTICS

 $E_f = 6.3$ VOLTS

ANODE VOLTS = 7000 - 10000

GRID N₂1 BIASED TO CUTOFF
OF UNDEFLECTED FOCUSED SPOT

MAR. 20, 1951

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7615

Picture Tube

MAGNETIC FOCUS **RECTANGULAR GLASS TYPE** **70° MAGNETIC DEFLECTION**

GENERAL DATA

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to anode	} 2000 max. 750 min.	pf pf

Heater Current at 6.3 volts 600 ± 30 ma
 Electron Gun. Ion-Trap Type Requiring External Single-Field Magnet

Optical:

Phosphor (For Curves, see front of this Section). .P4—Sulfide Type Faceplate, Spherical. Filterglass
 Light transmission (Approx.). 66%

Mechanical:

Weight (Approx.). 10 lbs
 Overall Length. 16-15/32" ± 3/8"
 Neck Length 7 3/16" ± 3/16"
 Projected Area of Screen. 96 sq.in.

External Conductive Coating:

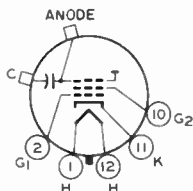
Type. Regular-Band
 Contact area for grounding. Near Reference Line

For Additional Information on Coatings and Dimensions:

See *Picture-Tube Dimensional-Outlines and Bulb J109-1/2 A/C* sheets at front of this section

Cap Recessed Small Cavity (JFDFC No.J1-21)
 Base. Small-Shell Duodecal 5-Pin (JFDFC Group 4, No.85-57)
 Basing Designation for BOTTOM VIEW. 12N

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater



- Cap—Anode (Grid No.3, Screen, Collector)
- C—External Conductive Coating

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE	15500 max.	volts
GRID-No.2 VOLTAGE	450 max.	volts



14EP4

GRID-NO.1 VOLTAGE:

Negative bias value	140 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE.	{ 6.9 max.	volts
	{ 5.7 min.	volts

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	165 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage.	165 max.	volts
DC component.	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	12000	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster.	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section





14CP4

KINESCOPE

RECTANGULAR GLASS TYPE

MAGNETIC FOCUS

MAGNETIC DEFLECTION

14CP4

DATA

General:

Heater, for Unipotential Cathode;
 Voltage 6.3 ac or dc volts
 Current 0.6 amp

Direct Interelectrode Capacitances:

Grid No.1 to All Other Electrodes. 6 $\mu\mu\text{f}$
 Cathode to All Other Electrodes. 5 $\mu\mu\text{f}$
 External Conductive Coating to Anode $\left\{ \begin{array}{l} 2000 \text{ max.} \\ 750 \text{ min.} \end{array} \right. \mu\mu\text{f}$

Face Plate (With about 66% light transmission) Filterglass
 Phosphor (For Curves, see front of this Section) P4—Sulfide Type
 Fluorescence and Phosphorescence White
 Persistence of Phosphorescence Short

Focusing Method Magnetic
 Deflection Method Magnetic

Deflection Angles (Approx.):

Diagonal 70°
 Horizontal 65°
 Vertical 50°

Ion-Trap Gun Requires External, Single-Field Magnet

Overall Length 16-3/4" ± 3/8"

Greatest Diagonal of Tube at Face 13-11/16" ± 1/8"

Greatest Width of Tube at Face 12-17/32" ± 1/8"

Greatest Height of Tube at Face 9-23/32" ± 1/8"

Screen Size 11-3/8" x 8-1/2"

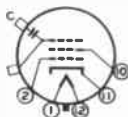
Mounting Position Any

Cap. Recessed Small Cavity (JETEC No.J1-21)

Base Small-Shell Duodecal 5-Pin (JETEC No.85-57)

BOTTOM VIEW

Pin 1-Heater
 Pin 2-Grid No.1
 Pin 10-Grid No.2
 Pin 11-Cathode



Pin 12-Heater
 Cap-Anode
 C-External
 Conductive
 Coating

Maximum Ratings, Design-Center Values:

ANODE VOLTAGE 14000 max. volts

GRID-No.2 VOLTAGE 410 max. volts

GRID-No.1 VOLTAGE:

Negative bias value 125 max. volts

Positive bias value 0 max. volts

Positive peak value 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode:

During equipment warm-up period
 not exceeding 15 seconds 410 max. volts

After equipment warm-up period. 150 max. volts

Heater positive with respect to cathode 150 max. volts

AUG. 1, 1951

TUBE DEPARTMENT

TENTATIVE DATA

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

I4CP4



I4CP4

KINESCOPE

Typical Operation:

Anode Voltage*	12000	volts
Grid-No.2 Voltage.	300	volts
Grid-No.1 Voltage for Visual Extinction of Undelected Focused Spot.	-33 to -77	volts
Focusing-Coil Current (DC, approx.) [•]	92	ma
Field Strength of Single-Field Ion-Trap Magnet (Approx.) [#]	35	gausses

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
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* Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 10000 volts.

• For specimen focusing coil similar to JETEC Focusing Coil No.109 positioned with airgap toward kinescope screen and center line of air gap 3 inches from Reference Line (see Outline Drawing). The indicated current is for condition with combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 35 foot-lamberts on an 11-3/8" x 8-1/2" picture area sharply focused at center of screen.

Measured at center of field with General Electric Gauss Meter, Cat. No.409X51.

OPERATING NOTES

X-Ray Warning. When operated at or below the maximum ratings shown in the tabulated data, the I4CP4 does not produce any harmful x-ray radiation. All types of picture tubes may be operated at voltages (if ratings permit) up to 16 kilovolts (absolute value) without personal injury on prolonged exposure at close range. Above 16 kilovolts, special shielding precautions for x-ray radiation may be necessary.

Direction of the field of the ion-trap magnet should be such that the north pole is adjacent to vacant pin position No.8 and the south pole to pin No.2.

AUG. 1, 1951

TUBE DEPARTMENT

TENTATIVE DATA

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

14CP4



World Radio History

AVERAGE GRID-DRIVE CHARACTERISTICS

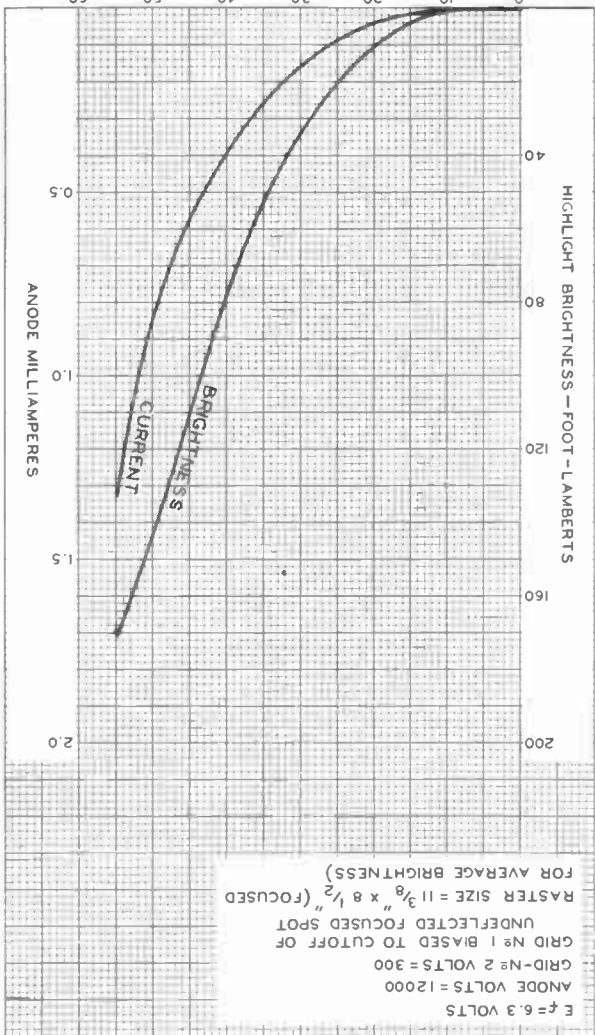
$E_f = 6.3$ VOLTS

ANODE VOLTS = 12000

GRID-N₂ 2 VOLTS = 300

GRID N₁ BIASED TO CUTOFF OF UNDEFLECTED FOCUSED SPOT

RASTER SIZE = $11 \frac{3}{8}$ " x $8 \frac{1}{2}$ " (FOCUSED FOR AVERAGE BRIGHTNESS)



92CM-7625

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TUBE DEPARTMENT

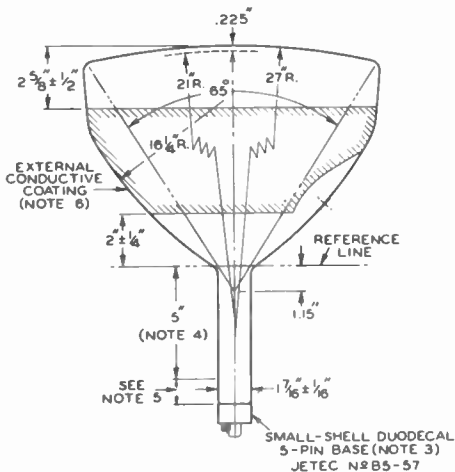
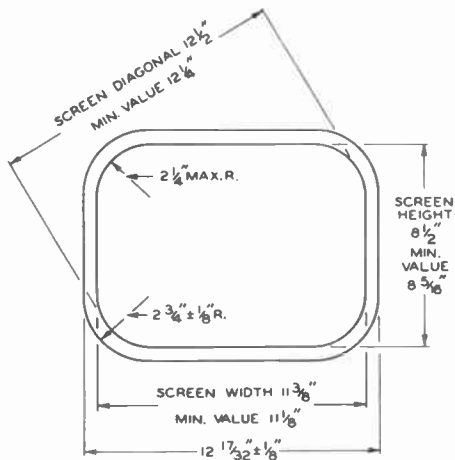
APRIL 11, 1951

14CP4



14CP4

KINESCOPE



AUG. 1, 1951

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

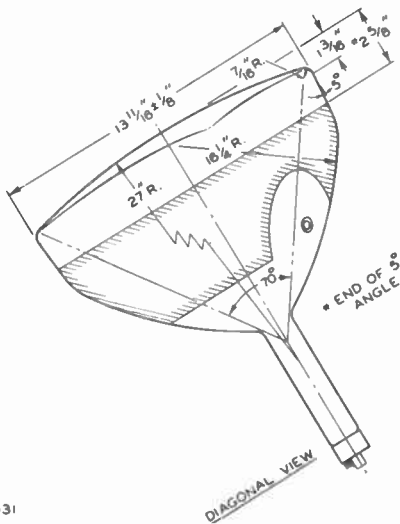
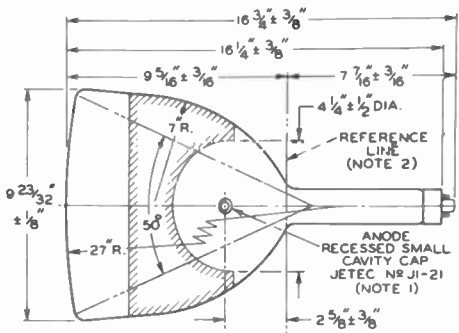
CE-7631A



14CP4

KINESCOPE

14CP4



92CL-7631

I4CP4



I4CP4

KINESCOPE

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No.6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 3D^{\circ}$. ANODE TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION No.6.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No.11D (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-1/2".

NOTE 4: LOCATION OF DEFLECTING YOKE AND FOCUSING DEVICE MUST BE WITHIN THIS SPACE.

NOTE 5: KEEP THIS SPACE CLEAR FOR SINGLE-FIELD, ION-TRAP MAGNET.

NOTE 6: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

AUG. 1, 1951

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

CE-7631C

14QP4B

Picture Tube

**RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS**

**ALUMINIZED SCREEN
70° MAGNETIC DEFLECTION**

Electrical:

Direct Inter-electrode Capacitance:		
Cathode to all other electrodes	5	pf
Grid No. 1 to all other electrodes	6	pf
External Inductively-Coupled Anode	(1000 max. 600 min.)	pf
Heater Current at 5.5 volt	600 ± 60	ma
Heater Warm-Up Time (A.C. only)	11	seconds
Electron Gun	Type E—Ring No Ion-Trap Magnet	

Optical:

Phosphor (For Curves, see front of this section)	P4—Sulfide Type, Aluminized
Faceplate	Filterglass
Light transmission (Approx.)	76%

Mechanical:

Weight (Approx.)	10 lbs
Overall Length	16-1/2" ± 3/8"
Neck Length	6-7/8" ± 3/16"
Projected Area of Neck	36 sq. in.

External Conductive Coating:

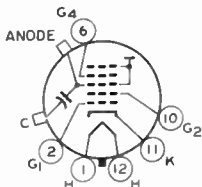
Type Scalloped-Band
Contact Near Reference Line
For Additional Information on Coating, Dimensions, and Deflection Angles:

See *Picture-Tube Dimensional-Outlines and Bulb J100-112 AIC* sheets at front of this section.

Cap. Reduced Small Cavity (JEDEC No. J1-21)
Base Small-Shell Duodecal Pin Arrangement 1
(JEDEC Group 4, No. B6-63)

Base Designation for BOTTOM VIEW 1z1

- Pin 1—Heater
- Pin 2—Grid No. 1
- Pin 6—Grid No. 4
- Pin 10—Grid No. 2
- Pin 11—Cathode
- Pin 12—Heater



- Cap—Anode
- (Grid No. 3,
- Grid No. 5,
- Screen,
- Collector)
- C—External
Conductive
Coating

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	12000 max.	volts
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14QP4B

Grid-No.1 (Focus) Voltage:

Positive value	1100 max.	volts
Negative value	150 max.	volts
Grid-No.2 Voltage	150 max.	volts

Grid-No.2 Voltage:

Negative peak value	100 max.	volts
Negative bias value	150 max.	volts
Positive bias value	0 max.	volts
Positive peak value	0 max.	volts
Heater Voltage	{ 6.9 max. 5.7 min.	{ volts volts

Peak Heater-Cathode Voltage:

Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	9000	volts
Grid-No.4 Voltage	-50 to 250	volts
Grid-No.2 Voltage	250	volts
Grid-No.1 Voltage for visual extinction of focused raster	-24 to -64	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
 at front of this Section



Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
90° MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes 5 pf
Grid No.1 to all other electrodes 6 pf

External conductive coating to anode. $\begin{cases} 1200 \text{ max.} & \text{pf} \\ 800 \text{ min.} & \text{pf} \end{cases}$

Heater Current at 6.3 volts 600 ± 30 ma

Heater Warm-Up Time (Average) 11 seconds

Electron Gun. Type Requiring No Ion-Trap Magnet

Optical:

Phosphor (for curves, see front of this section). P4—Sulfide Type, Aluminized

Faceplate, Spherical. Filterglass

Light transmission (Approx.). 78%

Mechanical:

Weight (Approx.). 8.5 lbs

Overall Length. $13\text{-}3/16" \pm 5/16"$

Neck Length. $5\text{-}1/2" \pm 3/16"$

Projected Area of Screen. 104 sq. in.

External Conductive Coating:

Type. Regular-Band

Contact area for grounding. Near Reference Line

For Additional Information on Coatings and Dimensions:

See *Picture-Tube Dimensional-Outlines and Bulb J112 A/B* sheets at front of this section

Cap Recessed Small Cavity (JEDEC No.J1-21)

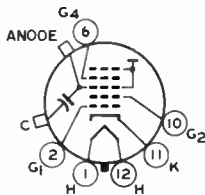
Bases (Alternates):

Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-63)

Short Small-Shell Duodecal 6-Pin (JEDEC No.B6-203)

Basing Designation for BOTTOM VIEW. 12L

Pin 1—Heater
Pin 2—Grid No.1
Pin 6—Grid No.4
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater



Cap—Anode
(Grid No.3,
Grid No.5,
Screen,
Collector)
C—External
Conductive
Coating



14WP4

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE.	{ 15500 max. 9000 min.	volts volts
GRID-No. 4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
GRID-No. 2 VOLTAGE	550 max.	volts
GRID-No. 1 VOLTAGE:		
Negative peak value.	220 max.	volts
Negative bias value.	200 max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts
HEATER VOLTAGE	{ 6.9 max. 5.7 min.	volts volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage.	200 max.	volts
DC component.	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage.	12000	volts
Grid-No.4 Voltage.	-50 to + 350	volts
Grid-No.2 Voltage.	300	volts
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



15AEP22

Color Picture Tube

This data sheet is to be used in conjunction with data for RCA-15NP22

For general data, maximum and minimum ratings, equipment design ranges, limiting circuit values, and terminal diagram of the 15AEP22, refer to 15NP22 except as noted below.

MECHANICAL

Tube Dimensions (excluding mounting lugs):

Diagonal $14.910 \pm .093$ in (378.21 ± 2.36 mm)

Greatest width $12.949 \pm .093$ in (328.90 ± 2.36 mm)

Greatest height (including tension-band clip) $10.613 \pm .100$ in (269.57 ± 2.54 mm)

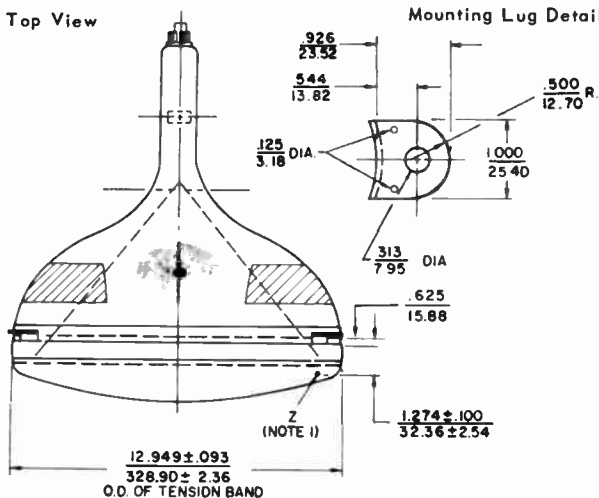
Weight (Approx.) 11.3 lb (5.1 kg)

DIMENSIONAL OUTLINE

Dimensions shown are only those which are different from the corresponding dimensions for the 15NP22.

Top View

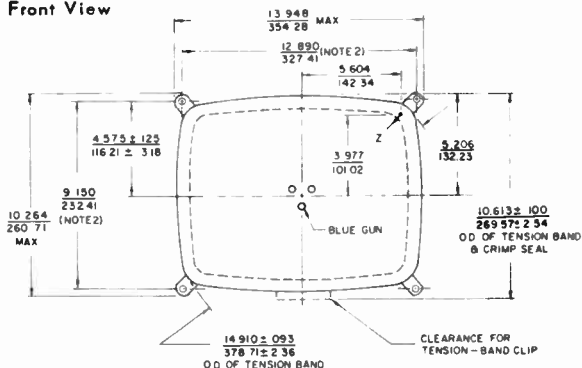
Mounting Lug Detail



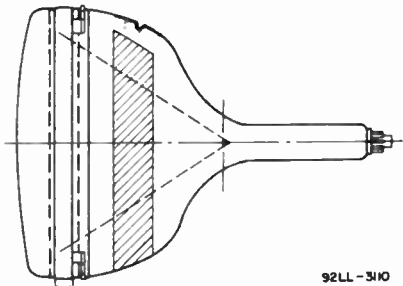
15AEP22

DIMENSIONAL OUTLINE (Cont'd)

Front View



Front Side View



Dimensions in $\frac{\text{Inches}}{\text{mm}}$ unless otherwise noted.

Note 1: "Z" is located on the outside surface of the faceplate, on the screen diagonal at a point .094 in (2.39 mm) beyond the minimum screen. This point is used as a reference for the mounting lugs.

Note 2: The tolerance of the mounting lug holes will accommodate mounting screws up to 0.250 in (6.35 mm) in diameter when positioned on the true hole centers.



16ADP7

OSCILLOGRAPH TUBE

METAL-SHELL ENVELOPE

MAGNETIC FOCUS

MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

Voltage 6.3 ac or oc volts

Current 0.6 amp

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to All Other Electrodes 6 μf

Cathode to All Other Electrodes 5 μf

Faceplate, Spherical Filterglass

Light Transmission (Approx.) 66%

Phosphor (For Curves, see front of this Section) P7

Fluorescence Blue

Persistence Short

Phosphorescence Greenish-Yellow

Persistence Long

Focusing Method Magnetic

Deflection Method Magnetic

Deflection Angle (Approx.) 53°

Maximum Overall Length 22"

Greatest Diameter at Lip 15-7/8" + 1/8"

Minimum Useful Screen Diameter 14-3/8"

Ultor* Terminal Metal-Shell Lip

Mounting Position Any

Base Small-Shell Duodecal 7-Pin (JETEC No. B7-51)

OTTOM VIEW

- Pin 1 - Heater
- Pin 2 - Grid No. 1
- Pin 6 - No Connection
- Pin 7 - No Connection



- Pin 10 - Grid No. 2
- Pin 11 - Cathode
- Pin 12 - Heater
- Cap - Ultor (Grid No. 3, Collector)

Maximum Ratings, Design-Center Values:

ULTOR* VOLTAGE 14000 max. volts

GRID-No. 2 VOLTAGE:

Positive value (DC or Peak AC) 410 max. volts

Negative value (DC or Peak AC) 180 max. volts

GRID-No. 1 VOLTAGE:

Negative bias value 180 max. volts

Positive bias value φ 0 max. volts

Positive peak value 2 max. volts

PEAK GRID-No. 1 DRIVE FROM CUTOFF 65 max. volts

* In the 16ADP7, grid No. 3 which has the ultor function, and collector are connected together within the tube and are conveniently referred to collectively as "ultor". The "ultor" in a cathode-ray tube is the electrode, or the electrode in combination with one or more additional electrodes connected within the tube to it, to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection.

φ At or near this rating, the effective resistance of the ultor supply should be adequate to limit the ultor input power to 6 watts.

FEB. 1, 1952

TUBE DEPARTMENT

TENTATIVE DATA

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

16ADP7



16ADP7 OSCILLOGRAPH TUBE

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode .	125 max.	volts
Heater positive with respect to cathode .	125 max.	volts

Typical Operation:

Ultor Voltage [*]	12000	volts
Grid-No.2 Voltage	250	volts
Grid-No.1 Voltage for Visual Extinction of Undelected Focused Spot	-27 to -63	volts
Grid-No.2 Current	-15 to +15	μamp
Focusing-Coil Current (DC) ^{oo}	95 ± 15%	ma
Spot Position	**	

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
---------------------------------------	----------	---------

* Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 8000 volts.

^{oo} For specimen focusing coil similar to JETEC Focusing Coil No.109 positioned with air gap toward faceplate and center line of air gap 3-1/4" from Reference Line (see Outline Drawing) and ultor current of 200 microamperes.

** The center of the undeflected, unfocused spot will fall within a circle having 25-mm radius concentric with the center of the tube face.

16BGP4

Picture Tube

PAN-O-PLY — INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands around Periphery of Tube Panel— No Separate Safety-Glass or Integral Protective Window Required)

RECTANGULAR GLASS TYPE ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS 114° MAGNETIC DEFLECTION
NO ION-TRAP MAGNET REQUIRED

Electrical:

Direct Interelectrode Capacitances:

Grid No.1 to all other electrodes	b	μf
Cathode to all other electrodes	5	pf
External conductive coating to anode ^a	$\left\{ \begin{array}{l} 1500 \text{ max.} \\ 800 \text{ min.} \end{array} \right.$	pf
		pf

Heater Current at 6.3 volts 450 ± 20 ma

Heater Warm-Up Time (Average) 11 seconds

Electron Gun Type Requiring No Ion-Trap Magnet

Optical:

Phosphor (for curves, see front of this section) . . P4—Sulfide Type
Aluminized

Faceplate Filterglass

Light transmission at center (Approx.) 54%

Mechanical:

Weight (Approx.) 9.5 lbs

Overall Length 10.569" ± .242"

Neck Length 4.375" ± .125"

Projected Area of Screen 125 sq. in.

External Conductive Coating:

Type Regular Band

Contact area for grounding Near Reference Line

For Additional Information on Coatings, Dimensions, and Deflection Angles, See *Picture-Tube Dimensional-Outlines* and *Bulb J125 B* sheets at front of this Section

Cap Recessed Small Cavity (JEDEC No. J1-21)

Base Small-Button Noveightar 7-Pin,
Arrangement 1, (JEDEC No. B7-208)

Basing Designation for BOTTOM VIEW BHR

Pin 1—Heater

Pin 2—Grid No.1

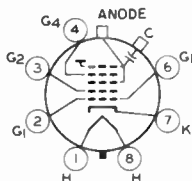
Pin 3—Grid No.2

Pin 4—Grid No.4

Pin 6—Grid No.1

Pin 7—Cathode

Pin 8—Heater



Cap—Anode
(Grid No.3,
Grid No.5,
Screen,
Collector)
C—External
Conductive
Coating



16BGP4

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	{ 20000 max. volts 12000 min. volts
Grid-No.4 Voltage:	
Positive value	1100 max. volts
Negative value	550 max. volts
Grid-No.2 Voltage	{ 550 max. volts 200 min. volts
Grid-No.1 Voltage:	
Negative peak value	220 max. volts
Negative bias value	155 max. volts
Positive bias value	0 max. volts
Positive peak value	2 max. volts
Heater Voltage	{ 6.9 max. volts 5.7 min. volts
Peak Heater-Cathode Voltage:	
Heater negative with respect to cathode:	
During equipment warm-up period	
not exceeding 15 seconds	450 max. volts
After equipment warm-up period	300 max. volts
Heater positive with respect to cathode:	
Peak value	200 max. volts
DC component	100 max. volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	16000	volts
Grid-No.4 Voltage ^b	100	volts
Grid-No.2 Voltage	300	volts
Cathode Voltage for visual extinction		
of focused raster	28 to 60	volts
Field Strength of required adjustable		
centering magnet	0 to 8	gauss

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
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^a Includes implosion protection hardware.

^b The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between -100 and +300 volts with the combined cathode voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 9-inch by 12-inch pattern from an RCA-2F21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section



16CHP4A

Picture Tube

PAN-O-PLY TYPE
114° MAGNETIC DEFLECTION

LOW-VOLTAGE ELECTROSTATIC FOCUS
LOW GRID-No.2 VOLTAGE

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid-No.1 to all other electrodes	6	pF
External grid to grid-to-focus ^a	1000 min—1500 max	pF
Heater Current at 6.3 V	450 ± 20	mA
Heater Warm-Up Time (Average)	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	
Focus Lens	Unipotential	

OPTICAL

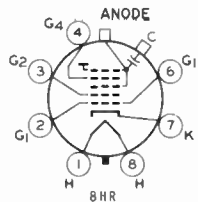
Phosphor	P4—Sulfide Type, Aluminized
Faceplate	Filterglass
Light transmittance at center of screen	54%

MECHANICAL

Weight (Approx.)	9.5 lb
Overall Length	10.569 ± .242 in
Neck Length	4.375 ± .125 in
Projected Area of Screen	125 sq in
External Conductive Coating	
Type (see CAP OUTLINE 2 at front of this section)	Regular-Band
Location (see front of drawing)	Near Reference Line
Cap	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No. B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1—Heater
Pin 2—Grid No. 1
Pin 3—Grid No. 2
Pin 4—Grid No. 3
Pin 6—Grid No. 4
Pin 7—Anode
Pin 8—Heater
G1—Anode (Grid No. 5, Grid No. 6, Screen, Collector)
C—External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to grid No. 1

Anode Voltage	12000 min—20000 max	V
Grid-No.4 Voltage		
Positive value	1250 max	V
Negative value	400 max	V
Cathode Voltage		
Negative peak value	2 max	V
Negative bias value	0 max	V
Positive bias value	100 max	V
Positive peak value	150 max	V



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Electronic Components and Devices
Harrison, N. J.

DATA
7-67

16CHP4A

Grid-No.2 Voltage	20 min—60 max	V
Heater Voltage	5.7 min—6.9 max	V
Peak Heater-Cathode Voltage		
for a 100 microampere current		
during operation with $i_{a1} \leq 1.5$	450 max	V
after adjustment of r-m-a prior	300 max	V
to a 100 microampere current		
with a 100 microampere current	200 max	V
at 100 microampere current	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No. 1

Anode Voltage	16000	V
Grid-No.4 Voltage ^b	100	V
Grid-No.2 Voltage	30	V
Cathode Voltage	22 to 45	V
for a field strength of 0 to 8		
Field Strength	0 to 8	G

MAXIMUM CIRCUIT VALUE

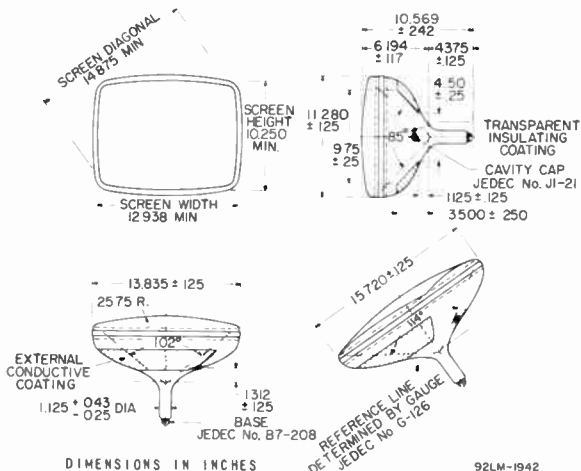
Grid-No.1 Circuit Resistance	1.5 max	M.
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^a Includes explosion protection hardware.

^b The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between -100 and +100 volts with the combined cathode voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 9-inch by 12-inch pattern from an RCA-2F21 monoscope, or equivalent.

See A-RADIATION PRECAUTIONS at front of this section

DIMENSIONAL OUTLINE (BULB J125 B2A)



DIMENSIONS IN INCHES

92LM-1942



16CMP4A

Picture Tube

PAN-O-PLY TYPE

114° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid-No.1 to all other electrodes	6	pF
Control Grid to all other electrodes	1000 min—1500 max	pF

Heater Current at 6.3 V 450 ± 20 mA

Heater Warm-Up Time (Average) 11 s

Electron Gun Type Requiring No Ion-Trap Magnet

OPTICAL

Phosphor P4—Sulfide Type, Aluminized
for curves, on front of the section

Faceplate Filterglass
Light transmission for 400 mμ 54%

MECHANICAL

Weight (Approx.) 9.5 lb

Overall Length 10.569 ± 0.242 in

Neck Length 4.375 ± 0.125 in

Projected Area of Screen 125 sq in

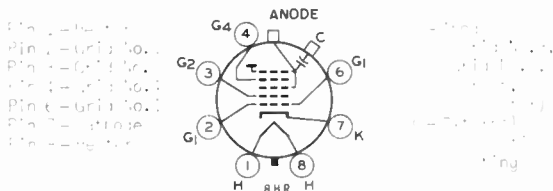
External Conductive Coating^a

Type 1—Chromium Regular-Band
Contact area for grounding Near Reference Line

Cap Recessed Small Cavity (JEDEC No. J1-21)

Base Small-Button Neoeight 7-Pin,
Arrangement 1. (JEDEC No. B7-208)

TERMINAL DIAGRAM (Bottom View)



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage 10000 min—18000 max V

Grid-No.4 Voltage

Positive value 1100 max V

Negative value 550 max V

Grid-No.2 Voltage 200 min—550 max V

Grid-No.1 Voltage

Positive peak value 220 max V

Negative value 155 max V

Positive bias value 0 max V

Negative bias value 2 max V



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16CMP4A

Heater Voltage	5.7 min—6.9 max	V
Peak Heater-Cathode Voltage		
Heater relative with respect to cathode:		
During equipment warm-up periods (1)	450 max	V
After equipment warm-up period	300 max	V
Heater to filament with respect to cathode:		
Combined AC & DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No. 1

Anode Voltage	16000	V
Grid-No. 4 Voltage	-100 to 300	V
Grid-No. 2 Voltage	300	V
Cathode Voltage	28 to 60	V
Control grid extension or to lead resistor		
Field Strength	0 to 8	G
Control grid to anode centering magnet		

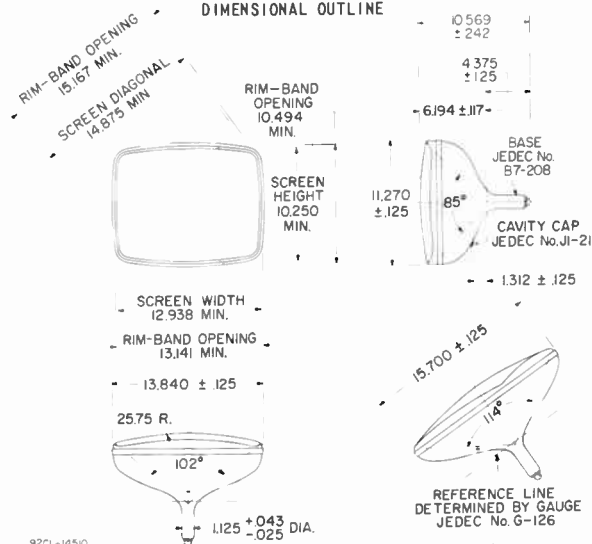
MAXIMUM CIRCUIT VALUE

Grid-No. 1 Circuit Resistance	1.5 max	M.
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^a Includes explosion protection hardware.

For X-ray radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
 at front of this section.

DIMENSIONAL OUTLINE



92CL-14510

DIMENSIONS IN INCHES

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16RP4B

Picture Tube

MAGNETIC FOCUS NO ION-TRAP MAGNET REQUIRED 70° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances

Grid-No.1 to Heater	5	pF
Grid-No.1 to Grid-No.2	6	pF
Grid-No.1 to Grid-No.3	2000 max	pF
Grid-No.1 to Collector	750 min	pF
Heater Current at 6.3 V.	600 ± 30	mA

Electron Gun Type Requiring No Ion-Trap Magnet

OPTICAL

Phosphor	P4—Sulfide Type, Aluminized
Faceplate	Filterglass
Light Transmission (Approx.)	66%

MECHANICAL

Weight (Approx.)	16 lb
Overall Length	18.750 ± 0.375 in
Neck Length	7.500 ± 0.188 in
Projected Area of Screen	139 sq in

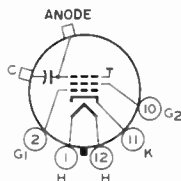
External Conductive Coating Regular-Band
Contact for Ion Trapping Near Reference-Line

For Additional Information on Coatings and Dimensions

See Picture-Tube Dimensional-Outlines on Bulb J129A B Sheets at front of this section

Cap.	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Shell Duodecal 5-Pin (JEDEC Group 4, No. B5-57)
Basing Designation for BOTTOM VIEW	12N

- Pin 1—Heater
- Pin 2—Grid-No.2
- Pin 3—Grid-No.1
- Pin 4—Control
- Pin 5—Heater
- Co—Anode-Grid No.2 Screen
- Sc—Collector
- Ex—External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	17500 max	V
Grid-No.2 Voltage	450 max	V
Grid-No.1 Voltage	140 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V



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16RP4B

Heater Voltage	} 6.9 max 5.7 min	V
Peak Heater-Cathode Voltage		V
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max	V
After equipment warm-up period	165 max	V
Heater positive with respect to cathode:		
Combined AC and DC voltage	165 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR GRID-DRIVE SERVICE

*Unless otherwise specified, voltage values
are positive with respect to cathode*

Anode Voltage	12000	V
Grid-No.2 Voltage	300	V
Grid-No.1 Voltage	-28 to -72	V
For visual extinction of focused raster		

MAXIMUM CIRCUIT VALUE

Grid-No.1-Circuit Resistance	1.5 max	MΩ
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
90° MAGNETIC DEFLECTION

GENERAL DATA

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes.	5	pf
Grid No.1 to all other electrodes.	6	pf
External conductive coating to anode	{ 1500 max.	pf
	{ 1000 min.	pf
Heater Current at 6.3 volts.	600 ± 30	ma
Electron Gun	Type Requiring	No Ion-Trap Magnet

Optical:

Phosphor (For curves, see front of this section). .P4—Sulfide Type, Aluminized	
Faceplate, Spherical	Filterglass
Light transmission (Approx.)	74%

Mechanical:

Weight (Approx.)	15 lbs
Overall Length	14-5/8" ± 3/8"
Neck Length.	5-1/2" ± 3/16"
Projected Area of Screen	149 sq. in.

External Conductive Coating:

Type	Regular-Band
Contact area for grounding	Near Reference Line

For Additional Information on Coatings and Dimensions:

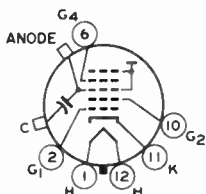
See *Picture-Tube Dimensional-Outlines and Bulb J133 F/G* sheets at front of this section

Cap. Recessed Small Cavity (JEDEC No.J1-21)

Bases (Alternates):

- Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.86-63)
- Short Small-Shell Duodecal 6-Pin (JEDEC No.86-203)
- Basing Designation for BOTTOM VIEW 12L

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 6 - Grid No.4
- Pin 10 - Grid No.2
- Pin 11 - Cathode
- Pin 12 - Heater



- Cap - Anode
- (Grid No.3,
Grid No.5,
Screen,
Collector)
- C - External
Conductive
Coating

← Indicates a change.



17BJP4

→ Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE	{ 17500 max. 11000 min.	volts volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE	{ 6.9 max. 5.7 min.	volts volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	14000	volts
Grid-No.4 Voltage	-55 to +300	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section

→ Indicates a change.



17BP4D

Picture Tube

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE
MAGNETIC FOCUS

ALUMINIZED SCREEN
70° MAGNETIC DEFLECTION

Electrical:

Direct Inter-electrode Capacitance:		
Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to Anode	{ 25% max.	pf
	{ 750 min.	pf
Heater Current at 6.3 volt	600 ± 60	ma
Electron Gun	Type 442	Tripping
	No Ion-Trap Magnet	

Optical:

Photo. (For curves, see front of this section)	F4—multiside Type, Aluminized
Exc. plate, Screen,	Fluorescent
Light transmission (Approx.)	74%

Mechanical:

Weight (Approx.)	18 lbs
Overall Length	19-3/16" ± 3/16"
Neck Length	7-1/2" ± 3/16"
Projected Area of Screen	149 sq. in.

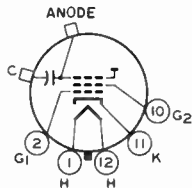
External Conductive Coating:
Type Type 442
Contact area for grounding Near Reference Line

For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines and Bulb J13B D Sheets*
at front of this section

Cap	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-heel Dodecal Pin (JEDEC Group 4, No. B5-57)

Basing Designation for BOTTOM VIEW 12N

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater



- Cap—Anode
(Grid No. 3,
Screen,
Collector)
- (External
Conductive
Coating)



17BP4D

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	17500 max.	volts
Grid-No.2 Voltage	550 max.	volts
Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage.	{ 6.9 max. 5.7 min.	{ volts volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	165 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage.	165 max.	volts
DC component.	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	12000	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster.	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section





17CFP4

17CFP4 PICTURE TUBE

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

Voltage (AC or DC) 6.3 volts
Current $0.6 \pm 10\%$ amp

Direct Interelectrode Capacitances:

Grid No.1 to all other electrodes. 6 $\mu\mu\text{f}$
Cathode to all other electrodes. 5 $\mu\mu\text{f}$
External conductive coating to ultor $\left\{ \begin{array}{l} 1500 \text{ max.} \\ 1200 \text{ min.} \end{array} \right.$ $\mu\mu\text{f}$

Faceplate, Spherical Filterglass

Light transmission (Approx.) 79%

Phosphor (For curves, see front of this Section) . P4—Sulfide Type
Aluminized

Fluorescence White

Phosphorescence. White

Persistence. Medium-Short

Focusing Method. Electrostatic

Deflection Method. Magnetic

Deflection Angles (Approx.):

Diagonal 90°

Horizontal 85°

Vertical 68°

Electron Gun Type Requiring No Ion-Trap Magnet

Tube Dimensions:

Overall length $15'' \pm 3/8''$

Greatest width $15-5/8'' \pm 1/8''$

Greatest height. $12-3/4'' \pm 1/8''$

Diagonal $16-9/16'' \pm 1/8''$

Neck length. $5-1/2'' \pm 3/16''$

Radius of curvature of faceplate (External surface) $20-3/4''$

Screen Dimensions (Minimum):

Greatest width $14-3/4''$

Greatest height. $11-11/16''$

Diagonal $15-3/4''$

Projected area 155 sq. in.

Weight (Approx.) 10 lbs

Operating Position Any

Cap. Recessed Small Cavity (JEDEC No. J1-21)

Bulb J132-1/2 C1/D1

Base Short Small-Shell Duodecal 6-Pin
(JEDEC Group 4, No.B6-203)

Basing Designation for BOTTOM VIEW 12L

Pin 1—Heater

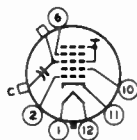
Pin 2—Grid No.1

Pin 6—Grid No.4

Pin 10—Grid No.2

Pin 11—Cathode

Pin 12—Heater



Cap—Ultor

(Grid No.3,

Grid No.5,

Collector)

C—External

Conductive

Coating

17CFP4



17CFP4 PICTURE TUBE

GRID-DRIVE^A SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, Design-Center Values:

ULTOR VOLTAGE.	{16000 max.	volts
	{12000* min.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1000 max.	volts
Negative value	500 max.	volts
GRID-No.2 VOLTAGE.	500 max.	volts
GRID-NO.1 VOLTAGE:		
Negative-peak value.	200 max.	volts
Negative-bias value.	140 max.	volts
Positive-bias value.	0 max.	volts
Positive-peak value.	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not		
exceeding 15 seconds	410 max.	volts
After equipment warm-up period	180 max.	volts
Heater positive with respect to cathode.	180 max.	volts

Equipment Design Ranges:

With any ultor voltage (E_{c5k}) between 12000* and 16000 volts and grid-No.2 voltage (E_{c2k}) between 200 and 500 volts

Grid-No.4 Voltage for focus \S	-50 to +350	volts
Grid-No.1 Voltage for visual extinction of focused raster.	See Raster-Cutoff-Range Chart for Grid-Drive Service	
Grid-No.1 Video Drive From Raster Cutoff (Black level):		
White-level value (Peak positive)	Same value as determined for E_{c1k} except video drive is a positive voltage	
Grid-No.4 Current	-25 to +25	μ a
Grid-No.2 Current	-15 to +15	μ a
Field Strength of Adjustable Centering Magnet*.	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor voltage of	16000	volts
and grid-No.2 voltage of	300	volts
Grid-No.4 Voltage for focus	-50 to +350	volts
Grid-No.1 Voltage for visual extinction of focused raster.	-28 to -72	volts



17CFP4

PICTURE TUBE

17CFP4

Grid-No.1 Video Drive from Raster
Cutoff (Black level):
White-level value. 28 to 72 volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance 1.5 max. megohms

CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Maximum and Minimum Ratings, Design-Center Values:

ULTOR-TO-GRID-No.1 VOLTAGE { 16000 max. volts
12000* min. volts

GRID-No.4-TO-GRID-No.1 VOLTAGE:
Positive value 1000 max. volts
Negative value 500 max. volts

GRID-No.2-TO-GRID-No.1 VOLTAGE 640 max. volts
GRID-No.2-TO-CATHODE VOLTAGE 500 max. volts

CATHODE-TO-GRID-No.1 VOLTAGE:
Positive-peak value. 200 max. volts
Positive-bias value. 140 max. volts
Negative-bias value. 0 max. volts
Negative-peak value. 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period
not exceeding 15 seconds 410 max. volts
After equipment warm-up period 180 max. volts
Heater positive with respect to cathode. 180 max. volts

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage (E_{c5g1}) between 12000* and 16000 volts and grid-No.2-to-grid-No.1 voltage (E_{c2g1}) between 220 and 640 volts

Grid-No.4-to-Grid-No.1
Voltage for focus § 0 to 400 volts

Cathode-to-Grid-No.1
Voltage (E_{kg1}) for visual extinction of focused raster. See Raster-Cutoff-Range Chart for Cathode-Drive Service

Cathode-to-Grid-No.1
Video Drive from Raster
Cutoff (Black level):
White-level value
(Peak negative). Same value as determined for E_{kg1} except video drive is a negative voltage

Grid-No.4 Current. -25 to +25 μ a

17CFP4



17CFP4

PICTURE TUBE

Grid-No.2 Current.	-15 to +15	μ a
Field Strength of Adjustable Centering Magnet*	0 to 8	gausses

Examples of Use of Design Ranges:

<i>With ultor-to-grid-</i>		
<i>No.1 voltage of.</i>	<i>16000</i>	<i>volts</i>
<i>and grid-No.2-to-grid-</i>		
<i>No.1 voltage of.</i>	<i>300</i>	<i>volts</i>
Grid-No.4-to-Grid-No.1		
Voltage for focus.	0 to 400	volts
Cathode-to-Grid No.1		
Voltage for visual extinction of focused raster	28 to 60	volts
Cathode-to-Grid-No.1		
Video Drive from Raster Cutoff (Black level):		
White-level value.	-28 to -60	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
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▲ Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

◆ This value is a working design-center minimum. The equivalent absolute minimum ultor- or ultor-to-grid-No.1 voltage is 10,800 volts. Below which the serviceability of the 17CFP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor- or ultor-to-grid-No.1 voltage is never less than 10,800 volts.

§ The grid-No.4 voltage or grid-No.4-to-grid-No.1 voltage required for focus of any individual tube is independent of ultor current and will remain essentially constant for values of ultor voltage (or ultor-to-grid-No.1 voltage) or grid-No.2 voltage (or grid-No.2-to-grid-No.1 voltage) within design ranges shown for these items.

■ Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/2". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 5/16-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

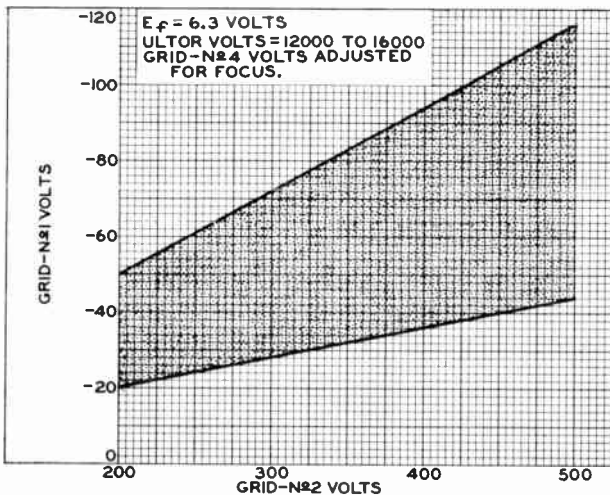
■ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

*For X-ray shielding considerations, see sheet
X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section*



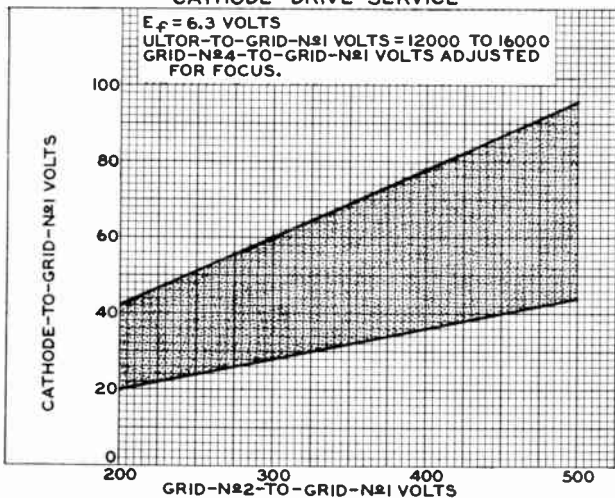
17CFP4

17CFP4 RASTER-CUTOFF-RANGE CHARTS GRID-DRIVE SERVICE



92CS-10246

CATHODE-DRIVE SERVICE

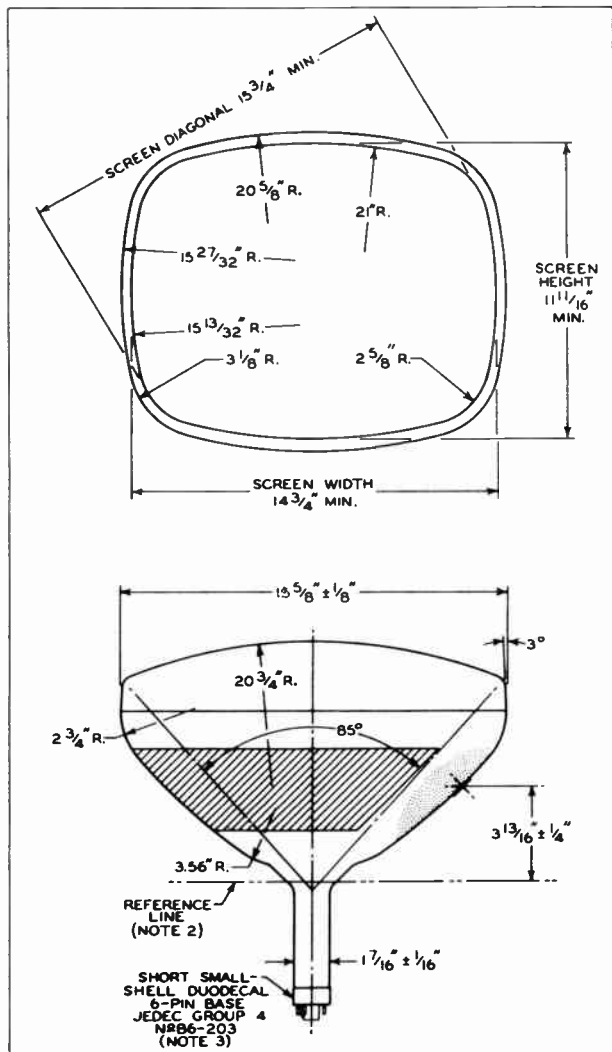


92CS-10247

17CFP4



17CFP4 PICTURE TUBE

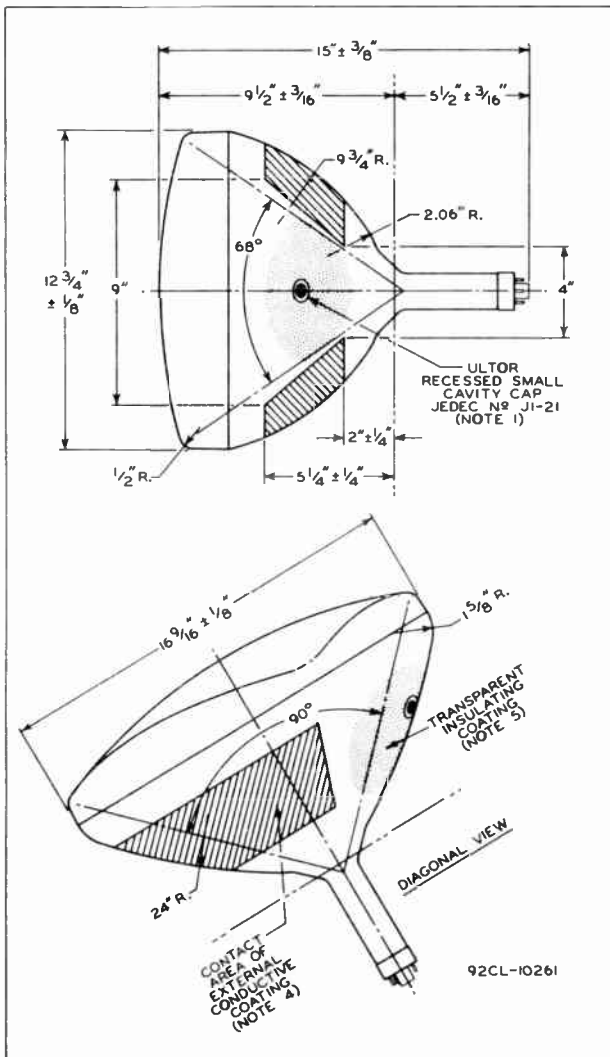




17CFP4

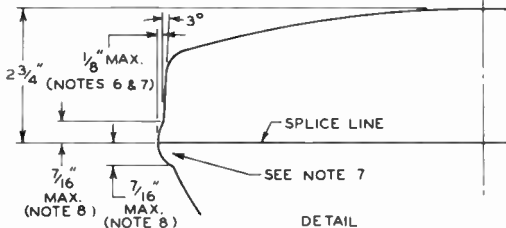
PICTURE TUBE

17CFP4





17CFP4 PICTURE TUBE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 30^\circ$. ULTOR TERMINAL IS ON SAME SIDE AS, PIN 6.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No. G-116 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUITRY CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

NOTE 6: MEASURED 2-9/32" \pm 1/32" FROM THE PLANE TANGENT TO THE SURFACE OF THE FACEPLATE AT THE TUBE AXIS.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/4", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/8" BEYOND THE ENVELOPE SURFACE AT THE LOCATION SPECIFIED FOR DIMENSIONING THE ENVELOPE WIDTH, DIAGONAL, AND HEIGHT.

NOTE 8: THE TUBE SHOULD BE SUPPORTED ON BOTH SIDES OF THE BULGE. THE MECHANISM USED SHOULD PROVIDE CLEARANCE FOR THE MAXIMUM DIMENSIONS OF THE BULGE.



17CFP4

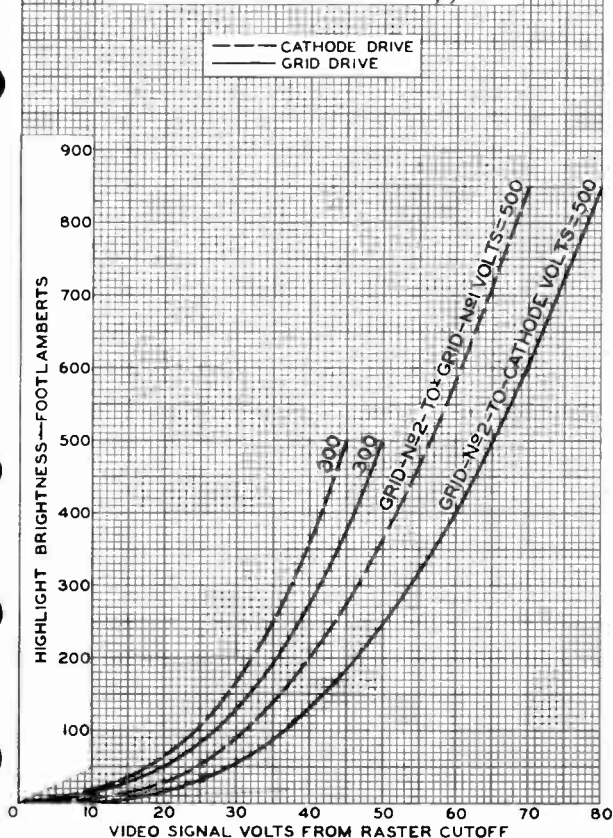
17CFP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE
 $E_f = 6.3$ VOLTS
 ULTOR-TO-GRID-N₁ VOLTS = 16000
 CATHODE BIASED POSITIVE WITH
 RESPECT TO GRID N₁ TO GIVE
 FOCUSED RASTER CUTOFF.
 RASTER FOCUSED
 AT AVERAGE BRIGHTNESS.
 RASTER SIZE = 14" x 10 1/2"

GRID-DRIVE SERVICE
 $E_f = 6.3$ VOLTS
 ULTOR VOLTS = 16000
 GRID N₁ BIASED NEGATIVE WITH
 RESPECT TO CATHODE TO GIVE
 FOCUSED RASTER CUTOFF.
 RASTER FOCUSED
 AT AVERAGE BRIGHTNESS.
 RASTER SIZE = 14" x 10 1/2"

I.C.I. COORDINATES OF SCREEN: X=0.270, Y=0.300



17CFP4



17CFP4

AVERAGE DRIVE CHARACTERISTICS

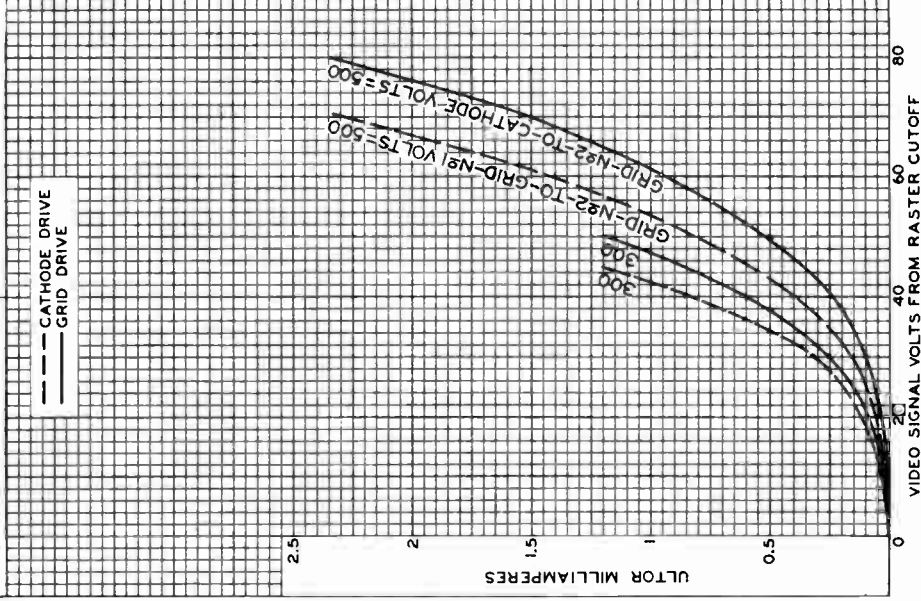
CATHODE-DRIVE SERVICE

 $E_f = 6.3$ VOLTSULTOR-TO-GRID-N₁
VOLTS=12000 TO 16000CATHODE BIASED POSITIVE WITH
RESPECT TO GRID N₁ TO GIVE
FOCUSED RASTER CUTOFF.

GRID-DRIVE SERVICE

 $E_f = 6.3$ VOLTSULTOR VOLTS=12000 TO 16000
GRID N₁ BIASED NEGATIVE WITH
RESPECT TO CATHODE TO GIVE
FOCUSED RASTER CUTOFF.

--- CATHODE DRIVE
— GRID DRIVE



Picture Tube

SHORT RECTANGULAR GLASS TYPE
 LOW-VOLTAGE ELECTROSTATIC FOCUS
 LOW GRID-No.2 VOLTAGE

ALUMINIZED SCREEN
 110° MAGNETIC DEFLECTION
 CATHODE-DRIVE TYPE

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts.	450 ± 5%	ma
Heater Warm Up Time (Average).	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes.	0	μmf
Cathode to all other electrodes.	5	μmf
External conductive coating to ultor	{ 1700 max. 1200 min.	μmf
		μmf
Electron Gun	Type Requiring No Ion-Trap Magnet	

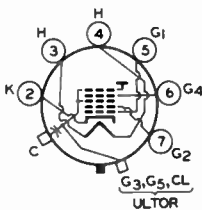
Optical:

Faceplate.	Filterglass
Light transmission (Approx.)	77%
Phosphor (for Curves, see front of this section)	P4—Sulfide Type, Aluminized

Mechanical:

Operating Position	Any
Weight (Approx.)	10 lbs
Overall Length	12-1/8" ± 1/4"
Neck Length.	5" ± 1/8"
Projected Area of Screen	155 sq. in.
External Conductive Coating:	
Type	Regular Band
Contact area for grounding	Near Reference Line
For Additional Information on Coatings and Dimensions: See <i>Picture-Tube Dimensional-Outlines</i> and <i>Bulb J132-1/2 A/B</i> sheets at the front of this section	
Cap.	Recessed Small Cavity (JEDEC No. J1-21)
Base	Special 6-Pin (JEDEC No. B6-214)
Basing Designation for BOTTOM VIEW . . . . .	.7FA

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



- Cap - Ultor
 (Grid No.3,
 Grid No.5,
 Collector)
- C - External
 Conductive
 Coating



17DQP4

Maximum Ratings, Design-Maximum Values:

ULTOR-TO-GRID-No.1 VOLTAGE.	17600 max.	volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value.	1100 max.	volts
Negative value.	550 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE.	70 max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive bias value.	150 max.	volts
Negative peak value.	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period:		
not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage of	11500	volts
and grid-No.2-to-grid-No.1 voltage of	50	volts
Grid-No.4-to-Grid-No.1 Voltage for focus.	-700 to +350	volts
Cathode-to-Grid-No.1 voltage for visual extinction of focused raster.	41 to 49	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding consideration, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



Picture Tube

SHORT RECTANGULAR GLASS TYPE ALUMINIZED SCREEN
 LOW-VOLTAGE ELECTROSTATIC FOCUS 110° MAGNETIC DEFLECTION
 INTERNAL MAGNETIC SHIELD

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Direct Interelectrode Capacitances:		
Cathode to all other electrodes.	3.65	pf
Grid No.1 to all other electrodes.	4.15	pf
External conductive coating to anode	{ 1400 max. 900 min.	pf
Heater Current at 2.68 volts		450 ± 45	ma
Heater Warm-Up Time (Average).	11	seconds
Electron Gun	Type Requiring No Ion-Trap Magnet	

Optical:

Phosphor (For curves, see front of this section) .P4—Sulfide Type, Aluminized	
Faceplate, Spherical	Filterglass
Light transmission (Approx.)	77%

Mechanical:

Weight (Approx.)	10 lbs
Overall Length	10-13/16" ± 3/16"
Neck Length.	3-11/16" ± 1/16"
Projected Area of Screen	155 sq. in.

External Conductive Coating:
 Type Modified-Band
 Contact area for grounding Near Reference Line

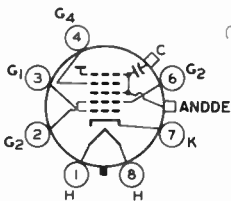
For Additional Information on Coatings and Dimensions:

See *Picture-Tube Dimensional-Outlines and Bulb J192-1/2 A/B* sheets at front of this section

Cap. Recessed Small Cavity (JEDEC No.J1-21)
 Base Small-Button Neoeightar 7-Pin, Arrangement 1,
 (JEDEC No.B7-208)

Basing Designation for BOTTOM V1FW 8JK

- Pin 1 - Heater
- Pin 2 - Grid No.2
- Pin 3 - Grid No.1
- Pin 4 - Grid No.4
- Pin 6 - Grid No.2
- Pin 7 - Cathode
- Pin 8 - Heater



Cap - Anode
 (Grid No.3,
 Grid No.5,
 Screen,
 Collector)
 C - External
 Conductive
 Coating



17DRP4

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE	17600 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value.	950 max.	volts
Negative value.	700 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	400 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE.	{ 2.9 max.	volts
	{ 2.4 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage.	200 max.	volts
DC component.	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	14000	volts
Grid-No.4 Voltage	100 to 500	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster.	-35 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section





17DSP4

17DSP4 PICTURE TUBE

RECTANGULAR GLASS TYPE ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

With heater having controlled warm-up time

DATA

General:

Heater, for Unipotential Cathode:

Voltage (AC or DC)	6.3	volts
Current	0.6	amp
Warm-up time (Average)	11	sec

Direct Interelectrode Capacitances:

Grid No.1 to all other electrodes	6	$\mu\mu\text{f}$
Cathode to all other electrodes	5	$\mu\mu\text{f}$
External conductive coating to ultor.	{ 1500 max.	$\mu\mu\text{f}$
	{ 1000 min.	$\mu\mu\text{f}$

Faceplate, Spherical Filterglass

Light transmission (Approx.) 78%

Phosphor (For curves, see front of this section) . . P4—Sulfide Type
Aluminized

Fluorescence White

Phosphorescence White

Persistence Medium-Short

Focusing Method Electrostatic

Deflection Method Magnetic

Deflection Angles (Approx.):

Diagonal 110°

Horizontal 105°

Vertical 87°

Electron Gun Type Requiring No Ion-Trap Magnet

Tube Dimensions:

Overall length 11-1/4" \pm 3/16"

Greatest width 15-5/8" \pm 1/8"

Greatest height 12-3/4" \pm 1/8"

Diagonal 16-9/16" \pm 1/8"

Neck length 4-1/8" \pm 1/8"

Radius of curvature of
faceplate (External surface) 20-3/4"

Screen Dimensions (Minimum):

Greatest width 14-3/4"

Greatest height 11-11/16"

Diagonal 15-3/4"

Projected area 155 sq. in.

Weight (Approx.) 10 lbs

Operating Position Any

Cap Recessed Small Cavity (JEDEC No. J1-21)

Bulb J132-1/2 A1/B1

Socket Ucinite Part No. 115446, or equivalent



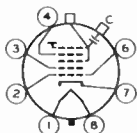
I7DSP4

PICTURE TUBE

Base Small-Button Neoeightar 7-Pin, Arrangement 1,
(JEDEC No. B7-208)

Basing Designation for BOTTOM VIEW. 8HR

Pin 1 - Heater
Pin 2 - Grid No. 1
Pin 3 - Grid No. 2
Pin 4 - Grid No. 4
Pin 6 - Grid No. 1
Pin 7 - Cathode
Pin 8 - Heater



Cap - Ultor
(Grid No. 3,
Grid No. 5,
Collector)
C - External
Conductive
Coating

GRID-DRIVE^A SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, Design-Center Values:

ULTOR VOLTAGE	{	18000 max. volts	
		12000* min. volts	
GRID-No. 4 (FOCUSING) VOLTAGE:			
Positive value.		1000 max. volts	
Negative value.		500 max. volts	
GRID-No. 2 VOLTAGE		500 max. volts	
GRID-No. 1 VOLTAGE:			
Negative-peak value		200 max. volts	
Negative-bias value		140 max. volts	
Positive-bias value		0 max. volts	
Positive-peak value		2 max. volts	
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period			
not exceeding 15 seconds.		410 max. volts	
After equipment warm-up period.		180 max. volts	
Heater positive with respect to cathode.		180 max. volts	

Equipment Design Ranges:

With any ultor voltage (E_{c5k}) between 12000 and 18000 volts and grid-No. 2 voltage (E_{c2k}) between 200 and 500 volts*

Grid-No. 4 Voltage for focus§.	0 to 400	volts
Grid-No. 1 Voltage (E_{c1k}) for visual extinction of focused raster	See Raster-Cutoff-Range Chart for Grid-Drive Service	

Grid-No. 1 Video Drive from Raster Cutoff (Black level):		
White-level value (Peak positive)	Same value as determined for E_{c1k} except video drive is a positive voltage	



17DSP4

17DSP4

PICTURE TUBE

Grid-No.4 Current.	-25 to +25	μ a
Grid-No.2 Current.	-15 to +15	μ a
Field Strength of Adjustable Centering Magnet*	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor voltage of	16000	16000	volts
and grid-No.2 voltage of	300	400	volts
Grid-No.4 Voltage for focus.	0 to 400	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster	-38 to -72	-45 to -90	volts
Grid-No.1 Video Drive from Raster Cutoff (Black level):			
White-level value.	38 to 72	45 to 90	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
--	----------	---------

CATHODE-DRIVE[®] SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Maximum and Minimum Ratings, Design-Center Values:

ULTOR-TO-GRID-No.1 VOLTAGE	{ 18000 max.	volts
	{ 12000* min.	volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value	1000 max.	volts
Negative value	500 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE	640 max.	volts
GRID-No.2-TO-CATHODE VOLTAGE	500 max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive-peak value.	200 max.	volts
Positive-bias value.	140 max.	volts
Negative-bias value.	0 max.	volts
Negative-peak value.	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	410 max.	volts
After equipment warm-up period	180 max.	volts
Heater positive with respect to cathode.	180 max.	volts



17DSPA4

PICTURE TUBE

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage (E_{c5g_1}) between 12000* and 18000 volts and grid-No.2-to-grid-No.1 voltage (E_{c2g_1}) between 225 and 640 volts

Grid-No.4-to-Grid-No.1			
Voltage for focus \S	0 to 400		volts
Cathode-to-Grid-No.1 Voltage			
(E_{kg_1}) for visual extinction			
of focused raster	See Raster-Cutoff-Range Chart for Cathode-Drive Service		
Cathode-to-Grid-No.1 Video			
Drive from Raster Cutoff			
(Black level):			
White-level value			
(Peak negative)	Same value as determined for		
	E_{kg_1} except video drive is a		
	negative value		
Grid-No.4 Current	-25 to +25		μ a
Grid-No.2 Current	-15 to +15		μ a
Field Strength of Adjust-			
able Centering Magnet \circ	0 to 8		gausses

Examples of Use of Design Ranges:

With ultor-to-grid-			
No.1 voltage of	16000	16000	volts
and grid-No.2-to-grid-			
No.1 voltage of	300	400	volts
Grid-No.4-to-Grid-No.1			
Voltage for focus	0 to 400	0 to 400	volts
Cathode-to-Grid-No.1			
Voltage for visual extinc-			
tion of focused raster.	35 to 63	43 to 78	volts
Cathode-to-Grid-No.1 Video			
Drive from Raster Cutoff			
(Black level):			
White-level value	-35 to -63	-43 to -78	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance. 1.5 max. megohms

Δ Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

* This value is a working design-center minimum. The equivalent absolute minimum ultor (or ultor-to-grid-No.1) voltage is 11,000 volts, below which the serviceability of the 17DSPA will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor (or ultor-to-grid-No.1) voltage is never less than 11,000 volts.

\S The grid-No.4 (or grid-No.4-to-grid-No.1) voltage required for optimum focus of any individual tube will have a value between 0 and 400 volts independent of ultor current and will remain essentially constant for values of ultor (or ultor-to-grid-No.1) voltage or grid-No.2 (or grid-No.2-to-grid-No.1) voltage within design ranges shown for these items.



17DSP4

PICTURE TUBE

17DSP4

- Distance from *Reference Line* for suitable PM centering magnet should not exceed $2\text{-}1/8"$. Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a $5/16$ -inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as $1/2$ -inch deflection of the spot from the center of the tube face.
- Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid no.1 and the other electrodes.

OPERATING CONSIDERATIONS

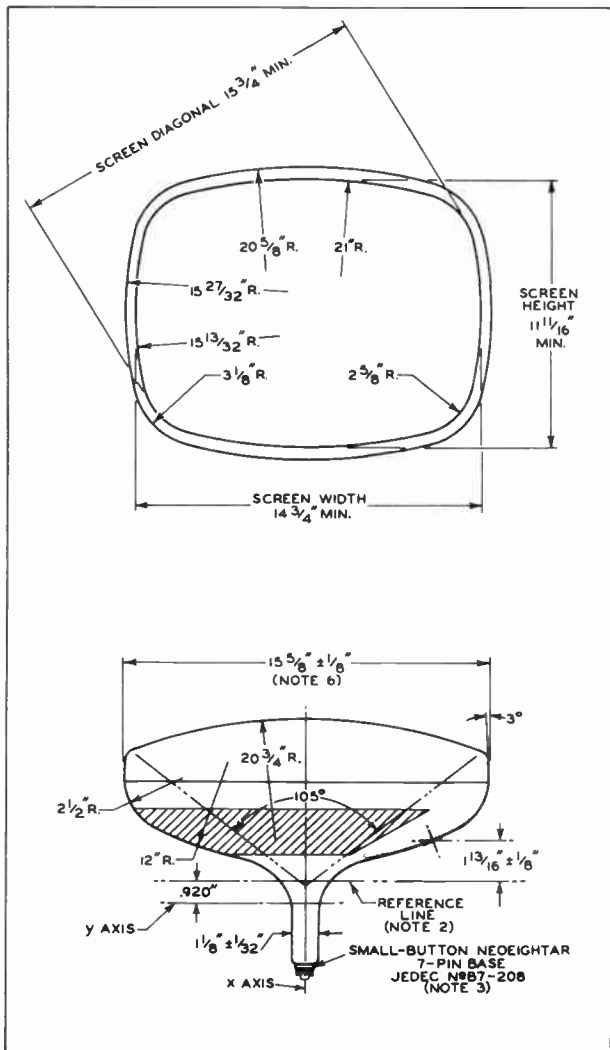
Shatter-Proof Cover Over the Tube Face. Following conventional picture-tube practice, it is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of the 17DSP4 to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.

*For X-ray shielding considerations, see sheet
X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section*

17DSP4



17DSP4 PICTURE TUBE

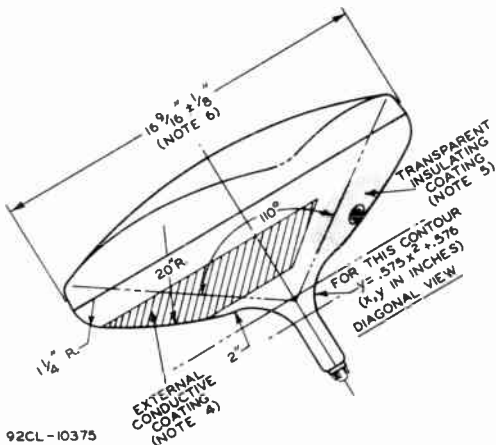
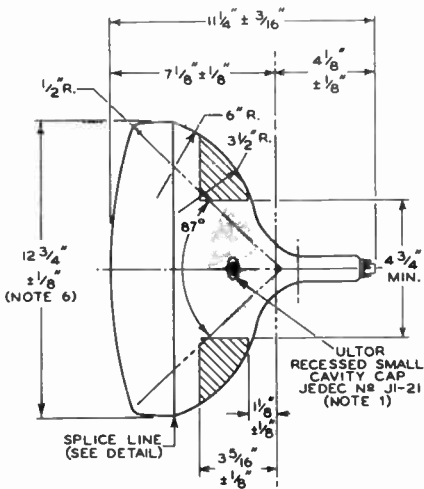




17DSP4

PICTURE TUBE

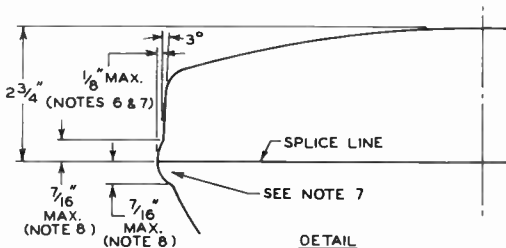
17DSP4



92CL-10375



17DSPA PICTURE TUBE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 30^\circ$. ULTOR TERMINAL IS ON SAME SIDE AS PIN 4.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No. G-126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1- $\frac{3}{4}$ ".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDING.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

NOTE 6: MEASURED 2- $\frac{9}{32}$ " \pm $\frac{1}{32}$ " FROM THE PLANE TANGENT TO THE SURFACE OF THE FACEPLATE AT THE TUBE AXIS.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN $\frac{1}{4}$ ", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN $\frac{1}{8}$ " BEYOND THE ENVELOPE SURFACE AT THE LOCATION SPECIFIED FOR DIMENSIONING THE ENVELOPE WIDTH, DIAGONAL, AND HEIGHT.

NOTE 8: THE TUBE SHOULD BE SUPPORTED ON BOTH SIDES OF THE BULGE. THE MECHANISM USED SHOULD PROVIDE CLEARANCE FOR THE MAXIMUM DIMENSIONS OF THE BULGE. SUPPORTS MUST BE SPACED FROM THE TUBE BY THE USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.

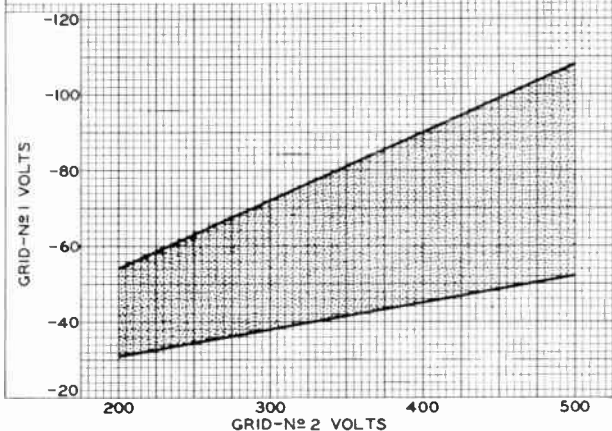


17DSP4

17DSP4

RASTER-CUTOFF-RANGE CHARTS GRID-DRIVE SERVICE

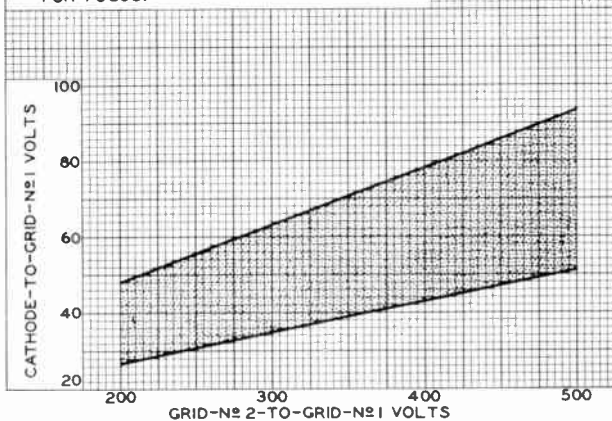
$E_f = 6.3$ VOLTS
ULTOR VOLTS = 12000 TO 18000
GRID-Nº 4 VOLTS ADJUSTED FOR FOCUS.



92CS-10376

CATHODE-DRIVE SERVICE

$E_f = 6.3$ VOLTS
ULTOR-TO-GRID-Nº 1 VOLTS = 12000 TO 18000
GRID-Nº 4 -TO-GRID-Nº 1 VOLTS ADJUSTED FOR FOCUS.



92CS-10377

17DSP4



17DSP4

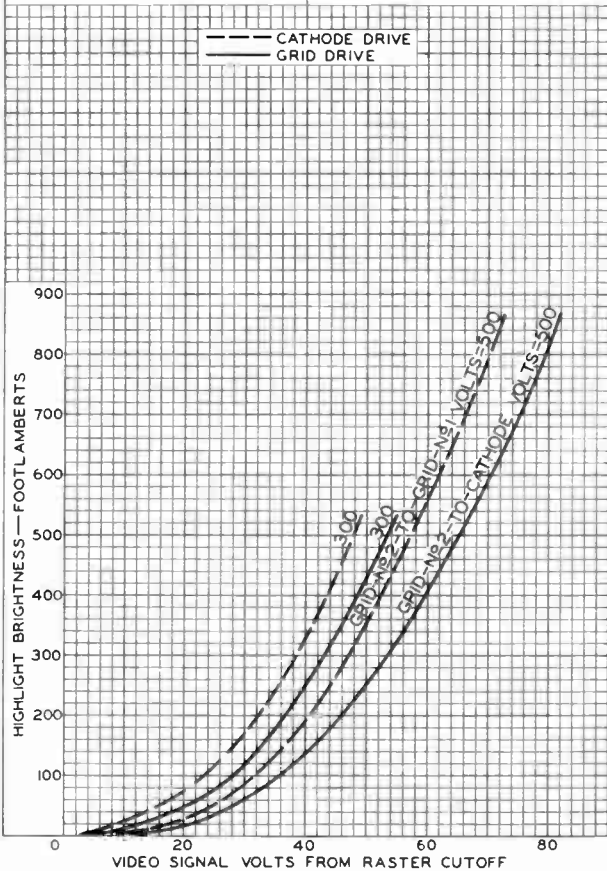
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE

$E_f = 6.3$ VOLTS
 ULTOR-TO-GRID-№1 VOLTS = 16000
 CATHODE BIASED POSITIVE WITH
 RESPECT TO GRID №1 TO GIVE
 FOCUSED RASTER CUTOFF,
 RASTER FOCUSED
 AT AVERAGE BRIGHTNESS.
 RASTER SIZE = 14" x 10 1/2"

GRID-DRIVE SERVICE

$E_f = 6.3$ VOLTS
 ULTOR VOLTS = 16000
 GRID №1 BIASED NEGATIVE WITH
 RESPECT TO CATHODE TO GIVE
 FOCUSED RASTER CUTOFF,
 RASTER FOCUSED
 AT AVERAGE BRIGHTNESS.
 RASTER SIZE = 14" x 10 1/2"





17DSP4

AVERAGE DRIVE CHARACTERISTICS

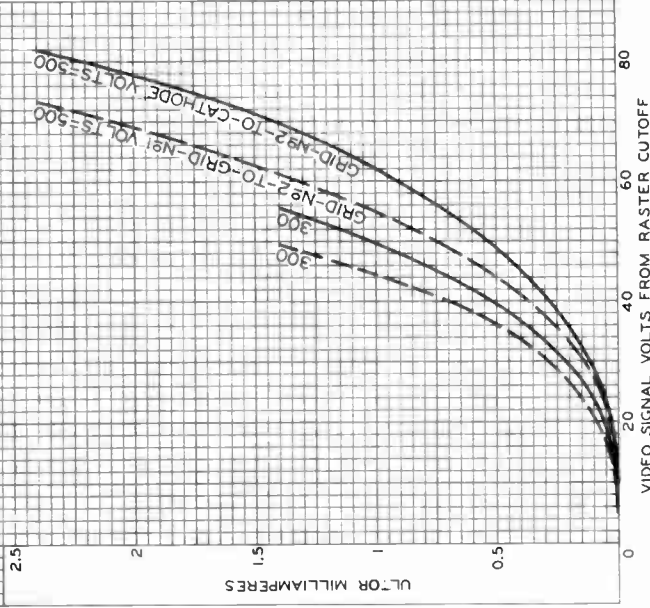
CATHODE-DRIVE SERVICE

$E_f = 6.3$ VOLTS
ULTOR - TO - GRID - N₂I
VOLTS = 12000 TO 18000
CATHODE BIASED POSITIVE WITH
RESPECT TO GRID N₂I TO GIVE
FOCUSED RASTER CUTOFF.

GRID-DRIVE SERVICE

$E_f = 6.3$ VOLTS
ULTOR VOLTS = 12000 TO 18000
GRID N₂I BIASED NEGATIVE WITH
RESPECT TO CATHODE TO GIVE
FOCUSED RASTER CUTOFF.

--- CATHODE DRIVE
- - - GRID DRIVE





17DWP4

Maximum Ratings, Design-Maximum Values:

ULTOR VOLTAGE	22000 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value.	800 max.	volts
GRID-No.2 VOLTAGE	700 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	180 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts

Typical Operating Conditions:

With ultor voltage of	18000	volts
and grid-No.2 voltage of	300	volts
Grid-No.4 Voltage for focus	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster.	-28 to -72	volts

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



Picture Tube

SHORT RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

DATA

General:

Heater, for Unipotential Cathode:

Voltage (AC or DC)	6.3	volts
Current at 6.3 volts.	0.45	amp
Warm-up time (Average).	11	sec

Direct Interelectrode Capacitances:

Grid No. 1 to all other electrodes . . .	6	μf
Cathode to all other electrodes	5	μf
External conductive coating to ultor. .	{ 1500 max.	μf
	{ 1000 min.	μf

Faceplate, Spherical. Filterglass

Light transmission (Approx.). 77%

Phosphor (For curves, see front of this section). P4—Sulfide Type
Aluminized

Fluorescence. White

Phosphorescence White

Persistence Medium Short

Focusing Method Electrostatic

Deflection Method Magnetic

Deflection Angles (Approx.):

Diagonal. 110°

Horizontal. 105°

Vertical. 87°

Electron Gun. Type Requiring No Ion-Trap Magnet

Tube Dimensions:

Overall length. 10-11/16" \pm 1/4"

Greatest width. 15-5/8" \pm 1/8"

Greatest height 12-3/4" \pm 1/8"

Diagonal. 16-9/16" \pm 1/8"

Neck length 3-9/16" \pm 1/8"

Radius of curvature of faceplate
(External surface). 20-3/4"

Screen Dimensions (Minimum):

Greatest width. 14-3/4"

Greatest height 11-11/16"

Diagonal. 15-3/4"

Projected area. 155 sq. in.

Weight (Approx.). 10 lbs

Operating Position. Any

Cap Recessed Small Cavity (JEDEC No. J1-21)

Bulb. J132-1/2 A/B

Socket. Ucinite Part No. 115446, or equivalent

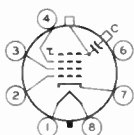
Base. Small-Button Neoeightar 7-Pin, Arrangement 1,
(JEDEC No. B7-208)



17DXP4

Basing Designation for BOTTOM VIEW. 8J2

- Pin 1 - Heater
- Pin 2 - Grid No. 1
- Pin 3 - Grid No. 2
- Pin 4 - Grid No. 3
- Pin 6 - Internal Connection—
Do Not Use
- Pin 7 - Cathode



- Pin 8 - Heater
- Cap - Ultor
(Grid No. 4,
Collector)
- C - External
Conductive
Coating

GRID-DRIVE[▲] SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, Design-Center Values:

ULTOR VOLTAGE.	{ 16000 max. volts 12000* min. volts
GRID-No. 3 (FOCUSING) VOLTAGE	650 max. volts
GRID-No. 2 VOLTAGE.	{ 550 max. volts 300 min. volts
GRID-No. 1 VOLTAGE:	
Negative-peak value.	200 max. volts
Negative-bias value.	140 max. volts
Positive-bias value.	0 max. volts
Positive-peak value.	2 max. volts
PEAK HEATER-CATHODE VOLTAGE:	
Heater negative with respect to cathode:	
During equipment warm-up period	
not exceeding 15 seconds	410 max. volts
After equipment warm-up period	180 max. volts
Heater positive with respect to cathode.	180 max. volts

Equipment Design Ranges:

With any ultor voltage (E_{c_4k}) between 12000 and 16000 volts and grid-No. 2 voltage (E_{c_2k}) between 400 and 550 volts

Grid-No. 3 voltage for focus§	0 to 400 volts
Grid-No. 1 Voltage (E_{c_1k}) for visual extinction of focused raster.	See Raster-Cutoff-Range Chart for Grid-Drive Service
Grid-No. 1 Video Drive from Raster Cutoff (Black level):	
White-level value (Peak positive).	Same value as determined for E_{c_1k} except video drive is a positive voltage
Grid-No. 3 Current.	-25 to +25 μ A
Grid-No. 2 Current.	-15 to +15 μ A



Field Strength of Adjustable Centering Magnet 0 to 12 gaussess

Examples of Use of Design Ranges:

With ultor voltage of	16000	16000	volts
and grid-No.2 voltage of	400	500	volts
Grid-No.3 Voltage for focus	0 to 400	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster	-34 to -63	-43 to -78	volts
Grid-No.1 Video Drive from Raster Cutoff (Black level):			
White-level value	34 to 63	43 to 78	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance 1.5 max. megohms

CATHODE-DRIVE[■] SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Maximum and Minimum Ratings, Design-Center Values:

ULTOR-TO-GRID-No.1 VOLTAGE	{ 16000* max. { 12000* min.	volts
		volts
GRID-No.3-TO-GRID-No.1 (FOCUSING) VOLTAGE	650 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE	690 max.	volts
GRID-No.2-TO-CATHODE VOLTAGE	{ 550 max. { 300 min.	volts
		volts
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive-peak value	200 max.	volts
Positive-bias value	140 max.	volts
Negative-bias value	0 max.	volts
Negative-peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	410 max.	volts
After equipment warm-up period	180 max.	volts
Heater positive with respect to cathode	180 max.	volts

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage (E_{c4g1}) between 12000 and 16000 volts and grid-No.2-to-grid-No.1 voltage (E_{c2g1}) between 400 and 690 volts

Grid-No.2-to-Grid-No.1 voltage for focus \S 0 to 400 volts



17DXP4

Cathode-to-Grid-No.1 Voltage (E_{k_1}) for visual extinction of focused raster.	See <i>Raster-Cutoff-Range Chart for Cathode-Drive Service</i>
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value (Peak negative)	Same value as determined for E_{k_1} except video drive is a negative voltage
Grid-No.3 Current	-25 to +25 μ a
Grid-No.2 Current	-15 to +15 μ a
Field Strength of Adjust- able Centering Magnet	0 to 12 gauss

Examples of Use of Design Ranges:

<i>With ultor-to-grid- No.1 voltage of</i>	16000	16000	volts
<i>and grid-No.2 to-grid- No.1 voltage of</i>	400	500	volts
Grid-No.3 to-Grid- No.1 Voltage for focus	0 to 400	0 to 400	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster.	34 to 56	41 to 69	volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value	-34 to -56	-41 to -69	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max. megohms
---------------------------------------	------------------

▲ Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

* This value is a working design-center minimum. The equivalent absolute minimum ultor- or ultor-to-grid-No.1 voltage is 11,000 volts, below which the serviceability of the 17DXP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor- or ultor-to-grid-No.1 voltage is never less than 11,000 volts.

§ The grid-No.3 voltage required for optimum focus of any individual tube may have a value anywhere between 0 and 400 volts and is a function of the value of the ultor voltage, ultor current, and grid-No.2 voltage. It changes directly with the ultor voltage at the rate of approximately 46 volts for each 1000-volt change in ultor voltage; inversely with grid-No.2 voltage at the rate of about 60 volts for each 100-volt change in grid-No.2 voltage; and inversely with ultor current at the rate of about 60 volts for each 100-microampere change in ultor current. Because the 17DXP4 has a narrow depth of focus, it is necessary to provide means such as a potentiometer or a 4-tap switch for adjusting the focusing voltage. In general, commercially acceptable focus is obtained if the focusing voltage is within 75 volts of the value required for optimum focus and if the focusing voltage is maintained to within 75 volts of the optimum value during line-voltage fluctuations.



- Distance from *Reference Line* for suitable PM centering magnet should not exceed $2\frac{1}{4}$ ". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a $\frac{5}{16}$ -inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as $\frac{1}{2}$ -inch deflection of the spot from the center of the tube face.
- Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

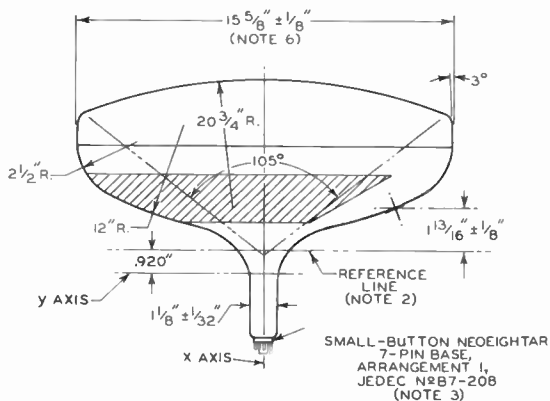
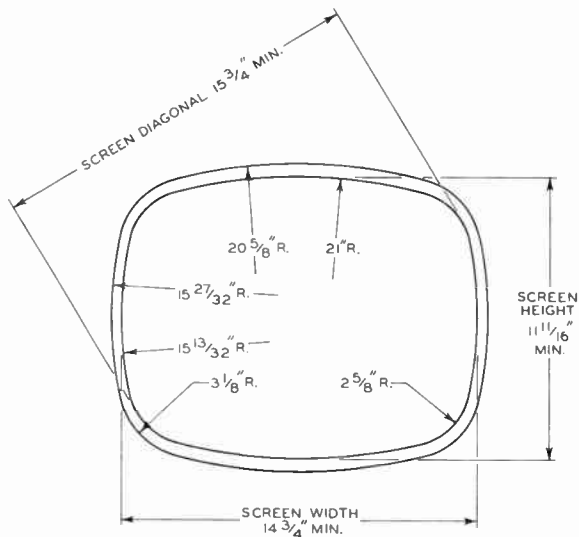
OPERATING CONSIDERATIONS

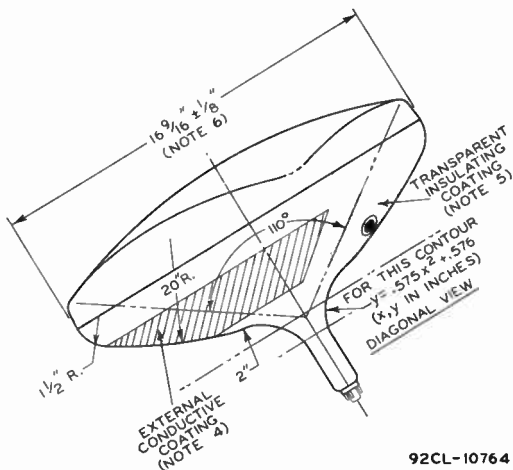
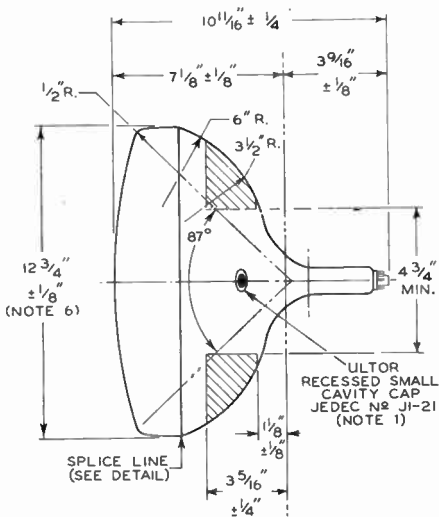
Shatter-Proof Cover Over the Tube Face. Following conventional picture-tube practice, it is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of the 17DXP4 to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.

*For X-ray shielding considerations, see sheet
X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section*



17DXP4

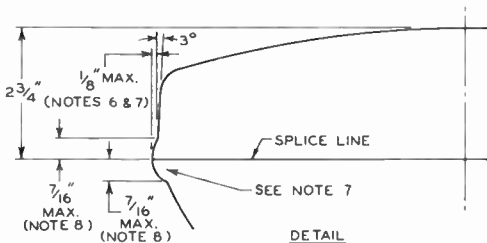




92CL-10764



17DXP4



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 30^\circ$. ULTOR TERMINAL IS ON SAME SIDE AS PIN 4.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No. G-126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF $1\text{--}3\frac{1}{4}$ ".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

NOTE 6: MEASURED $2\text{--}9\frac{32}{32} \pm \frac{1}{32}$ " FROM THE PLANE TANGENT TO THE SURFACE OF THE FACEPLATE AT THE TUBE AXIS.

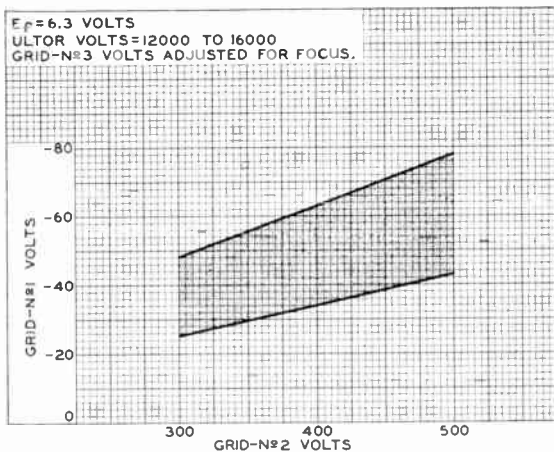
NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN $\frac{1}{4}$ ", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN $\frac{1}{8}$ " BEYOND THE ENVELOPE SURFACE AT THE LOCATION SPECIFIED FOR DIMENSIONING THE ENVELOPE WIDTH, DIAGONAL, AND HEIGHT.

NOTE 8: THE TUBE SHOULD BE SUPPORTED ON BOTH SIDES OF THE BULGE. THE MECHANISM USED SHOULD PROVIDE CLEARANCE FOR THE MAXIMUM DIMENSIONS OF THE BULGE. SUPPORTS MUST BE SPACED FROM THE TUBE BY THE USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.

NOTE 9: NECK DIAMETER IS MAINTAINED TO AT LEAST $2\text{--}7\frac{16}{16}$ " FROM REFERENCE LINE.

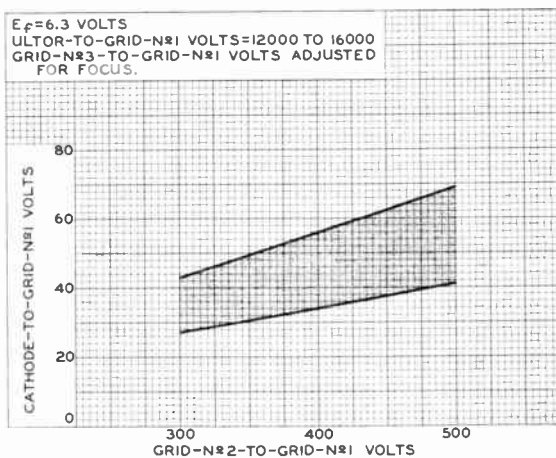
RASTER-CUTOFF-RANGE CHARTS

Grid-Drive Service



92CS-9930

Cathode-Drive Service



92CS-9931





Color Picture Tube

Perma-Chrome Banded-Type Implosion Protection
 90° Rectangular Hi-Lite Screen
 Blue-Gun-Down Operation Unity Current Ratios

ELECTRICAL

Electron Guns, Three with Axes
 Tilted Toward Tube Axis Red, Blue, Green
 Heater, of Each Gun Series
 Connected within Tube with
 Each of the Other Two Heaters:

Current at 6.3 V 900 mA

Focusing Method Electrostatic

Focus Lens Unipotential

Convergence Method Magnetic

Deflection Method Magnetic

Deflection Angles (Approx.):

Diagonal 90 deg.

Horizontal 79 deg.

Vertical 63 deg.

Direct Interelectrode Capacitances (Approx.):

Grid No.1 of any gun
 to all other electrodes 7.5 pF

Grid No.4 to all other electrodes 6 pF

All cathodes to all other electrodes 15 pF

External conductive coating
 to anode $\left\{ \begin{array}{l} 1500 \text{ max. pF} \\ 1000 \text{ min. pF} \end{array} \right.$

OPTICAL

Faceplate Filterglass

Light transmission at center
 (Approx.) 48 %

Surface Polished

Screen Aluminized

Matrix Black opaque material

Phosphor, rare-earth (red),
 sulfide (blue & green) P22

Persistence Medium-Short

Array Dot trios

Spacing between centers of
 adjacent dot trios (approx.) 0.029 in (0.74 mm)

17E2P22

MECHANICAL

Minimum Screen Area (Projected) . . . 145 sq. in (935 sq. cm)
Bulb Funnel Designation JEDEC No. J 139 A1
Bulb Panel Designation JEDEC No. FP 139B1
Base Designation^a Small-Button Diheptar 12-pin
Basing Designation JEDEC No. 14BH
Pin Position Alignment Pin No. 5 Aligns Approx.
with Anode Bulb Contact

Operating Position:

For blue gun down Anode Bulb Contact on Top
For blue gun up Anode Bulb Contact on Bottom
Weight (Approx.) 17.5 lb (8.0 kg)

MAXIMUM AND MINIMUM RATINGS, Design-Maximum Values

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

Anode Voltage	{ 22,500 max. 17,000 min.	V V
Total Anode Current, Long-Term Average	750 max.	μA
(Grid-No.4 (Focusing Electrode) Voltage:		
Positive value	1100 max.	V
Negative value	550 max.	V
Peak Grid-No.2 Voltage, Including Video Signal Voltage	1000 max.	V
Grid-No.1 Voltage:		
Negative bias value	400 max.	V
Negative operating cutoff value	140 max.	V
Positive bias value	0 max.	V
Positive peak value	2 max.	V
Heater Voltage (ac or dc): ^c		
Under operating conditions	{ 6.9 max. 5.7 min.	V V
Under standby conditions ^d	5.5 max.	V
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	V
After equipment warm-up period:		
Combined AC and DC value	200 max.	V
DC component value	200 max.	V
Heater positive with respect to cathode:		
AC component value	200 max.	V
DC component value	0 max.	V

EQUIPMENT DESIGN RANGES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 17,000 and 22,500 V

Grid-No.4 (Focusing Electrode) Voltage . . . -75 to 400 V

Grid-No.2 and Grid-No.1 Voltages for
Visual Extinction of Focused
Spot SEE CUTOFF DESIGN CHART

Maximum Ratio of Grid-No.2 Voltages,
Highest Gun to Lowest Gun in Any
Tube (At grid-No.1 spot cutoff
voltage of -100 V) 1.86

Heater Voltage:^c

Under operating conditions:

When standby operation is not utilized 6.3 V

When 5.0-V standby operation is utilized^d 6.0 V

Under standby conditions^d 5.0 V

Grid-No.4 Current (Total) -60 to +60 μ A

Grid-No.2 Current -5 to +5 μ A

To Product White of 9300^o K + 27 M.P.C.D.

(CIE Coordinates $x = 0.281$, $y = 0.311$):

Percentage of total anode current supplied by	<i>Red</i>	<i>Blue</i>	<i>Green</i>	
each gun (average)	34	32	34	%

Ratio of cathode currents:	<i>Min.</i>	<i>Typ.</i>	<i>Max.</i>
----------------------------	-------------	-------------	-------------

Red/blue	0.75	1.10	1.50
--------------------	------	------	------

Red/green	0.65	1.00	1.50
---------------------	------	------	------

Blue/green	0.60	0.91	1.30
----------------------	------	------	------

Displacements, Measured at Center of Screen:

Raster centering displacement:

Horizontal ± 0.45 in (± 11.4 mm)

Vertical ± 0.45 in (± 11.4 mm)

Lateral distance between the
blue beam and the converged
red and green beams ± 0.25 in (± 6.4 mm)

Radial convergence displacement
excluding effects of dynamic
convergence (each beam) ± 0.37 in (± 9.4 mm)

Maximum Required Correction for
Register^e (Including Effect of
Earth's Magnetic Field when
Using Recommended Components)
as Measured at the center of the
Screen in any Direction 0.005 in (0.13 mm) max.

LIMITING CIRCUIT VALUES

Effective grid-No.1-to-cathode-
circuit resistance (each gun) 0.75 max. M Ω

The low-voltage circuits, including all heater circuits, should be analyzed by assuming the color picture tube heater is connected directly to the receiver chassis ground. Under these conditions the circuits to the elements of all tubes, including the color picture tube, operating from the same heater winding and all connections of any other circuits to the heater winding should each have an impedance such that their respective power sources in combination will not supply a continuous

17E2P22

short circuit current of more than 750 mA total in the assumed picture tube heater ground connection. The leads from all other circuits must be separated from the picture tube leads by a minimum distance of 0.25 inch (6.4 mm) to prevent energy transfer to the picture tube circuits. Such current limitation will help prevent picture tube damage in case of momentary cascade arcing.

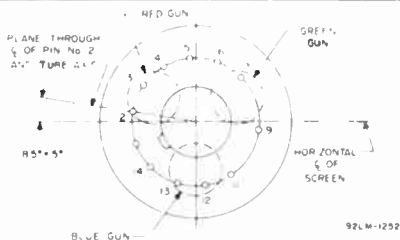
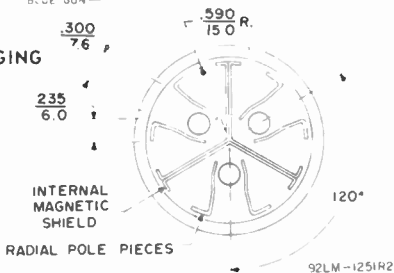
- a The mating socket, including its associated, physically-attached hardware and circuitry, must not weigh more than one pound.
- c For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts. The series impedance to any chassis connection in the DC biasing circuit for the heater should be between 100,000 ohms and 1 megohm.
- d For "instant on" applications, a maximum heater voltage of 5.5 volts (design-maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.
- e Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

X-RADIATION WARNING

Because the 17E2P22 is designed to be operated at anode voltages as high as 22.5 kilovolts (design-maximum value), shielding of the 17E2P22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

BASE SPECIFICATION - JEDEC No. 14BH

Pin 1: Heater	Pin 12: Grid No.1 of Blue Gun
Pin 2: Cathode of Red Gun	Pin 13: Grid No.2 of Blue Gun
Pin 3: Grid No.1 of Red Gun	Pin 14: Heater
Pin 4: Grid No.2 of Red Gun	Cap: Anode (Grid No.3, Grid No.5, Screen, Collector)
Pin 5: Grid No.2 of Green Gun	C: External Conductive Coating
Pin 6: Cathode of Green Gun	
Pin 7: Grid No.1 of Green Gun	
Pin 9: Grid No.4	
Pin11: Cathode of Blue Gun	

**BOTTOM VIEW
OF BASE**

**LOCATION OF
RADICAL-CONVERGING
POLE PIECES
VIEWED FROM
SCREEN END
OF GUNS**

NOTES FOR DIMENSIONAL OUTLINE

Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge (JFDEC No.G162) and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C' of the gauge with the glass funnel.

Note 2: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.

Note 3: The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

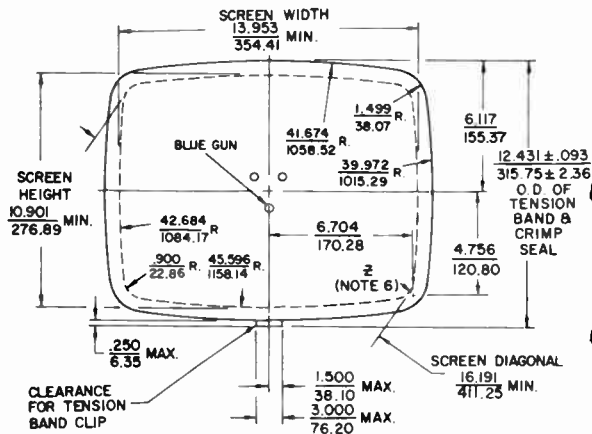
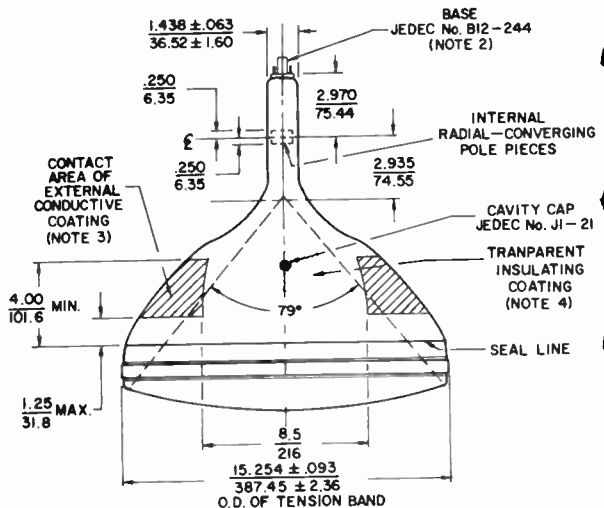
Note 4: To clean this area, wipe only with soft, dry, lintless cloth.

Note 5: All peripheral points of the faceplate lie on a spherical surface having a radius of 25.141 inches (638.58 mm). The center of the faceplate is located .016 inch (.41 mm) above this spherical surface.

Note 6: "Z" is located on the outside surface of the faceplate, on the screen diagonal at a point .125 in (3.18 mm) beyond the minimum screen. This point is used as a reference for the tension band.

17EZP22

DIMENSIONAL

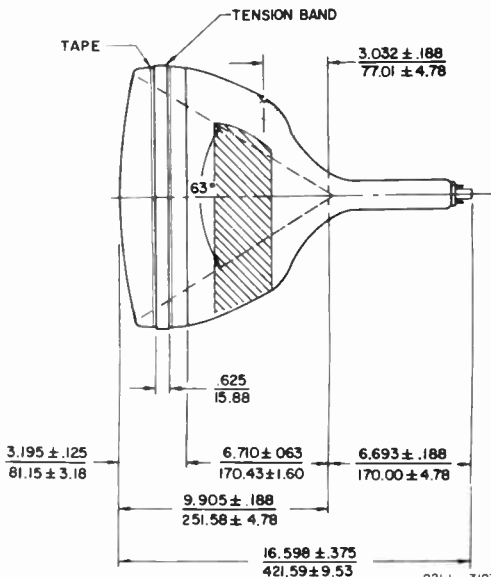
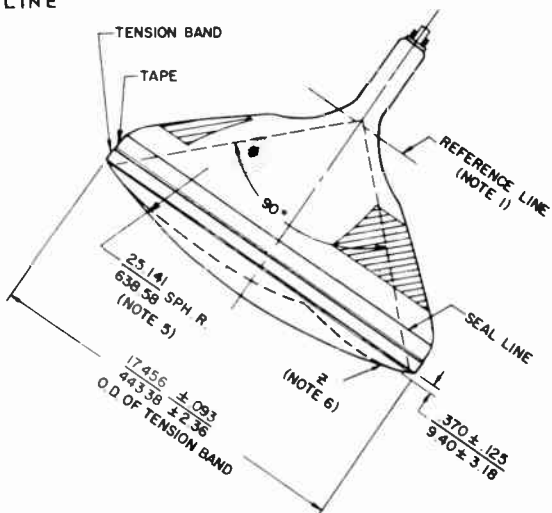


SAGITTAL HEIGHTS AT POINTS $\frac{125}{318}$ BEYOND EDGE OF MIN. SCREEN

DIAGONAL $\frac{1.398}{35.51}$ WIDTH $\frac{1.040}{26.42}$ HEIGHT $\frac{.642}{16.31}$

Dimensions in Inches / mm unless otherwise noted

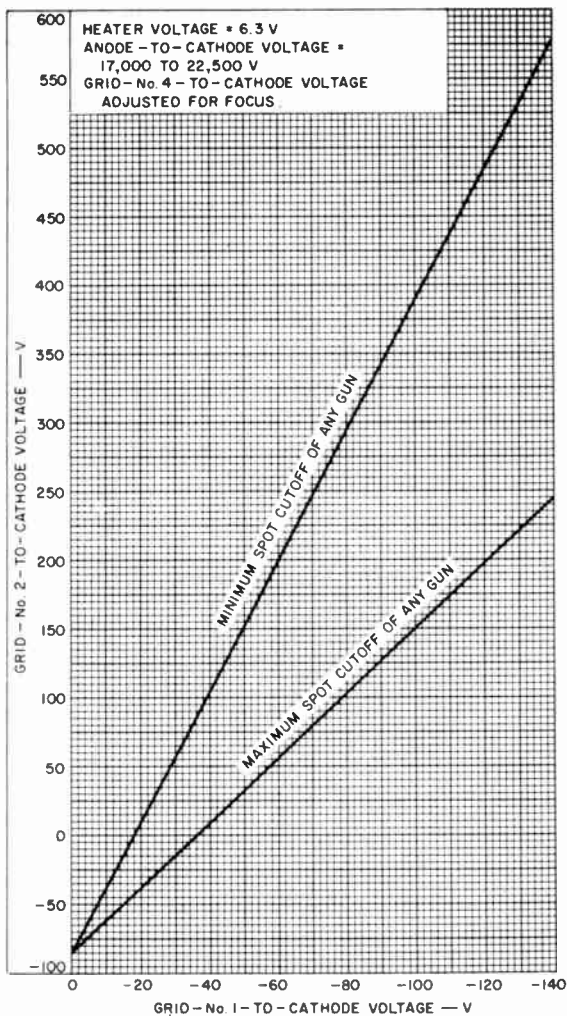
OUTLINE



92LL-3193R1

17E2P22

CUTOFF DESIGN CHART



92LM-1083R5

17HP4C

Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
70° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes.	5	pf
Grid No.1 to all other electrodes.	6	pf
External conductive coating to anode	{ 1500 max. 750 min.	pf
		pf
Heater Current at 0.3 volts.	600 ± 30	ma
Electron Gun	Type Requiring No Ion-Trap Magnet	

Optical:

Phosphor (For Curves, see front of this section). .P4—Sulfide Type, Aluminized
Faceplate, Spherical Filterglass
Light transmission (Approx.) 74%

Mechanical:

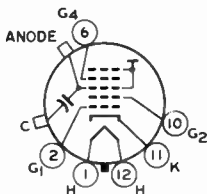
Weight (Approx.) 18 lbs
Overall Length 19-3/16" ± 3/8"
Neck Length. 7-1/2" ± 3/16"
Projected Area of Screen 149 sq. in.
External Conductive Coating:

Type Regular-Band
Contact area for grounding Near Reference Line
For Additional Information on Coatings and Dimensions:

See *Picture-Tube Dimensional-Outlines and Bulb J133 B/D* sheets at front of this section

Cap. Recessed Small Cavity (JEDEC No.J1-21)
Base . . Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.R6-63)
Basing Designation for BOTTOM VIEW 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Anode
(Grid No.3,
Grid No.5,
Screen,
Collector)
C - External
Conductive
Coating

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE.	17500 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts



17HP4C

GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE	{ 6.9 max.	volts
	{ 5.7 min.	volts
PFAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	14000	volts
Grid-No.4 Voltage	-56 to +310	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster		
	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section



17LP4B

Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
70° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes.	5	pf
Grid No.1 to all other electrodes.	6	pf
External conductive coating to anode	{ 1500 max.	pf
	{ 750 min.	pf
Heater Current at 6.3 volts.	600 ± 30	ma
Electron Gun	Type Requiring	
	to Ion-Trap Magnet	

Optical:

Phosphor (For curves, see front of this section). P4—Sulfide Type, Aluminized
 Faceplate, Cylindrical Filterglass
 Light transmission (Approx.) 66%

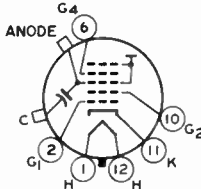
Mechanical:

Weight (Approx.) 19 lbs
 Overall Length 19-3/16" ± 3/8"
 Neck Length. 7-1/2" ± 3/16"
 Projected Area of Screen 149 sq. in.

External Conductive Coating:
 Type Regular-Band
 Contact area for grounding Near Reference Line

For Additional Information on Coatings and Dimensions:
 See *Picture-Tube Dimensional-Outlines and Bulb J133 C/E* sheets at front of this section
 Cap. Recessed Small Cavity (JFDEC No. J1-21)
 Base Small-Shell Duodecal 6-Pin (JFDEC Group 4, No. B6-63)
 Basing Designation for BOTTOM VIEW 12L

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 6—Grid No.4
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater



- Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)
- C—External Conductive Coating

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE.	17500 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts



17LP4B

GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE.	{ 6.9 max.	volts
	{ 5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage.	200 max.	volts
DC component.	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	14000	volts
Grid-No.4 Voltage	-56 to +310	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster.	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section



17QP4B

Picture Tube

RECTANGULAR GLASS TYPE
MAGNETIC FOCUS

ALUMINIZED SCREEN
70° MAGNETIC DEFLECTION

Electrical:

Plate (Anode) Voltage (typical) 100 V
 Cathode (Heater) Filament Voltage (500 mA) 5.0 V
 Grid No. 1 Voltage (typical) 0 V
 Grid No. 2 Voltage (typical) 0 V
 Collector Voltage (typical) 100 V
 Heater (Cathode) Filament Current (500 mA) 500 mA
 Heater (Cathode) Filament Resistance (500 mA) 10 Ω
 Deflection Factor (at 100 V) 1.5 mm/deg

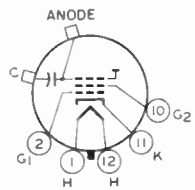
Optical:

Screen Type Aluminum
 Screen Glass 7%
 Deflection Factor (at 100 V) 1.5 mm/deg

Mechanical:

Overall Length 19 1/2" ± .015
 Overall Diameter 2 1/8" ± .015
 Neck Diameter 7/16" ± .015
 External Thread 1/4-28 UNF
 Mounting Bracket Regular-Band
 Control Grids Control Grids
 Deflection Factor (at 100 V) 1.5 mm/deg
 Picture Tube Dimensional Outlines and Bulb Size Code Sheets
 at front of this publication
 Deflection Factor (at 100 V) 1.5 mm/deg
 Deflection Factor (at 100 V) 1.5 mm/deg
 Deflection Factor (at 100 V) 1.5 mm/deg
 Deflection Factor (at 100 V) 1.5 mm/deg

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



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

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

Across Voltage	2000 max.	volts
Grid-to-Cathode Voltage	150 max.	volts



17QP4B

Grid-No.1 Voltage:

Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage.	{ 6.9 max.	volts
	{ 5.7 min.	volts

Peak Heater-Cathode Voltage:

Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage.	200 max.	volts
DC component.	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	14000	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster.	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section



Picture Tube

SHORT RECTANGULAR GLASS TYPE **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS **114° MAGNETIC DEFLECTION**
INTERNAL MAGNETIC SHIELD

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes	3.4	pf
Grid No.1 to all other electrodes	3.4	pf
External conductive coating to anode.	{ 1400 max.	pf
	850 min.	pf
Heater Current at 2.68 volts.	450 ± 45	ma
Heater Warm-Up Time (Average)	11	seconds
Electron Gun.	Type Requiring No Ion-Trap Magnet	

Optical:

Phosphor (For curves, see front of this section). P4—Sulfide Type, Aluminized
 Faceplate Filterglass
 Light transmission (Approx.). 77%

Mechanical:

Weight (Approx.). 14 lbs
 Overall Length. 10-15/16" ± 3/16"
 Neck Length 3-11/16" ± 1/16"
 Projected Area of Screen. 172 sq.in.

External Conductive Coating:

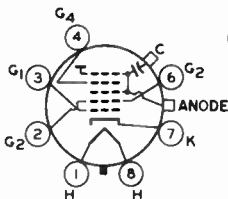
Type. Regular-Band
 Contact area for grounding. Near Reference Line
 For Additional Information on Coatings and Dimensions:

See *Picture-Tube Dimensional-Outlines and Bulb J149 A* sheets at front of this section

Cap Recessed Small Cavity (JEDEC No..J1-21)
 Base. Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

Basing Designation for BOTTOM VIEW. 8JK

Pin 1 - Heater
 Pin 2 - Grid No.2
 Pin 3 - Grid No.1
 Pin 4 - Grid No.4
 Pin 6 - Grid No.2
 Pin 7 - Cathode
 Pin 8 - Heater



Cap - Anode
 (Grid No.3,
 Grid No.5,
 Screen,
 Collector)
 C - External
 Conductive
 Coating



19ABP4

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE	20000 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value.	950 max.	volts
Negative value.	700 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	400 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE.	{ 2.9 max. 2.4 min.	volts volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage.	200 max.	volts
DC component.	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	16000	volts
Grid-No.4 Voltage	100 to 500	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster.	-35 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section



Picture Tube

**BI-PANEL RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS**

**ALUMINIZED SCREEN
114° MAGNETIC DEFLECTION**

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts.	600 ± 5%	ma
Heater Warm-Up Time (Average).	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes.	6	μμf
Cathode to all other electrodes.	5	μμf
External conductive coating to ultor	{ 1500 max. 1000 min.	{ μμf μμf
Electron Gun	Type Requiring No Ion-Trap Magnet	

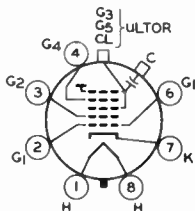
Optical:

Faceplate and Protective Panel	Filterglass
Light transmission (Approx.)	44%
Phosphor (For curves, see front of this section)	P4—Sulfide Type, Aluminized

Mechanical:

Operating Position	Any
Weight (Approx.)	18-1/2 lbs
Overall Length	11-5/8" ± 5/16"
Neck Length.	4-1/8" ± 1/8"
Projected Area of Screen	172 sq. in.
External Conductive Coating:	
Type	Regular Band
Contact area for grounding	Near Reference Line
For Additional Information on Coatings and Dimensions: See <i>Picture-Tube Dimensional-Outlines</i> and <i>Bulb J149 C</i> sheets at the front of this section	
Cap	Recessed Small Cavity (JEDEC No. J1-21)
Base.	Small-Button Neoeightar 7-Pin, Arrangement 1 (JEDEC No. B7-208)
Basing Designation for BOTTOM VIEW . . . . .	.8HR

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 3 - Grid No.2
- Pin 4 - Grid No.4
- Pin 6 - Grid No.1
- Pin 7 - Cathode
- Pin 8 - Heater



- Cap - Ultor
(Grid No.3,
Grid No.5,
Collector)
- C - External
Conductive
Coating



19AFP4

Maximum Ratings, Design-Maximum Values:

ULTOR VOLTAGE.	20000 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
GRID-No.2 VOLTAGE.	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value.	220 max.	volts
Negative bias value.	155 max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds	450 max.	volts
after equipment warm-up period . . .	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With ultor voltage of	16000	volts
and grid-No.2 voltage of	300	volts
Grid-No.4 voltage for focus.	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster.	-35 to -72	volts

Maximum Circuit Values:

Grid-No.1- circuit Resistance	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



Picture Tube

SHORT RECTANGULAR GLASS TYPE
 LOW-VOLTAGE ELECTROSTATIC FOCUS
 LOW GRID-No.2 VOLTAGE

ALUMINIZED SCREEN
 114° MAGNETIC DEFLECTION
 CATHODE-DRIVE TYPE

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts	450 ± 10%	ma
Heater Warm-Up Time (Average)	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor.	{ 1900 max. 1400 min.	{ μμf μμf
Electron Gun.	Type Requiring No Ion-Trap Magnet	

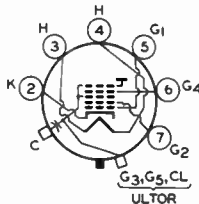
Optical:

Faceplate	Filterglass
Light transmission (Approx.)	78%
Phosphor (For Curves, see front of this Section)	F4—Sultide Type, Aluminized

Mechanical:

Operating Position.	Any
Weight (Approx.)	14 lbs
Overall Length.	11-3/8" ± 1/4"
Neck Length	4-1/8" ± 1/8"
Projected Area of Screen.	172 sq. in.
External Conductive Coating:	
Type.	Regular Band
Contact area for grounding.	Near Reference Line
For Additional Information on Coatings and Dimensions:	
See <i>Picture-Tube Dimensional-Outlines</i> and <i>Bulb J149 A</i> sheets at the front of this section	
Cap	Recessed Small Cavity (JEDEC No. J1-21)
Base.	Special 6-Pin (JEDEC No. B6-214)
Basing Designation for BOTTOM VIEW. 7FA	

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



- Cap - Ultor
- (Grid No.3, Grid No.5, Collector)
- C - External Conductive Coating



19AJP4

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

ULTOR-TO-GRID-No.1 VOLTAGE.	{ 19800 max. 12000 min.	volts volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value.	1100 max.	volts
Negative value.	500 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE.	{ 70 max. 40 min.	volts volts
CATHODE-TO-GRID-No.1 VOLTAGE.	100 max.	volts
HEATER VOLTAGE.	{ 7 max. 5.8 min.	volts volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	410 max.	volts
After equipment warm-up period.	180 max.	volts
Heater positive with respect to cathode.	180 max.	volts

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage of	14500	volts
and grid-No.2-to-grid-No.1 voltage of	50	volts
Grid-No.4-to-Grid-No.1 Voltage for focus	0 to 500	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster.	31 to 49	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section





19AP4

KINESCOPE

The 19AP4 is like the 19AP4-B except that it has a face plate made of *unfrosted, clear glass*. As a result, the light output is about 30% greater than shown by the curves under Type 19AP4-B.

19AP4-A

KINESCOPE

The 19AP4-A is like the 19AP4-B except that it has an *unfrosted Filterglass* face plate. The light output is essentially the same as that of the Type 19AP4-B.

As soon as feasible, the 19AP4-B will supersede the 19AP4 and 19AP4-A.

19AP4
19AP4-A





19AP4-D

KINESCOPE

19AP4-D

The 19AP4-D is like the 19AP4-B except that it has a face plate made of *frosted, clear glass*. As a result, the light output is about 30% greater than shown by the curves under Type 19AP4-B.

As soon as feasible, the 19AP4-B will supersede the 19AP4-D.

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19AVP4

Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts.	600 ± 30	ma
Heater Warm-Up Time (Average).	11	seconds
Focusing Method.	Electrostatic	
Deflection Method.	Magnetic	
Deflection Angles (Approx.):		
Diagonal	114°	
Horizontal	102°	
Vertical	85°	
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes.	6	μμf
Cathode to all other electrodes.	5	μμf
External conductive coating to ultor.	{1500 max. 1000 min.	{μμf μμf
Electron Gun	Type Requiring No Ion-Trap Magnet	

Optical:

Faceplate.	Filterglass	
Light transmission at center (Approx.)	78%	
Phosphor (For curves, see front of this section)	P4—Sulfide Type	
	Aluminized	
Fluorescence	White	
Phosphorescence.	White	
Persistence.	Medium Short	

Mechanical:

Tube Dimensions:		
Overall length	11-3/8" ± 1/4"	
Greatest width	16-13/32" ± 1/8"	
Greatest height.	13-11/32" ± 1/8"	
Diagonal	18-5/8" ± 1/8"	
Neck length.	4-1/8" ± 1/8"	
Curvature of faceplate (External Radii):		
Center	48"	
Edge	21"	
Screen Dimensions (Minimum):		
Greatest width	15-1/8"	
Greatest height.	12"	
Diagonal	17-9/16"	
Projected area	172 sq. in.	
Weight (Approx.)	14 lbs	
Operating Position	Any	
Cap.	Recessed Small Cavity (JEDEC No. J1-21)	
Bulb	J149A1	

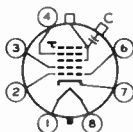


19AVP4

Base. Small-Button Neoeightar 7-Pin, Arrangement 1,
(JEDEC No. B7-208)

Basing Designation for BOTTOM VIEW. BHR

- Pin 1 - Heater
- Pin 2 - Grid No. 1
- Pin 3 - Grid No. 2
- Pin 4 - Grid No. 4
- Pin 6 - Grid No. 2
- Pin 7 - Cathode
- Pin 8 - Heater



Cap - Ultor
(Grid No. 3,
Grid No. 5,
Collector)
C - External
Conductive
Coating

GRID-DRIVE^A SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR VOLTAGE	{ 23000 max. 15000 min.	volts volts
GRID-No. 4 (FOCUSING) VOLTAGE:		
Positive value.	1100 max.	volts
Negative value.	550 max.	volts
GRID-No. 2 VOLTAGE	{ 550 max. 200 min.	volts volts
GRID-No. 1 VOLTAGE:		
Negative-peak value	220 max.	volts
Negative-bias value	154 max.	volts
Positive-bias value	0 max.	volts
Positive-peak value	2 max.	volts
HEATER VOLTAGE.	{ 6.9 max. 5.7 min.	volts volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Typical Operating Conditions:

With ultor voltage (E_{c5k}) of	20000	volts
and grid-No. 2 voltage (E_{c2k}) of	400	volts
Grid-No. 4 Voltage for focus	0 to 400	volts
Grid-No. 1 Voltage for visual extinction of focused raster*	-36 to -94	volts
Field Strength of Adjustable Centering Magnet	0 to 9	gausses

Maximum Circuit Values:

Grid-No. 1-Circuit Resistance.	1.5 max.	megohms
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CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR-TO-GRID-No.1 VOLTAGE.	{ 23000 max. 15000 min.	volts volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value.	1250 max.	volts
Negative value.	400 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE.	{ 700 max. 350 min.	volts volts
GRID-No.2-TO-CATHODE VOLTAGE.	550 max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive-peak value	220 max.	volts
Positive-bias value	154 max.	volts
Negative-bias value	0 max.	volts
Negative-peak value	2 max.	volts
HEATER VOLTAGE.	{ 6.9 max. 5.7 min.	volts volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage (E_{C5g1}) of	20000	volts
and grid-No.2-to-grid-No.1 voltage (E_{C2g1}) of	400	volts
Grid-No.4-to-Grid-No.1 Voltage for focus.	0 to 400	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster.	36 to 78	volts
Field Strength of Adjustable Centering Magnet.	0 to 9	gausses

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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▲ Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

● The grid-No.4 (or grid-No.4-to-grid-No.1) voltage required for optimum focus of any individual tube will have a value anywhere between 0 and 400 volts, is independent of ultor current and will remain essentially constant for values of ultor (or ultor-to-grid-No.1) voltage or grid-No.2 (or grid-No.2-to-grid-No.1) voltage within design-maximum ratings shown for these items.

★ See Raster-Cutoff-Range Chart for Grid-Drive Service.

◆ Distance from Reference Line for suitable PM centering magnet should not exceed $2-1/4"$. The specified centering magnet compensates only for the effect which mechanical tube tolerances may have on the location of the undeflected focused spot with respect to the center of the tube face. Maximum field strength of adjustable centering magnet equals:



19AVP4

$$\sqrt{\frac{E_{c5k} \text{ or } E_{c591} \text{ (volts)}}{16000 \text{ (volts)}}} \times 8 \text{ gaussess}$$

The equipment manufacturer must determine and supply additional compensation for the effects of the earth's magnetic field and extraneous fields due to choice of circuitry and components. The additional compensation should preferably be applied as part of the magnetic field of the deflecting yoke.

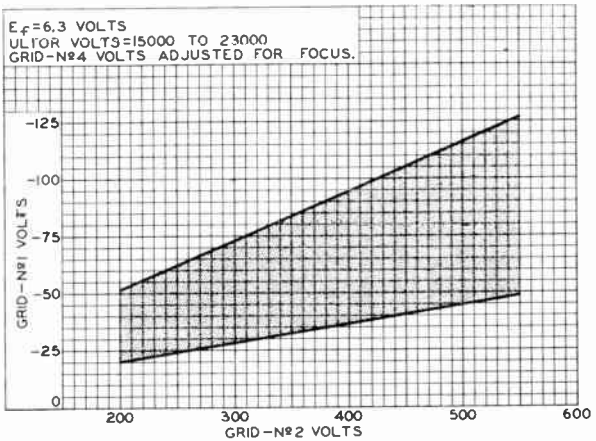
- Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.
- See *Raster-Cutoff-Range Chart for Cathode-Drive Service.*

OPERATING CONSIDERATIONS

X-Ray Warning. When operated at ultor voltages up to 16 kilovolts, this picture tube does not produce any harmful X-ray radiation. However, because the rating of this type permits operation at voltages as high as 23 kilovolts (Design-maximum value), shielding of this picture tube for X-ray radiation may be needed to protect against possible injury from prolonged exposure at close range whenever the operating conditions involve voltages in excess of 16 kilovolts.

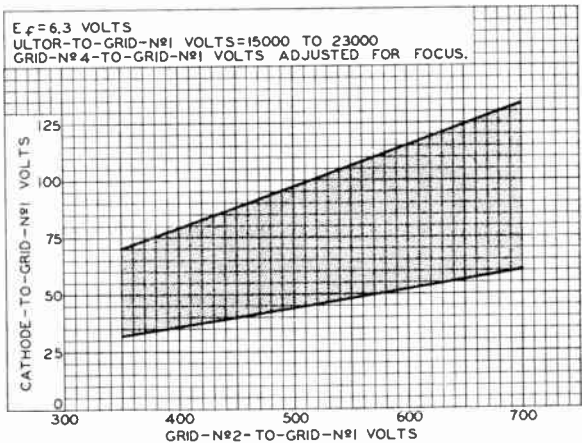
Shatter-Proof Cover Over the Tube Face. Following conventional picture tube practice, it is recommended that the cabinet be provided with a shatterproof, glass cover over the face of this picture tube to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.

RASTER-CUTOFF-RANGE CHARTS Grid-Drive Service



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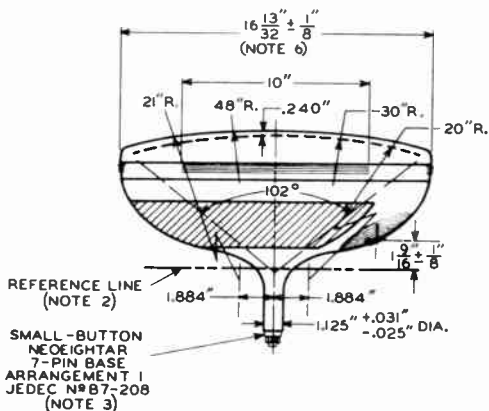
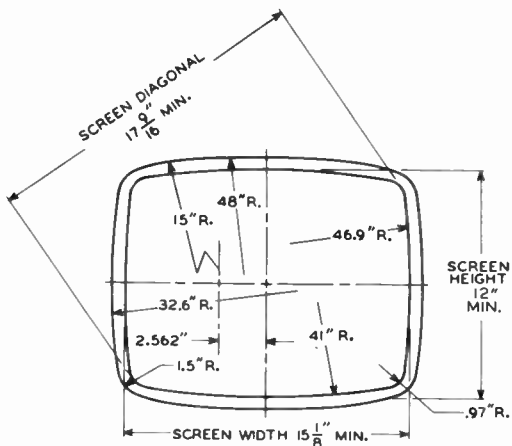
Cathode-Drive Service

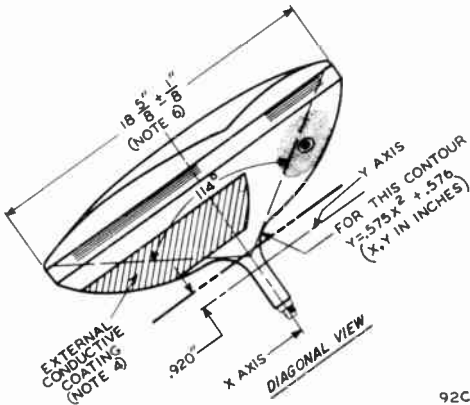
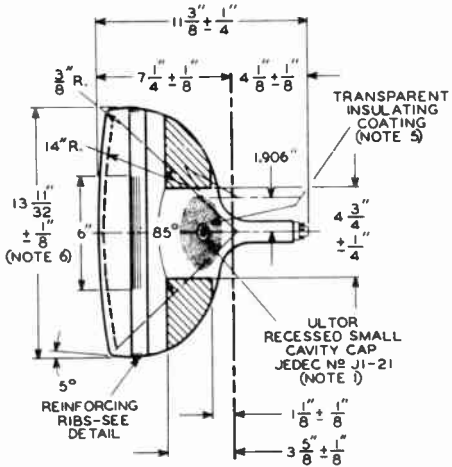


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19AVP4

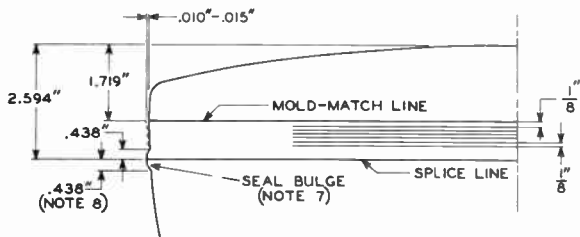




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19AVP4



DETAIL OF PANEL

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 30^\circ$. ULTOR TERMINAL IS ON SAME SIDE AS PIN 4.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No. G-126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

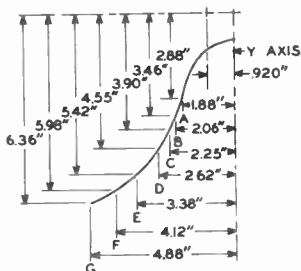
NOTE 6: MEASURED AT THE MOLD-MATCH LINE.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/16" BEYOND THE ENVELOPE SURFACE AT THE MOLD-MATCH LINE.

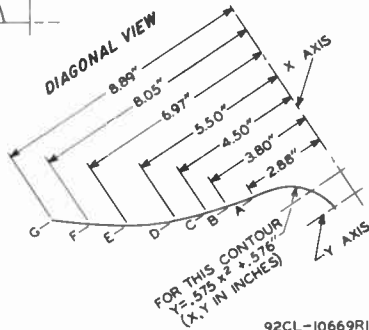
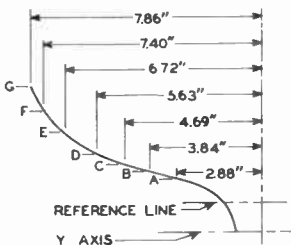
NOTE 8: UNDISTURBED AREA BETWEEN MOLD-MATCH LINE AND SPLICE LINE IS 3/8" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF THE TUBE SUPPORT BAND. TUBE MOUNTING AND YOKE SUPPORT CLAMPS MUST BE SPECED FROM THE TUBE BY USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.

BULB-CONTOUR DIMENSIONS

SHORT-SIDE VIEW



LONG-SIDE VIEW



92CL-10669RI

NOTE: PLANES A THROUGH G ARE NORMAL TO THE TUBE AXIS AND AT FIXED LOCATIONS FROM THE Y AXIS. THESE COORDINATES DESCRIBE THE BOGIE-BULB EXTERNAL CONTOUR IN PLANES THROUGH THE TUBE AXIS AND THE RESPECTIVE FACEPLATE AXES.





19AYP4

Picture Tube

SHORT RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
114° MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

The 19AYP4 is the same as the 19AVP4 except for the following item:

Electrical:

Heater Current at 6.3 volts. 450 ± 20 ma





Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
LOW-GRID-No.2 VOLTAGE

ALUMINIZED SCREEN
92° MAGNETIC DEFLECTION
CATHODE-DRIVE TYPE

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts	600 ± 10%	ma
Heater Warm-Up Time (Average)	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	μf
Cathode to all other electrodes	5	μf
External conductive coating to ultor.	{ 2000 max. 1500 min.	{ μf μf
Electron Gun.	Type Requiring No Ion-Trap Magnet	

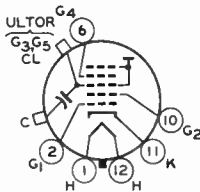
Optical:

Faceplate	Filterglass
Light transmission (Approx.)	78%
Phosphor (For curves, see front of this section)	P4—Sulfide Type, Aluminized

Mechanical:

Operating Position.	Any
Weight (Approx.)	15 lbs
Overall Length.	15-1/4" ± 3/8"
Neck Length	5-1/2" ± 3/16"
Projected Area of Screen.	172 sq. in.
External Conductive Coating:	
Type.	Regular Band
Contact area for grounding.	Near Reference Line
For Additional Information on Coatings and Dimensions: See <i>Picture-Tube Dimensional-Outlines</i> and <i>Bulb J149 B</i> sheets at the front of this section	
Cap	Recessed Small Cavity (JEDEC No. J1-21)
Bases (Alternates):	
Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No. B6-203)	
Small-Shell Duodecal 6-Pin, Arrangement 1 (JEDEC Group 4, No. B6-63)	
Basing Designation for BOTTOM VIEW.	12L

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 6 - Grid No.4
- Pin 10 - Grid No.2
- Pin 11 - Cathode
- Pin 12 - Heater



Cap - Ultor
 (Grid No.3,
 Grid No.5,
 Collector)
 C - External
 Conductive
 Coating



19BDP4

Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR-TO-GRID-NO.1 VOLTAGE.	{ 13500 max. 12000 min.	volts volts
GRID-NO.4-TO-GRID-NO.1 (FOCUSING) VOLTAGE:		
Positive value.	1100 max.	volts
Negative value.	500 max.	volts
GRID-NO.2-TO-GRID-NO.1 VOLTAGE.	{ 70 max. 40 min.	volts volts
CATHODE-TO-GRID-NO.1 VOLTAGE.	100 max.	volts
HEATER VOLTAGE.	{ 7 max. 5.8 min.	volts volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	410 max.	volts
After equipment warm-up period.	180 max.	volts
Heater positive with respect to cathode.	180 max.	volts

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage of	14500	volts
and grid-No.2-to-grid-No.1 voltage of	50	volts
Grid-No.4-to-Grid-No.1 Voltage for focus	0 to 500	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster.	31 to 49	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
92° MAGNETIC DEFLECTION

GENERAL DATA

Electrical:

Heater Current at 6.3 volts 600 ± 5% ma

Direct Interelectrode Capacitances:

Grid No.1 to all other electrodes 6 μμf

Cathode to all other electrodes 5 μμf

External conductive coating to ultor. { 2000 max. μμf
1500 min. μμf

Electron Gun. type Requiring No Ion-Trap Magnet

Optical:

Faceplate Filterglass

Light transmission (Approx.). 78%

Phosphor (for curves, see front of this Section). P4—Sulfide Type, Aluminized

Mechanical:

Operating Position. Any

Weight (Approx.). 14-3/4 lbs

Overall length. 15-1/4" ± 3/8"

Neck Length 5-1/2" ± 3/16"

Projected Area of Screen. 172 sq. in.

External Conductive Coating:

Type. Regular Band

Contact area for grounding. Near Reference Line

For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines* and *Bulb J149 B* sheets at the front of this section

Car Recessed Small Cavity (JEDEC No. J1-21)

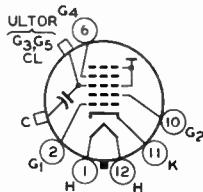
Bases (Alternates):

Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No. B6-203)

Small-Shell Duodecal 6-Pin, Arrangement 1 (JEDEC Group 4, No. B6 63)

Basing Designation for BOTTOM VIEW. 12L

Pin 1—Heater
Pin 2—Grid No.1
Pin 6—Grid No.4
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater



Cap—Ultor
(Grid No.3,
Grid No.5,
Collector)

C—External
Conductive
Coating



19BFP4

Maximum Ratings, Design-Maximum Values:

ULTOR VOLTAGE	20000 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value.	1100 max.	volts
Negative value.	550 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	154 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Typical Operating Conditions:

With ultor voltage of	16000	volts
and grid-No.2 voltage of	400	volts
Grid-No.4 Voltage for focus	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster.	-36 to -94	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



Picture Tube

SHORT RECTANGULAR GLASS TYPE
 LOW-VOLTAGE ELECTROSTATIC FOCUS
 LOW GRID-No.2 VOLTAGE

ALUMINIZED SCREEN
 114° MAGNETIC DEFLECTION
 CATHODE-DRIVE TYPE

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at (117 volts)	600 ± 30	ma
Heater Warm-Up Time (Average)	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor.	{ 1500 max. 1000 min.	{ μμf μμf
Electron Gun.	Type Requiring	No Ion-Trap Magnet

Optical:

Faceplate	Filter glass
Light transmission (Approx.)	78%
Phosphor (For curves, see front of this section). P4—Sulfide Type, Aluminized	

Mechanical:

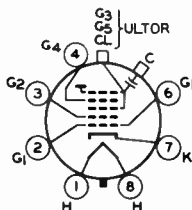
Operating Position.	Any
Weight (Approx.)	14 lbs
Overall Length.	11-5/8" ± 1/4"
Neck Length	4-3/8" ± 1/8"
Projected Area of Screen.	172 sq. in.

External Conductive Coating:
 Type Regular Band
 Contact area for grounding. Near Reference Line

For Additional Information on Coatings and Dimensions:
 See *Picture-Tube Dimensional-Outlines* and *Bulb J149 A* sheets
 at the front of this section

Cap	Recessed Small Cavity (JEDEC No. J1-21)
Base.	Small-Button Noveightar 7-Pin, Arrangement 1 (JEDEC No. B7-208)
Basing Designation for BOTTOM VIEW.	8HR

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 3 - Grid No.2
- Pin 4 - Grid No.4
- Pin 6 - Grid No.1
- Pin 7 - Cathode
- Pin 8 - Heater



- Cap - Ultor
 (Grid No.3,
 Grid No.5,
 Collector)
- C - External
 Conductive
 Coating



19CHP4

Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR-TO-GRID-No.1 VOLTAGE.	{ 20000 max. 10000 min.	volts volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value.	1250 max.	volts
Negative value.	400 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE.	{ 70 max. 40 min.	volts volts
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive peak value	150 max.	volts
Positive bias value	100 max.	volts
Negative bias value	0 max.	volts
Negative peak value	2 max.	volts
HEATER VOLTAGE.	{ 6.9 max. 5.7 min.	volts volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage of	16000	volts
and grid-No.2-to-grid-No.1 voltage of	50	volts
Grid-No.4-to-Grid-No.1 Voltage for focus	-50 to +250	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster	32 to 50	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



19CMP4

Picture Tube

LOW-VOLTAGE ELECTROSTATIC FOCUS 114° MAGNETIC DEFLECTION

Low-Grid-No. 2 Voltage — for Cathode-Drive Operation

The 19CMP4 is the same as the 19CHP4 except for the following items:

ELECTRICAL

Heater Current at 6.3 volts 450 ± 20 mA

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Anode Voltage 12000 min V





19CXP4

Picture Tube

NO ION-TRAP MAGNET REQUIRED

LOW-VOLTAGE ELECTROSTATIC FOCUS 114° MAGNETIC DEFLECTION

Low-Grid-No.2 Voltage — for Cathode-Drive Operation

ELECTRICAL

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode	{ 1900 max 1400 min	pF pF
Heater Current at 6.3 V . . . . .			600 +60	mA
Heater Warm-Up Time (Average)	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

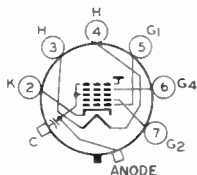
OPTICAL

Phosphor	P4—Sulfide Type, Alumined
<i>(on curved, rear part of this section)</i>	
Faceplate	Filterglass
<i>(Light transmission approx.)</i>	
	78%

MECHANICAL

Weight (Approx.)	14 lb
Overall Length	11.625 + 0.250 in
Neck Length	4.375 + 0.125 in
Projected Area of Screen	172 sq in
External Conductive Coating	Regular-Band
<i>(Contact area for drawing)</i>	
	Near Reference Line
For Addition Information on Coatings and Dimensions	
<i>See Picture-Tube Dimensional-Outlines (see Bulb 1149A)</i>	
<i>at front of this section</i>	
Cap	Recessed Small Cavity (JEDEC No. J1-21)
Base	Special 6-Pin (JEDEC No. 86-214)
Basing Designation for BOTTOM VIEW	7FA

- Pin 2—Cathode
- Pin 3—Heater
- Pin 4—Heater
- Pin 5—Grid No.1
- Pin 6—Grid No.2
- Pin 7—Grid No.3
- Cap—Anode-Grid No.3,
Grid No.1, Screen,
Collector
- C—External Conductive
Coating



19CXP4

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	{ 20000 max 12000 min	V V
Grid-No. 4 (Focusing) Voltage		
Positive value	1100 max	V
Negative value	500 max	V
Grid-No. 2 Voltage	{ 55 max 30 min	V V
Cathode Voltage		
Negative peak value	2 max	V
Negative bias value	0 max	V
Positive bias value	100 max	V
Positive peak value	150 max	V
Heater Voltage	{ 6.9 max 5.7 min	V V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds	450 max	V
After equipment warm-up period	200 max	V
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	16000	V
Grid-No. 4 Voltage	0 to 500	V
Grid-No. 2 Voltage	45	V
Cathode Voltage	35 to 50	V

For visual extinction of focused raster

MAXIMUM CIRCUIT VALUE

Grid-No. 1 Circuit Resistance	1.5 max	M Ω
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES at
front of this section



Picture Tube

PAN-O-PLY—INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands Around Periphery of Tube Panel—No Separate Safety-Glass or Integral Protective Window Required)

LOW-VOLTAGE ELECTROSTATIC FOCUS 114° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid No. 1 to all other electrodes	6	pF
External conductive coating to anode	1250 min—1750 max	pF ←
Heater Current at 6.3 volts	450 ± 20	mA
Heater Warm-Up Time (Average)	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

Phosphor	P4—Sulfide Type, Aluminized
For curves, see front of this section	
Faceplate	Filterglass
Light Transmission (Approx.)	48%

MECHANICAL

Weight (Approx.)	15 lb
Overall Length	11.375 ± .250 in
Neck Length	4.125 ± .125 in
Projected Area of Screen	172 sq in
External Conductive Coating ^a	

Coating	Regular-Band
Contact area for grounding	Near Reference Line

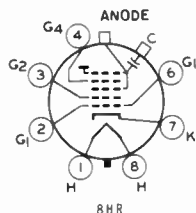
For Additional Information on Coatings and Dimensions

See *Picture-Tube Dimensional Outlines and Bulb J149F* charts at front of this section

Cap.	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Noveightar 7-Pin, Arrangement 1, (JEDEC No. B7-208)

TERMINAL DIAGRAM (Bottom View)

- Pin 1—Heater
- Pin 2—Grid No. 1
- Pin 3—Grid No. 2
- Pin 4—Grid No. 3
- Pin 5—Grid No. 4
- Pin 6—Cathode
- Pin 7—Heater
- Cap—Anode (Grid No. 5, Grid No. 6, Screen, Collector)
- C—External Conductive Coating



← Indicates a change.



19DQP4

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage.	11000 min—23000 max	V
Grid-No.4 (Focusing) Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage.	200 min—550 max	V
Grid-No.1 Voltage		
Negative peak value.	220 max	V
Negative bias value.	155 max	V
Positive bias value.	0 max	V
Positive peak value.	2 max	V
Heater Voltage	5.7 min—6.9 max	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds. . .	450 max	V
After equipment warm-up period	300 max	V
Heater positive with respect to cathode:		
Combined AC and DC voltage . .	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage.	16000	V
Grid-No.4 Voltage ^b	200	V
Grid-No.2 Voltage.	300	V
Cathode Voltage.	28 to 62	V
For visual extinction of focused raster		
Field Strength of required adjustable centering magnet ^c	0 to 8	G

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	M.
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^a External conductive coating and implosion protection hardware must be grounded.

^b The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 10-1 2-inch by 13-inch pattern from an HA-2F21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
 at front of this section



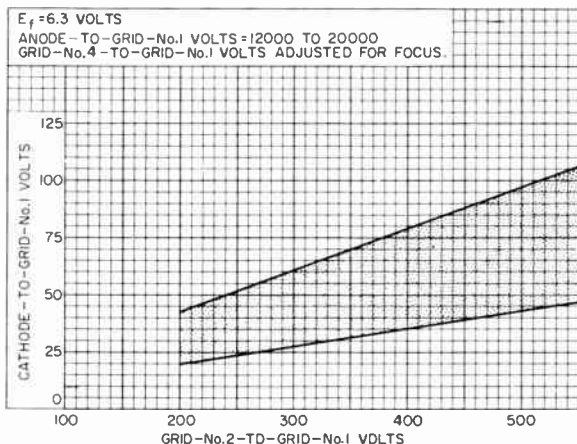
- c Distance from Reference Line for suitable PM centering magnet should not exceed $\pm 1/4$ inch. The specified centering magnet compensates only for the effect which mechanical tube tolerances may have on the location of the deflected, focused spot with respect to the center of the tube face. Maximum field strength of adjustable centering magnet equal.

$$\sqrt{\frac{\text{Anode volts}}{16000 \text{ volts}}} \times 8 \text{ Gauss}$$

The equipment manufacturer must determine and supply additional compensation for the effect of the earth's magnetic field and extraneous field due to choice of circuitry and components. The additional compensation should preferably be applied as part of the magnetic field of the deflecting yoke.

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section.

RASTER-CUTOFF-RANGE CHART Cathode-Drive Service



92CS-12008





Picture Tube

PAN-O-PLY — INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands Around Periphery of Tube Panel — No Separate Safety-Glass or Integral Protective Window Required)

RECTANGULAR GLASS TYPE	NO ION-TRAP MAGNET REQUIRED
LOW-VOLTAGE ELECTROSTATIC FOCUS	114° MAGNETIC DEFLECTION
HEATER CONTROLLED WARM-UP TIME	ALUMINIZED SCREEN

The 19DRP4 is the same as the 19DQP4 except for the following items:

Electrical:

Heater current at 6.3 volts 600 ± 30 ma





Picture Tube

PAN-O-PLY — INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands Around Periphery of Tube Panel — No Separate Safety-Glass or Integral Protective Window Required)

LOW-VOLTAGE ELECTROSTATIC FOCUS **114° MAGNETIC DEFLECTION**
NO ION-TRAP MAGNET REQUIRED

Low-Grid-No.2-Voltage — for Cathode-Drive Operation

ELECTRICAL

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode ^a	{ 1750 max 1250 min	pF ←
		pF ←
Heater Current at 6.3 volts	600 ± 30	mA
Heater Warm-Up Time (Average)	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

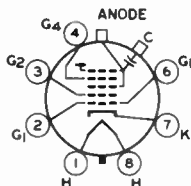
OPTICAL

Phosphor	P4—Sulfide Type, Aluminized
(For Curves, see front of this section)	
Faceplate	Filterglass
Light Transmission (Approx.)	48% ←

MECHANICAL

Weight (Approx.)	15.5 lbs ←
Overall Length	11.625 ± 0.250 in
Neck Length	4.375 ± 0.125 in
Projected Area of Screen	172 sq in
External Conductive Coating ^a	
Type	Regular-Band
Contact area for grounding	Near Reference Line
For Additional Information on Coatings and Dimensions	
See <i>Picture-Tube Dimensional-Outlines</i> and <i>Bulb J149 F</i> sheets at front of this section	
Cap	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No. B7-208)
Basing Designation for BOTTOM VIEW	8HR

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 3—Grid No.2
- Pin 4—Grid No.4
- Pin 6—Grid No.1
- Pin 7—Cathode
- Pin 8—Heater
- Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)
- C—External Conductive Coating



← Indicates a change.



19DSP4

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	{ 20000 max 10000 min	V V
Grid-No.4 (Focusing) Voltage		
Positive value	1250 max	V
Negative value	400 max	V
Grid-No.2 Voltage	{ 70 max 40 min	V V
Cathode Voltage		
Negative peak value	2 max	V
Negative bias value	0 max	V
Positive bias value	100 max	V
Positive peak value	150 max	V
Heater Voltage	{ 6.9 max 5.7 min	V V
Peak Heater-Cathode Voltage		
Heater positive with respect to cathode and equipment warm-up period	450 max	V
Heater positive with respect to cathode after positive with respect to anode and 100 ms DC voltage	300 max	V
Cathode	200 max	V
Component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	16000	V
Grid-No.4 Voltage ^b	100	V
Grid-No.2 Voltage	50	V
Cathode Voltage for visual extinction of focused raster	32 to 50	V
Field Strength of required adjustable centering magnet	0 to 8	G

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	M Ω
--	---------	------------

^a External conductive coating and implosion protection hardware must be grounded.

^b The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between +100 and +300 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 10-1/2-inch by 14-inch pattern from an RCA-2121 monoscope, or equivalent.

CAUTION: This tube contains a radioactive source. Observe the following X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES and related components:



19EBP4

Picture Tube

FILLED-RIM TYPE

114° MAGNETIC DEFLECTION

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode	1250 min—1750 max	pF
Heater Current at 6.3 V.	600 ± 30	mA
Heater Warm-Up Time (Average).	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

Phosphor	P4—Sulfide Type, Aluminized
For curves, see front of this section	
Faceplate	Filterglass
Light transmission at center (Approx.)	48 %

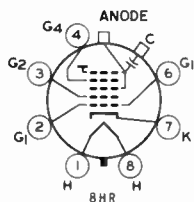
MECHANICAL

Weight (Approx.)	16 lb
Overall Length	11.625 ± .250 in
Neck Length.	4.375 ± .125 in
Projected Area of Screen	172 sq in
External Conductive Coating	

Type (see front outlines at front of this section)	Regular-Band
Contact area for grounding	Near Reference Line
Cap.	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No. B7-208)

TERMINAL DIAGRAM (Bottom View)

- Pin 1 - Heater
- Pin 2 - Grid No. 1
- Pin 3 - Grid No. 2
- Pin 4 - Grid No. 4
- Pin 6 - Grid No. 1
- Pin 7 - Cathode
- Pin 8 - Heater
- Cap - Anode (Grid No. 3, Grid No. 5, Screen, Collector)
- C - External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage.	11000 min—23000 max	V
Grid-No. 4 Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No. 2 Voltage.	200 min—550 max	V
Grid-No. 1 Voltage		
Negative peak value.	220 max	V
Negative bias value.	155 max	V
Positive bias value.	0 max	V
Positive peak value.	2 max	V
Heater Voltage	5.7 min—6.9 max	V



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

DATA
4-57

19BP4

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:		
During equipment warm-up period: ≤ 15	450 max	V
After equipment warm-up period:	300 max	V
Heater positive with respect to cathode:		
Combined AC & DC voltage:	200 max	V
DC component:	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No. 1

Anode Voltage.	16000	V
Grid-No. 4 Voltage.	0 to 400	V
Grid-No. 2 Voltage.	300	V
Cathode Voltage.	28 to 62	V

For visual extinction of focused raster

Field Strength.	0 to 8	G
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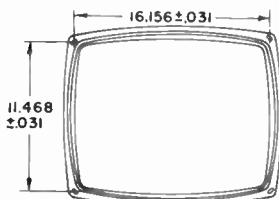
Of required adjustable centering error

MAXIMUM CIRCUIT VALUE

Grid-No. 1 Circuit Resistance	1.5 max	M Ω
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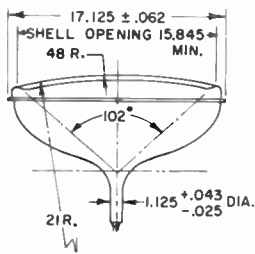
^a Includes implosion protection hardware.

DIMENSIONAL OUTLINE (Bulb J149 F)

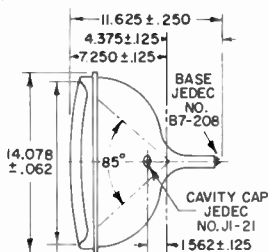


MINIMUM SCREEN

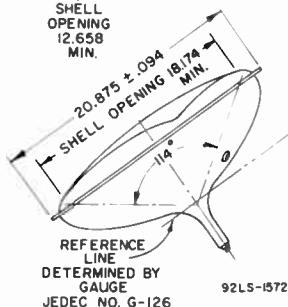
DIAGONAL	17562
GREATEST WIDTH	15188
GREATEST HEIGHT	12000



1.844



SHELL OPENING
12.658
MIN.



REFERENCE LINE
DETERMINED BY
GAUGE
JEDEC NO. G-126

92L5-1572

DIMENSIONS IN INCHES



19EGP4

Picture Tube

FILLED-RIM TYPE

114° MAGNETIC DEFLECTION

LOW GRID-NO.2 VOLTAGE

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid No. 1 to all other electrodes	6	pF
External conductive coating to anode ^a	1000 min—1500 max	pF
Heater Current at 6.3 V	450 ± 20	mA
Heater Warm-Up Time (Average)	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

Phosphor	P4—Sulfide Type, Aluminized
<i>For curves, see front of this section</i>	
Faceplate	Filterglass
<i>Light transmission at center (approx.) 48%</i>	

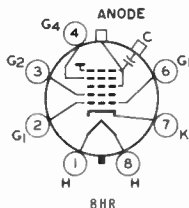
MECHANICAL

Weight (Approx.)	16 lb
Overall Length	11.625 ± .250 in
Neck Length	4.375 ± .125 in
Projected Area of Screen	172 sq in
External Conductive Coating	

Type (see CRT OUTLINES 1 at front of this section)	Modified-Band
Contact area for grounding	Near Reference Line
Cap	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No. B7-208)

TERMINAL DIAGRAM (Bottom View)

- Pin 1—Heater
- Pin 2—Grid No. 1
- Pin 3—Grid No. 2
- Pin 4—Grid No. 4
- Pin 5—Grid No. 1
- Pin 7—Cathode
- Pin 8—Heater



- C—Anode
- (Grid No. 1, Grid No. 2, Screen, Collector)
- C—External conductive coating

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to grid No. 1

Anode Voltage	12000 min—21000 max	V
Grid-No. 4 Voltage		
Positive value	1250 max	V
Negative value	400 max	V
Grid-No. 2 Voltage	25 min—60 max	V
Cathode Voltage		
Negative peak value	2 max	V
Negative min value	0 max	V
Positive peak value	100 max	V
Positive peak value	150 max	V



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19EGP4

Heater Voltage. 5.7 min—6.9 max V

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:

During equipment warm-up period ≤ 15 s. 450 max V

After equipment warm-up period. 300 max V

Heater positive with respect to cathode:

Combined AC & DC voltage. 200 max V

DC component. 100 max V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage 16000 V

Grid-No.4 Voltage 0 to 400 V

Grid-No.2 Voltage 50 V

Cathode Voltage 32 to 50 V

For visual extinction of focused raster

Field Strength. 0 to 8 G

Of required adjustable centering magnet

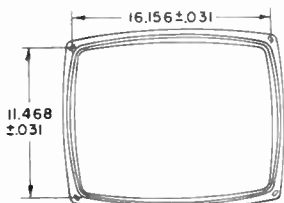
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance. 1.5 max M Ω

^a Includes implosion protection hardware.

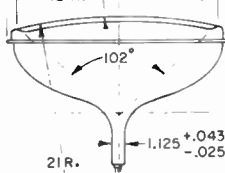
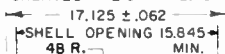
DIMENSIONAL OUTLINE (Bulb J149 F)

DIMENSIONS IN INCHES

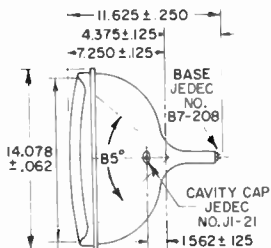


MINIMUM SCREEN

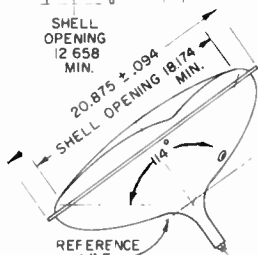
DIAGONAL 17.562
GREATEST WIDTH 15.188
GREATEST HEIGHT 12.000



1.844



SHELL
OPENING
12.658
MIN.



REFERENCE
LINE
DETERMINED BY GAUGE
JEDEC NO. G-126

92LS-1572



19ENP4A

Picture Tube

PAN-O-PLY—INTEGRAL IMPLOSION PROTECTION
 LOW-VOLTAGE ELECTROSTATIC FOCUS 114° MAGNETIC DEFLECTION
 LOW-GRID-No. 2 VOLTAGE CATHODE-DRIVE TYPE

ELECTRICAL

Direct Interelectrode Capacitances		
Cathode to all other electrodes	5	pF
Grid No. 1 to all other electrodes	6	pF
External conductive coating to anode ^a	{ 1500 max 1000 min	pF
		pF
Heater Current at 6.3 V.	450 ± 20	mA
Heater Warm-Up Time (Average).	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

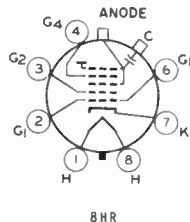
Phosphor	P4—Sulfide Type, Aluminized
For curves, see front of this section	
Faceplate.	Filterglass
Light transmission at center (approx.)	48%

MECHANICAL

Weight (Approx.)	15 lb
Overall Length	11.625 ± 0.250 in
Neck Length.	4.375 ± 0.125 in
Projected Area of Screen	172 sq in
External Conductive Coating	
Type	Modified-Band
Contact area for grounding	Near Reference Line
For Additional Information on Coatings and Dimensions	
See <i>Picture-Tube Dimensional-Outlines and Bulb J149 Facts</i>	
at front of this section	
Cap.	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Noveightar 7-Pin, Arrangement 1, (JEDEC No. 87-208)

TERMINAL DIAGRAM (Bottom View)

- Pin 1—Heater
- Pin 2—Grid No. 1
- Pin 3—Grid No. 2
- Pin 4—Grid No. 4
- Pin 6—Grid No. 1
- Pin 7—Cathode
- Pin 8—Heater
- Cap—Anode (Grid No. 3,
Grid No. 5, Screen,
Collector)
- C—External Conductive
Coating



19ENP4A

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to Grid No. 1

Anode Voltage	{ 21000 max V 12000 min V
Grid-No. 4 (Focusing) Voltage	
Positive value	1250 max V
Negative value	400 max V
Grid-No. 2 Voltage	{ 60 max V 25 min V
Cathode Voltage	
Negative peak value	2 max V
Negative bias value	0 max V
Positive bias value	100 max V
Positive peak value	150 max V
Heater Voltage	{ 6.9 max V 5.7 min V
Peak Heater-Cathode Voltage	
Heater negative with respect to cathode:	
During equipment warm-up period not exceeding 15 seconds	450 max V
After equipment warm-up period	300 max V
Heater positive with respect to cathode:	
Combined AC and DC voltage	200 max V
DC component	100 max V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	16000 V
Grid-No. 4 Voltage	250 V
Grid-No. 2 Voltage	50 V
Cathode Voltage	32 to 50 V

For visual extinction of focused raster

MAXIMUM CIRCUIT VALUE

Grid-No. 1-Circuit Resistance	1.5 max M Ω
---	--------------------

^a External conductive coating and implosion protection hardware must be grounded.

^b The grid-No. 4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 to +400 volts with the combined grid-No. 1 voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 10-1/2 inch by 14-inch pattern from an RCA-2F21 monoscope, or equivalent.

For x-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



Picture Tube

PAN-O-PLY TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

LOW-GRID-No.2 VOLTAGE
114° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode	1250 min—1750 max	pF
Heater Current at 6.3 volts.	450 ± 20	mA
Heater Warm-Up Time (Average).	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	
Focus Lens	Unipotential	

OPTICAL

Phosphor	P4—Sulfide Type, Aluminized	
	for outside, the front of this section	
Faceplate.	Filterglass	
Light transmission at center (approx.)		48%

MECHANICAL

Weight (Approx.)		15 lb
Overall Length	11.625 ± .250	in
Neck Length.	4.375 ± .125	in
Projected Area of Screen		172 sq in
External Conductive Coating ^a		

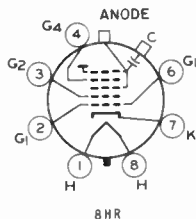
^aType Regular-Band
Contact area for grounding Near Reference Line
For Additional Information on Coatings and Dimensions

See *Picture-Tube Dimensional-Outlines* in: *Bulb J149F* starts at front of this section

Cap. Recessed Small Cavity (JEDEC No. J1-21)
Base Small-Button Neocightar 7-Pin, Arrangement 1, (JEDEC No. B7-208)

TERMINAL DIAGRAM (Bottom View)

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 3—Grid No.2
- Pin 4—Grid No.4
- Pin 6—Grid No.1
- Pin 7—Cathode
- Pin 8—Heater
- Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)
- C—External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage.	12000 min—23500 max	V
Grid-No. 4 Voltage		
Positive value.	1250 max	V
Negative value.	400 max	V
Grid-No. 2 Voltage.	20 min—60 max	V
Cathode Voltage		
Positive peak value.	2 max	V
Negative bias value.	0 max	V
Positive bias value.	100 max	V
Positive peak value.	150 max	V
Heater Voltage.	5.7 min—6.9 max	V
Peak Heater-Cathode Voltage		
Heater negative with respect to anode:		
during equipment warm-up period:		
exceeding 15 seconds.	450 max	V
during equipment warm-up period.	300 max	V
Heater positive with respect to cathode:		
combined AC and DC voltage.	200 max	V
AC component.	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage.	16000	V
Grid-No. 4 Voltage ^b	100	V
Grid-No. 2 Voltage.	30	V
Cathode Voltage.	22 to 45	V
<i>For grid-No. 1, the ratio of total to grid-No. 1 voltage is 1.5 to 1.</i>		
Field Strength of required adjustable centering magnet.	0 to 8	G

MAXIMUM CIRCUIT VALUE

Grid-No. 1-Circuit Resistance	1.5 max	MΩ
---	---------	----

^a Includes explosion protection hardware.

^b The grid-No. 4 voltage required for optimum focus of any individual tube will have a value anywhere between -100 and +300 volts with the combined grid-No. 1 voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 10.5-inch by 14-inch pattern from an RCA-2F21 monoscope, or equivalent.

For additional information, consult the following literature:

A-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES



Picture Tube

PAN-O-PLY—INTEGRAL IMPLOSION PROTECTION
 LOW-VOLTAGE ELECTROSTATIC FOCUS 114° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid-No.2 to all other electrodes	6	pF
External conductive coating to anode	1250 min—1750 max	pF
Heater Current at 6.3 V.	450 ± 20	mA
Heater Warm-up Time (Average).	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

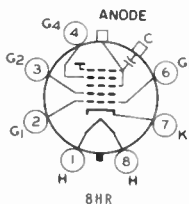
Phosphor	P4—Sulfide Type, Aluminized	for curve, see front of this section
Faceplate.	Filterglass	Light transmission at center (approx.) 48%

MECHANICAL

Weight (Approx.)	15 lb
Overall Length	11.625 ± 0.250 in
Neck Length.	4.375 ± 0.125 in
Projected Area of Screen	172 sq in
External Conductive Coating	
Type (see cut outline, table on this page)	Regular-Band
Contact area for ground lead	Near Reference Line
Cap.	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No. B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1—Heater
 Pin 2—Grid No. 1
 Pin 3—Grid No. 2
 Pin 4—Grid No. 3
 Pin 5—Grid No. 1
 Pin 6—Cathode
 Pin 7—Heater
 Pin 8—Heater



Pin 1—Heater
 Pin 2—Grid No. 1
 Pin 3—Grid No. 2
 Pin 4—Grid No. 3
 Pin 5—Grid No. 1
 Pin 6—Cathode
 Pin 7—Heater
 Pin 8—Heater

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage.	11000 min—23000 max	V
Grid-No. 4 (Focusing) Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No. 2 Voltage.	200 min—550 max	V
Grid-No. 1 Voltage		
Negative peak value.	220 max	V
Negative bias value.	155 max	V
Positive bias value.	0 max	V
Positive peak value.	2 max	V



19FLP4

Heater Voltage 5.7 min—6.9 max V

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:

During equipment warm-up period: ≤ 20 volts 450 max V

After equipment warm-up period 300 max V

Heater positive with respect to anode:

Combined AC and DC voltage 200 max V

DC component 100 max V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No. 1

Anode Voltage 16000 V

Grid-No. 4 Voltage^b 200 V

Grid-No. 2 Voltage 300 V

Cathode Voltage 28 to 62 V

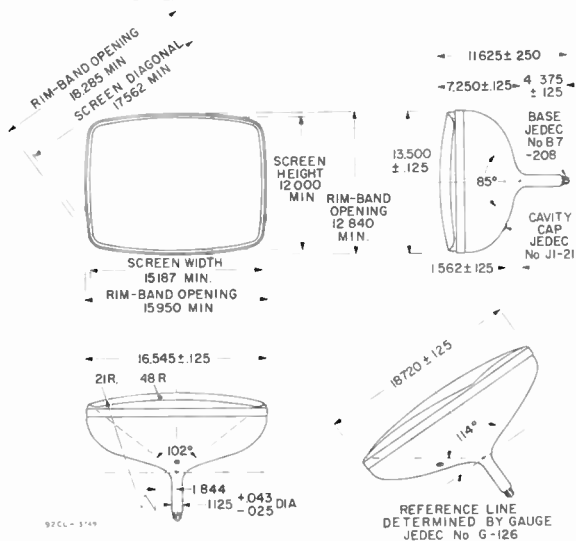
MAXIMUM CIRCUIT VALUE

Grid-No. 1 Circuit Resistance 1.5 max Ω

^a External conductive coating and implosion protection hardware must be grounded.

^b The grid-No. 1 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +300 volts with the combined grid-No. 1 voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 10.5-inch by 11-inch pattern from an RCA-2F21 monoscope, or equivalent.

DIMENSIONAL OUTLINE (BULB J149 FA)



DIMENSIONS IN INCHES



19GEP4A

Picture Tube

PAN-O-PLY TYPE WITH MOUNTING LUGS

114° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances

Grid No. 1 to All Other Grids from	5	pF
Grid No. 2 to All Other Grids from	6	pF
Internal conductive coating to anode	1250 min—1750 max	pF
Heater Current at 6.3 V	450	mA
Heater Warm-Up Time (Average)	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

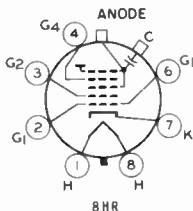
Phosphor	P4—Sulfide Type, Aluminized
Faceplate	Filterglass
Light transmittance for phosphor (typical)	48%

MECHANICAL

Weight (Approx.)	15 lb
Overall Length	11.625 ± .250 in
Neck Length	4.375 ± .125 in
Projected Area of Screen	172 sq in
External Conductive Coating ^a	
Type (See CRT OUTLINES 1 at front of this section)	Regular-Band
Contact area for grounding	Near Reference Line
Cap	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No. B7-208)

TERMINAL DIAGRAM (Bottom View)

- Pin 1—Heater
- Pin 2—Grid No. 3
- Pin 3—Grid No. 2
- Pin 4—Grid No. 4
- Pin 6—Grid No. 1
- Pin 7—Cathode
- Pin 8—Heater
- Cap—Anode (Grid No. 5, Grid No. 6, Screen, Collector)
- C—External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage	11000 min—23000 max	V
Grid-No. 4 Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No. 2 Voltage	200 min—550 max	V



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Grid-No.1 Voltage

Negative peak value.	220 max	V
Negative bias value.	155 max	V
Positive bias value.	0 max	V
Positive peak value.	2 max	V

Heater Voltage 5.7 min—6.9 max V

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:		
During equipment warm-up period ≤ 15 s	450 max	V
After equipment warm-up period	300 max	V
Heater positive with respect to cathode:		
Combined AC & DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage.	16000	V
Grid-No.4 Voltage.	0 to 400	V
Grid-No.2 Voltage.	300	V
Cathode Voltage.	28 to 62	V

For visual extinction of focused raster

Field Strength 0 to 8 G

Of required adjustable centering magnet

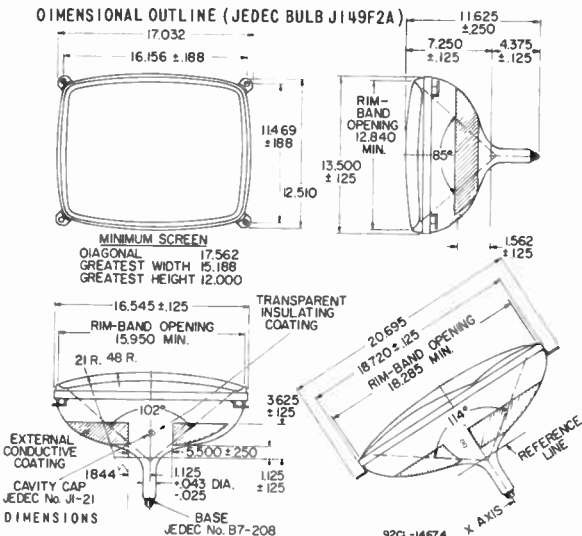
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance 1.5 max M Ω

^a Includes implosion protection hardware.

See X-RADIATION PRECAUTIONS at front of this section

DIMENSIONAL OUTLINE (JEDEC BULB J149F2A)



19GJP4A

Picture Tube

PAN-O-PLY TYPE

114° MAGNETIC DEFLECTION

The 19GJP4A is the same as the 19GJP4 except for the following items:

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Anode Voltage. 10000 min—23000 max V



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Color Picture Tube

"PERMA-CHROME" ASSEMBLY FOR OPTIMUM FIELD
 PURITY AND UNIFORMITY DURING WARM-UP

RECTANGULAR TUBE 90° MAGNETIC DEFLECTION
 MAGNETIC CONVERGENCE 3 ELECTROSTATIC-FOCUS GUNS

ALUMINIZED TRICOLOR PHOSPHOR-DOT "Hi-Lite" SCREEN
 (Utilizing a New, Improved Rare-Earth Red-Emitting Phosphor)

For Use in Color-TV Receivers

The 19GVP22 is the same as the 19GWP22 except for the following items:

OPTICAL

Faceplate Filterglass
 Light transmission (Approx.) 69%
 Faceplate does not have integral protective window

MECHANICAL

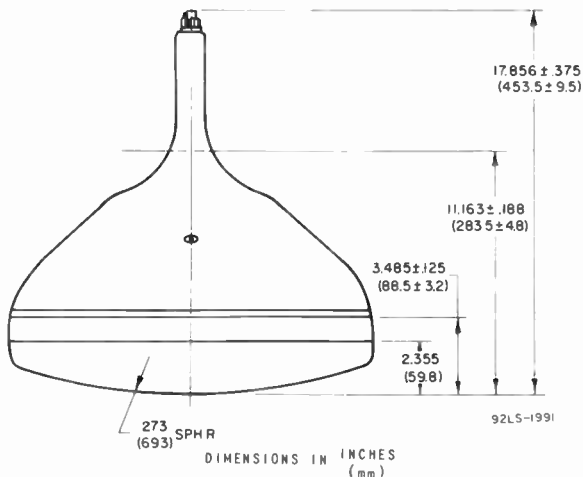
Tube Dimensions

Overall length $17.856 \pm .375$ in (453.5 ± 9.5 mm)
 Weight (Approx.) 21 lb (9.5 kg)

^a It is recommended that the cabinet be provided with a shatter-proof glass cover over the face of the 19GVP22 to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide x-radiation protection when required.

DIMENSIONAL OUTLINE

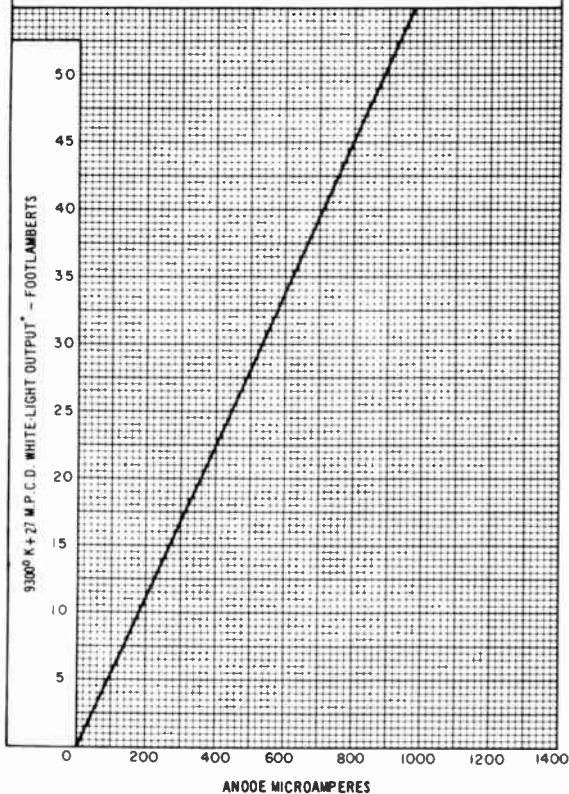
Dimensions shown are only those which are different from the corresponding dimensions for the 19GWP22



Typical Light-Output Characteristic

HEATER VOLTAGE - 6.3 VOLTS
 ANODE-TO-CATHODE VOLTAGE - 25000 VOLTS
 GRID-No.3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
 DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE
 CURRENT TO PRODUCE 9300° K · 27 M.P.C.D. WHITE-LIGHT OUTPUT.
 PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN
 TO PRODUCE 9300° K · 27 M.P.C.D. WHITE
 RED GUN: 34%
 BLUE GUN: 32%
 GREEN GUN: 34%

RASTER SIZE: 15.585 x 12.185" (395.9 mm X 309.5 mm)
 *MEASURED WITHIN 4" DIAMETER AREA CENTERED ON TUBE FACE



92LM-1990



Color Picture Tube

ULTRA-RECTANGULAR

HI-LITE SCREEN

4 X 3 Aspect Ratio

Blue-Gun-Down Operation

Electrical

Electron Guns, Three with Axes

Tilted Toward Tube Axis Red, Blue, Green

Heater, of Each Gun Series Connected within

Tube with Each of the Other Two Heaters:

Current at 6.3 V 900 mA

Focusing Method Electrostatic

Focus Lens Unipotential

Convergence Method Magnetic

Deflection Method Magnetic

Deflection Angles (Approx.):

Diagonal 90 deg

Horizontal 78 deg

Vertical 60 deg

Direct Interelectrode Capacitance (Approx.):

Grid No.1 of any gun to all other electrodes 7.5 pF

Grid No.4 to all other electrodes 6 pF

All cathodes to all other electrodes 15 pF

Capacitance Between Anode and External

Conductive Coating { 2300 max. pF
1800 min. pF

Resistance Between Metal Hardware and

External Conductive Coating 50 MΩ

Optical

Faceplate Filterglass

Light transmission at center (Approx.) 53%

Surface Polished

Screen Aluminized

Phosphor, rare-earth (red) sulfide (blue & green) P22

Persistence Medium-Short

Array 382,000 Dot trios

Spacing between centers of adjacent

dot trios (Approx.) 0.024 in (0.61 mm)

Mechanical

Minimum Screen Area (Projected) 185 sq in (1194 sq cm)

Bulb Funnel Designation JEDEC No.J160-3/4 B1/C1

Bulb Panel Designation JEDEC No.FP161-3/4 V1

Base Designation^a Small-Button Diheptar 12-Pin
(JEDEC No.B12-244)

Basing Designation JEDEC No.14BH

Pin Position Alignment Pin No.5 Aligns Approx. with
Anode Bulb Contact

19VANP22

Operating Position, preferred Anode Bulb Contact on Top
 Gun Configuration Delta
 Weight (Approx.) 25 lb (11.4 kg)

Implosion Protection

Type Banded

Maximum and Minimum Ratings, Design-Maximum Values

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode.

Anode Voltage	} 22.5 max. kV 17 min. kV	
Anode Current, Long-Term Average ^b		1000 max. μ A
Grid-No.4 (Focusing Electrode) Voltage:		
Positive value	1100 max.	V
Negative value	550 max.	V
Peak-Grid-No.2 Voltage, Including Video Signal Voltage	1000 max.	V
Grid-No.1 Voltage:		
Negative bias value	400 max.	V
Negative operating cutoff value	140 max.	V
Positive bias value	0 max.	V
Positive peak value	2 max.	V
Heater Voltage (ac or dc): ^c	} 6.9 max. V 5.7 min. V 5.5 max. V	
Under operating conditions		
Under standby conditions ^d		
Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	V
After equipment warm-up period:		
DC component value	200 max.	V
Peak value	200 max.	V
Heater positive with respect to cathode:		
DC component value	0 max.	V
Peak value	200 max.	V

Equipment Design Ranges

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode.

For anode voltages between 17 and 22.5 kV

Grid-No.4 (Focusing Electrode) Voltage -75 to 400 V

Grid-No.2 Voltage for Visual Extinction

of Undelected Focused Spot . . . See CUTOFF DESIGN CHART
in Figure 3

At Grid No.1 voltage of -75 V 90 to 270 V

At Grid No.1 voltage of -125 V	210 to 505 V
At Grid No.1 voltage of -140 V	245 to 580 V

Maximum Ratio of Grid-No.2 Voltages, Highest Gun to Lowest Gun in Any Tube (At grid-No.1 spot cutoff voltage of -100 V) 1.86

Heater Voltage:^c

Under operating conditions:

When standby operation is not utilized 6.3 V

When 5.0-V standby operation is utilized^d 6.0 V

Under standby conditions^d 5.0 V

Grid-No.4 Current (Total) $\pm 60 \mu\text{A}$

Grid-No.2 Current $\pm 5 \mu\text{A}$

Grid-No.1 Current $\pm 5 \mu\text{A}$

To Produce White Light of	Illum. D 6550 ^o K + 7 M.P.C.D.	Color 9300 ^o K + 27 M.P.C.D.
---------------------------	---	---

CIE Coordinates:

X 0.313 0.281

Y 0.329 0.311

Percentage of total anode current supplied by each gun (average):

Red 41 30 %

Blue 24 31 %

Green 35 39 %

Ratio of cathode currents:

Red/blue:

Minimum 1.35 0.75

Typical 1.70 0.95

Maximum 2.20 1.25

Red/green:

Minimum 0.95 0.60

Typical 1.15 0.75

Maximum 1.70 1.10

Blue/green:

Minimum 0.50 0.60

Typical 0.70 0.80

Maximum 0.95 1.10

Displacements, Measured at Center of Screen:

Raster centering displacement:

Horizontal ± 0.45 in (± 11.4 mm)

Vertical ± 0.45 in (± 11.4 mm)

Lateral distance between the blue beam and the converged red and green beams . . . ± 0.25 in (± 6.4 mm)

Radial convergence displacement excluding effects of dynamic convergence (each beam) ± 0.37 in (± 9.4 mm)

19VANP22

Maximum Required Correction for Register^e
(Including Effect of Earth's Magnetic Field
when Using Recommended Components) as
Measured at the Center of the Screen in
any Direction 0.005 in (0.13 mm) max.

Typical Operation

Heater Voltage 6.3 V
Anode Voltage 20 kV
Grid-No.4 Voltage Adjusted for focus
Color Temperature 9300^o K + 27 M.P.C.D.
Raster Size 15.922 x 11.941 in
(404.42 x 303.30 mm)

Typical White-Light Output Measured within 4 in
(102 mm) diameter area centered on tube face:

At anode current of 1000 μ A $\left\{ \begin{array}{l} 44 \text{ fL} \\ 151 \text{ Nit} \end{array} \right.$

Limiting Circuit Values

Low-Voltage Circuits:

Effective grid-No.1-to-cathode-
circuit resistance (each gun) 0.75 max. M Ω

X-Radiation Characteristic:

Maximum Anode Voltage at which the X-radiation emitted
will not exceed 0.5 mR/h at an anode current of
300 μ A 33 kV

The X-radiation emitted from this picture tube, as measured in accordance with the procedure of JEDEC Publication No.64A will not exceed 0.5 mR/h throughout the useful life of the tube when operated within the Design-Maximum ratings: 27.5 kV anode voltage and 1000 μ A anode current. The tube should not be operated beyond its Design-Maximum ratings stated above (such operation may shorten tube life or have other permanent adverse affects on its performance), but its X-radiation will not exceed 0.5 mR/h for anode voltage and current combinations given by the isodose-rate limit characteristics as shown in Figure 1. Operation above the values shown by the curve may result in failure of the television receiver to comply with the Federal Performance Standard for Television Receivers. Sub-Part C of Part 78 of Title 42, Code of Federal Regulations (PL90-602) as published in the Federal Register Vol.34, No. 247, Thursday, December 25, 1969. Maximum X-radiation as a function of anode voltage at 300 μ A anode current is shown by the curve in Figure 2. X-radiation at a constant anode voltage varies linearly with anode current.

- a The mating socket, including its associated, physically-attached hardware and circuitry, must not weigh more than one pound (one-half kilogram).
- b The short-term average anode current should be limited by circuitry to 1500 microamperes.
- c For maximum cathode life, it is recommended that the heater supply be regulated. The series impedance to any chassis con-

nection in the dc biasing circuit for the heater should be between 100 kilohms and 1 megohm. The surge voltage across the heater must be limited to 9.5 volts rms.

- d The use of a 5-volt standby condition in conjunction with 6-volt operating conditions is recommended to improve the reliability of the color picture tube by extending the emission wear-out life and reducing other gun-related defects. A maximum heater voltage of 5.5 volts (Design-Maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.
- e Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

IMPORTANT: Refer to sheet Safety Precautions For Color Picture Tubes at front of this section.

Notes For Dimensional Outline

Note 1 — With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge (JEDEC No.G162) and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C' of the gauge with the glass funnel.

Note 2 — Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.

Note 3 — The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

Note 4 — To clean this area, wipe only with soft, dry, lintless cloth.

SAGITTAL HEIGHTS AT POINTS $\frac{125}{3.18}$ BEYOND EDGE OF MIN SCREEN

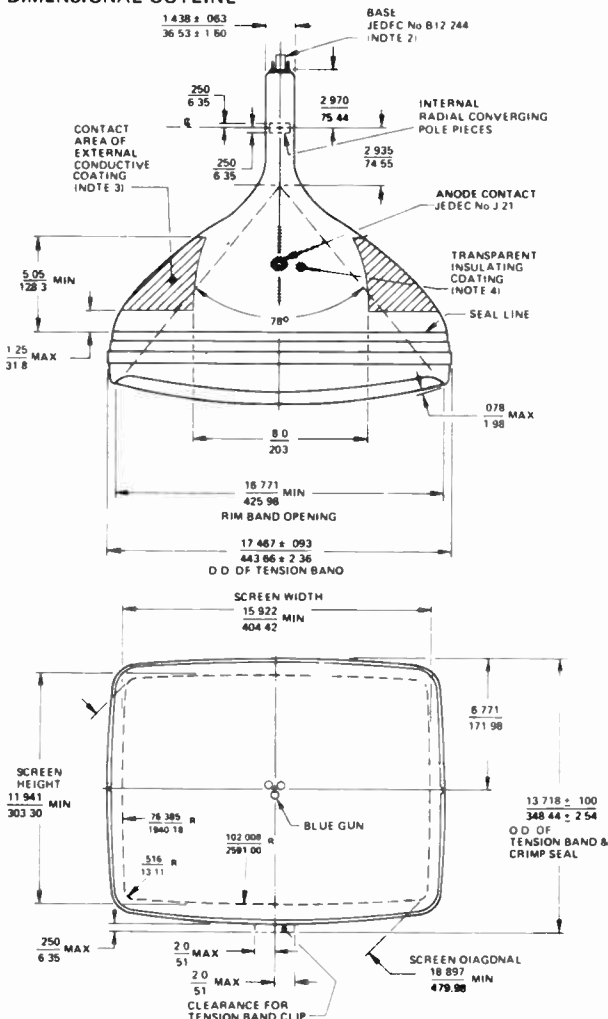
DIAGONAL $\frac{1.485}{37.72}$

WIDTH $\frac{1.044}{26.52}$

HEIGHT $\frac{5.82}{14.78}$

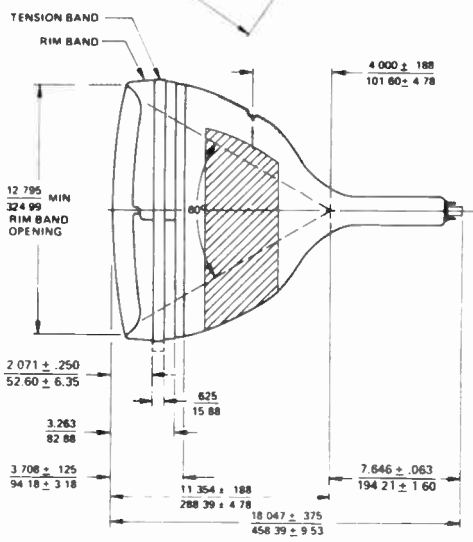
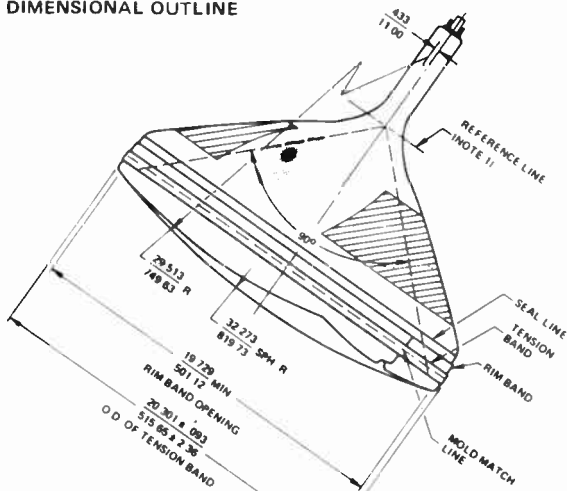
19VANP22

DIMENSIONAL OUTLINE



Dimensions in $\frac{\text{Inches}}{\text{mm}}$ unless otherwise noted

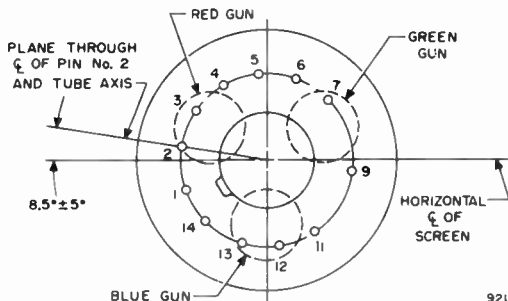
DIMENSIONAL OUTLINE



72L 3549-1

19VANP22

BOTTOM VIEW OF BASE

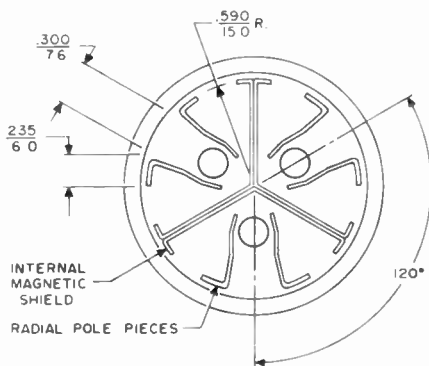


92LM-1252

Base Specification — JEDEC No.14BH

Pin 1:	Heater	Cap:	Anode (Grid No.3, Grid No.5, Screen, Collector)
Pin 2:	Cathode of Red Gun	C:	External Conductive Coating
Pin 3:	Grid No.1 of Red Gun		
Pin 4:	Grid No.2 of Red Gun		
Pin 5:	Grid No.2 of Green Gun		
Pin 6:	Cathode of Green Gun		
Pin 7:	Grid No.1 of Green Gun		
Pin 9:	Grid No.4		
Pin 11:	Cathode of Blue Gun		
Pin 12:	Grid No.1 of Blue Gun		
Pin 13:	Grid No.2 of Blue Gun		
Pin 14:	Heater		

LOCATION OF RADIAL-COVERING POLE PIECES VIEWED FROM SCREEN END OF GUNS



92LM-1251R1

0.5 mR/h ISODOSE – RATE LIMIT CURVE

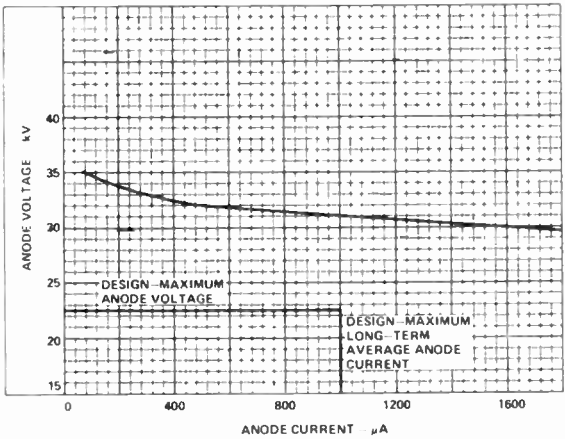


Figure 1

92LS 3657

X-RADIATION LIMIT CURVE AT A CONSTANT ANODE CURRENT OF 300 μA (X-RADIATION AT A CONSTANT ANODE VOLTAGE VARIES LINEARLY WITH ANODE CURRENT)

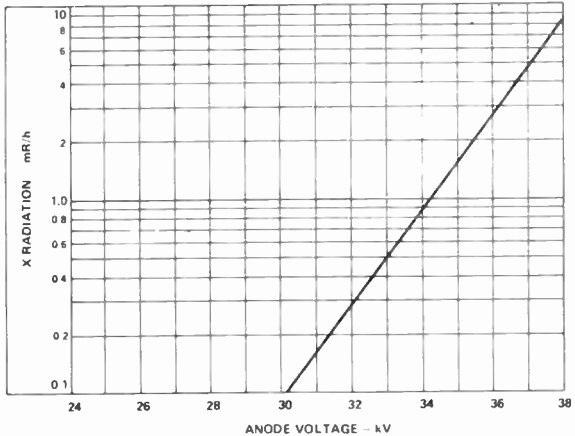
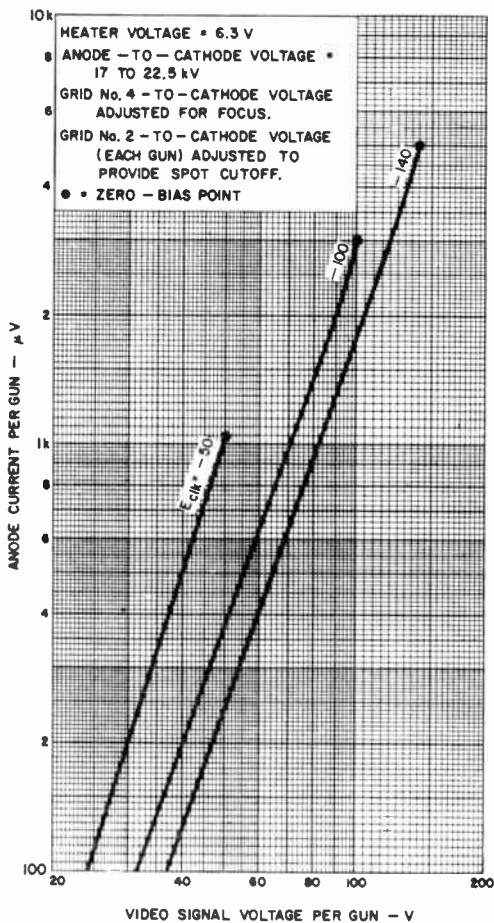


Figure 2

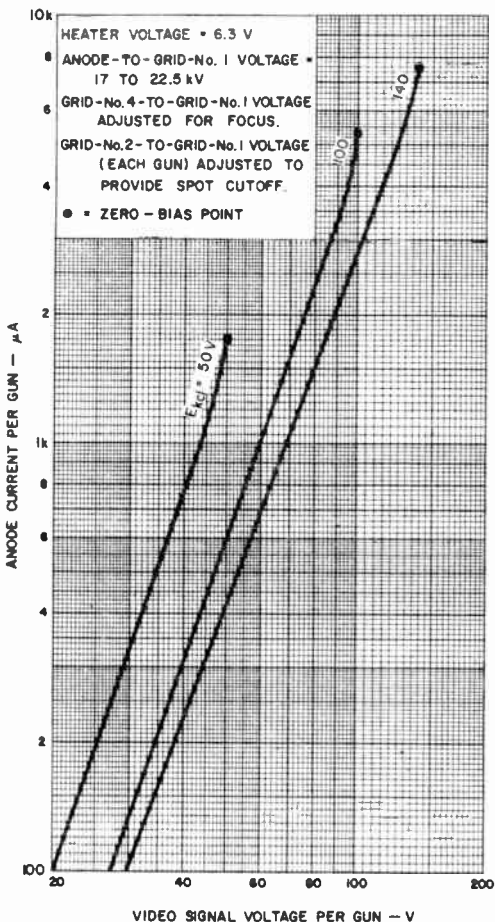
92LS 3796R1

19VANP22

TYPICAL DRIVE CHARACTERISTICS, GRID-DRIVE SERVICE



TYPICAL DRIVE CHARACTERISTICS, CATHODE-DRIVE SERVICE



92LM-3542

CUTOFF DESIGN CHART

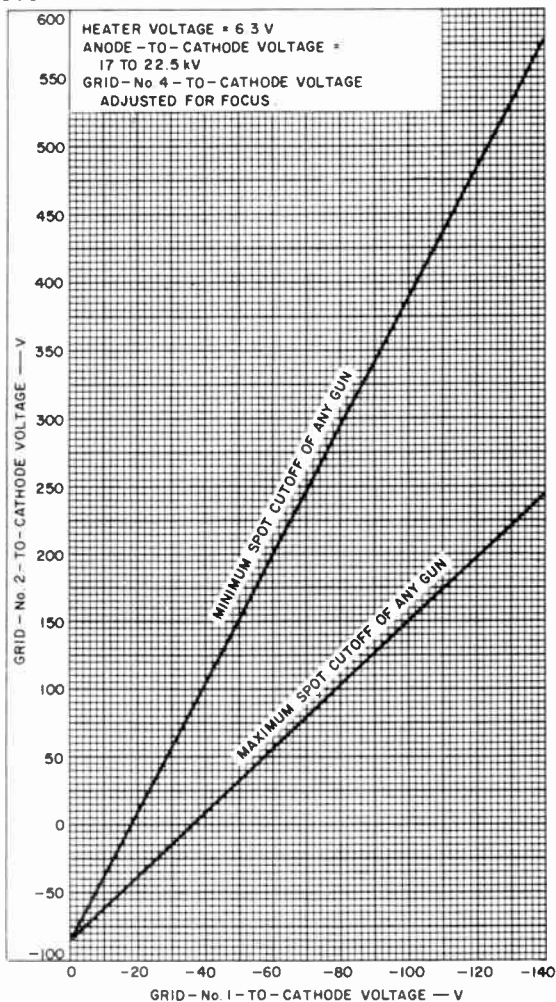


Figure 3

Color Picture Tube

Ultra-Rectangular
4 x 3 Aspect Ratio

Hi-Lite Matrix Screen
Light Neutral Screen Appearance

Electrical:

Electron Guns, Three with Axes

Tilted Toward Tube Axis Red, Blue, Green

Heater:

Voltage 6.3 V

Current 900 mA

Focusing Method Electrostatic

Focus Lens Bipotential

Convergence Method Magnetic

Deflection Method Magnetic

Deflection Angles (Approx.):

Diagonal 90 deg

Horizontal 78 deg

Vertical 60 deg

Direct Interelectrode Capacitance (Approx.):

Grid No.1 of any gun to all other electrodes 6 pF

Grid No.3 to all other electrodes 6.5 pF

All cathodes to all other electrodes 15 pF

Capacitance Between Anode and External
Conductive Coating { 2300 max. pF
1800 min. pF

Resistance Between Metal Hardware and
External Conductive Coating 50 MΩ

Optical:

Faceplate Filterglass

Light transmission at center (Approx.) 70%

Surface Polished

Screen Aluminized

Matrix Black opaque material

Phosphor, rare-earth (red) sulfide (blue & green) P22

Persistence Medium-Short

Array 382,000 Dot trios

Spacing between centers of adjacent
dot trios (Approx.) 0.024 in (0.61 mm)

Mechanical:

Minimum Screen Area (Projected) 185 sq in (1194 sq cm)

Bulb Funnel Designation JEDEC No.J510A06

Bulb Panel Designation JEDEC No.FP161-3/4 W1

Base Designation[®] Small-Button Diheptar 12-Pin
(JEDEC No.B12-244)

Basing Designation JEDEC No.14BE

Pin Position Alignment Pin No.12 Aligns Approx. with
Anode Bulb Contact

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Operating Position, preferred Anode Bulb Contact on Top
Gun Configuration Delta
Weight (Approx.) 25 lb (11.4 kg)

Implosion Protection:

Type Rim Bands and Tension Band

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode.

Anode Voltage	}	27.5 max.	kV
		20 min.	kV
Anode Current, Long-Term Average ^b		1000 max.	μ A
Grid-No.3 (Focusing Electrode) Voltage		6000 max.	V
Peak-Grid-No.2 Voltage, Including Video Signal Voltage		1000 max.	V
Grid-No.1 Voltage:			
Negative bias value		400 max.	V
Negative operating cutoff value		200 max.	V
Positive bias value		0 max.	V
Positive peak value		2 max.	V
Heater Voltage (ac or dc): ^c			
Under operating conditions	}	6.9 max.	V
		5.7 min.	V
Under standby conditions ^d		5.5 max.	V
Heater-Cathode Voltage:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds		450 max.	V
After equipment warm-up period:			
DC component value		200 max.	V
Peak value		200 max.	V
Heater positive with respect to cathode:			
DC component value		0 max.	V
Peak value		200 max.	V

Equipment Design Ranges:

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 20 and 27.5 kV

Grid-No.3 (Focusing Electrode) Voltage 16.8% to 20% of
Anode voltage

Grid-No.2 Voltage for Visual Extinction of Undelected Focused Spot. . . . See CUTOFF DESIGN CHART in **Figure 3**

At Grid No.1 voltage of -75 V	80 to 280 V
At Grid No.1 voltage of -125 V	215 to 550 V
At Grid No.1 voltage of -175 V	355 to 820 V

Maximum Ratio of Grid-No.2 Voltages, Highest Gun to Lowest Gun in Any Tube (At grid-No.1 spot cutoff voltage of -100 V) 1.86

Heater Voltage ^c

Under operating conditions:	
When standby operation is not utilized	6.3 V
When 5.0-V standby operation is utilized ^d	6.0 V
Under standby conditions ^d	5.0 V

Grid-No.3 Current (Total) $\pm 15 \mu\text{A}$

Grid-No.2 Current $\pm 5 \mu\text{A}$

Grid-No.1 Current $\pm 5 \mu\text{A}$

To Produce White Light of	Illum. D 6550 ^o K + 7 M.P.C.D.	Color 9300 ^o K + 27 M.P.C.D.	
CIE Coordinates.			
X	0.313	0.281	
Y	0.329	0.311	
Percentage of total anode current supplied by each gun (average):			
Red	41	30	%
Blue	24	31	%
Green	35	39	%
Ratio of cathode currents:			
Red/blue:			
Minimum	1.35	0.75	
Typical	1.70	0.95	
Maximum	2.20	1.25	
Red/green:			
Minimum	0.95	0.60	
Typical	1.15	0.75	
Maximum	1.70	1.10	
Blue/green:			
Minimum	0.50	0.60	
Typical	0.70	0.80	
Maximum	0.95	1.10	

Displacements, Measured at Center of Screen:

Raster centering displacement:	
Horizontal	± 0.45 in (± 11.4 mm)
Vertical	± 0.45 in (± 11.4 mm)
Lateral distance between the blue beam and the converged red and green beams . . .	
	± 0.25 in (± 6.4 mm)

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Radial convergence displacement excluding effects of dynamic convergence (each beam) ± 0.37 in (± 9.4 mm)

Maximum Required Correction for Register[®] (Including Effect of Earth's Magnetic Field when Using Recommended Components) as Measured at the Center of the Screen in any Direction 0.005 in (0.13 mm) max.

Light-Output Characteristic:

Typical White-Light Output $\left\{ \begin{array}{l} 80 \text{ fL} \\ 274 \text{ Nit} \end{array} \right.$

Measured within a 4 in (102 mm) diameter area centered on the tube face with the following operating conditions:

Anode Voltage 25 kV
Anode Current 1000 μA
Grid No.3 Voltage Adjusted for focus
Color Temperature 9300^o K + 27 M.P.C.D.

Limiting Circuit Values:

High-Voltage Circuits.
Grid-No 3 circuit resistance 7.5 max. $\text{M}\Omega$

Low-Voltage Circuits.
Effective grid-No.1-to-cathode-circuit resistance (each gun) 0.75 max. $\text{M}\Omega$

X-Radiation Characteristic:

Maximum Anode Voltage at which the X-radiation emitted will not exceed 0.5 mR/h at an anode current of 300 μA 33 kV

The X-radiation emitted from this picture tube, as measured in accordance with the procedure of JEDEC Publication No.64A will not exceed 0.5 mR/h throughout the useful life of the tube when operated within the Design-Maximum ratings: 27.5 kV anode voltage and 1000 μA anode current. The tube should not be operated beyond its Design-Maximum ratings stated above (such operation may shorten tube life or have other permanent adverse affects on its performance), but its X-radiation will not exceed 0.5 mR/h for anode voltage and current combinations given by the isodose-rate limit characteristics as shown in Figure 1. Operation above the values shown by the curve may result in failure of the television receiver to comply with the Federal Performance Standard for Television Receivers, Sub-Part C of Part 78 of Title 42, Code of Federal Regulations (PL90-602) as published in the Federal Register Vol.34, No. 247, Thursday, December 25, 1969. Maximum X-radiation as a function of anode voltage at 300 μA anode current is shown by the curve in Figure 2. X-radiation at a constant anode voltage varies linearly with anode current.

- a The mating socket, including its associated, physically-attached hardware and circuitry, must not weigh more than one pound (one-half kilogram).
- b The short-term average anode current should be limited by circuitry to 1500 microamperes.
- c For maximum cathode life, it is recommended that the heater supply be regulated. The series impedance to any chassis connection in the dc biasing circuit for the heater should be between 100 kilohms and 1 megohm. The surge voltage across the heater must be limited to 9.5 volts rms.
- d The use of a 5-volt standby condition in conjunction with 6-volt operating conditions is recommended to improve the reliability of the color picture tube by extending the emission wear-out life and reducing other gun-related defects. A maximum heater voltage of 5.5 volts (Design-Maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.
- e Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

Notes for Dimensional Outline

Note 1 – With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge (JEDEC No.G162) and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C' of the gauge with the glass funnel.

Note 2 – Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.

Note 3 – The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

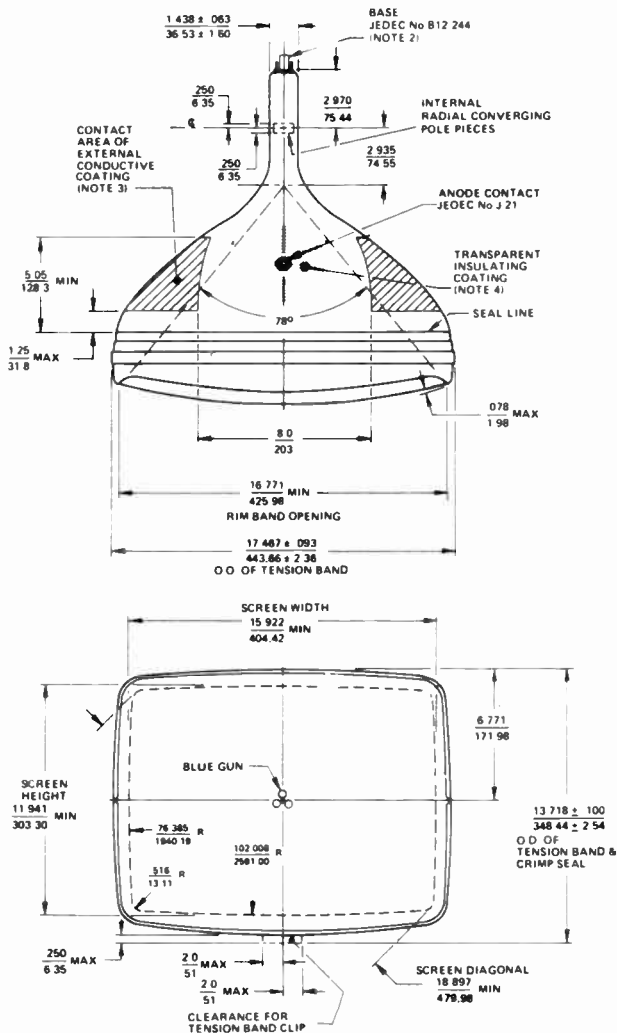
Note 4 – To clean this area, wipe only with soft, dry, lintless cloth.

SAGITTAL HEIGHTS AT POINTS $\frac{125}{3.18}$ BEYOND EDGE OF MIN. SCREEN

DIAGONAL	$\frac{1.485}{37.72}$	WIDTH	$\frac{1.044}{26.52}$	HEIGHT	$\frac{.582}{14.78}$
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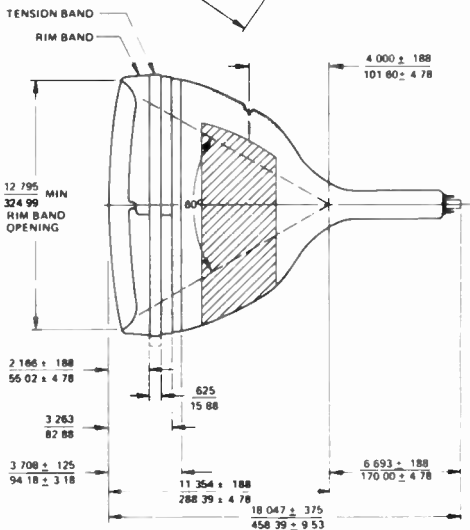
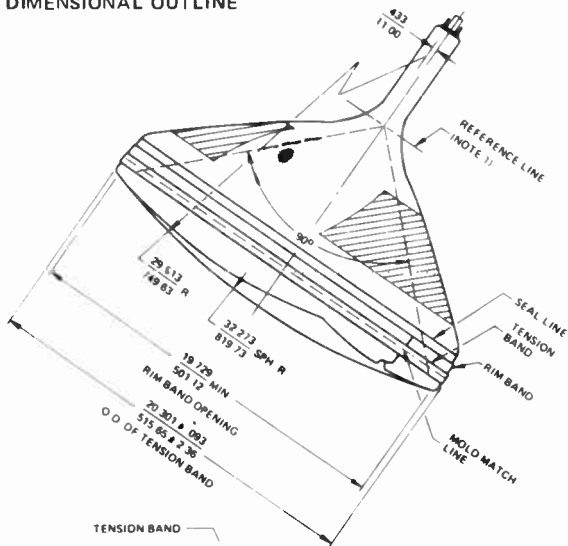
19VBRP22

DIMENSIONAL OUTLINE



Dimensions in Inches/mm unless otherwise noted

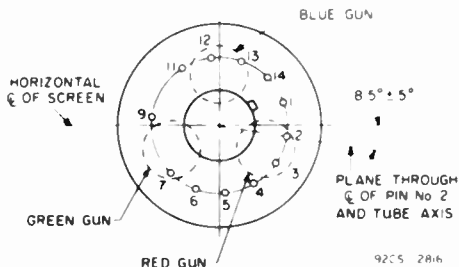
DIMENSIONAL OUTLINE



92LL 3048

19VBRP22

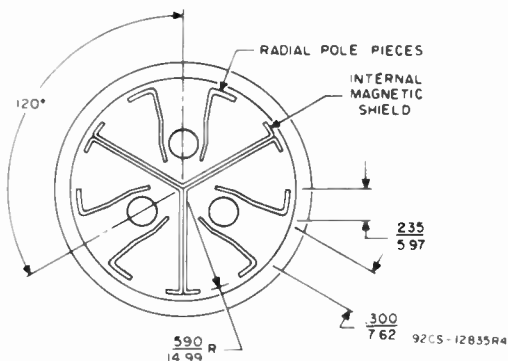
BOTTOM VIEW OF BASE



Base Specification – JEDEC No.14BE

- Pin 1 – Heater
 - Pin 2 – Cathode of Red Gun
 - Pin 3 – Grid No.1 of Red Gun
 - Pin 4 – Grid No.2 of Red Gun
 - Pin 5 – Grid No.2 of Green Gun
 - Pin 6 – Cathode of Green Gun
 - Pin 7 – Grid No.1 of Green Gun
 - Pin 9 – Grid No.3
 - Pin 11 – Cathode of Blue Gun
 - Pin 12 – Grid No.1 of Blue Gun
 - Pin 13 – Grid No.2 of Blue Gun
 - Pin 14 – Heater
- Bulb Contact – Anode (Grid No.4, Screen, Collector)
C – External Conductive Coating

LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



**0.5 mR/h ISODOSE -- RATE LIMIT CURVE
(JEDEC CURVE No.XC-2)**

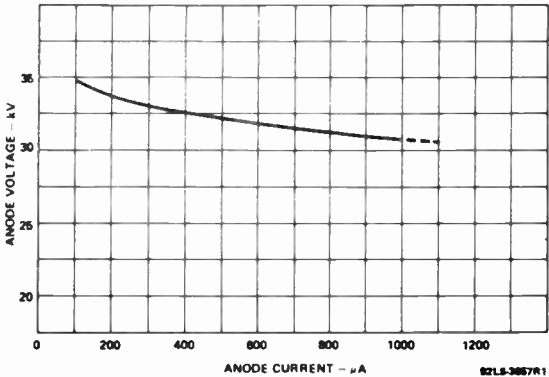


Figure 1

**X-RADIATION LIMIT CURVE AT A CONSTANT ANODE
CURRENT OF 300 μA (X-RADIATION AT A CONSTANT
ANODE VOLTAGE VARIES LINEARLY WITH ANODE CURRENT)
(JEDEC CURVE No.XC-1)**

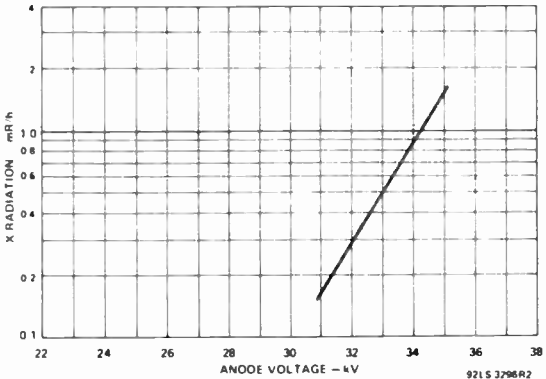
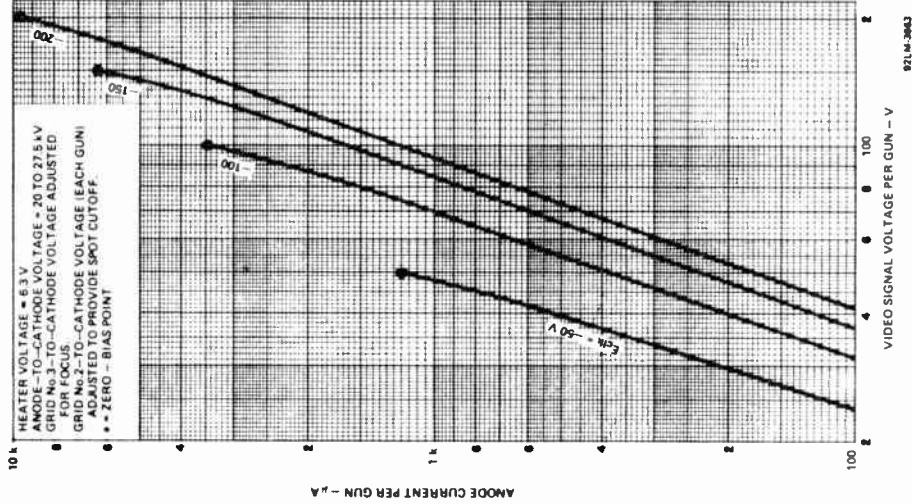


Figure 2

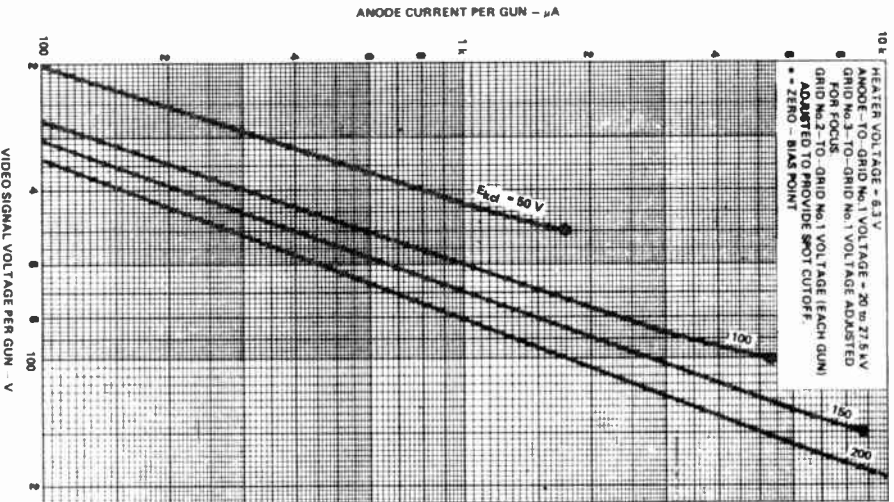
19VBRP22

TYPICAL DRIVE CHARACTERISTICS, GRID-DRIVE SERVICE



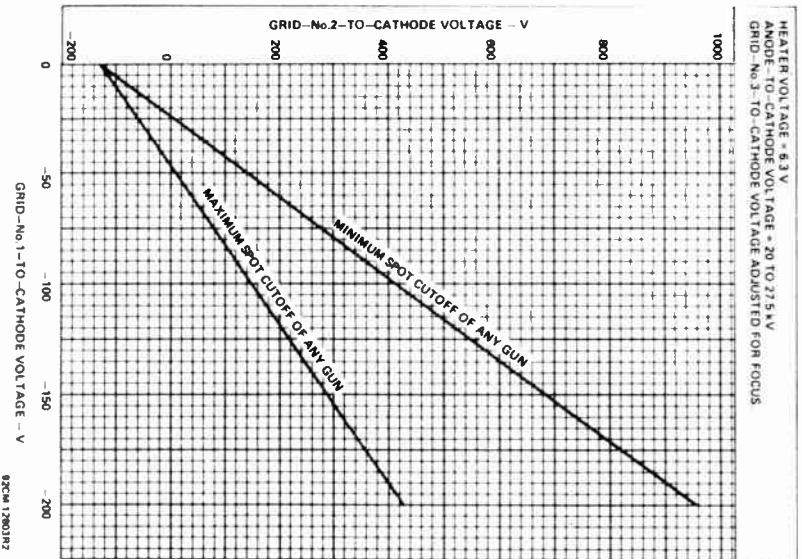
19VBRP22

TYPICAL DRIVE CHARACTERISTICS, CATHODE-DRIVE SERVICE



19VBRP22

CUTOFF DESIGN CHART



IMPORTANT: Refer to sheet Safety Precautions For Color Picture Tubes at front of this section.

FIGURE 3

Picture Tube

SHORT RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts.	600 ± 30	ma
Heater Warm-Up Time (Average).	11	seconds
Focusing Method.	Electrostatic	
Deflection Method.	Magnetic	
Deflection Angles (Approx.):		
Diagonal	114°	
Horizontal	102°	
Vertical	85°	
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes.	6	μμf
Cathode to all other electrodes.	5	μμf
External conductive coating to ultror	{ 1500 max. 1000 min.	{ μμf μμf
Electron Gun	Type Requiring No Ion-Trap Magnet	

Optical:

Faceplate.	Filterglass
Light transmission at center (Approx.)	78%
Phosphor (For Curves, see front of this Section)	P4—Sulfide Type Aluminized
Fluorescence	White
Phosphorescence.	White
Persistence.	Medium Short

Mechanical:

Tube Dimensions:	
Overall length	10-13/16" ± 1/4"
Greatest width	16-13/32" ± 1/8"
Greatest height.	13-11/32" ± 1/8"
Diagonal	18-5/8" ± 1/8"
Neck length.	3-9/16" ± 1/8"
Curvature of faceplate (External Radii):	
Center	48"
Edge	21"
Screen Dimensions (Minimum):	
Greatest width	15-1/8"
Greatest height.	12"
Diagonal	17-9/16"
Projected area	172 sq. in.
Weight (Approx.)	14 lbs
Operating Position	Any
Cap.	Recessed Small Cavity (JEDEC No. J1-21)
Bulb	J149A1



19YP4

Base Small-Button Neoeightar 7-Pin, Arrangement 1,
(JEDEC No. B7-208)

Basing Designation for BOTTOM VIEW. 8JR

Pin 1 - Heater

Pin 2 - Grid No.1

Pin 3 - Grid No.2

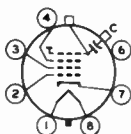
Pin 4 - Grid No.3

Pin 6 - Internal

Connection—

Do Not Use

Pin 7 - Cathode



Pin 8 - Heater

Cap - Ultor

(Grid No.4,
Collector)

C - External
Conductive
Coating

GRID-DRIVE[▲] SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR VOLTAGE	{ 20000 max. 11000 min.	volts volts
GRID-No.3 (FOCUSING) VOLTAGE:		
Positive value.	700 max.	volts
Negative value.	350 max.	volts
GRID-No.2 VOLTAGE	{ 600 max. 300 min.	volts volts
GRID-No.1 VOLTAGE:		
Negative-peak value	220 max.	volts
Negative-bias value	154 max.	volts
Positive-bias value	0 max.	volts
Positive-peak value	2 max.	volts
HEATER VOLTAGE.	{ 6.9 max. 5.7 min.	volts volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Typical Operating Conditions:

With ultor voltage (E_{c4k}) of	16000	volts
and grid-No.2 voltage (E_{c2k}) of	500	volts
Grid-No.3 Voltage for focus [•]	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster [*]	-43 to -78	volts
Field Strength of Adjustable Centering Magnet [♦]	0 to 10	gausses

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
---------------------------------------	----------	---------

CATHODE-DRIVE[▲] SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR-TO-GRID-No.1 VOLTAGE.	{ 20000 max. 11000 min.	volts volts
GRID-No.3-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value.	850 max.	volts
Negative value.	200 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE.	{ 750 max. 450 min.	volts volts
GRID-No.2-TO-CATHODE VOLTAGE.	600 max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive-peak value	220 max.	volts
Positive-bias value	154 max.	volts
Negative-bias value	0 max.	volts
Negative-peak value	2 max.	volts
HEATER VOLTAGE.	{ 6.9 max. 5.7 min.	volts volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage (E_{c4g1}) of	16000	volts
and grid-No.2-to-grid-No.1 voltage (E_{c2g1}) of	500	volts
Grid-No.3-to-Grid-No.1 Voltage for focus.	0 to 400	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster [▲]	41 to 69	volts
Field Strength of Adjustable Centering Magnet [◆]	0 to 10	gausses

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
---------------------------------------	----------	---------

▲ Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

◆ The grid-No.3 voltage required for optimum focus of any individual tube may have a value anywhere between 0 and 400 volts and is a function of the value of the ultor voltage, ultor current, and grid-No.2 voltage. It changes directly with the ultor voltage at the rate of approximately 46 volts for each 1000-volt change in ultor voltage; inversely with grid-No.2 voltage at the rate of about 60 volts for each 100-volt change in grid No.2 voltage; and inversely with ultor current at the rate of about 60 volts for each 100-microampere change in ultor current. Because this tube has a narrow depth of focus, it is necessary to provide means such as a potentiometer or a 4-tap switch for adjusting the focusing voltage. In general, commercially acceptable focus is obtained if the focusing voltage is within 75 volts of the value



19YP4

required for optimum focus and if the focusing voltage is maintained to within 75 volts of the optimum value during line-voltage fluctuations.

★ See *Raster-Cutoff-Range Chart for Grid-Drive Service.*

Distance from *Reference Line* for suitable PM centering magnet should not exceed 2-1/4". The specified centering magnet compensates only for the effect which mechanical tube tolerances may have on the location of the undeflected focused spot with respect to the center of the tube face. Maximum field strength of adjustable centering magnet equals:

$$\sqrt{\frac{E_{C4k} \text{ or } E_{C4Q1} \text{ (volts)}}{16000 \text{ (volts)}}} \cdot 10 \text{ gauss}$$

The equipment manufacturer must determine and supply additional compensation for the effects of the earth's magnetic field and extraneous fields due to choice of circuitry and components. The additional compensation should preferably be applied as part of the magnetic field of the deflecting yoke.

Cathode Drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

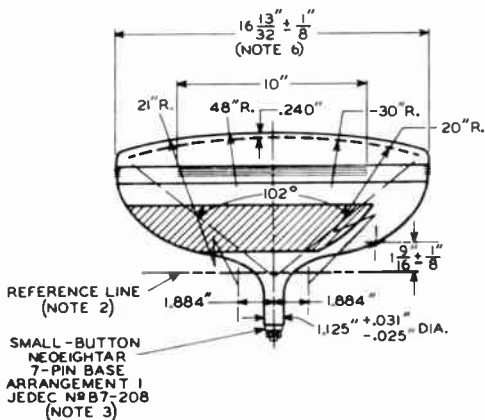
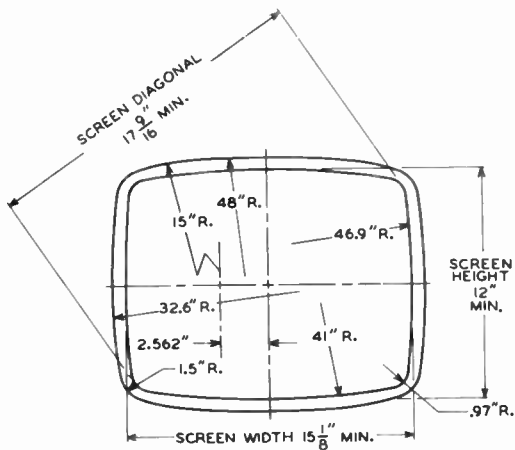
See *Raster-Cutoff-Range Chart for Cathode-Drive Service.*

OPERATING CONSIDERATIONS

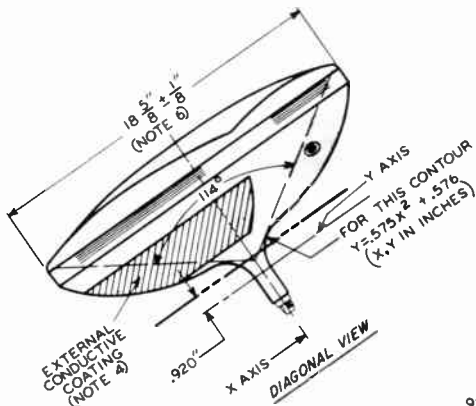
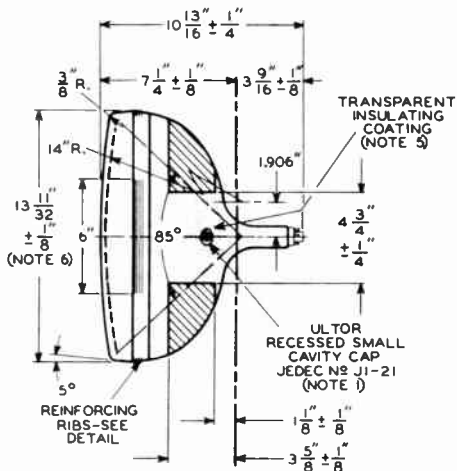
X-Ray Warning. When operated at ultraviolet voltages up to 16 kilovolts, this picture tube does not produce any harmful X-ray radiation. However, because the rating of this type permits operation at voltages as high as 20 kilovolts (Design-maximum value), shielding of this picture tube for X-ray radiation may be needed to protect against possible injury from prolonged exposure at close range whenever the operating conditions involve voltages in excess of 16 kilovolts.

Shatter-Proof Cover Over the Tube Face. Following conventional picture-tube practice, it is recommended that the cabinet be provided with a shatterproof, glass cover over the face of this picture tube to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.

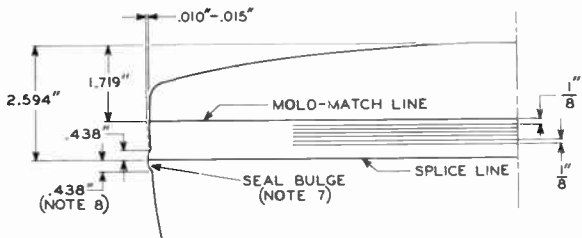




19YP4



92CL-10699



DETAIL OF PANEL

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 30^\circ$. ULTOR TERMINAL IS ON SAME SIDE AS PIN 4.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No. G-126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDING.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

NOTE 6: MEASURED AT THE MOLD-MATCH LINE.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/16" BEYOND THE ENVELOPE SURFACE AT THE MOLD-MATCH LINE.

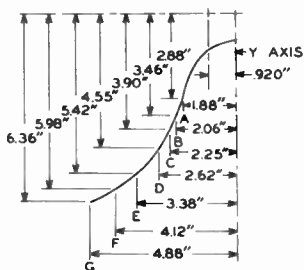
NOTE 8: UNDISTURBED AREA BETWEEN MOLD-MATCH LINE AND SPLICE LINE IS 3/8" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF THE TUBE SUPPORT BAND. TUBE MOUNTING AND YOKE SUPPORT CLAMPS MUST BE SPACED FROM THE TUBE BY USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.



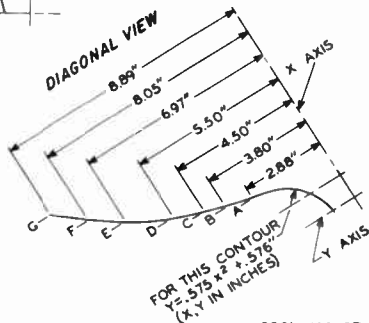
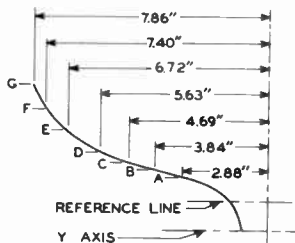
19YP4

BULB-CONTOUR DIMENSIONS

SHORT-SIDE VIEW



LONG-SIDE VIEW

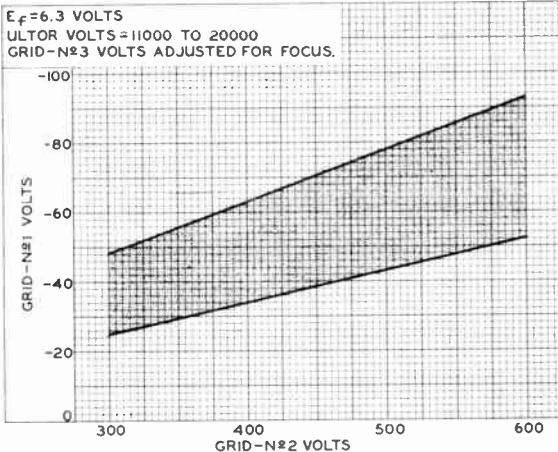


92CL-10669RI

NOTE: PLANES A THROUGH G ARE NORMAL TO THE TUBE AXIS AND AT FIXED LOCATIONS FROM THE Y AXIS. THESE COORDINATES DESCRIBE THE BOGIE-BULB EXTERNAL CONTOUR IN PLANES THROUGH THE TUBE AXIS AND THE RESPECTIVE FACEPLATE AXES.

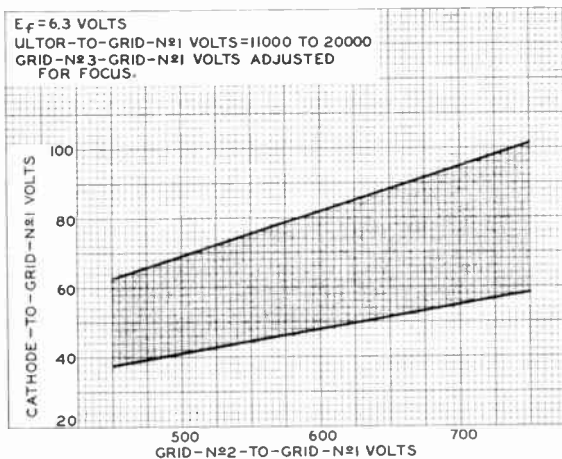
RASTER-CUTOFF-RANGE CHARTS

Grid-Drive Service



92CS-10789

Cathode-Drive Service



92CS-10818







20CP4

20CP4 KINESCOPE

RECTANGULAR GLASS TYPE

MAGNETIC FOCUS

MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

Voltage 6.3 ac or dc volts

Current 0.6 amp

Direct Interelectrode Capacitances:

Grid No.1 to All Other Electrodes 5 $\mu\mu\text{f}$

Cathode to All Other Electrodes 5 $\mu\mu\text{f}$

Face Plate (with about 66% light transmission) Filterglass

Phosphor (For Curves, see front of this Section) No.4-Sulfide Type

Fluorescence and Phosphorescence White

Persistence of Phosphorescence Short

Focusing Method Magnetic

Deflection Method Magnetic

Deflection Angles (Approx.):

Diagonal 70°

Horizontal 66°

Vertical 50°

Ion-Trap Gun Requires External, Single-Field Magnet

Overall Length 21-7/16" \pm 3/8"

Greatest Diagonal of Tube at Face 20-3/32" \pm 3/16"

Greatest Width of Tube at Face 18-11/16" \pm 3/16"

Greatest Height of Tube at Face 14-15/16" \pm 3/16"

Screen Size 17-1/4" x 13-1/4"

Mounting Position Any

Cap. Recessed Small Cavity (JETEC No. J1-21)

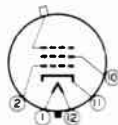
Base Small-Shell Duodecal 5-Pin (JETEC No. 85-57)

BOTTOM VIEW

Pin 1 - Heater

Pin 2 - Grid No.1

Pin 10 - Grid No.2



Pin 11 - Cathode

Pin 12 - Heater

Cap - Anode

Maximum Ratings, Design-Center Values:

ANODE VOLTAGE 18000 max. volts

GRID-No.2 VOLTAGE 410 max. volts

GRID-No.1 VOLTAGE:

Negative bias value 125 max. volts

Positive bias value 0 max. volts

Positive peak value 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode:

During equipment warm-up period not exceeding 15 seconds 410 max. volts

After equipment warm-up period 150 max. volts

Heater positive with respect to cathode. 150 max. volts

MAY 1, 1951

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE DATA 1

20CP4



20CP4

KINESCOPE

Typical Operation:

Anode Voltage*	14000	16000	volts
Grid-No.2 Voltage.	300	300	volts
Grid-No.1 Voltage for Visual Extinction of Undelected Focused Spot	-33 to -77	-33 to -77	volts
Focusing-Coil Current (DC) [□] .	104 ± 10%	110 ± 10%	ma
Field Strength of Single- Field, Ion-Trap Magnet (Approx.)†	50	55	gausses

Maximum Circuit Values:

Grid-No.1-Circuit Resistance 1.5 max. megohms

- * Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14000 volts.
- For specimen focusing coil similar to JETEC Focusing Coil No.109, positioned with air gap toward kinescope screen, and center line of air gap about 3 inches from Reference Line (see Outline Drawing). The indicated currents are for the condition with the combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 30 foot-lamberts on a 17" x 12-3/4" picture area sharply focused at center of screen.
- † Measured at center of field with General Electric Gauss Meter, Cat. No.409X51.



20CP4

KINESCOPE

20CP4

OPERATING NOTES

X-Ray Warning. When operated at or below 16000 volts, the 20CP4 does not produce any harmful x-ray radiation. In general, picture tubes may be operated at voltages (if ratings permit) up to 16000 volts without personal injury on prolonged exposure at close range. Above 16000 volts, special shielding precautions for x-ray radiation may be necessary.

Direction of the field of the ion-trap magnet should be such that the north pole is adjacent to vacant pin position No.8 and the south pole to pin No.2.

MAY 1, 1951

TUBE DEPARTMENT

TENTATIVE DATA 2

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

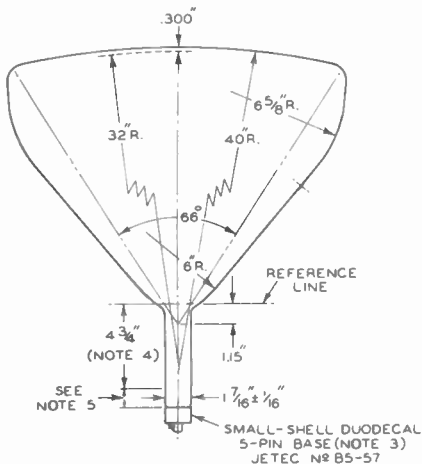
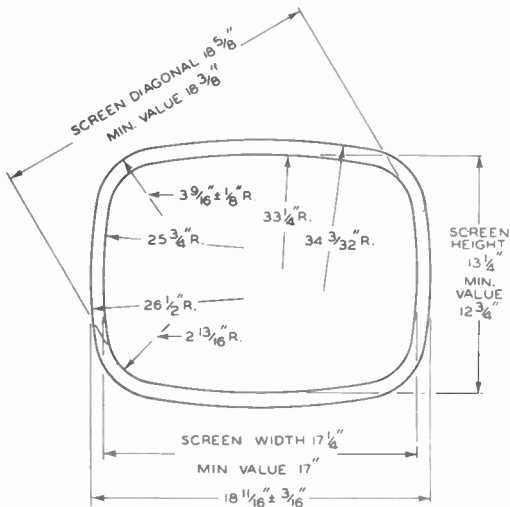
World Radio History

20CP4



20CP4

KINESCOPE



MAY 1, 1951

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

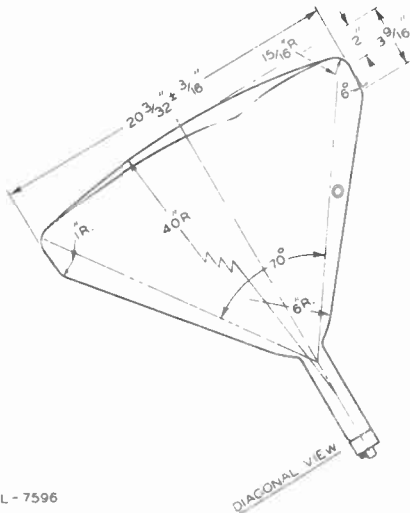
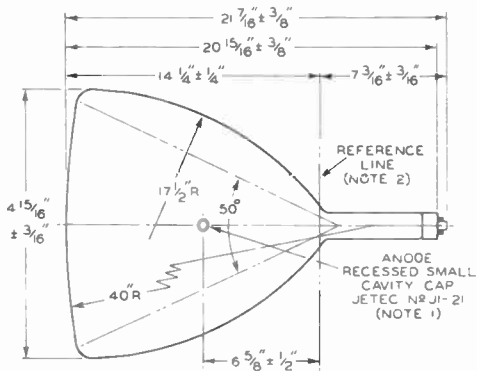
CE-7596A



20CP4

KINESCOPE

20CP4



92CL - 7596

20CP4



20CP4

KINESCOPE

- NOTE 1:** THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No.6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 30^\circ$. ANODE TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION No.6.
- NOTE 2:** WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No. 110 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.
- NOTE 3:** SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 3".
- NOTE 4:** LOCATION OF DEFLECTING YOKE AND FOCUSING DEVICE MUST BE WITHIN THIS SPACE.
- NOTE 5:** KEEP THIS SPACE CLEAR FOR SINGLE-FIELD, ION-TRAP MAGNET.

MAY 1, 1951

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

CE-7596C



20CP4

20CP4

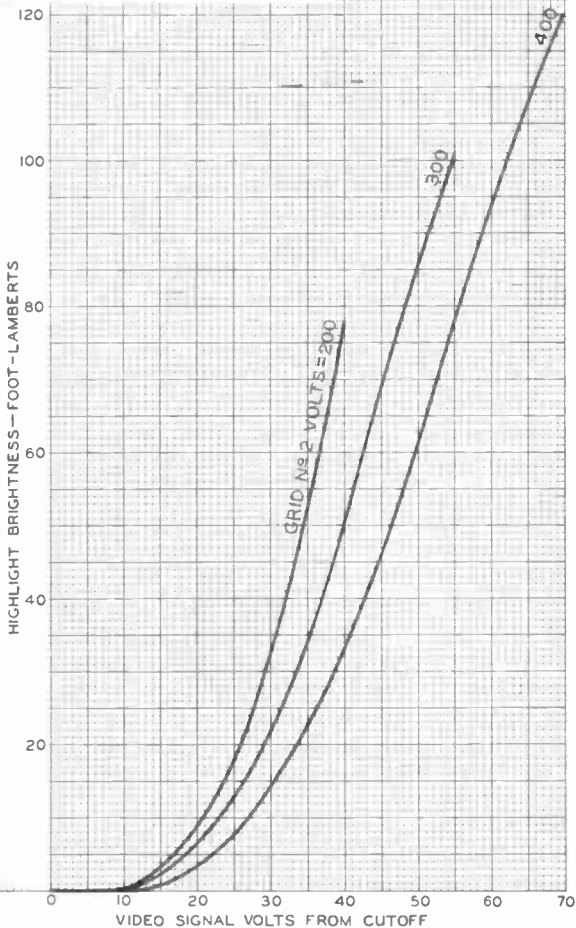
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS

ANODE VOLTS = 16000

GRID No 1 BIASED TO CUTOFF OF UNDEFLECTED FOCUSED SPOT

RASTER SIZE $17 \frac{1}{4} \times 13 \frac{1}{4}$ " (FOCUSED FOR AVERAGE BRIGHTNESS)



MAR. 22, 1951

TUBE DEPARTMENT

92CM-7616

RADIO CORPORATION OF AMERICA, HARTFORD, CONNECTICUT

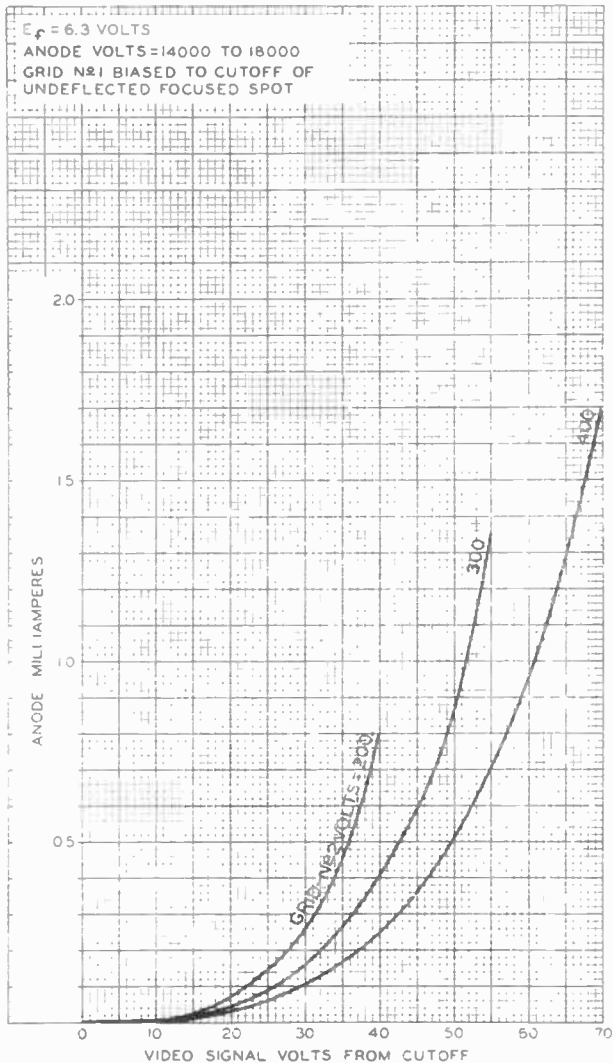
World Radio History

20CP4



20CP4

AVERAGE GRID-DRIVE CHARACTERISTICS



MAR 26, 1951

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-7618

Picture Tube

Pan-o-Ply Type **Low-Voltage Electrostatic Focus**
114° Magnetic Deflection **Low Grid-No.2 Voltage**

Direct Interelectrode Capacitances:

Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode ^a	} 2000 max. 1400 min.	pF
		pF

Heater Current at 6.3 volts 450 ± 20 mA

Heater Warm-Up Time (Average) 11 seconds

Electron Gun Type Requiring No Ion-Trap Magnet

Focus Lens Unipotential

Phosphor P4-Sulfide Type, Aluminized

Faceplate Filterglass

Light Transmission at Center (Approx.) 44%

Weight (Approx.) 16.5 lb

Overall length 12.269" ± .250"

Neck length 4.375" ± .125"

Projected Area of Screen 184 sq. in.

Cap Designation Recessed Small Cavity

(JEDEC No.J1-21)

Base Designation Small-Button Neoeightar 7-Pin,

Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1: Heater

Pin 2: Grid No.1

Pin 3: Grid No.2

Pin 4: Grid No.4

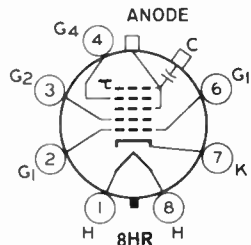
Pin 6: Grid No.1

Pin 7: Cathode

Pin 8: Heater

Cap: Anode (Grid No.3,
Grid No.5, Screen,
Collector)

C: External Conductive
Coating

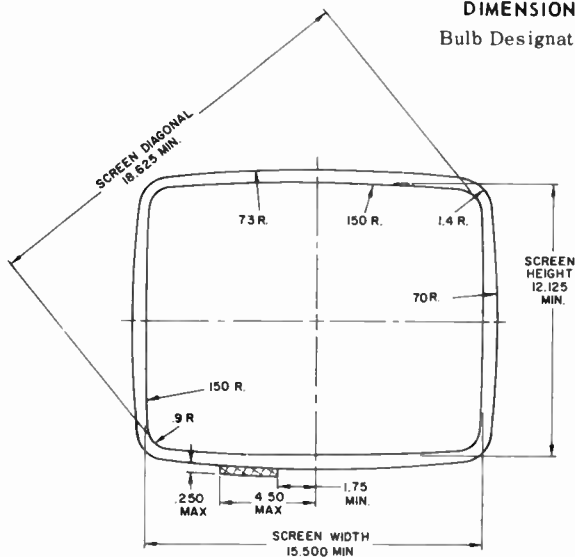


MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

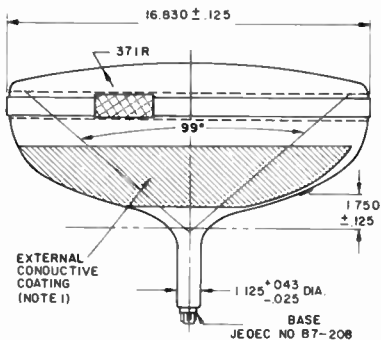
Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	} 23,000 max. 11,000 min.	V
Grid-No.4 Voltage:		V
Positive value	1250 max.	V
Negative value	400 max.	V

DIMENSIONAL Bulb Designation

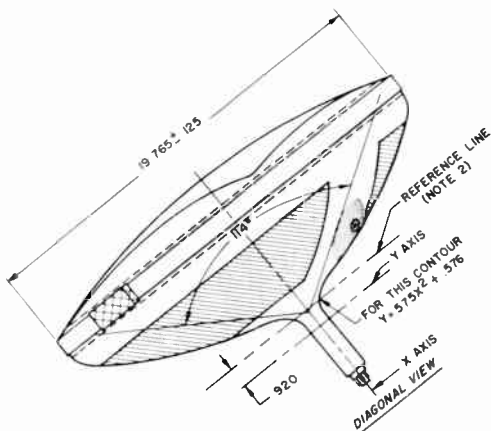
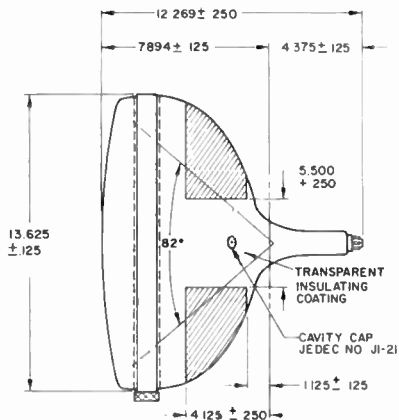


☒ KEEP THIS SPACE CLEAR OF ANY MECHANICAL OBSTRUCTION



OUTLINE

JEDEC NO. J157-1/2 A1



DIMENSIONS IN INCHES

92LL-1914R1

Note 1: External conductive coating and implosion protection hardware must be grounded.

Note 2: Determined by Gauge JEDEC No. G-126.

2OSP4

MAXIMUM AND MINIMUM RATINGS (CONT'D)

Grid-No.2 Voltage	{ 60 max.	V
	{ 20 min.	V
Cathode Voltage:		
Negative peak value	2 max.	V
Negative bias value.	0 max.	V
Positive bias value.	100 max.	V
Positive peak value	150 max.	V
Heater Voltage	{ 6.9 max.	V
	{ 5.7 min.	V
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds		
	450 max.	V
After equipment warm-up period		
	300 max.	V
Heater positive with respect to cathode:		
Combined AC & DC voltage.	200 max.	V
DC Component	100 max.	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	16,000	V
Grid-No.4 Voltage ^b	100	V
Grid-No.2 Voltage	30	V
Cathode Voltage for visual extinction of focused raster		
	22 to 40	V
Field Strength of required adjustable Centering Magnet . .		
	0 to 8	G

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance . . .	1.5 max.	MΩ
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^aIncludes implosion protection hardware.

^bThe grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between -100 and +300 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 11.25-inch by 15-inch pattern from an RCA-2F21 monoscope, or equivalent.

See X-RADIATION PRECAUTIONS at front of this section

Picture Tube

Pan-o-Ply Type
Low-Voltage Electrostatic Focus
114° Magnetic Deflection

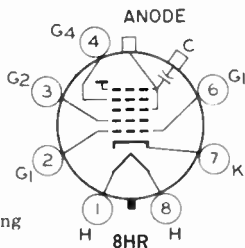
Direct Interelectrode Capacitances:

Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode ^o	} 2000 max. 1400 min.	pF
Heater Current at 6.3 volts . . . . .			450 ± 20	mA
Heater Warm-Up Time (Average)	11	seconds
Electron Gun	Type Requiring No Ion-Trap Magnet	
Focus Lens	Unipotential	
Phosphor	P4-Sulfide Type, Aluminized	
Faceplate	Filterglass	
Light Transmission at Center (Approx.)	44%	
Weight (Approx.)	16.5 lb	
Overall length	12.269 in ± .250 in	
Neck length	4.375 in ± .125 in	
Projected Area of Screen	184 sq. in	
Cap Designation	Recessed Small Cavity (JEDEC No.J1-21)	
Base Designation	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)	

TERMINAL DIAGRAM (Bottom View)

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 3 - Grid No.2
- Pin 4 - Grid No.4
- Pin 6 - Grid No.1
- Pin 7 - Cathode
- Pin 8 - Heater

- Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
- C - External Conductive Coating

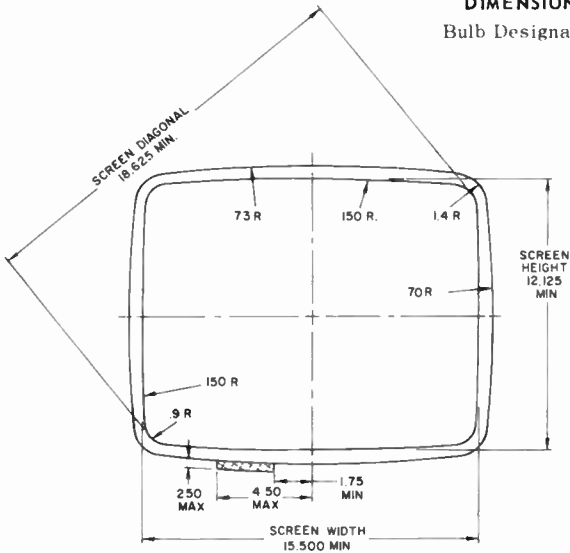


MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

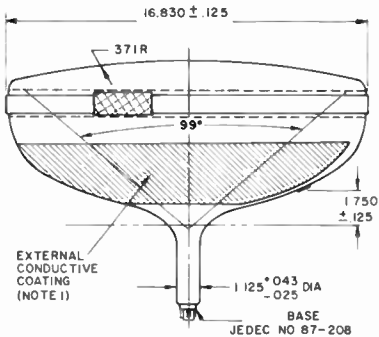
Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	} 23,000 max. 11,000 min.	V
Grid-No.4 Voltage:		V
Positive value	1100 max.	V
Negative value	550 max.	V

DIMENSIONAL Bulb Designation

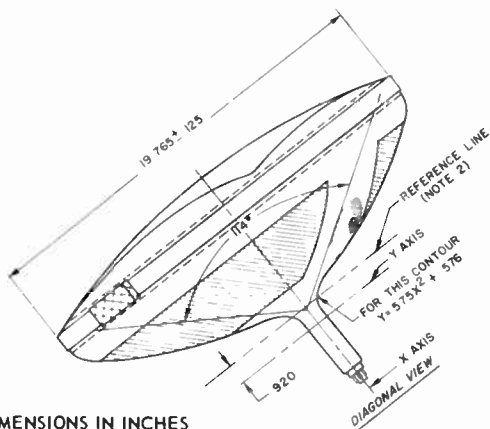
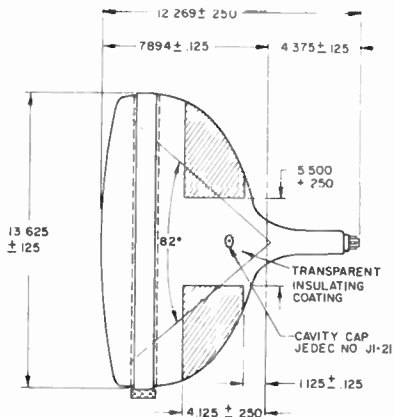


KEEP THIS SPACE CLEAR OF ANY MECHANICAL OBSTRUCTION



OUTLINE

JEDEC No. J157-1/2 A1



DIMENSIONS IN INCHES

92LL-1914R1

Note 1: External conductive coating and implosion protection hardware must be grounded.

Note 2: Reference line is determined by gauge JEDEC No. G-126.

20TP4

MAXIMUM AND MINIMUM RATINGS (CONT'D)

Grid-No.2 Voltage	}	550 max.	V
Grid-No.1 Voltage:		200 min.	V
Negative peak value		220 max.	V
Negative bias value		155 max.	V
Positive bias value		0 max.	V
Positive peak value		2 max.	V
Heater Voltage	}	6.9 max.	V
Peak Heater-Cathode Voltage:		5.7 min.	V
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds		450 max.	V
After equipment warm-up period		300 max.	V
Heater positive with respect to cathode:			
Combined AC & DC Voltage . .		200 max.	V
DC Component		100 max.	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE:

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	16,000	V
Grid-No.4 Voltage ^b	200	V
Grid-No.2 Voltage	300	V
Cathode Voltage for visual extinction of focused raster	28 to 62	V
Field Strength of required adjustable Centering Magnet	0 to 8	G

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max.	MΩ
--	----------	----

^aInclude implosion protection hardware.

^bThe grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 11.25-inch by 15-inch pattern from an RCA-2F21 monoscope, or equivalent.

See X-RADIATION PRECAUTIONS at front of this section.

21AMP4B

Picture Tube

**RECTANGULAR GLASS TYPE
MAGNETIC FOCUS**

**ALUMINIZED SCREEN
90° MAGNETIC DEFLECTION**

Electrical:

Heater Current at 6.3 volts.	600	ma
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes.	6	pf
Cathode to all other electrodes.	5	pf
External conductive coating to anode	{ 2500 max. 2000 min.	{ pf pt
Electron Gun	Type Requiring No Ion-Trap Magnet	

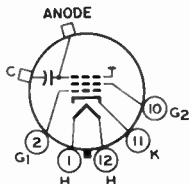
Optical:

Faceplate, Spherical	Filterglass
light transmission (Approx.)	74%
Phosphor (for curves, see front of this Section)	P4-Sulfide Type, Aluminized

Mechanical:

Operating Position	Any
Weight (Approx.)	24 lbs
Overall Length	20" ± 3/8"
Neck Length.	7-1/2" ± 3/16"
Projected Area of Screen	262 sq. in.
External Conductive Coating:	
Type	Regular-Band
Contact area for grounding	Near Reference Line
For Additional Information on Coatings, Dimensions, and Deflection Angles:	
See <i>Picture-Tube Dimensional-Outlines</i> and <i>Bulb J171 D/E</i> sheets at the front of this section	
Cap.	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Shell Duodecal 5-Pin (JEDEC Group 4, No. B5-57)
Basing Designation for BOTTOM VIEW	12N

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 10 - Grid No.2
- Pin 11 - Cathode
- Pin 12 - Heater



- Cap-Anode
(Grid No.3,
Collector)
- C-External
Conductive
Coating

Maximum Ratings, Design-Maximum Values:

Anode Voltage	20000 max.	volts
Grid-No.2 Voltage	550 max.	volts



21AMP4B

Grid-No.1 Voltage:

Negative peak value.	220 max.	volts
Negative bias value.	155 max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts

Peak Heater-Cathode Voltage:

Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

with anode voltage of	16000	volts
and grid-No.2 voltage of	300	volts

Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts
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Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
--	----------	---------

For x-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



Picture Tube

**RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS**

**ALUMINIZED SCREEN
72° MAGNETIC DEFLECTION**

Electrical:

Heater Current at 6.3 volts.	600	ma
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes.	6	pf
Cathode to all other electrodes.	5	pf
External conductive coating to anode	{ 2500 max. pf 2000 min. pf	
Electron Gun	Type Requiring No Ion-Trap Magnet	

Optical:

Faceplate, Spherical	Filterglass
Light transmission (Approx.)	74%
Phosphor (For curves, see front of this section)	P4-Sulfide Type, Aluminized

Mechanical:

Operating Position.	Any
Weight (Approx.)	24 lbs
Overall Length.	23-1/32" ± 3/8"
Neck Length	7-1/2" ± 3/16"
Projected Area of Screen.	262 sq. in.

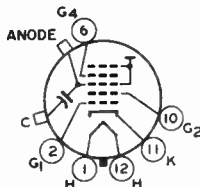
External Conductive Coating:
Type. Special
Contact area for grounding. Near Reference Line

For Additional Information on Coatings and Dimensions:

See *Picture-Tube Dimensional-Outlines and Bulb J171 B/F* sheets at the front of this section

Cap	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Shell Duodecal 6-Pin, Arrangement 1, (JEDEC Group 4, No. B6-63)
Basing Designation for BOTTOM VIEW.	12L

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 6 - Grid No.4
- Pin 10 - Grid No.2
- Pin 11 - Cathode
- Pin 12 - Heater



- Cap - Anode (Grid No.3, Grid No.5, Collector)
- C - External Conductive Coating



21AVP4C

Maximum Ratings, Design-Maximum Values:

Anode voltage	22000 max.	volts
Grid-No.4 (Focus) voltage:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
Grid-No.2 Voltage	550 max.	volts
Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With anode voltage of	18000	volts
and grid-No.2 voltage of	300	volts
Grid-No.4 Voltage for focus	-72 to +396	volts
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



21AWP4A

Picture Tube

NO ION-TRAP MAGNET REQUIRED

**RECTANGULAR GLASS TYPE
MAGNETIC FOCUS**

**ALUMINIZED SCREEN
72° MAGNETIC DEFLECTION**

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes.	5	pf
Grid No.1 to all other electrodes.	6	pf
External conductive coating to anode.	$\left\{ \begin{array}{l} \leq 500 \text{ max.} \\ \geq 2000 \text{ min.} \end{array} \right.$	$\left\{ \begin{array}{l} \text{max.} \\ \text{min.} \end{array} \right.$ pf
Heater Current at 6.3 volts.		600 \pm 30	ma
Heater Warm-up time (Average).	11	seconds
Electron Gun	Type Requiring No Ion-Trap Magnet	

Optical:

Phosphor (For Curves, see front of this section).	P4—Sulfide Type, Aluminized
Faceplate, Spherical	Filterglass
Light transmission (Approx.)	74%
Surface of Protective Window	Treated to reduce specular reflection

Mechanical:

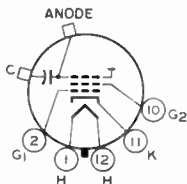
Weight (Approx.)	24 lbs
Overall Length	23.031" \pm .375"
Neck Length.	7.500" \pm .188"
Projected Area of Screen	262 sq. in.

External Conductive Coating:
 Type Regular-Band
 Contact area for grounding. Near Reference Line
 For Additional Information on Coatings and Dimensions:

See *Picture-Tube Dimensional-Outlines and Bulb J171 BIF Sheets* at front of this section

Cap. Recessed Small Cavity (JEDEC No. J1-21)
 Base Small-Shell Duodecal 5-Pin (JEDEC Group 4, No. B5-57)
 Basing Designation for BOTTOM VIEW. 12N

- Pin 1—Heater
- Pin 2—Grid-No.1
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater
- Cap—Anode (Grid No.3,
Screen,
Collector)
- C—External
Conductive Coating



Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage.	20000 max.	volts
Grid-No.2 Voltage.	550 max.	volts



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 Electronic Components and Devices
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Grid-No.1 Voltage:

Negative peak value.	220 max.	volts
Negative bias value.	155 max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts
Heater Voltage	{ 6.9 max.	volts
	{ 5.7 min.	volts

Peak Heater-Cathode Voltage:

Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.		
	450 max.	volts
	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage.	18000	volts
Grid-No.2 Voltage.	400	volts
Cathode Voltage for visual extinction of focused raster.	36 to 78	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section





2IAXP22

2IAXP22

COLOR KINESCOPE

THREE-GUN SHADOW-MASK TYPE
MAGNETIC CONVERGENCE

ELECTROSTATIC FOCUS
MAGNETIC DEFLECTION

DATA

General:

Electron Guns, Three with Axes Tilted
 Toward Tube Axis Blue, Green, Red

Heater, for Unipotential Cathode of
 Each Gun, Paralleled with Each of
 the Other Two Heaters within Tube:

Voltage. 6.3 ac or dc volts
 Current. 1.8 amp

Direct Interelectrode Capacitances (Approx.):

Grid No.1 of any gun to all other
 electrodes except the No.1 grids
 of the other two guns. 7 μ f

Cathode of blue gun + cathode of green
 gun + cathode of red gun to all
 other electrodes 16 μ f

Grid No.3 (Of each gun tied within
 tube to No.3 grids of other two
 guns) to all other electrodes. 9 μ f

Faceplate, Spherical Filterglass
 Light transmission (Approx.) 77%

Screen, on Inner Surface of Faceplate:

Type Metal-Backed, Tricolor, Phosphor-Dot
 Phosphor (Three separate phosphors, collectively). P22
 Fluorescence and phosphorescence of
 separate phosphors, respectively. Blue, Green, Red
 Persistence of group phosphorescence Medium
 Dot arrangement. Triangular group consisting of
 blue dot, green dot, and red dot

Spacing between centers of adjacent dot trios (Approx.) 0.029"

Size (Minimum):

Greatest width 19-1/16"
 Height 15-1/4"
 Projected area 255 sq. in.

Focusing Method. Electrostatic
 Convergence Method Magnetic
 Deflection Method. Magnetic

Deflection Angles (Approx.):

Horizontal 70°
 Vertical 55°

Tube Dimensions:

Maximum overall length 25-5/16"

Diameter:

At lip 20-9/16" \pm 1/8"
 At flange. 21-1/4" max.

Weight (Approx.) 28 lbs

Mounting Position. Any

Ultor Terminal. Metal-Shell Lip

Base Small-Shell Neodiheptal 12-Pin (JETEC No.B12-131)

*: See next page.

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TUBE DIVISION

TENTATIVE DATA 1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

21AXP22



21AXP22 COLOR KINESCOPE

Socket	Alden Nos. 214NMNSC (Radial leads), 214NMINC (Axial leads), or equivalent	
Basing Designation for BOTTOM VIEW	14W	
Pin 1 - Heater	Pin 9 - Grids No. 3	
Pin 2 - Grid No. 1 of Red Gun	Pin 11 - Grid No. 2 of Blue Gun	
Pin 3 - Grid No. 2 of Red Gun	Pin 12 - Grid No. 1 of Blue Gun	
Pin 4 - Cathode of Red Gun	Pin 13 - Cathode of Blue Gun	
Pin 5 - Cathode of Green Gun	Pin 14 - Heater	
Pin 6 - Grid No. 1 of Green Gun	METAL-SHELL LIP: Ultor (Grid No. 4, Grid No. 5, Collector)	
Pin 7 - Grid No. 2 of Green Gun		



Maximum Ratings, Design-Center Values:

ULTOR* - TO - CATHODE (Of each gun) VOLTAGE	25000 max.	volts
ULTOR CURRENT, (Average, each gun)	500 max.	μamp
GRID-NO. 3 - TO - CATHODE (Of each gun) VOLTAGE	6000 max.	volts
GRID-NO. 2 - TO - CATHODE VOLTAGE (Each gun)	800 max.	volts
GRID-NO. 1 - TO - CATHODE VOLTAGE (Each gun):		
Negative bias value	400 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER - CATHODE VOLTAGE (Each gun):		
Heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds	410 max.	volts
After equipment warm-up period	180 max.	volts
Heater positive with respect to cathode	180 max.	volts

Equipment Design Ranges:

For ultor voltage (E_{c4} each gun) of 25000 volts

Grid-No. 3 (Focusing electrode) - to - Cathode (Of each gun) Voltage	10.2% to 21.2% of E_{c4} each gun	volts
Grid-No. 2 - to - Cathode Voltage (Each gun) when circuit design utilizes grid-No. 1 - to - cathode voltage (E_{c1k}) at fixed value for raster cutoff	<i>See Cutoff Design Chart</i>	

* A value of average ultor current per gun higher than 500 microamperes will increase picture brightness but may impair resolution and shorten cathode life.

• See next page.

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TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE DATA 1



21AXP22

21AXP22 COLOR KINESCOPE

Grid-No.1-to-Cathode Voltage (Each gun) for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2-to-cathode voltage (E_{c2k}) at fixed value See Cutoff Design Chart

Variation in Raster Cutoff Between Guns in Any Tube. $\pm 21\%$ of average of highest and lowest cutoff values

Grid-No.3 Current for ultor current of 800 μ amp. -45 to +75 μ amp

Grid-No.2 Current (Each gun) . . . -5 to +5 μ amp

Percentage of Total Ultor Current Supplied by Each Gun:

To produce Illuminant-C White (I.C.I. Coordinates $x = 0.310, y = 0.316$):

Red gun	47 to 67	per cent
Blue gun	11 to 24	per cent
Green gun	20 to 33	per cent

To produce White of 8500°K + 27M.P.C.D. (I.C.I. Coordinates $x = 0.287, y = 0.316$):

Red gun	42 to 60	per cent
Blue gun	12 to 27	per cent
Green gun	23 to 38	per cent

Maximum Raster Shift in Any Direction from Screen Center[□]. 1 inch

Maximum Compensation to be Provided by the Following Components:

Purifying coil or magnet Raster shift of 1" in any direction from screen center

Converging component (Each gun):

For static convergence—

After adjustment has been made for optimum color purity and dynamic convergence

Shift of spot by $\pm 5/8$ "

• The "ultor" in a cathode-ray 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 21AXP22, the ultor function is performed by grid No.4. Since grid No.4, grid No.5, and collector are connected together within the 21AXP22, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.

□ Centering of the raster on the screen is accomplished by passing direct current of the required value through each pair of deflecting coils to compensate for raster shift resulting from adjustments for optimum convergence and color purity.

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21AXP22 COLOR KINESCOPE

For dynamic convergence†—

Effected by mmf of approxi-
mately parabolic waveshape
synchronized with scanning

Horizontal:

Red spot and green spot Shift of 1/4"
Blue spot Shift of 1/2"

Vertical:

Red spot and green spot Shift of 3/8"
Blue spot Shift of 1/8"

Blue-positioning magnet (Blue gun):

After adjustment has been
made for color purity
and dynamic convergence Shift of blue
spot by $\pm 1/2$ "

Examples of Use of Design Ranges:

For ultor voltage of 25000 volts

Grid-No.3 (Focusing electrode)-
to-Cathode (Of each gun)
Voltage 3800 to 5300 volts

Grid-No.2-to-Cathode Voltage
(Each gun) when circuit design
utilizes grid-No.1-to-cathode
voltage of -70 volts for
raster cutoff 130 to 370 volts

Grid-No.1-to-Cathode Voltage
(Each gun) for Visual Extinction
of Focused Raster when circuit
design utilizes grid-No.2-to-
cathode voltage of 200 volts. . . . -45 to -100 volts

Limiting Circuit Values:

High-Voltage Circuits:

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the *ultor power supply* and the *grid-No.3 power supply* be of the limited-energy type with inherent regulation to limit the continuous short-circuit current to 50 milliamperes. In addition, to prevent cathode damage with resultant decrease in tube life, the effective resistance between the ultor power supply output capacitor and the ultor, and the effective resistance between grid-No.3 power supply output capacitor and the grid-No.3 electrode should not be less than 50000 ohms. These resistances should be capable of withstanding the maximum instantaneous currents and voltages in their

† Indicated values apply when RCA test yoke is used with the 21AXP22.



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21AXP22

COLOR KINESCOPE

respective circuits. It is to be noted that the effectiveness of the resistance between the ultor power supply output capacitor and the ultor may be impaired if capacitance in excess of 750 $\mu\mu\text{f}$ is introduced between the kinescope and ground by the mounting arrangement of the kinescope.

In equipment utilizing a well-regulated ultor power supply, the *grid-No.3-circuit resistance* should be limited to 7.5 megohms.

Low-Voltage Circuits:

Grid-No.1-Circuit Resistance (Each gun). . 1.5 max. megohms

When the cathode of each gun is not connected directly to its associated heater, the grid-No.2-to-heater circuit, the grid-No.1-to-heater circuit, and the cathode-to-heater circuit, should each have an impedance such that their respective power sources in combination will not supply an instantaneous or continuous short-circuit current of more than 300 milliamperes total. Such current limitation will prevent heater burnout in case of a momentary internal arc within the tube.

When the cathode is connected directly to the heater, the grid-No.2-to-heater circuit, and the grid-No.1-to-heater circuit should have an impedance such that their respective power sources in combination will not supply an instantaneous or continuous short-circuit current of more than 300 milliamperes total. Such current limitation will prevent heater burnout in case of a momentary internal arc within the tube.

X-RAY WARNING

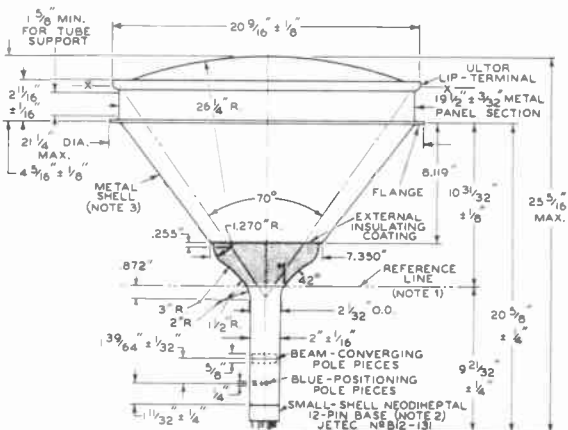
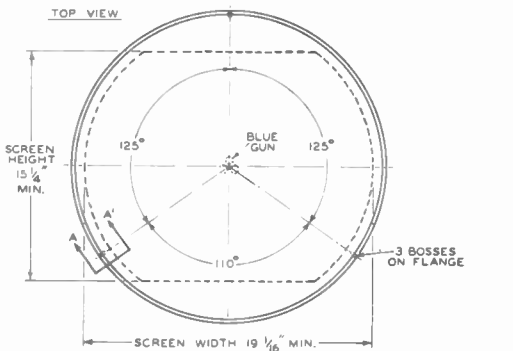
X-ray radiation is produced by the 21AXP22 when it is operated at its normal ultor voltage. The radiation is through the faceplate, and is sufficient to require the adoption of safety measures in TV receivers. Shielding such as that provided by a 1/4-inch thickness of safety glass (lime) in front of the faceplate, should prove adequate to provide protection against personal injury from prolonged exposure at close range when the tube is operated at its maximum ultor voltage rating.

When this tube is being serviced outside of the TV receiver cabinet, it should never be operated without providing adequate X-ray shielding in front of faceplate. Because the ultor voltage may rise above its maximum rated value for short periods during adjustment with increase in the amount of X-ray radiation, provision should be made for placing a 3/8-inch thickness of safety glass in front of the faceplate to avoid the hazard of X-ray radiation.

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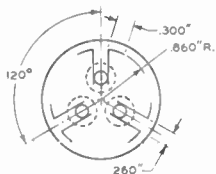
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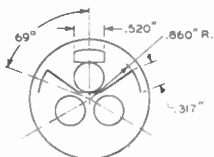


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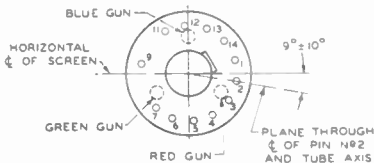
21AXP22 COLOR KINESCOPE



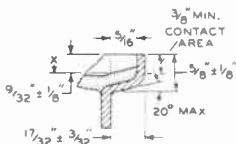
LOCATION OF BEAM-CONVERGING POLE PIECES



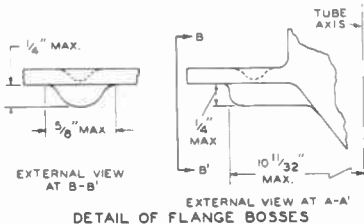
LOCATION OF BLUE-POSITIONING POLE PIECES



BASE
BOTTOM VIEW



DETAIL OF LIP



EXTERNAL VIEW AT A-A'
DETAIL OF FLANGE BOSSES

92CL-8399R3

21AXP22



21AXP22 COLOR KINESCOPE

NOTE 1: REFERENCE LINE IS DETERMINED BY POSITION WHERE A CYLINDRICAL GAUGE $2.465" \pm 0.001"$ I.D. CONCENTRIC WITH NECK AXIS, WILL REST ON ENVELOPE FUNNEL.

NOTE 2: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH METAL-SHELL AXIS AND HAVING A DIAMETER OF 3".

NOTE 3: METAL SHELL AND GLASS FACE OPERATE AT HIGH VOLTAGE. ANY MATERIAL IN CONTACT WITH THE SHELL OR THE FACE MUST BE INSULATED TO WITHSTAND THE MAXIMUM APPLIED ULTRAVOLTAGE.

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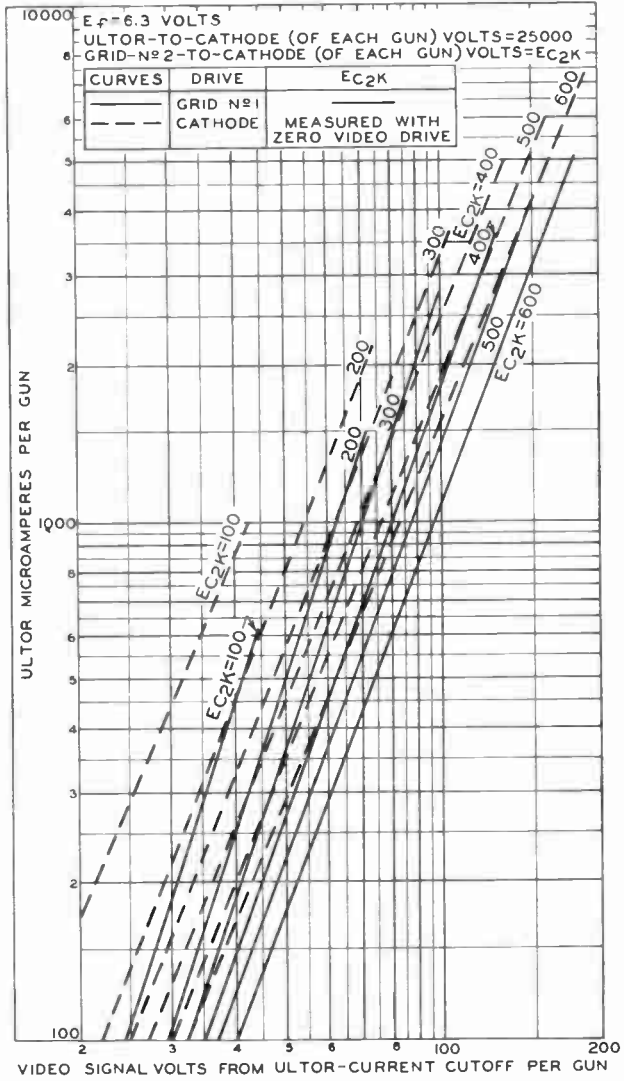
World Radio History



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TYPICAL DRIVE CHARACTERISTICS



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92CM-8566

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TYPICAL LIGHT-OUTPUT CHARACTERISTIC

 $E_f = 6.3$ VOLTS

ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 25000

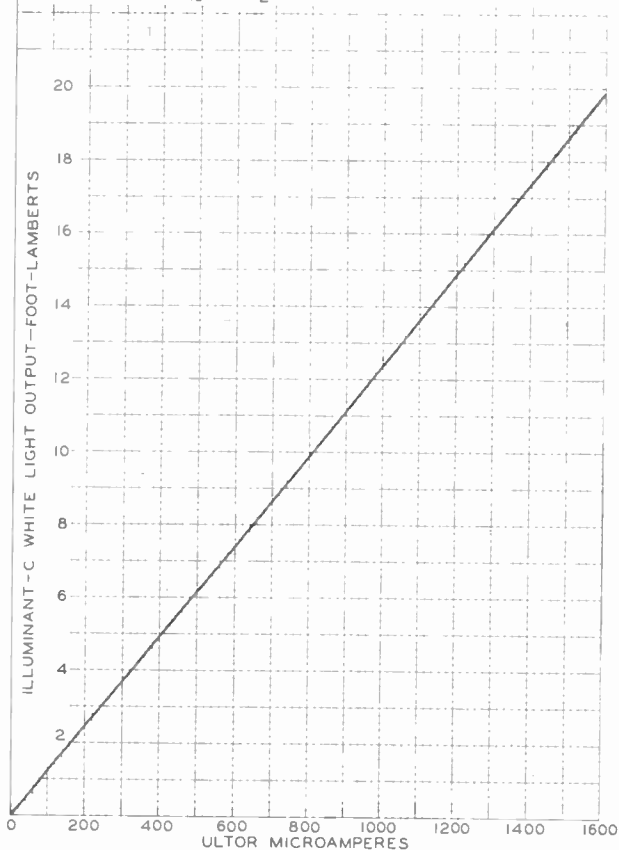
GRID-N^o3-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS

DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ULTOR CURRENT TO PRODUCE ILLUMINANT-C WHITE LIGHT OUTPUT PERCENTAGE OF TOTAL ULTOR CURRENT SUPPLIED BY EACH GUN TO PRODUCE ILLUMINANT-C WHITE:

RED GUN: 57 %

BLUE GUN: 17 %

GREEN GUN: 26 %

RASTER SIZE = $19\frac{1}{16}$ " x $14\frac{1}{2}$ "

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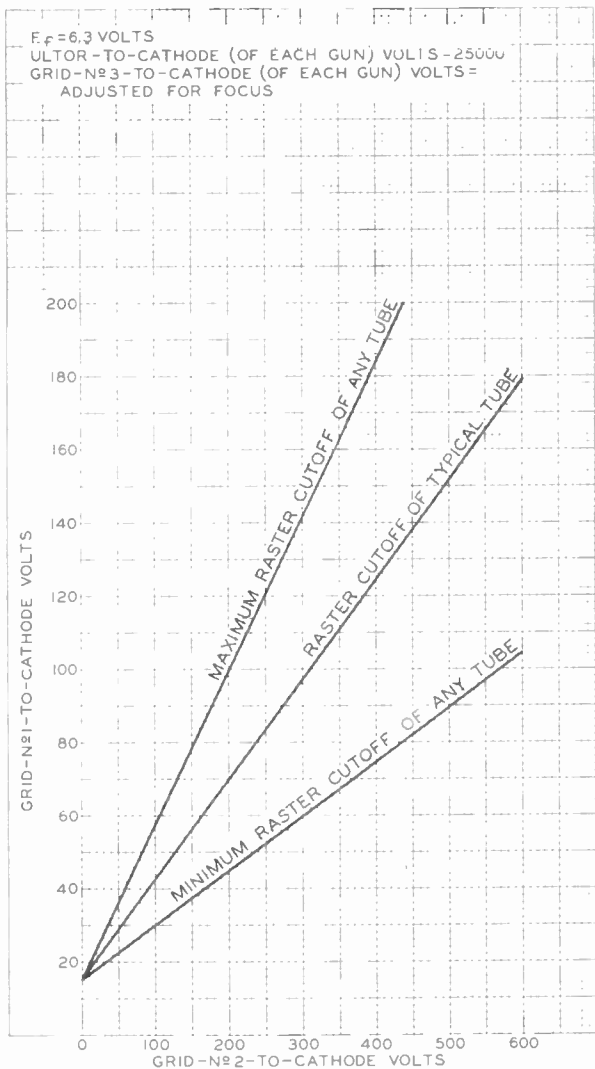
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21AXP22

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CUTOFF DESIGN CHART



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TUBE DIVISION

92CM-8565

RAD CO CORPORATION OF AMERICA HARRISON, NEW JERSEY

World Radio History





21AXP22-A

21AXP22-A COLOR KINESCOPE

THREE-GUN SHADOW-MASK TYPE ELECTROSTATIC FOCUS
 MAGNETIC CONVERGENCE MAGNETIC DEFLECTION
 ALUMINIZED TRICOLOR PHOSPHOR-DOT SCREEN
Supersedes Type 21AXP22

DATA

General:

Electron Guns, Three with Axes Tilted
 Toward Tube Axis Blue, Green, Red

Heater, for Unipotential Cathode of
 Each Gun, Paralleled with Each of
 the Other Two Heaters within Tube:
 Voltage. 6.3 ac or dc volts
 Current. $1.8 \pm 10\%$ amp

Direct Interelectrode Capacitances (Approx.):

Grid No.1 of any gun to all other
 electrodes except the No.1 grids
 of the other two guns. 7 $\mu\mu\text{f}$

Cathode of blue gun + cathode of green
 gun + cathode of red gun to all
 other electrodes 16 $\mu\mu\text{f}$

Grid No.3 (Of each gun tied within
 tube to No.3 grids of other two
 guns) to all other electrodes. 9 $\mu\mu\text{f}$

Faceplate, Spherical Filterglass
 Light transmission (Approx.) 77%

Screen, on Inner Surface of Faceplate:
 Type Aluminized, Tricolor, Phosphor-Dot
 Phosphor (Three separate phosphors, collectively). . . . P22
 Fluorescence and phosphorescence of
 separate phosphors, respectively. . . Blue, Green, Red
 Persistence of group phosphorescence Medium
 Dot arrangement. Triangular group consisting of
 blue dot, green dot, and red dot

Spacing between centers of adjacent dot trios (Approx.) 0.029"

Size (Minimum):
 Greatest width 19-1/16"
 Height 15-1/4"
 Projected area 255 sq. in.

Focusing Method. Electrostatic
 Convergence Method Magnetic
 Deflection Method. Magnetic

Deflection Angles (Approx.):
 Horizontal 70°
 Vertical 55°

Tube Dimensions:
 Maximum overall length 25-5/16"
 Diameter:
 At lip 20-9/16" \pm 1/8"
 At flange. 20-15/16" \pm 5/16"

Weight (Approx.) 28 lbs
 Mounting Position. Tube axis horizontal
 (base pin 12 on top)

21AXP22-A



21AXP22-A COLOR KINESCOPE

Ultor Terminal. Metal Shell
 Base. . . . Small-Shell Neodiheptal 12-Pin (JETEC No. B12-131)
 Socket. Alden Nos. 214NMINS (Radial leads),
 214NMINC (Axial leads), or equivalent

Basing Designation for BOTTOM VIEW. 14AH

- Pin 1-Heater
- Pin 2-Grid No.1
of Red Gun
- Pin 3-Grid No.2
of Red Gun
- Pin 4-Cathode
of Red Gun
- Pin 5-Cathode
of Green Gun
- Pin 6-Grid No.1
of Green Gun
- Pin 7-Grid No.2
of Green Gun



- Pin 9-Grids No.3
- Pin 11-Grid No.2
of Blue Gun
- Pin 12-Grid No.1
of Blue Gun
- Pin 13-Cathode
of Blue Gun
- Pin 14-Heater

METAL SHELL:
 Ultor
 (Grid No.4,
 Grid No.5,
 Collector)

Maximum Ratings, Design-Center Values:

ULTOR-TO-CATHODE (Of each gun) VOLTAGE. . .	25000 max.	volts
ULTOR CURRENT, (Average, each gun).	500* max.	μamp
GRID-No.3-TO-CATHODE (Of each gun) VOLTAGE . . .	6000 max.	volts
GRID-No.2-TO-CATHODE VOLTAGE (Each gun) . . .	800 max.	volts
GRID-No.1-TO-CATHODE VOLTAGE (Each gun):		
Negative bias value	400 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE (Each gun):		
Heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds.	410 max.	volts
After equipment warm-up period.	180 max.	volts
Heater positive with respect to cathode . . .	180 max.	volts

Equipment Design Ranges:

With any ultor voltage (E_{c4k} each gun) between 20000# and 25000 volts

Grid-No.3 (Focusing electrode)-to-Cathode (Of each gun) Voltage . 15.2% to 21.2% of E_{c4k} each gun volts

Grid-No.2-to-Cathode Voltage (Each gun) when circuit design utilizes grid-No.1-to-cathode voltage (E_{c1k}) at fixed value for raster cutoff. See Cutoff Design Chart

*, #: See next page.



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21AXP22-A COLOR KINESCOPE

Grid-No.1-to-Cathode Voltage (Each gun) for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2-to-cathode voltage (E_{c2k}) at fixed value. See Cutoff Design Chart

Variation in Raster Cutoff Between Guns in Any Tube. $\pm 21\%$ of average of highest and lowest cutoff values

Grid-No.3 Current for ultor current of 800 μ amp. -45 to +75 μ amp

Grid-No.2 Current (Each gun) -5 to +5 μ amp

Percentage of Total Ultor Current Supplied by Each Gun:

To produce Illuminant-C White (I.C.I. Coordinates $x = 0.310, y = 0.316$):

Red gun.	47 to 67	per cent
Blue gun	11 to 24	per cent
Green gun.	20 to 33	per cent

To produce White of 8500°K + 27 M.P.C.D. (I.C.I. Coordinates $x = 0.287, y = 0.316$):

Red gun.	42 to 60	per cent
Blue gun	12 to 27	per cent
Green gun.	23 to 38	per cent

Maximum Raster Shift in Any Direction from Screen Center[□]. 1 inch

Adjustment to be Provided by the Following Components:

Purifying magnet Raster shift of 1" max. in any direction from screen center

Magnetic-field equalizer Beam displacement with respect to phosphor dot at position of max. displacement (i.e., edge of screen)

Tangential	$\pm 0.0005"$ to $\pm 0.007"$
Radial	$\pm 0.0005"$ to $\pm 0.005"$

* A value of average ultor current per gun higher than 500 microamperes will increase picture brightness but may impair resolution and shorten cathode life.

□ Centering of the raster on the screen is accomplished by passing direct current of the required value through each pair of deflecting coils to compensate for raster shift resulting from adjustments for optimum convergence and color purity.

Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 20000 volts.

21AXP22-A



21AXP22-A COLOR KINESCOPE

Lateral-Converging Magnet: [Ⓢ]_Ⓛ

After adjustment has been made for color purity and dynamic convergence—

- Max. shift of blue beam. ±1/4"
- Max. shift of red and green beams. ±1/8" to ±3/8"
- Average of max. shift of red and green beams. ±7/32" to ±9/32"

Radial-Converging Magnet Assembly: [Ⓢ]

For static convergence—

After adjustment has been made for optimum color purity and dynamic convergence

(Each beam). Shift of ±5/8"

For dynamic convergence†—

Effected by magnetomotive force of parabolic and/or sawtooth waveshape synchronized with scanning.

Horizontal:

Blue pattern—

Parabola amplitude to provide[Ⓢ]. Shift of 1/4" to 9/16"

Sawtooth amplitude to provide[Ⓢ] Shift of ±50% of the shift caused by parabola amplitude

Red pattern & green pattern—

Parabola:

Amplitude to provide[Ⓢ]. Shift of 1/8" to 3/8"

Ratio of red-pattern shift to green-pattern shift. 1/2 to 2

Sawtooth:

Amplitude for red pattern to provide[Ⓢ] Shift of -35% to +85% of the shift caused by parabola amplitude

Amplitude for green pattern to provide[Ⓢ] Shift of -85% to +35% of the shift caused by parabola amplitude

Difference between red-pattern shift and green-pattern shift (Shift_R - Shift_G).

0 to +100%

Vertical:

Blue pattern—

Parabola amplitude to provide[Ⓢ]. Shift of 0 to 1/8"

[Ⓢ], [†], [Ⓢ], [Ⓢ]: See next page.



21AXP22-A

21AXP22-A COLOR KINESCOPE

For dynamic convergence† (Cont'd):

Vertical:

Sawtooth amplitude to provide^{OO} Shift of 0 to 1/4"

Red pattern & green pattern—

Parabola:

Amplitude to provide[▲] Shift of 1/8" to 3/8"

Ratio of red-pattern shift to green-pattern shift 1/2 to 2

Sawtooth:

Amplitude to provide^{OO} Shift of -1/8" to +3/16"

Difference between red-pattern shift and green-pattern shift (Shift_R - Shift_G) 0 to +100%

Examples of Use of Design Ranges:

	20000	25000	volts
Grid-No.3 (Focusing Electrode)- to-Cathode (Of Each Gun)			
Voltage.	3040 to 4240	3800 to 5300	volts
Grid-No.2-to-Cathode Voltage (Each Gun) when circuit design utilizes grid-No.1-to-cathode voltage of -70 volts for raster cutoff.	130 to 370	130 to 370	volts
Grid-No.1-to-Cathode Voltage (Each Gun) for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2-to-cathode voltage of 200 volts	-45 to -100	-45 to -100	volts

Limiting Circuit Values:

High-Voltage Circuits:

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the *ultor power supply* and the *grid-No.3 power supply* be of the limited-energy type with inherent regulation to limit the continuous short-circuit current to 50 milliamperes. In addition, to prevent cathode damage with resultant decrease in tube life, the effective resistance between grid-No.3 power supply output capacitor and the grid-No.3 electrode should be not less than 50000 ohms. This resistance should be capable of withstanding the maximum instantaneous current and voltage in the grid-No.3 circuit.

In equipment utilizing a well-regulated ultor power supply, the *grid-No.3-circuit resistance* should be limited to 7.5 megohms.

⊙, †, ▲, OO: See next page.



21AXP22-A COLOR KINESCOPE

Low-Voltage Circuits:

Grid-No.1-Circuit Resistance
(Each Gun) 1.5 max. megohms

When the cathode of each gun is not connected directly to the heater, the grid-No.2-to-heater circuit, the grid-No.1-to-heater circuit, and the cathode-to-heater circuit should each have an impedance such that their respective power sources in combination will not supply an instantaneous or continuous short-circuit current of more than 300 milliamperes total. Such current limitation will prevent heater burnout in case of a momentary internal arc within the tube.

When the cathode is connected directly to the heater, the grid-No.2-to-heater circuit, and the grid-No.1-to-heater circuit should each have an impedance such that their respective power sources in combination will not supply an instantaneous or continuous short-circuit current of more than 300 milliamperes total. Such current limitation will prevent heater burnout in case of a momentary internal arc within the tube.

- ⊙ Shift is the movement of the regions of bar-or-dot-generator pattern indicated in notes (▲) and (⊙⊙).
- ↓ The direction of movement of the red and green beam is opposite to that of the blue beam.
- † Indicated values apply when RCA test yoke is used with the 21AXP22-A.
- ▲ The parabola amplitude is determined by the average value of the shifts at the extremities of the respective horizontal and vertical axes of the screen with convergence of the three beams maintained at the center of the screen. An increase in amplitude should move the blue beam toward the top of the screen; the red beam toward the lower left of the screen; and the green beam toward the lower right of the screen.
- ⊙⊙ The sawtooth amplitude is determined by the difference between the shifts at the extremities of the respective horizontal and vertical axes of the screen. Positive amplitude indicates that the shift at the right or bottom of the screen is greater than the shift at the left or top of the screen.

X-RAY WARNING

X-ray radiation is produced by the 21AXP22-A when it is operated at its normal ultor voltage. The radiation is through the faceplate, and is sufficient to require the adoption of safety measures in TV receivers. Shielding such as that provided by a 1/4-inch thickness of safety glass (lime) in front of the faceplate, should prove adequate to provide protection against personal injury from prolonged exposure at close range when the tube is operated at its maximum ultor voltage rating.

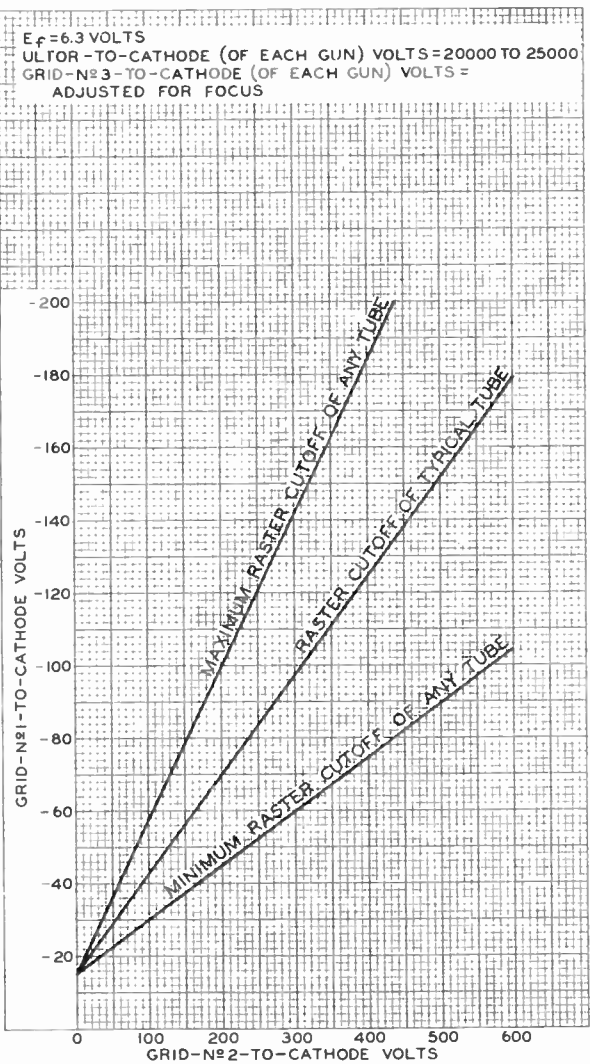
When this tube is being serviced outside of the TV receiver cabinet, it should never be operated without providing adequate X-ray shielding in front of faceplate. Because the ultor voltage may rise above its maximum rated value for short periods during adjustment with increase in the amount of X-ray radiation, provision should be made for placing a 3/8-inch thickness of safety glass in front of the faceplate to avoid the hazard of X-ray radiation.



2IAXP22-A

2IAXP22-A CUTOFF DESIGN CHART

$E_f = 6.3$ VOLTS
ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 20000 TO 25000
GRID-N^o3-TO-CATHODE (OF EACH GUN) VOLTS =
ADJUSTED FOR FOCUS



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

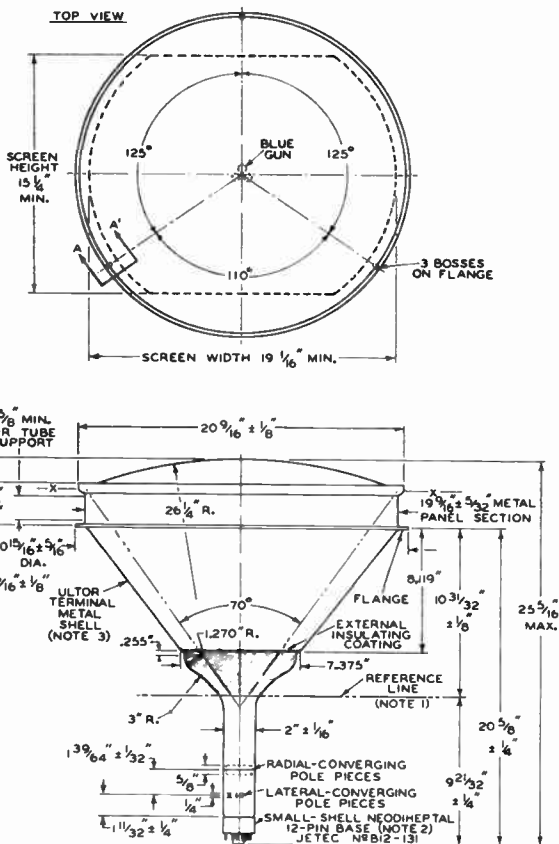
92CM-8565RI

21AXP22-A



21AXP22-A

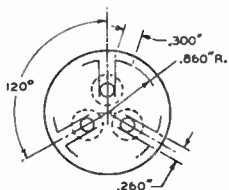
COLOR KINESCOPE



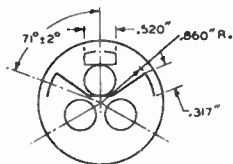


21AXP22-A

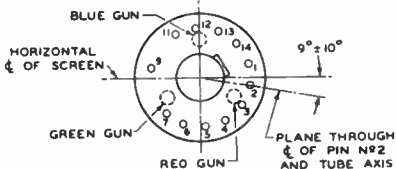
21AXP22-A COLOR KINESCOPE



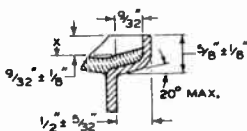
LOCATION OF RADIAL-
CONVERGING POLE PIECES



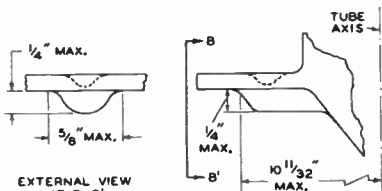
LOCATION OF LATERAL-
CONVERGING POLE PIECES



BASE
BOTTOM VIEW



DETAIL OF LIP



EXTERNAL VIEW AT A-A'
DETAIL OF FLANGE BOSSES

92CL-8399R4

21AXP22-A



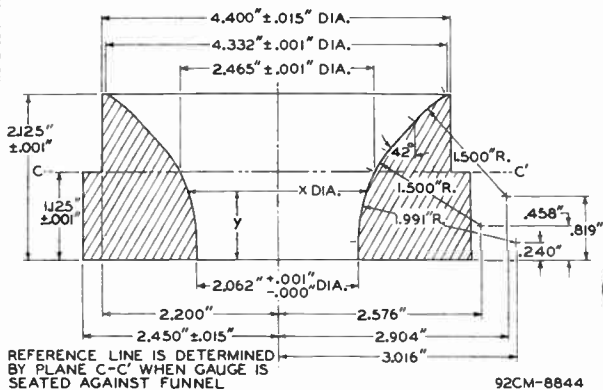
21AXP22-A COLOR KINESCOPE

NOTE 1: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE (SHOWN BELOW) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 2: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH METAL-SHELL AXIS AND HAVING A DIAMETER OF 3".

NOTE 3: METAL SHELL AND GLASS FACE OPERATE AT HIGH VOLTAGE. ANY MATERIAL IN CONTACT WITH THE SHELL OR THE FACE MUST BE INSULATED TO WITHSTAND THE MAXIMUM APPLIED ULTOR VOLTAGE.

REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE



y	x	y	x
0.000"	2.062" ± 0.001 " - 0.000"	0.385"	2.062" ± 0.001 " - 0.000"
0.125"	2.062" ± 0.001 " - 0.000"	0.500"	2.084" ± 0.001 "
0.250"	2.062" ± 0.001 " - 0.000"	0.625"	2.122" ± 0.001 "
0.375"	2.062" ± 0.001 " - 0.000"	0.750"	2.182" ± 0.001 "



21AXP22-A
COLOR KINESCOPE

21AXP22-A

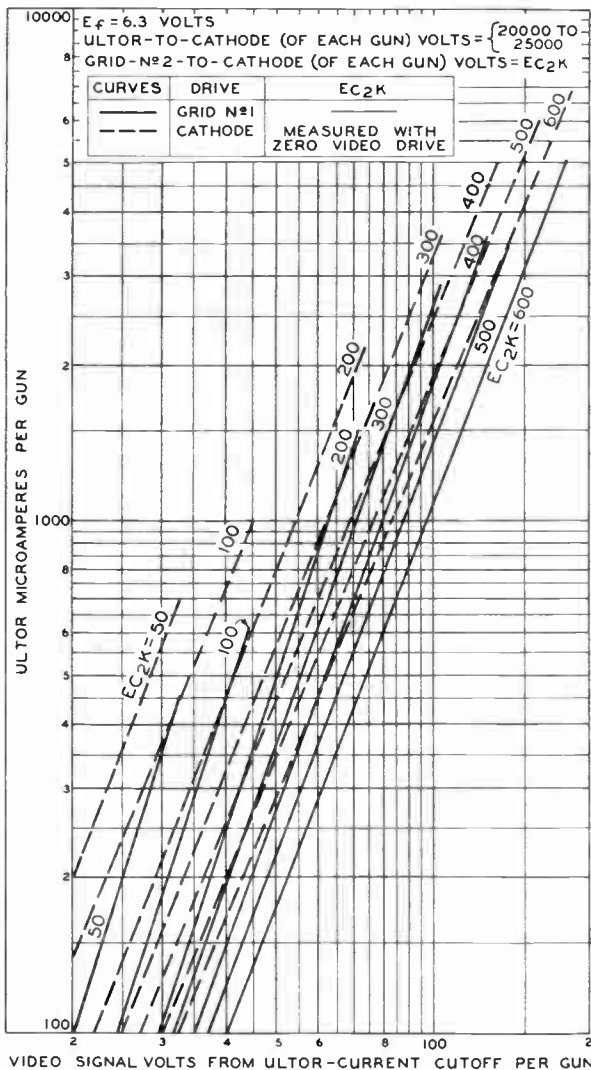
y	x	y	x
0.875"	2.258" ± 0.001"	1.625"	3.216" ± 0.001"
1.000"	2.352" ± 0.001"	1.750"	3.440" ± 0.001"
1.125"	2.465" ± 0.001"	1.875"	3.678" ± 0.001"
1.250"	2.604" ± 0.001"	2.000"	3.958" ± 0.001"
1.375"	2.778" ± 0.001"	2.125"	4.352" ± 0.001"
1.500"	2.990" ± 0.001"		

21AXP22-A



21AXP22-A

TYPICAL DRIVE CHARACTERISTICS



100 2 3 4 5 6 8 100 2

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8566RI

World Radio History



2IAXP22-A

2IAXP22-A

TYPICAL LIGHT-OUTPUT CHARACTERISTICS

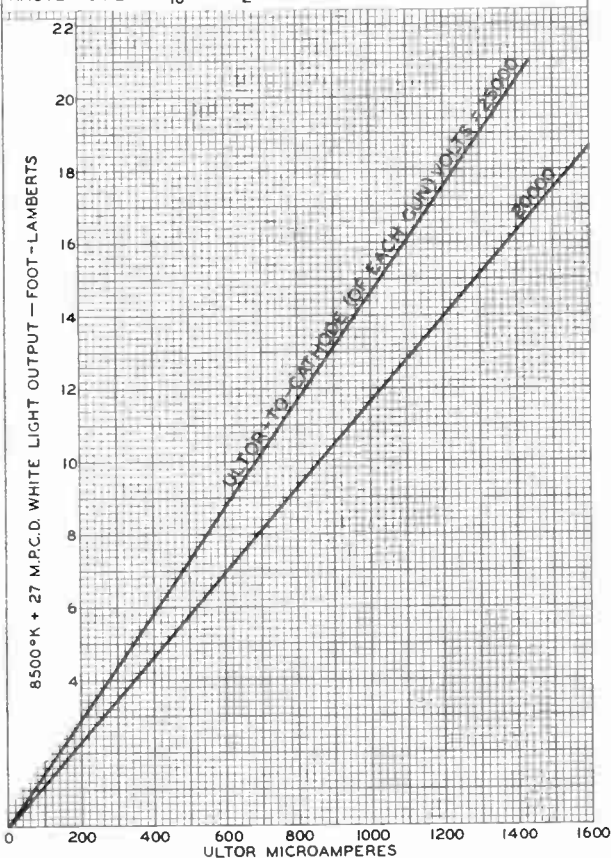
$E_f = 6.3$ VOLTS

GRID-N \pm 3-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS

DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ULTOR CURRENT TO PRODUCE 8500°K + 27 M.P.C.D. WHITE LIGHT OUTPUT
PERCENTAGE OF TOTAL ULTOR CURRENT SUPPLIED BY EACH GUN TO PRODUCE 8500°K + 27 M.P.C.D. WHITE:

- RED GUN: 51%
- BLUE GUN: 19%
- GREEN GUN: 30%

RASTER SIZE: 19 1/16" x 14 1/2"





21CBP4A

Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR VOLTAGE	22000 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value.	1000 max.	volts
Negative value.	500 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE.	{ 6.9 max. 5.7 min.	volts volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Typical Operating Conditions:

With ultor voltage of	16000	volts
and grid-No.2 voltage of	300	volts
Grid-No.4 Voltage for focus	0 to 450	volts
Grid-No.1 Voltage for visual extinction of focused raster.	-28 to -72	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section





21CQP4 PICTURE TUBE

21CQP4

RECTANGULAR GLASS TYPE ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

With heater having controlled warm-up time

DATA

General:

Heater, for Unipotential Cathode:

Voltage (AC or DC)	6.3	volts
Current	0.6 ± 5%	amp
Warm-up time (Average)	11	sec

Capacitance between External Conductive

Coating and Ultor	{ 2500 max.	μf
	{ 2000 min.	μf

Faceplate, Spherical Filterglass

Phosphor (For Curves, see front of this section) . P4—Sulfide Type
Aluminized

Deflection Angles (Approx.):

Diagonal	110°
Horizontal	105°
Vertical	87°

Electron Gun Type Requiring No Ion-Trap Magnet

Tube Dimensions:

Overall length	14-7/16" ± 3/8"
Greatest width	20-1/4" ± 1/8"
Greatest height	16-3/8" ± 1/8"
Diagonal	21-3/8" ± 1/8"
Neck length	5-3/16" ± 3/16"
Radius of curvature of faceplate (External surface)	28-1/2"

Screen Dimensions (Minimum):

Greatest width	19-1/16"
Greatest height	15-1/16"
Diagonal	20-1/4"
Projected area	262 sq. in.

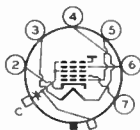
Operating Position Any

Cap Recessed Small Cavity (JEDEC No. J1-21)

Base Special (JEDEC No. B6-1B5)

Basing Designation for BOTTOM VIEW 7FA

- Pin 2—Cathode
- Pin 3—Heater
- Pin 4—Heater
- Pin 5—Grid No.1
- Pin 6—Grid No.4
- Pin 7—Grid No.2



- Cap—Ultor
- (Grid No.3,
- Grid No.5,
- Collector)
- C—External
- Conductive
- Coating

Maximum Ratings, Design-Center Values:

ULTOR VOLTAGE	18000 max.	volts
GRID-NO.4 (FOCUSING) VOLTAGE:		
Positive value	1000 max.	volts
Negative value	500 max.	volts
GRID-NO.2 VOLTAGE	500 max.	volts

21CQP4



21CQP4

PICTURE TUBE

GRID-No.1 VOLTAGE:

Negative-peak value.	200 max.	volts
Negative-bias value.	140 max.	volts
Positive-bias value.	0 max.	volts
Positive-peak value.	2 max.	volts

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds		
	410 max.	volts
	180 max.	volts
After equipment warm-up period		
Heater positive with respect to cathode		
	180 max.	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
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*For X-ray shielding considerations, see sheet
X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section*

21CYP22-A

Color Picture Tube

THREE-GUN, GRADED-HOLE, SHADOW-MASK TYPE
ALUMINIZED TRICOLOR PHOSPHOR-DOT SCREEN

ALL-GLASS ENVELOPE
MAGNETIC CONVERGENCE

ELECTROSTATIC FOCUS
MAGNETIC DEFLECTION

Supersedes Type 21CYP22

DATA

General:

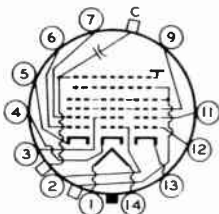
Electron Guns, Three with Axes Tilted Toward Tube Axis	Blue, Green, Red	
Heater, for Unipotential Cathode of Each Gun, Paralleled with Each of the Other Two Heaters within Tube: Voltage (AC or DC)▲	6.3	volts
Current at 6.3 volts	1.6	amp
Direct Interelectrode Capacitances (Approx.): Grid No.1 of any gun to all other electrodes except the No.1 grids of the other two guns.	7	μf
Cathode of blue gun + cathode of green gun + cathode of red gun to all other electrodes	16	μf
Grid No.3 (Of each gun tied within tube to No.3 grids of other two guns) to all other electrodes.	9	μf
External conductive coating to grid No.6	{ 2500 max. 2000 min.	{ μf μf
Faceplate, Spherical	Filterglass	
Light transmission (Approx.)	72%	
Screen, on Inner Surface of Faceplate: Type	Aluminized, Tricolor, Phosphor-Dot Phosphor (Three separate phosphors, collectively)●	P22
Fluorescence and phosphorescence of separate phosphors, respectively	Blue, Green, Red	
Persistence of group phosphorescence	Medium	
Dot arrangement.	Triangular group consisting of blue dot, green dot, and red dot	
Spacing between centers of adjacent dot trios (Approx.)	0.029"	
Size (Minimum): Greatest width	19-1/4"	
Height	15-1/2"	
Projected area	261 sq. in.	
Focusing Method.	Electrostatic	
Convergence Method	Magnetic	
Deflection Method.	Magnetic	
Deflection Angles (Approx.): Horizontal	70°	
Vertical	55°	
Tube Dimensions: Overall length	25-1/32" ± 3/8"	
Diameter	20-13/16" ± 1/8"	
Weight (Approx.)	36-1/2 lbs	



21CYP22-A

Operating Position Tube Axis Horizontal
 (Base pin 12 and V-grooved panel pad on top)
 Caps (Two) Recessed Small Cavity (JEDEC No. J1-21)
 Socket Alden Nos. 214NMINSC (Radial leads),
 214NMINC (Axial leads), or equivalent
 Base Small-Shell Neodiheptal 12-Pin (JEDEC No. B12-131)
 Basing Designation for BOTTOM VIFW 14AL

- Pin 1 - Heater
 - Pin 2 - Grid No.1 of Red Gun
 - Pin 3 - Grid No.2 of Red Gun
 - Pin 4 - Cathode of Red Gun
 - Pin 5 - Cathode of Green Gun
 - Pin 6 - Grid No.1 of Green Gun
 - Pin 7 - Grid No.2 of Green Gun
 - Pin 9 - Grid No.3 of Blue Gun
 - Pin 11 - Grid No.2 of Blue Gun
 - Pin 12 - Grid No.1 of Blue Gun
 - Pin 13 - Cathode of Blue Gun
 - Pin 14 - Heater
- Cap Over
 Pin 1 - Ultor (Grid No.4, Grid No.5)



- Can* Over
 Pin 2 - Grid No.6, Collector, High-Voltage-Supply Terminal
- C - External Conductive Coating

Maximum Ratings, Design-Center Values:

ULTOR-TO-CATHODE (Of each gun) VOLTAGE . . . 25000 max. volts

Between the Ultor Terminal and the High-Voltage-Supply Terminal (See *Dimensional Outline*), it is necessary to connect a resistor of 50,000 ohms as described under *Limiting Circuit Values*. The high voltage must be connected to the High-Voltage-Supply Terminal—never directly to the Ultor Terminal.

GRID-No.3-TO-CATHODE (Of each gun) VOLTAGE 6000 max. volts

GRID-No.2-TO-CATHODE VOLTAGE (Each gun) 600 max. volts

GRID-No.1-TO-CATHODE VOLTAGE (Each gun):
 Negative-bias value 400 max. volts
 Positive-bias value 0 max. volts
 Positive-peak value 2 max. volts

PEAK HEATER-CATHODE VOLTAGE (Each gun):
 Heater negative with respect to cathode:
 During equipment warm-up period
 not exceeding 15 seconds 410 max. volts
 After equipment warm-up period 180 max. volts
 Heater positive with respect to cathode. 180 max. volts



21CYP22-A

Equipment Design Ranges:

With ultor voltage (E_{c4k} each gun)
between 20000 and 25000 volts

Grid-No.3 (Focusing Electrode)-to-Cathode (Of each gun) Voltage	16.8% to 20% of E_{c4k} each gun	volts	
Grid-No.2-to-Cathode Voltage (Each gun) when circuit design utilizes grid-No.1-to-cathode voltage (E_{c1k}) at fixed value for raster cutoff . . . . .	.See Cutoff Design Chart	
Grid-No.1-to-Cathode Voltage (Each gun) for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2-to-cathode voltage (E_{c2k}) at fixed value . . . . .	.See Cutoff Design Chart	
Variation in Raster Cutoff Between Guns in Any Tube	$\pm 21\%$ of average of highest and lowest cutoff values		
Grid-No.3 Current	-45 to +45	μa	
Grid-No.2 Current (Each gun)	-5 to +5	μa	
Percentage of Total Ultor Current Supplied by Each Gun:			
<i>To Produce White of 8500° K + 27 M.P.C.D. (CIE Coordinates</i>			
<i>x = 0.287, y = 0.316):</i>			
Red gun	49	%	
Blue gun	18	%	
Green gun	33	%	
Ratios of Cathode Currents:			
<i>To Produce White of 8500° K + 27 M.P.C.D. (CIE Coordinates</i>			
<i>x = 0.287, y = 0.316):</i>			
Red cathode to green cathode	1.2	1.5	1.8
Red cathode to blue cathode	2.1	2.7	3.3
Maximum Raster Shift in Any Direction from Screen Center	7/8		inch



21CYP22-A

Maximum Required Displacements
of Beam Trios with Respect to
Associated Phosphor-Dot Trios:
Uniform in any direction over
entire screen area0.005"▲

Adjustment to be Provided by
the Following Components:

Lateral-Converging Magnet:▲,⊕

Maximum lateral shift of blue beam ±1/4"

Maximum lateral shift of red beam and
green beam ±1/8" to ±3/8"

Average of maximum lateral shift
of red beam and green beam ±7/32" to ±9/32"

Radial-Converging Magnet Assembly:▲

For static convergence including
compensation for dc component
of dynamic convergence
(Each beam). Shift of ±5/8"

For dynamic convergence:▲—
Effected by magnetomotive force
of parabolic and/or sawtooth
waveshape synchronized with
scanning.

Horizontal:

Blue pattern—

Parabola amplitude to
provide▲ Shift of 3/16" to 1/2"

Sawtooth amplitude to
provide▲ Shift of ±50% of the
shift caused by pa-
rabola amplitude

Red pattern & green pattern—

Parabola:
Amplitude to provide▲ Shift of 1/16" to 5/16"
Ratio of red-pattern shift
to green-pattern shift 2/3 to 3/2

Sawtooth:
Amplitude to provide▲ Shift of -60% to +60%
of the shift caused by
parabola amplitude

Difference between red-
pattern shift and green-
pattern shift (Shift_R -
Shift_G). -75% to +75%

Vertical:

Blue pattern—

Parabola amplitude to
provide▲ Shift of -1/8" to +1/16"

Sawtooth amplitude to
provide▲ Shift of -1/16" to +3/16"



Red pattern & green pattern—

Parabola:

Amplitude to provide* Shift of 1/8" to 5/16"
 Ratio of red-pattern shift
 to green-pattern shift 2/3 to 3/2

Sawtooth:

Amplitude to provide* . . . Shift of -1/8" to +3/16"
 Difference between red-
 pattern shift and green-
 pattern shift (Shift_R -
 Shift_G). -100% to +100%

Examples of Use of Design Ranges:

<i>For ultor voltage of</i>	30000	25000	<i>volts</i>
Grid-No.3 (Focusing Electrode)-to-Cathode (Of each gun) Voltage. .	3360 to 4000	4200 to 5000	volts
Grid-No.2-to-Cathode Voltage (Each gun) when circuit design utilizes grid-No.1-to-cathode voltage of -70 volts for raster cutoff. . .	130 to 370	130 to 370	volts
Grid-No.1-to-Cathode Voltage (Each gun) for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2-to-cathode voltage of 200 volts . .	-45 to -100	-45 to -100	volts

Limiting Circuit Values:

High-Voltage Circuits:

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the *high-voltage power supply* and the *grid-No.3 power supply* be of the limited-energy type with inherent regulation to limit the continuous short-circuit current to 50 milliamperes. In addition, to prevent cathode damage with resultant decrease in tube life, an external resistor having a value of 50,000 ohms must be connected between the two bulb terminals and the effective resistance between the grid-No.3 power-supply output capacitor and the grid-No.3 electrode should not be less than 50,000 ohms. These resistances should be capable of withstanding the maximum instantaneous currents and voltages in their respective circuits. It is to be noted that the high voltage must be connected only to the High-Voltage-Supply Terminal—*never directly to the Ultor Terminal*. A resistor of 50,000 ohms must be connected between the Ultor Terminal and the High-Voltage-Supply Terminal.

In equipment utilizing a well-regulated high-voltage power supply, the *grid-No.3-circuit resistance* should be limited to 7.5 megohms.



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The maximum dc current capability of the high-voltage power supply should be limited to a value of 1100 μ a as measured by a dc ammeter in the lead from the high-voltage power supply to the high-voltage terminal of the tube. The product of the maximum current capability and the maximum dc voltage between the high-voltage terminal and any cathode of the tube, as measured by an electrostatic voltmeter, should not exceed 25 watts.

Low-Voltage Circuits:

Effective Grid-No.1-to-Cathode-

Circuit Resistance (Each gun). . . . 0.75 max. megohm

When the cathode of each gun is not connected directly to the heater, the grid-No.2-to-heater circuit, the grid-No.1-to-heater circuit, and the cathode-to-heater circuit should each have an impedance such that their respective power sources in combination will not supply an instantaneous or continuous short-circuit current of more than 300 milliamperes total. Such current limitation will prevent heater burnout in case of a momentary internal arc within the tube.

When the cathode is connected directly to the heater, the grid-No.2-to-heater circuit, and the grid-No.1-to-heater circuit should each have an impedance such that their respective power sources in combination will not supply an instantaneous or continuous short-circuit current of more than 300 milliamperes total. Such current limitation will prevent heater burnout in case of a momentary internal arc within the tube.

- ▲ For maximum cathode life, it is recommended that the heater supply be regulated. When current regulation is employed, the regulator should be designed to provide a heater current of 1.5 amperes with variations not exceeding $\pm 3\%$ under normal line-voltage variations. When voltage regulation is employed, the regulator should be designed to provide a heater voltage of 5.5 volts with variations not exceeding $\pm 6\%$ under normal line-voltage variations.
- For Curves, see front of this Section.
- ★ Connect high-voltage supply to this cap and also connect 50,000-ohm resistor between this cap and cap over pin 1 (ultor cap).
- ◆ Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 20,000 volts.
- ⬇ Centering of the raster on the screen may be accomplished by passing direct current of the required value through each pair of deflecting coils to compensate for raster shift resulting from adjustments for optimum convergence and color purity.
- ◆ If this displacement is accomplished by means of a purifying magnet located on the neck of the tube, the equivalent raster movement is about $3/4"$.
- ◆ Shift is the movement of the regions of dot/crosshatch-generator pattern indicated in notes (♦) and (♣).
- The direction of movement of the red and green beam is opposite to that of the blue beam.
- ⚡ Indicated values apply when RCA test yoke is used with this color picture tube.
- The parabola amplitude is determined by the average value of the shifts at the extremities of the respective horizontal and vertical axes of the screen with convergence of the three beams maintained at the center of the screen. An increase in amplitude should move the blue beam toward the top of the screen; the red beam toward the lower left of the screen; and the green beam toward the lower right of the screen.
- ◆ The sawtooth amplitude is determined by the difference between the shifts at the extremities of the respective horizontal and vertical axes of the screen. Positive amplitude indicates that the shift at the right or bottom of the screen is greater than the shift at the left or top of the screen.



DEFINITIONS

Beam Trio. The red beam, green beam, and blue beam passing through a common hole in the shadow mask.

Register. Exact correspondence in position of the centers of beam trios with respect to the centers of the associated phosphor-dot trios.

Misregister. Lack of correspondence in position of the centers of the beam trios with respect to the centers of the center of the associated phosphor-dot trios.

Displacement. Shift of the position of the beams with respect to the phosphor dots.

GENERAL CONSIDERATIONS

X-Ray-Warning. Because this color picture tube is designed to be operated at ultra voltages as high as 25 kilovolts (Design-center maximum value), shielding of this color picture tube for X-ray radiation may be needed to protect against possible injury from prolonged exposure at close range.

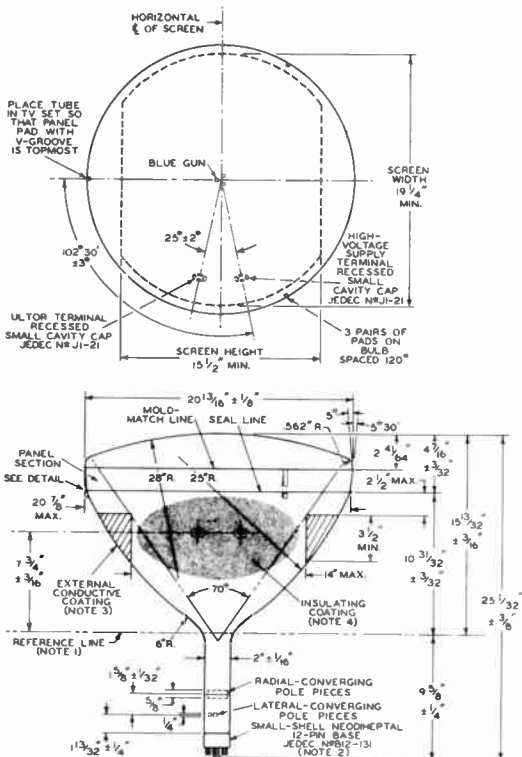
Shatter-Proof Cover Over the Tube Face. Following conventional picture-tube practice, it is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of this color picture tube to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.

High Voltages. The high voltages at which cathode-ray tubes are operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Precautions include the inclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is required.

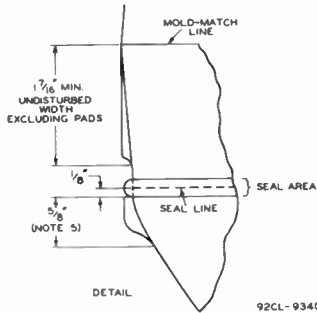
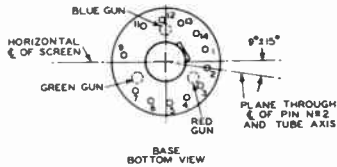
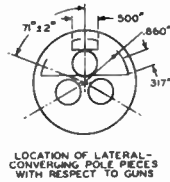
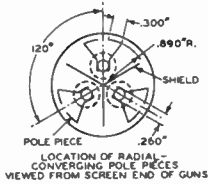
REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE
for Type 21CYP22-A is the same as that shown for
Type 21AXP22-A



21CYP22-A



21CYP22-A



21CYP22-A

NOTE 1: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 2: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 3".

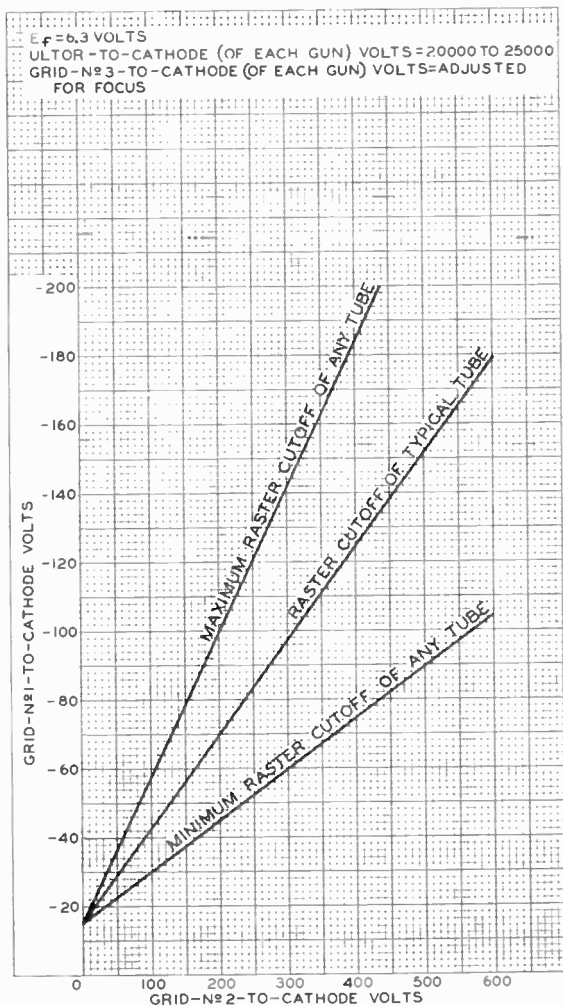
NOTE 3: THE DRAWING SHOWS THE MINIMUM SIZE AND LOCATION OF THE CONTACT BAND OF THE EXTERNAL CONDUCTIVE COATING. THE ACTUAL AREA OF THIS COATING WILL BE GREATER THAN THAT OF THE CONTACT BAND SO AS TO PROVIDE THE REQUIRED CAPACITANCE. EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 4: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

NOTE 5: THE MAXIMUM EFFECTIVE WIDTH OF A FUNNEL PAD IS 5/8".



CUTOFF DESIGN CHART



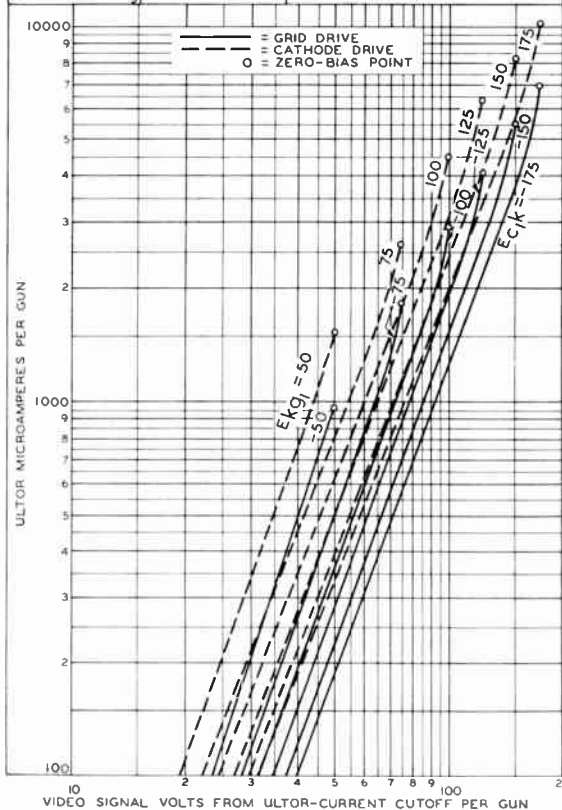
92CM-8565R1



21CYP22-A

TYPICAL DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
$E_f = 6.3$ VOLTS	$E_f = 6.3$ VOLTS
ULTOR-TO-GRID-N ϕ 1 (OF EACH GUN) VOLTS = 20000 TO 25000	ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 20000 TO 25000
GRID-N ϕ 3-TO-GRID-N ϕ 1 (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS	GRID-N ϕ 3-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS
GRID-N ϕ 2-TO-GRID-N ϕ 1 VOLTS (EACH GUN) = ADJUSTED TO PROVIDE ULTOR-CURRENT CUTOFF FOR DESIRED FIXED CATHODE-TO-GRID-N ϕ 1 (EACH GUN) VOLTAGE ($E_{k\phi}$)	GRID-N ϕ 2-TO-CATHODE VOLTS (EACH GUN) = ADJUSTED TO PROVIDE ULTOR-CURRENT CUTOFF FOR DESIRED FIXED GRID-N ϕ 1-TO-CATHODE (EACH GUN) VOLTAGE ($E_{c\phi k}$)



92CL-9421

TYPICAL LIGHT-OUTPUT CHARACTERISTICS

$E_p = 6.3$ VOLTS
 GRID-N₂3-TO-CATHODE (OF EACH GUN) VOLTS=ADJUSTED FOR
 FOCUS
 DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ULTOR CUR-
 RENT TO PRODUCE 8500° K+27 M.P.C.D. WHITE LIGHT OUTPUT,
 PERCENTAGE OF TOTAL ULTOR CURRENT SUPPLIED BY EACH GUN
 TO PRODUCE 8500° K+27 M.P.C.D. WHITE:

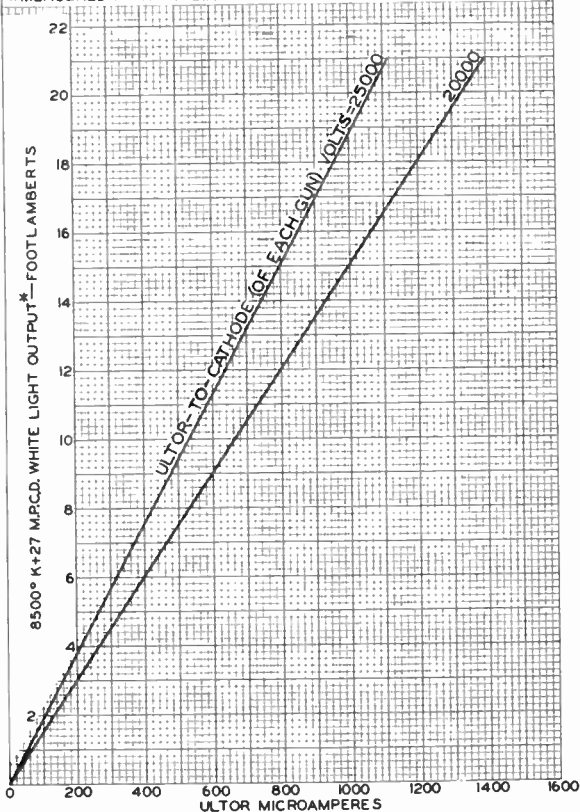
RED GUN: 50%

BLUE GUN: 19%

GREEN GUN: 31%

RASTER SIZE: $19\frac{1}{4} \times 14\frac{1}{2}$ " CENTERED ON TUBE FACE.

* MEASURED WITHIN 5-DIAMETER AREA CENTERED ON TUBE FACE.



92CM-9417





21DHP4

Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
110° MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts.	450 ± 5%	ma
Heater Warm-Up Time (Average).	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes. . .	6	μf
Cathode to all other electrodes. . . .	3	μf
External conductive coating to ultor .	{ 2500 max. 1700 min.	{ μf μf
Electron Gun Type Requiring No Ion-Trap Magnet		

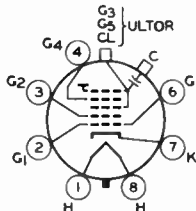
Optical:

Faceplate.	Filterglass
Light transmission (Approx.)	76%
Phosphor (For curves, see front of this section) . P4—Sulfide Type, Aluminized	

Mechanical:

Operating Position	Any
Weight (Approx.)	20 lbs
Overall Length	14-11/16" + 5/16" - 5/8"
Neck Length.	5-7/16" + 1/8" - 7/16"
Projected Area of Screen	262 sq. in.
External Conductive Coating:	
Type	Regular Band
Contact area for grounding	Near Reference Line
For Additional Information on Coatings and Dimensions: See <i>Picture-Tube Dimensional-Outlines</i> and <i>Bulb J171 G/K</i> sheets at the front of this section	
Cap.	Recessed Small Cavity (JEDEC No. J1-21)
Bases (Alternates):	
Small-Button Eightar 7-Pin, Arrangement 2, (JEDEC No. B7-183)	
Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No. B7-208)	
Basing Designation for BOTTOM VIEW . . . . .	.8HR

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 3 - Grid No.2
- Pin 4 - Grid No.4
- Pin 6 - Grid No.1
- Pin 7 - Cathode
- Pin 8 - Heater



- Cap - Ultor
(Grid No.3,
Grid No.5,
Collector)
- C - External
Conductive
Coating



21DHP4

Maximum Ratings, Design-Maximum Values:

ULTOR VOLTAGE	19800 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	220 max.	volts
Negative bias value	154 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With ultor voltage of	16000	volts
and grid-No.2 voltage of	300	volts
Grid-No.4 Voltage for focus	0 to 100	volts
Grid-No.1 Voltage for visual extinction of focused raster	-50 to -70	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



21DLP4



21DLP4 PICTURE TUBE

GRID-DRIVE[▲] SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, Design-Center Values:

ULTOR VOLTAGE	{ 20000 max. volts 12000* min. volts
GRID-No.4 (FOCUSING) VOLTAGE:	
Positive value	1000 max. volts
Negative value	500 max. volts
GRID-No.2 VOLTAGE	500 max. volts
GRID-No.1 VOLTAGE:	
Negative-peak value	200 max. volts
Negative-bias value	140 max. volts
Positive-bias value	0 max. volts
Positive-peak value	2 max. volts
PEAK HEATER-CATHODE VOLTAGE:	
Heater negative with respect to cathode:	
During equipment warm-up period	
not exceeding 15 seconds	410 max. volts
After equipment warm-up period	180 max. volts
Heater positive with respect to cathode.	180 max. volts

Equipment Design Ranges:

With any ultor voltage (E_{c5k}) between 12000 and 20000 volts and grid-No.2 voltage (E_{c2k}) between 200 and 500 volts

Grid-No.4 Voltage for focus [§]	-50 to +400	volts
Grid-No.1 Voltage (E_{c1k}) for visual extinction of focused raster.	See Raster-Cutoff-Range Chart for Grid-Drive Service	
Grid-No.1 Video Drive from Raster Cutoff (Black Level):		
White-level value		
(Peak positive).	Same value as determined for E_{c1k} except video drive is a positive voltage	
Grid-No.4 Current	-25 to +25	μ A
Grid-No.2 Current	-15 to +15	μ A
Field Strength of Adjustable Centering Magnet*	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor voltage of	16000	volts
and grid-No.2 voltage of	300	volts
Grid-No.4 Voltage for focus.	0 to 400	volts

▲, §, *: See next page.



21DLP4

PICTURE TUBE

21DLP4

Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts
Grid No.1 Video Drive from Raster Cutoff (Black Level):		
White-level value.	28 to 72	volts

Maximum Circuit Values:

Grid No. 1 Circuit Resistance	1.5 max.	megohms
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CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Maximum and Minimum Ratings, Design-Center Values:

ULTOR-TO-GRID-No.1 VOLTAGE	{ 20000 max.	volts
	{ 12000* min.	volts
GRID-No.4-TO-GRID-No.1 VOLTAGE:		
Positive value	1000 max.	volts
Negative value	500 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE	640 max.	volts
GRID-No.2-TO-CATHODE VOLTAGE	500 max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive-peak value.	200 max.	volts
Positive-bias value.	140 max.	volts
Negative-bias value.	0 max.	volts
Negative-peak value.	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds	410 max.	volts
After equipment warm-up period	180 max.	volts
Heater positive with respect to cathode.	180 max.	volts

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage (E_{C5G1}) between 12000 and 20000 volts and grid-No.2-to-grid-No.1 voltage (E_{C2G1}) between 225 and 640 volts

Grid-No.4-to-Grid-No.1 Voltage for focus§	0 to 450	volts
Cathode-to-Grid-No.1 voltage ($E_{K G1}$) for visual extinction of focused raster.	See Raster-Cutoff-Range Chart for Cathode-Drive Service	

▲, §, •: See next page.

21DLPA



21DLPA PICTURE TUBE

Cathode-to-Grid-No.1		
Video Drive from Raster		
Cutoff (Black Level):		
White-level value		
(Peak negative)	Same value as determined for	
	E_{k1} except video drive is a	
	negative voltage	
Grid-No.4 Current	-25 to +25	μ a
Grid-No.2 Current	-15 to +15	μ a
Field Strength of Adjust-		
able Centering Magnet . . .	0 to 8	gausses

Examples of Use of Design Ranges:

<i>With ultor-to-grid-</i>		
<i>No.1 voltage of</i>		
	16000	volts
<i>and grid-No.2-to-grid-</i>		
<i>No.1 voltage of</i>		
	300	volts
Grid-No.4-to-Grid-No.1		
Voltage for focus		
	0 to 400	volts
Cathode-to-Grid-No.1		
Voltage for visual		
extinction of focused		
raster		
	28 to 60	volts
Cathode-to-Grid-No.1		
Video Drive from		
Raster Cutoff		
(Black Level):		
White-level value	-28 to -60	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
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▲ Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

⊕ This value is a working design-center minimum. The equivalent absolute minimum ultor- or ultor-to-grid-No.1 voltage is 11,000 volts, below which the serviceability of the 21DLPA will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor- or ultor-to-grid-No.1 voltage is never less than 11,000 volts.

⊙ The grid-No.4 voltage or grid-No.4-to-grid-No.1 voltage required for focus of any individual tube is independent of ultor current and will remain essentially constant for values of ultor voltage (or ultor-to-grid-No.1 voltage) or grid-No.2 voltage (or grid-No.2-to-grid-No.1 voltage) within design ranges shown for these items.

■ Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 7/16-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

■ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

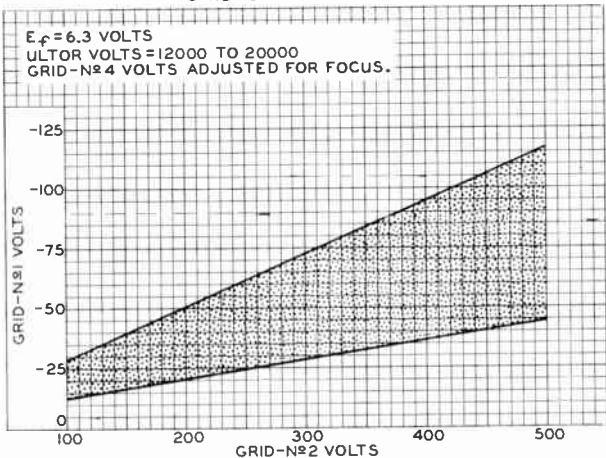
*For X-ray shielding considerations, see sheet
X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section*



21DLP4

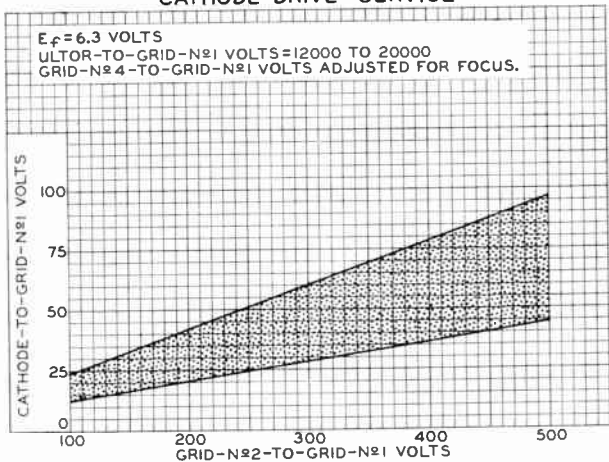
21DLP4

RASTER-CUTOFF-RANGE CHARTS GRID-DRIVE SERVICE



92CS-9349V

CATHODE-DRIVE SERVICE

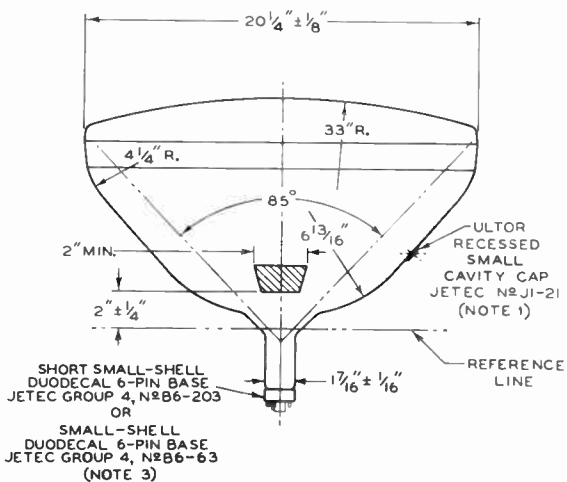
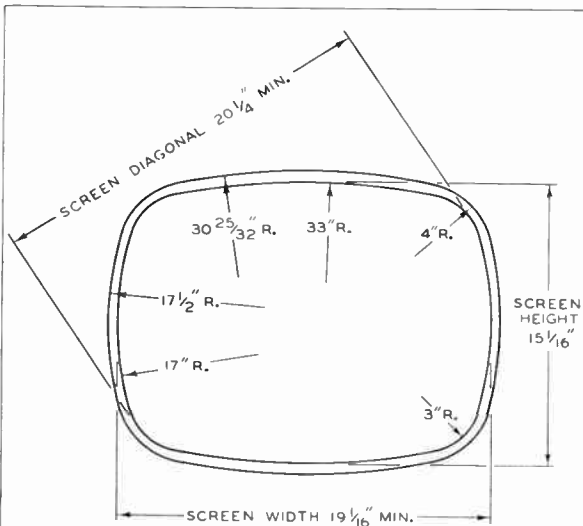


92CS-9350V

21DLP4



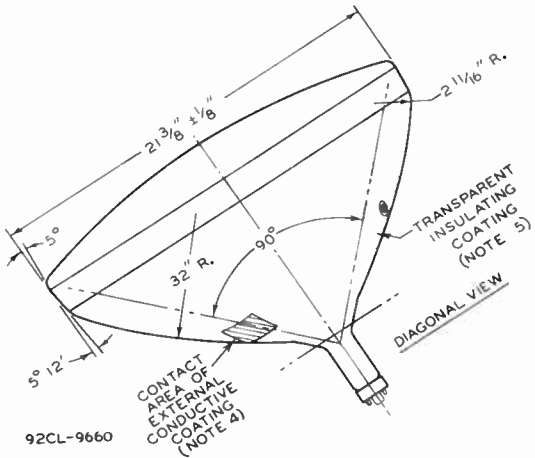
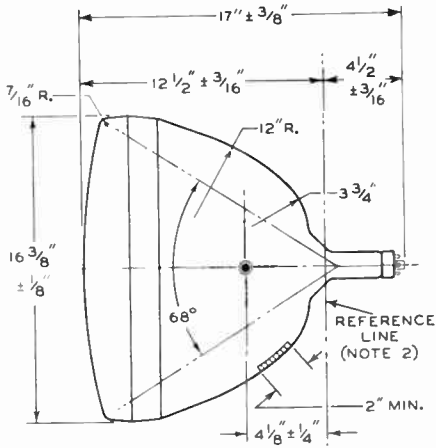
21DLP4 PICTURE TUBE





21DLP4

21DLP4 PICTURE TUBE

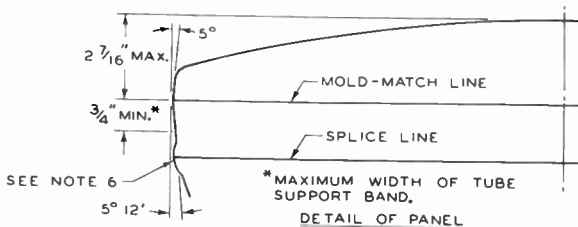


92CL-9660

21DLP4



21DLP4 PICTURE TUBE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 30^\circ$. ULTOR TERMINAL IS ON SAME SIDE AS PIN 6.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No. G-116 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4".

NOTE 4: THE DRAWING SHOWS THE MINIMUM SIZE AND LOCATION OF THE CONTACT AREA OF THE EXTERNAL CONDUCTIVE COATING. THE ACTUAL AREA OF THIS COATING WILL BE GREATER THAN THE CONTACT AREA SO AS TO PROVIDE THE REQUIRED CAPACITANCE. EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

NOTE 6: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/16" BEYOND THE ENVELOPE SURFACE AT THE MOLD-MATCH LINE.

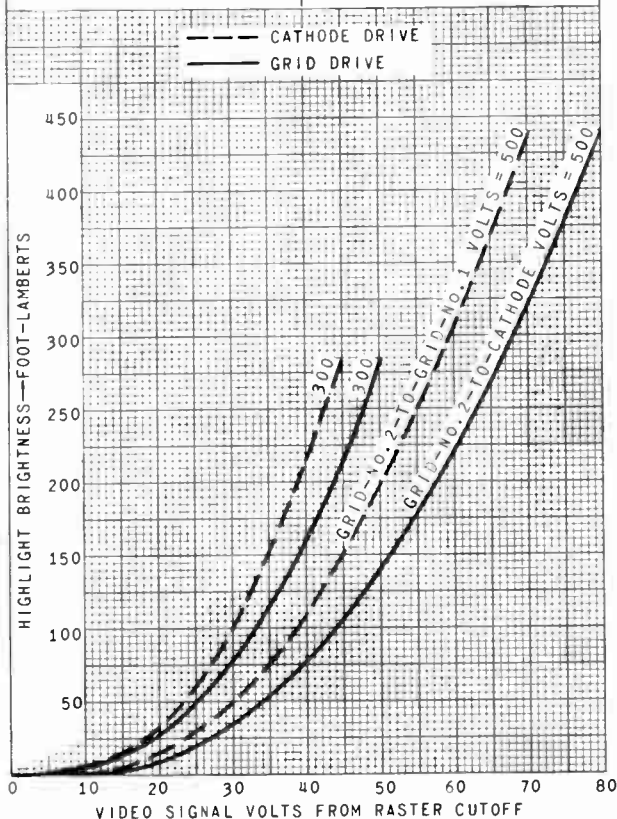


21DLP4

21DLP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
$E_f = 6.3$ VOLTS	$E_f = 6.3$ VOLTS
ULTOR-TO-GRID-NO.1 VOLTS = 16000	ULTOR VOLTS = 16000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID NO.1 TO GIVE FOCUSED RASTER CUTOFF.	GRID NO.1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.
RASTER FOCUSED AT AVERAGE BRIGHTNESS.	RASTER FOCUSED AT AVERAGE BRIGHTNESS.
RASTER SIZE = 18"x13-1/2"	RASTER SIZE = 18"x13-1/2"



21DLP4



21DLP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE

$E_f = 6.3$ VOLTS

ULTOR-TO-GRID-No.1

VOLTS = 12000 TO 20000

CATHODE BIASED POSITIVE
WITH RESPECT TO GRID No.1
TO GIVE FOCUSED RASTER
CUTOFF.

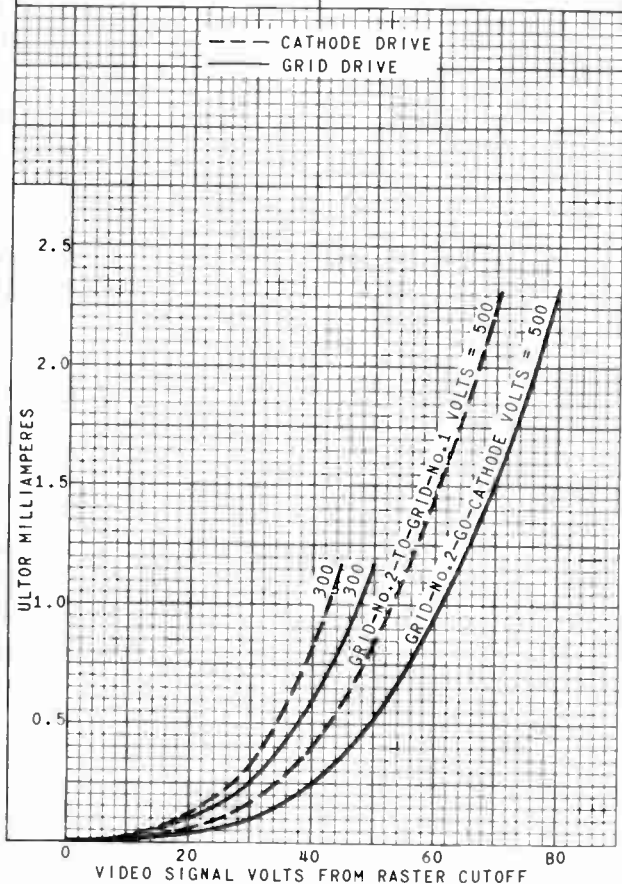
GRID-DRIVE SERVICE

$E_f = 6.3$ VOLTS

ULTOR VOLTS =

12000 TO 20000

GRID No.1 BIASED NEGATIVE
WITH RESPECT TO CATHODE
TO GIVE FOCUSED RASTER
CUTOFF.



ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CS-9351



21D5P4

21D5P4 PICTURE TUBE

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
LOW GRID-No. 2 VOLTAGE

ALUMINIZED SCREEN
MAGNETIC DEFLECTION
CATHODE-DRIVE TYPE

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3	volts
Current	0.6	amp
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	$\mu\mu\text{f}$
Cathode to all other electrodes	5	$\mu\mu\text{f}$
External conductive coating to ultor.	{2500 max.	$\mu\mu\text{f}$
	{2000 min.	$\mu\mu\text{f}$
Faceplate, Spherical		Filterglass
Light transmission (Approx.)		74%
Phosphor (For Curves, see front of this section)	P4—Sulfide Type	Aluminized
Fluorescence		White
Phosphorescence		White
Persistence		Medium-Short
Focusing Method		Electrostatic
Deflection Method		Magnetic
Deflection Angles (Approx.):		
Diagonal		90°
Horizontal		85°
Vertical		68°
Electron Gun	Type Requiring No Ion-Trap Magnet	
Tube Dimensions:		
Overall length	18" \pm 3/8"	
Greatest width	20-1/4" \pm 1/8"	
Greatest height	16-3/8" \pm 1/8"	
Diagonal	21-3/8" \pm 1/8"	
Neck length	5-1/2" \pm 3/16"	
Radius of curvature of faceplate (External surface)	33"	
Screen Dimensions (Minimum):		
Greatest width	19-1/16"	
Greatest height	15-1/16"	
Diagonal	20-1/4"	
Projected area	262 sq. in.	
Weight (Approx.)	24 lbs	
Operating Position	Any	
Cap	Recessed Small Cavity (JEDEC No. J1-21)	
Bulb	J171 D2/E1	
Base	Small-Shell Duodecal 6-Pin, Arrangement 1 (JEDEC Group 4, No. B6-63), or Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No. B6-203)	

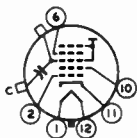
21DSPA



21DSPA PICTURE TUBE

Basing Designation for BOTTOM VIEW. 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Ultor
(Grid No.3,
Grid No.5,
Collector)
C - External
Conductive
Coating

CATHODE-DRIVE[®] SERVICE

*Unless otherwise specified, voltage values
are positive with respect to grid No. 1*

Maximum and Minimum Ratings, Design-Center Values:

ULTOR-TO-GRID-No.1 VOLTAGE.	}	20000 max.	volts
		12000 [#] min.	volts
GRID-No.4-TO-GRID-No.1 VOLTAGE:			
Positive value.		1000 max.	volts
Negative value.		500 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE.		64 max.	volts
GRID-No.2-TO-CATHODE VOLTAGE.		64 max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:			
Positive-peak value		200 max.	volts
Positive-bias value		140 max.	volts
Negative-bias value		0 max.	volts
Negative-peak value		2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds.		410 max.	volts
After equipment warm-up period.		180 max.	volts
Heater positive with respect to cathode.			
		180 max.	volts

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage (E_{c5g1}) between 12000 and 20000 volts and grid-No.2-to-grid-No.1 voltage (E_{c2g1}) between 40 and 64 volts

Grid-No.4-to-Grid-No.1 Voltage for focus [§]	0 to 400	volts
Cathode-to-Grid-No.1 Voltage (E_{kg1}) for visual extinction of focused raster	<i>See Raster-Cutoff-Range Chart</i>	
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level):		
White-level value		
(Peak negative) . . . . .	.Same value as determined for E_{kg1} except video drive is a negative voltage	



2IDSP4

2IDSP4

PICTURE TUBE

Grid-No.4 Current	-25 to +25	μ a
Grid-No.2 Current	-15 to +15	μ a
Field Strength of Adjustable Centering Magnet*	0 to 8	gausses

Examples of Use of Design Ranges:

<i>With ultor-to-grid-</i>		
<i>No.1 voltage of</i>	18000	volts
<i>and grid-No.2-to-grid-</i>		
<i>No.1 voltage of</i>	50	volts
Grid-No.4-to-Grid-No.1 Voltage for focus	0 to 350	volts
Cathode-to-Grid-No.1 Voltage \blacklozenge for visual extinction of focused raster	32 to 47	volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value	-32 to -47	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
---------------------------------------	----------	---------

■ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

Operation below this value is not recommended.

§ The grid-No.4 voltage or grid-No.4-to-grid-No.1 voltage required for focus of any individual tube is independent of ultor current and will remain essentially constant for values of ultor-to-grid-No.1 voltage or grid-No.2-to-grid-No.1 voltage within design ranges shown for these items.

• Distance from *Reference Line* for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 7/16-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

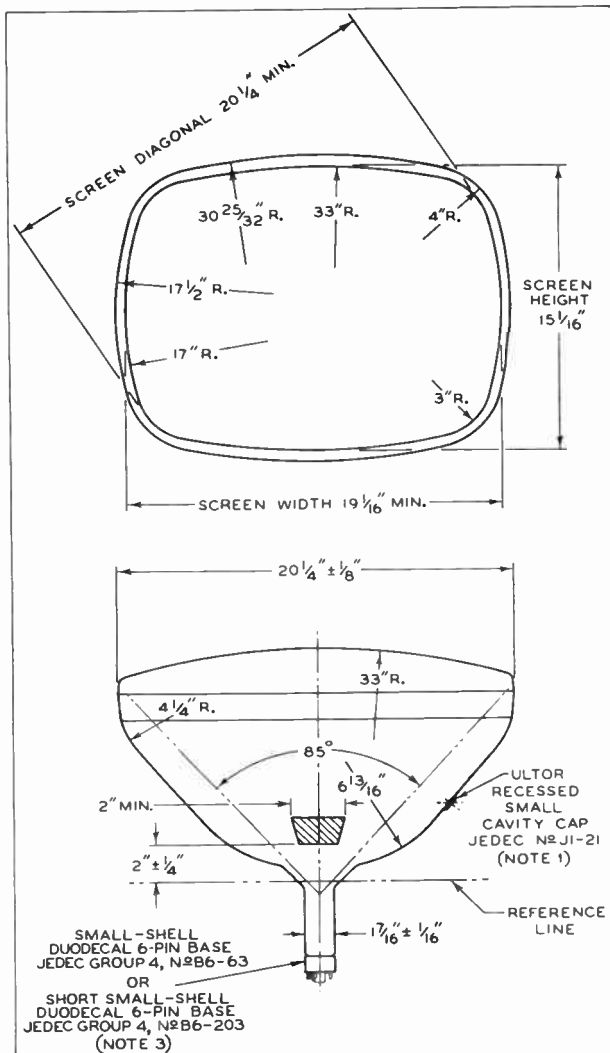
◆ The cathode-to-grid-No.1 voltage (E_{kg1}) for visual extinction of focused raster will increase by approximately 2 per cent for every 1000-volt increase in ultor-to-grid-No.1 voltage and will decrease by approximately 2 per cent for every 1000-volt decrease in ultor-to-grid-No.1 voltage.

*For x-ray shielding considerations, see sheet
X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section*

2IDSP4



2IDSP4 PICTURE TUBE

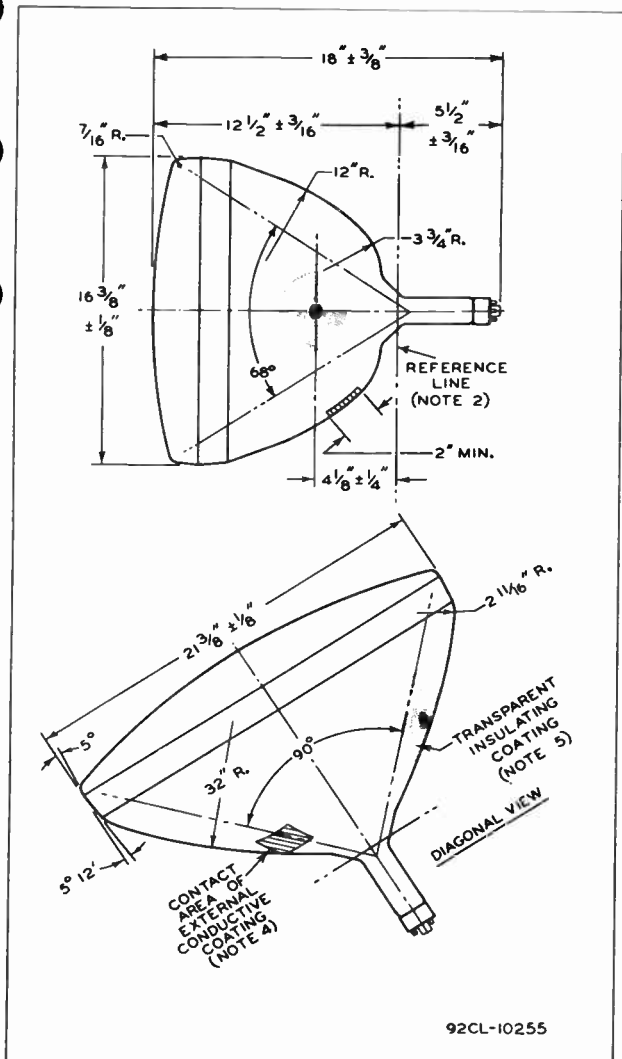




2IDSP4

PICTURE TUBE

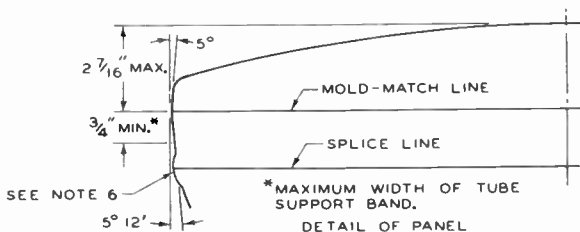
2IDSP4



2IDSP4



2IDSP4 PICTURE TUBE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 30^\circ$. ULTOR TERMINAL IS ON SAME SIDE AS PIN 6.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No. G-116 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4".

NOTE 4: THE DRAWING SHOWS THE MINIMUM SIZE AND LOCATION OF THE CONTACT AREA OF THE EXTERNAL CONDUCTIVE COATING. THE ACTUAL AREA OF THIS COATING WILL BE GREATER THAN THE CONTACT AREA SO AS TO PROVIDE THE REQUIRED CAPACITANCE. EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

NOTE 6: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/16" BEYOND THE ENVELOPE SURFACE AT THE MOLD-MATCH LINE.



21D5P4

21D5P4

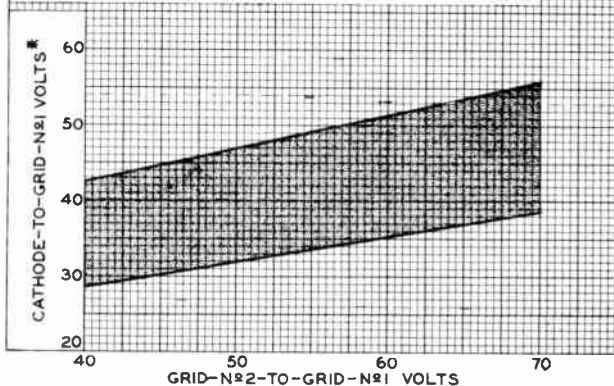
RASTER-CUTOFF-RANGE CHART

$E_f = 6.3$ VOLTS

ULTOR-TO-GRID-N^o1 VOLTS = 18000

GRID-N^o4-TO-GRID-N^o1 VOLTAGE ADJUSTED FOR FOCUS.

*INCREASES OR DECREASES DIRECTLY BY APPROX. 2%
FOR EVERY 1000-VOLT CHANGE IN ULTOR-TO-GRID-N^o1
VOLTAGE.



92CS-9911

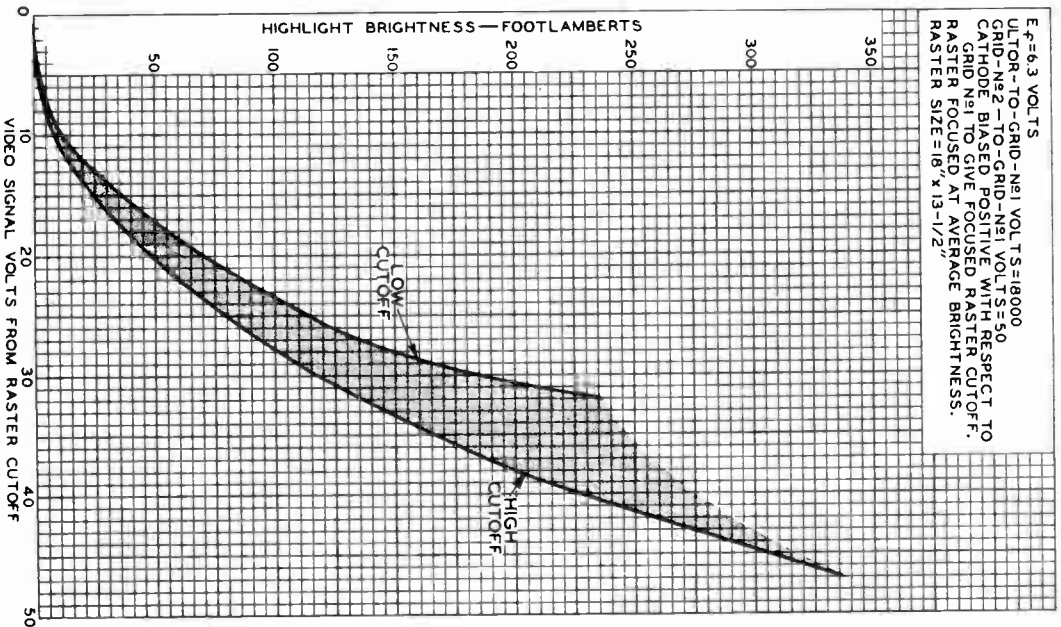
2IDSPA



2IDSPA4

CATHODE-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS
 ULTOR - TO - GRID - N₁ = 18000 VOLTS
 GRID - N₂ - TO - GRID - N₁ = 50 VOLTS
 CATHODE BIASED POSITIVE WITH RESPECT TO GRID N₁ TO GIVE FOCUSED RASTER CUTOFF.
 RASTER FOCUSED AT AVERAGE BRIGHTNESS.
 RASTER SIZE = 18" x 13-1/2"





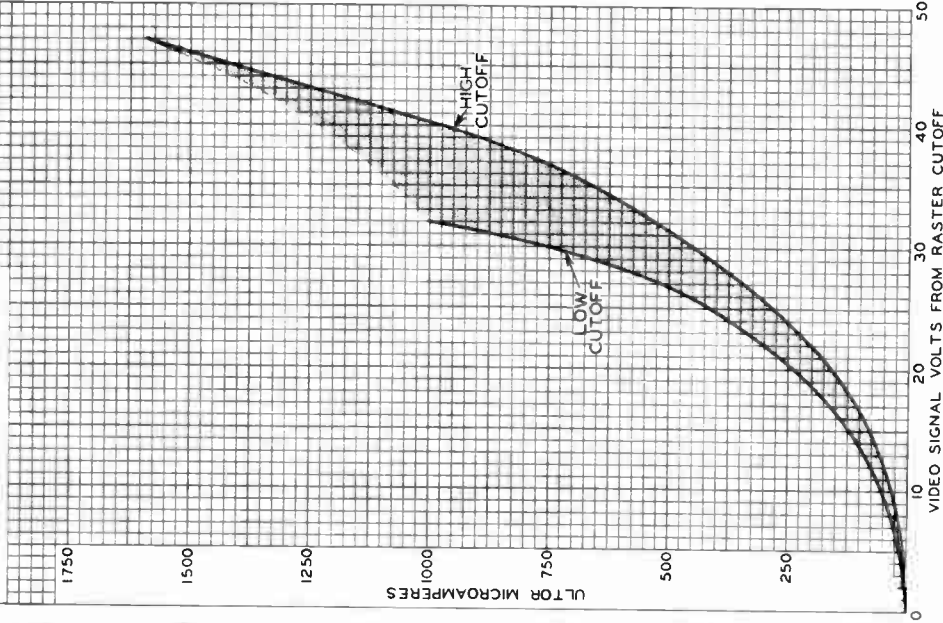
2IDSP4

2IDSP4

CATHODE-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS

ULTOR - TO - GRID - N₂1 VOLTS = 18000
GRID - N₂2 - TO - GRID - N₂1 VOLTS = 50
CATHODE BIASED POSITIVE WITH
RESPECT TO GRID N₂1 TO GIVE
FOCUSED RASTER CUTOFF.





21EP4C

Picture Tube

**RECTANGULAR GLASS TYPE
MAGNETIC FOCUS**

**ALUMINIZED SCREEN
70° MAGNETIC DEFLECTION**

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes	5	pf
Grid-No.1 to all other electrodes	6	pf
External conductive coating to anode. . .	{ 750 max.	pf
	{ 500 min.	pf
Heater Current at 6.3 volts	600 ± 60	ma
Electron Gun.	Type Requiring	No Ion Trap Magnet

Optical:

Phosphor (For curves, see front of this section). P4—Sulfide Type, Aluminized

Faceplate, Cylindrical. Filterglass

Light transmission (Approx.). 74%

Mechanical:

Weight (Approx.). 29 lbs

Overall Length. 23-1/32" ± 3/8"

Neck Length 7-1/2" ± 3/16"

Projected Area of Screen. 248 sq. in.

External Conductive Coating:

Type. Regular-Band

Contact area for grounding. Near Reference Line

For Additional Information on Coatings and Dimensions:

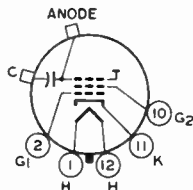
See *Picture-Tube Dimensional-Outlines and Bulb J170 A/C* sheets at front of this section

Cap Recessed Small Cavity (JEDEC No. J1-21)

Base. Small-Shell Duodecal 5-Pin (JEDEC Group 4, No. B5-57)

Basing Designation for BOTTOM VIEW. 12N

Pin 1—Heater
Pin 2—Grid No.1
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater



Cap - Anode
(Grid No. 3,
Screen,
Collector)
C - External
Conductive
Coating



21EP4C

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE	20000 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	220 max.	volts
Negative bias value	1 ^F max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE.	{ 6.9 max.	volts
	{ 5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage.	200 max.	volts
DC component.	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	12000	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster.	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section

Monitor Kinescope

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
72° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes.	5	pf
Grid No.1 to all other electrodes.	6.5	pf
External conductive coating to anode	$\left\{ \begin{array}{l} 1500 \text{ max.} \\ 1200 \text{ min.} \end{array} \right.$	pf
		ma

Heater Current at 6.3 volts. 600 ± 60
Electron Gun Type Requiring No Ion-Trap Magnet

Optical:

Phosphor (for curves, see front of this section) .P4—Sulfide Type,
Aluminized
Faceplate, Spherical Filterglass
Light transmission (Approx.) 75.5%

Mechanical:

Weight (Approx.) 24 lbs
Overall Length 23.031" ± .375"
Neck length. 7.500" ± .188"
Projected Area of Screen 262 sq.in.

External Conductive Coating:

Type Regular-Band
Contact area for grounding Near Reference Line

For Additional Information on Coatings and Dimensions:

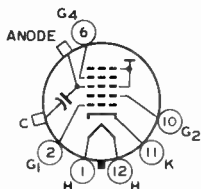
See *Picture-Tube Dimensional-Outlines and Bulb J171 B/F*
sheets at front of this Section

Cap. Recessed Small Cavity (JEDEC No. J1-21)

Base Small-Shell Duodecal 6-Pin, Arrangement 1,
(JEDEC No. B6-63)

Basing Designation for BOTTOM VIEW 12L

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 6—Grid No.4
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater
- Cap—Anode (Grid No.3,
Grid No.5, Screen,
Collector)
- C—External Conductive
Coating



Maximum and Minimum Ratings, Design-Maximum Values:

*Unless otherwise specified, voltage values
are positive with respect to cathode*

Anode Voltage. $\left\{ \begin{array}{l} 22000 \text{ max.} \\ 12000 \text{ min.} \end{array} \right.$ volts



21FP4D

Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
70° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to anode.	{ 750 max.	pf
	{ 500 min.	pf
Heater Current at 6.3 volts	600 ± 60	ma
Electron Gun.	Type requiring No Ion-Trap Magnet	

Optical:

Phosphor (For curves, see front of this section). P4—Sulfide Type, Aluminized
 Facerlate, Cylindrical. Filterglass
 Light transmission (Approx.). 74%

Mechanical:

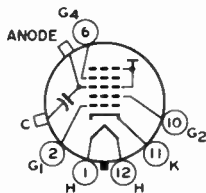
Weight (Approx.). 29 lbs
 Overall Length. 23-1/32" ± 3/8"
 Neck Length 7-1/2" ± 3/16"
 Projected Area of Screen. 248 sq. in.
 External Conductive Coating:

Type. Regular-Band
 Contact area for grounding. Near Reference Line
 For Additional Information on Coatings and Dimensions:

See *Picture-Tube Dimensional-Outlines and Bulb J170 A/C* sheets at front of this section

Cap. Pcessed Small Cavity (JEDEC No. J1-21)
 Base. Small-Shell Duodecal (JEDEC Group 4, No. B6-63)
 Basing Designation for BOTTOM VIEW. 12L

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 6—Grid No.4
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater



- Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)
- C—External Conductive Coating

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE	2000 max.	volts
GRID-NO.4 (FOCUSING) VOLTAGE:		
Positive value.	1100 max.	volts
Negative value.	550 max.	volts



21FP4D

GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE.	{ 6.9 max.	volts
	{ 5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage.	200 max.	volts
DC component.	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	14000	volts
Grid-No.4 Voltage	-56 to +310	volts
Grid-No.2 Voltage	> 10	volts
Grid-No.1 Voltage for visual extinction of focused raster.	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section



21FDP4

Maximum Ratings, Design-Maximum Values:

ULTOR VOLTAGE	20000 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	400 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With ultor voltage of	16000	volts
and grid-No.2 voltage of	300	volts
Grid-No.4 Voltage for focus	+100 to +500	volts
Grid-No.1 Voltage for visual extinction of focused raster	-35 to -72	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section





21MP4

21MP4 PICTURE TUBE

RECTANGULAR METAL-SHELL TYPE

LOW-VOLTAGE ELECTROSTATIC FOCUS

MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:
 Voltage 6.3 ac or dc volts
 Current $0.6 \pm 10\%$ amp
 Faceplate, Spherical Frosted filter glass
 Phosphor (for curves, see front of this Section) . P4—Sulfide type
 Deflection Angle (Approx.):
 Diagonal 70°
 Horizontal 66°
 Vertical 50°
 Electron Gun Ion-Trap Type Requiring
 External Single-Field Magnet

Tube Dimensions:

Maximum overall length 22-5/8"
 Greatest width at lip $19-23/32" \pm 1/8"$
 Greatest height at lip $15-5/16" \pm 1/8"$
 Diagonal at lip $20-3/4" \pm 1/4"$
 Neck length $7-1/2" \pm 3/16"$
 Radius of curvature of faceplate (external surface) . . 33"

Screen Dimensions (Minimum):

Greatest width 18-1/8"
 Greatest height $13-11/16"$
 Diagonal 19-1/8"

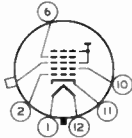
Operating Position Any

Ultor Terminal Metal-Shell Lip

Base . . Small-Shell Duodecal 6-Pin (JETEC Group 4, No. Bt-63)

Basing Designation for BOTTOM VIEW 1M

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 6 - Grid No.4
- Pin 10 - Grid No.2
- Pin 11 - Cathode
- Pin 12 - Heater



Metal-Shell Lip -
 Ultor
 (Grid No.3,
 Grid No.5,
 Collector)

Maximum Ratings, Design-Center Values:

ULTOR VOLTAGE 16000 max. volts
 GRID-No.4 (FOCUSING) VOLTAGE:
 Positive value 1000 max. volts
 Negative value 500 max. volts
 GRID-No.2 VOLTAGE 500 max. volts
 GRID-No.1 VOLTAGE:
 Negative-bias value 125 max. volts
 Positive-bias value 0 max. volts
 Positive-peak value 2 max. volts

← Indicates a change.

2IMP4



2IMP4

PICTURE TUBE

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds	410 max.	volts
After equipment warm-up period . . .	180 max.	volts
Heater positive with respect to cathode.	180 max.	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
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*For X-ray shielding considerations, see sheet
X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section*

21FVP4

Picture Tube

PAN-O-PLY-INTEGRAL IMPLSION PROTECTION
NO ION-TRAP MAGNET REQUIRED

114° MAGNETIC DEFLECTION
LOW-VOLTAGE ELECTROSTATIC FOCUS

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid No. 2 to all other electrodes	6	pF
External horizontal wire coating to anode	1500 min—2300 max	pF
Heater Current at 6.3 V.	450 ± 20	mA
Heater Warm-up Time (Average)	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

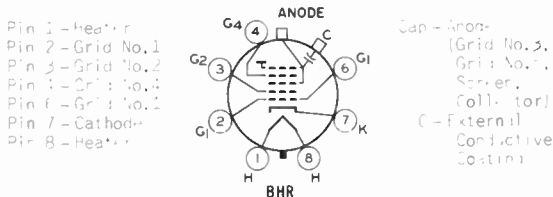
OPTICAL

Phosphor	P4—Sulfide Type, Aluminized
Faceplate	Filterglass
Light transmission at center (approx.)	46%

MECHANICAL

Weight (Approx.)	19 lb
Overall Length	12.656 ± .281 in
Neck Length	4.375 ± .125 in
Projected Area of Screen	212 sq in
External Conductive Coating ^a	Type I—see OUTLINE 1 at front of this section). Regular-Band
Cap.	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Noveightar 7-Pin, Arrangement 1, (JEDEC No. B7-20B)

TERMINAL DIAGRAM (Bottom View)



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage	11000 min—23000 max	V
Grid-No. 4 Voltage		
Positive bias value	1100 max	V
Negative value	550 max	V
Grid-No. 2 Voltage	200 min—550 max	V
Grid-No. 1 Voltage		
Negative peak value	220 max	V
Negative bias value	155 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V
Heater Voltage	5.7 min—6.9 max	V



21FVP4

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:

During equipment warm-up period < 15 seconds . . . 450 max V

After equipment warm-up period 300 max V

Heater positive with respect to cathode:

Combined AC & DC voltage 200 max V

DC component 100 max V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No. 1

Anode Voltage 20000 V

Grid-No. 4 Voltage^b 100 V

Grid-No. 2 Voltage 400 V

Cathode Voltage 36 to 78 V

For visual extinction of focused raster

Field Strength 0 to 10 G

Of required adjustable centering magnet

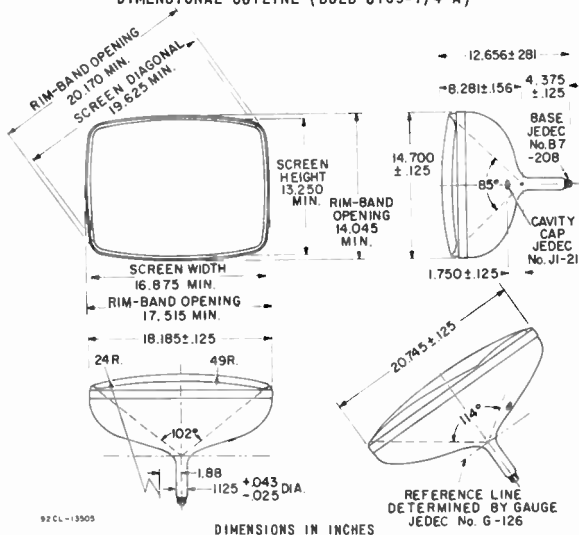
MAXIMUM CIRCUIT VALUE

Grid-No. 1 Circuit Resistance 1.5 max MΩ

^a includes implosion protection hardware.

^b The grid-No. 4 voltage required for optimum focus of any individual tube will have a value anywhere between -100 and +300 volts with the combined grid-No. 1 voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 11.750-inch by 15.500-inch pattern from an HCA-2F21 monoscope, or equivalent.

DIMENSIONAL OUTLINE (BULB J165-1/4 A)



92 CL-13905

DIMENSIONS IN INCHES



21GUP22

Color Picture Tube

New Rare-Earth (Red) Phosphor

70° Round

HI-LITE Screen

Unity Current Ratios

70° Magnetic Deflection

The 21GUP22 is the same as the 21GVP22 except for the following:

- Faceplate Filterglass
- Light transmission (Approx.) 72%
- Faceplate does not have an integral protective window^a

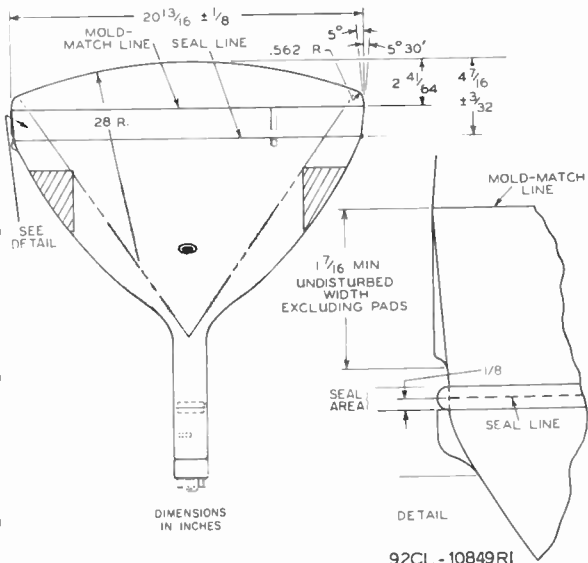
TUBE DIMENSIONS

- Overall length 25-1/32 ± 3/8 in
- Diameter 20-13/16 ± 1/8 in
- Weight (Approx.) 36.5 lb

^a It is recommended that the cabinet be provided with a shatter-proof glass cover over the face of the 21GUP22 to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide x-radiation protection when required.

DIMENSIONAL OUTLINE

Dimensions shown are only those which are different from the corresponding dimensions for the 21GVP22

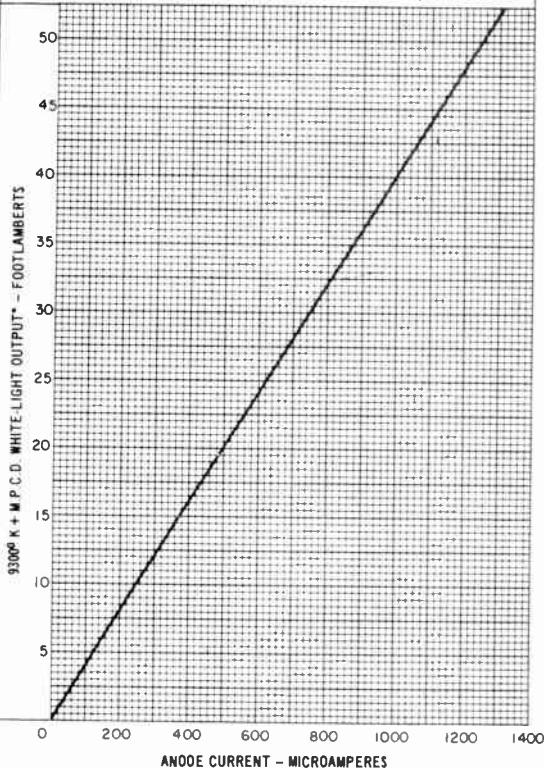


21GUP22

TYPICAL LIGHT-OUTPUT CHARACTERISTIC

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 25000 VOLTS
GRID-No.3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE
CURRENT TO PRODUCE 93000° K + 27 M.P.C.O. WHITE-LIGHT OUTPUT.
PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN TO
PRODUCE 93000° K + M.P.C.O. WHITE:
RED GUN: 34%
BLUE GUN: 32%
GREEN GUN: 34%

RASTER SIZE: 19 1/4" X 16"
*MEASURED WITHIN 5" DIAMETER AREA CENTERED ON TUBE FACE



92LM-2286

21GVP22

MECHANICAL

Minimum Screen Area (Projected)	267 sq. in
Bulb Funnel Designation	JEDEC No.J164-1/4A1
Bulb Panel Designation	JEDEC No.FP166-1/2D1
Protective Window Designation.	JEDEC No.FP166-1/2B1
Base	Small-Shell Neodiheptal 12-pin
Operating Position	Tube Axis Horizontal, V-grooved panel pad on top (Base pin 12 near top)
Socket	Alden Nos.214NMINSC (Radial leads), 214NMINC (Axial leads), or equivalent
Weight (Approx.)	41 lb

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

Anode Voltage	} 27,500 max. volts 20,000 min. volts
Total Anode Current, Long-Term Average . . . . .		1000 max. $\mu$A
Grid-No.3 (Focusing Electrode) Voltage	6000 max. volts
Peak Grid-No.2 Voltage, Including Video Signal Voltage	1000 max. volts
Grid-No.1 Voltage: Negative bias value.	400 max. volts
Negative operating cutoff value	200 max. volts
Positive bias value.	0 max. volts
Positive peak value	2 max. volts
Heater Voltage (ac or dc): Under operating conditions ^a	} 6.9 max. volts 5.7 min. volts
Under standby conditions ^c . . . . .		5.5 max. volts
Peak Heater-Cathode Voltage: Heater negative with respect to cathode: During equipment warm-up period not exceeding 15 seconds	450 max. volts
After equipment warm-up period: Combined AC and DC value	200 max. volts
DC component value	200 max. volts
Heater positive with respect to cathode: AC component value	200 max. volts
DC component value	0 max. volts

EQUIPMENT DESIGN RANGES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 20,000 and 27,500 volts

Grid-No.3 (Focusing Electrode) Voltage	16.8% to 20% of Anode volts
--	--------------------------------

Grid-No.2 and Grid-No.1 Voltages

for Visual Extinction of Focused

Spot See *CUTOFF DESIGN CHART*

Maximum Ratio of Grid-No.2 Voltages, Highest

Gun to Lowest Gun in Any Tube (At grid-No.1

spot cutoff voltage of -100 volts) 1.86

Grid-No.3 Current (Total) -45 to +15 μ A

Grid-No.2 Current -5 to +5 μ A

To Produce White of 9300°K + 27 M.P.C.D.

(CIE Coordinates $x = 0.281$, $y = 0.311$):

Red Blue Green

Percentage of total anode current

supply by each gun (average) . . . 34 32 34 %

Ratio of cathode currents:

Min. Typ. Max.

Red/blue 0.75 1.10 1.50

Red/green 0.65 1.00 1.50

Blue/green 0.60 0.91 1.30

Displacements, Measured at Center of Screen:

Raster centering displacement:

Horizontal ± 0.60 in

Vertical ± 0.45 in

Lateral distance between the blue beam and

the converged red and green beams ± 0.40 in

Radial convergence displacement excluding

effects of dynamic convergence (each beam). ± 0.50 in

Maximum Required Correction for Register^d (In-

cluding Effect of Earth's Magnetic Field when

Using Recommended Components) as Measured

at the Center of the Screen

in any Direction 0.005 in max.

LIMITING CIRCUIT VALUES

High-Voltage Circuits:

Grid-No.3 circuit resistance 7.5 max. megohms

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the *high-voltage power supply* and the *grid-No.3 power supply* be of the limited-energy type, in which the short-circuit current does not exceed 20 mA.

Low-Voltage Circuits:

Effective grid-No.1-to-cathode-

circuit resistance (each gun) 0.75 max. megohm

The low-voltage circuits, including all heater circuits, should be analyzed by assuming the color picture tube heater is connected directly to the receiver chassis ground. Under

21GVP22

these conditions the circuits to the elements of all tubes, including the color picture tube, operating from the same heater winding and all connections of any other circuits to the heater winding should each have an impedance such that their respective power sources in combination will not supply a continuous short-circuit current of more than 750 mA total in the assumed picture tube heater ground connection. The leads from all other circuits must be separated from the picture tube leads by a minimum distance of 0.25 inch to prevent energy transfer to the picture tube circuits. Such current limitation will help prevent picture tube damage in case of momentary cascade arcing.

- ^a For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts. The series impedance to any chassis connection in the DC biasing circuit for the heater should be between 100,000 ohms and 1 megohm.
- ^b For curve, see *Group Phosphor P22-New Rare-Earth (Red), Sulfide (Blue & Green)* at front of this section.
- ^c For "instant on" applications, a maximum heater voltage of 5.5 volts (design-maximum value) may be maintained on the color picture tube when the receiver is in the "off" (stand-by) position. All other voltages normally applied to the tube must be removed during standby operation.
- ^d Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

X-RADIATION WARNING

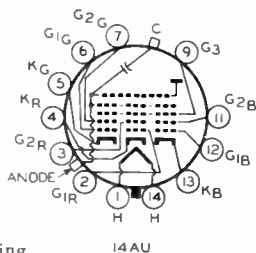
Because the 21GVP22 is designed to be operated at anode voltages as high as 27.5 kilovolts (design-maximum value), shielding of the 21GVP22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

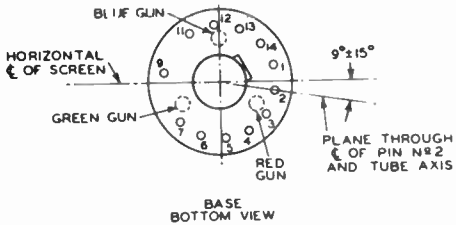
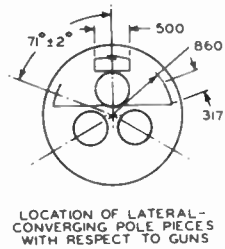
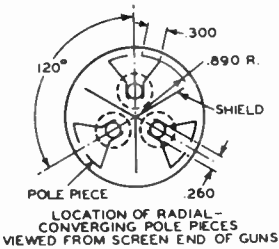
TERMINAL DIAGRAM (Bottom View)

- Pin 1- Heater
- Pin 2- Grid No.1 of Red Gun
- Pin 3- Grid No.2 of Red Gun
- Pin 4- Cathode of Red Gun
- Pin 5- Cathode of Green Gun
- Pin 6- Grid No.1 of Green Gun
- Pin 7- Grid No.2 of Green Gun
- Pin 9- Grid No.3
- Pin 11- Grid No.2 of Blue Gun
- Pin 12- Grid No.1 of Blue Gun
- Pin 13- Cathode of Blue Gun
- Pin 14- Heater

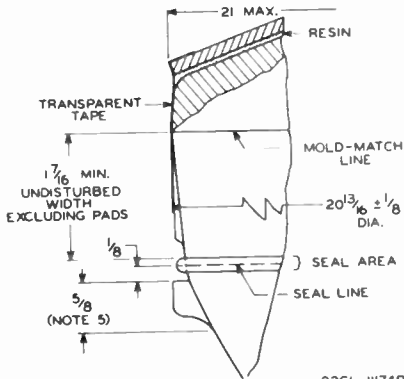
Cap- Anode

C - External Conductive Coating

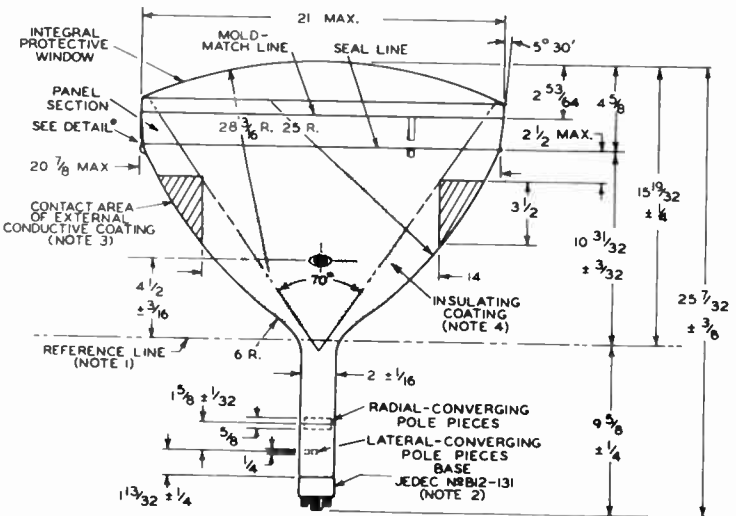




DIMENSIONAL OUTLINE DETAIL

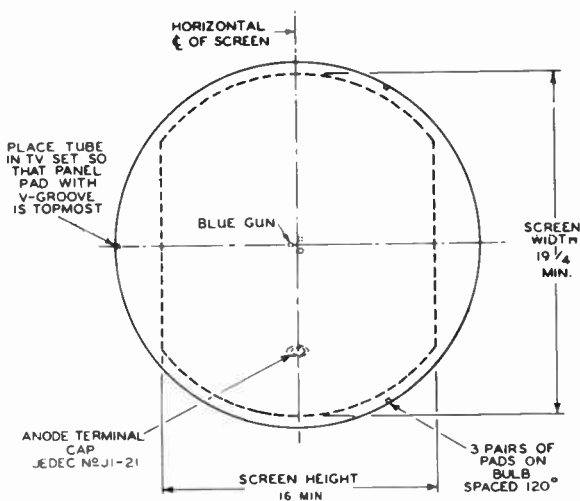


DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

DIMENSIONAL OUTLINE (Top View)

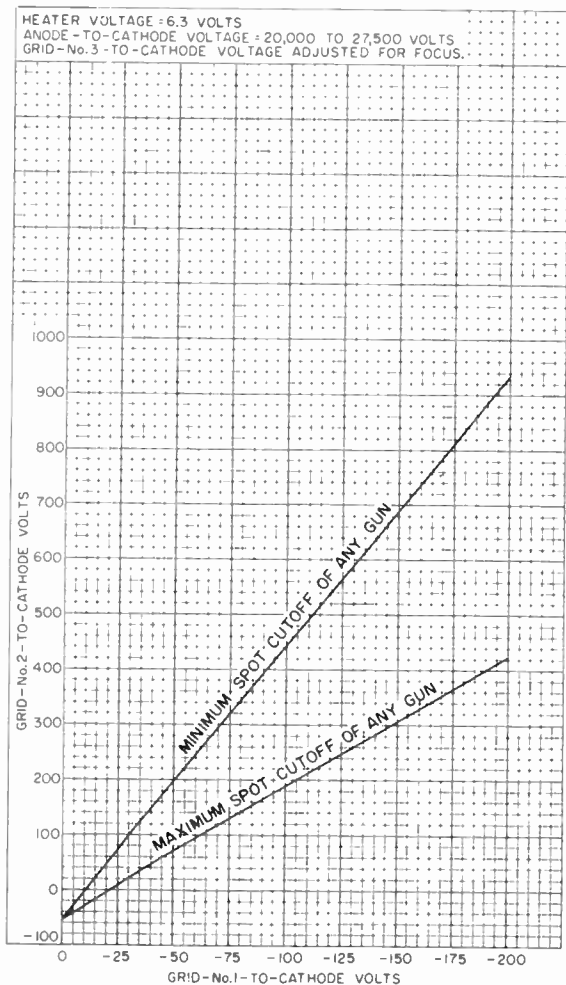


DIMENSIONS IN INCHES

NOTES FOR DIMENSIONAL OUTLINE

- Note 1:** With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge JEDEC No. G-150 and with tube seated in gauge, the reference line is determined by the intersection of the plane CC' of the gauge with the glass funnel.
- Note 2:** Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base shell will fall within a circle concentric with bulb axis and having a diameter of 3".
- Note 3:** The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.
- Note 4:** To clean this area, wipe only with soft dry lintless cloth.
- Note 5:** The maximum effective width of a funnel pad is $5/8"$.

CUTOFF DESIGN CHART



92CM-12330

Color Picture Tube

Ultra-Rectangular
4 X 3 Aspect Ratio
 Electrical

Hi-Lite Matrix Screen
Light Neutral Screen Appearance

Electron Guns, Three with Axes
 Tilted Toward Tube Axis Red, Blue, Green

Heater, of Each Gun Series Connected within
 Tube with Each of the Other Two Heaters:
 Current at 6.3 V 900 mA

Focusing Method Electrostatic

Focus Lens Bipotential

Convergence Method Magnetic

Deflection Method Magnetic

Deflection Angles (Approx.):

Diagonal 92 deg

Horizontal 79 deg

Vertical 61 deg

Direct Interelectrode Capacitance (Approx.):

Grid No.1 of any gun to all other electrodes 7.5 pF

Grid No.3 to all other electrodes 6.5 pF

All cathodes to all other electrodes 15 pF

Capacitance Between Anode and External
 Conductive Coating $\left. \begin{array}{l} 2250 \text{ max. pF} \\ 1750 \text{ min. pF} \end{array} \right\}$

Optical

Faceplate and Safety Panel Filterglass
 Light transmission at center (Approx.) 66%

Surface of Safety Panel Treated to minimize
 specular reflection

Screen Aluminized

Matrix Black opaque material

Phosphor, rare-earth (red) sulfide (blue & green) P22

Persistence Medium-Short

Array 377,000 Dot trios

Spacing between centers of adjacent
 dot trios (Approx.) 0.026 in (0.66 mm)

Mechanical

Minimum Screen Area (Projected) 226 sq in (1458 sq cm)

Bulb Funnel Designation JEDEC No.J561A06

Bulb Panel Designation JEDEC No.FP177-3/4 W2

Base Designation^a Small-Button Diheptar 12-Pin
 (JEDEC No.B12-244)

Basing Designation JEDEC No.14BE

Pin Position Alignment Pin No.12 Aligns Approx. with
 Anode Bulb Contact

21VAKP22

Operating Position, preferred Anode Bulb Contact on Top
Gun Configuration Delta
Weight (Approx.) 35.5 lb (16.0 kg)

Implosion Protection

Integral Safety Panel JEDEC No.SP177-1/4A1

Maximum and Minimum Ratings, Design-Maximum Values

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode.

Anode Voltage	}	27.5 max.	kV
		20 min.	kV
Anode Current, Long-Term Average ^b		1000 max.	μA
Grid-No.3 (Focusing Electrode) Voltage		6000 max.	V
Peak-Grid-No.2 Voltage, Including Video Signal Voltage		1000 max.	V
Grid-No.1 Voltage:			
Negative bias value		400 max.	V
Negative operating cutoff value		200 max.	V
Positive bias value		0 max.	V
Positive peak value		2 max.	V
Heater Voltage (ac or dc): ^c			
Under operating conditions	}	6.9 max.	V
		5.7 min.	V
Under standby conditions ^d		5.5 max.	V
Heater-Cathode Voltage:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds		450 max.	V
After equipment warm-up period:			
DC component value		200 max.	V
Peak value		200 max.	V
Heater positive with respect to cathode:			
DC component value		0 max.	V
Peak value		200 max.	V

Equipment Design Ranges

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 20 and 27.5 kV

Grid-No.3 (Focusing Electrode) Voltage 16.8% to 20% of Anode voltage

Grid-No.2 Voltage for Visual Extinction
of Undelected Focused Spot. . . . See CUTOFF DESIGN CHART
in Figure 3

At Grid No.1 voltage of -75 V	80 to 280 V
At Grid No.1 voltage of -125 V	215 to 550 V
At Grid No.1 voltage of -175 V	355 to 820 V

Maximum Ratio of Grid-No.2 Voltages, Highest Gun to
Lowest Gun in Any Tube (At grid-No.1 spot cutoff
voltage of -100 V) 1.86

Heater Voltage.^c

Under operating conditions:	
When standby operation is not utilized	6.3 V
When 5.0-V standby operation is utilized ^d	6.0 V
Under standby conditions ^d	5.0 V

Grid-No.3 Current (Total)	$\pm 15 \mu\text{A}$
Grid-No.2 Current	$\pm 5 \mu\text{A}$
Grid-No.1 Current	$\pm 5 \mu\text{A}$

	Illum. D	Color	
To Produce White Light of	6550 ^o K +	9300 ^o K +	
	7 M.P.C.D.	27 M.P.C.D.	
CIE Coordinates:			
X	0.313	0.281	
Y	0.329	0.311	
Percentage of total anode current supplied by each gun (average):			
Red	41	30	%
Blue	24	31	%
Green	35	39	%
Ratio of cathode currents:			
Red/blue:			
Minimum	1.35	0.75	
Typical	1.70	0.95	
Maximum	2.20	1.25	
Red/green:			
Minimum	0.95	0.60	
Typical	1.15	0.75	
Maximum	1.70	1.10	
Blue/green:			
Minimum	0.50	0.60	
Typical	0.70	0.80	
Maximum	0.95	1.10	

Displacements, Measured at Center of Screen:

Raster centering displacement:

Horizontal	± 0.45 in (± 11.4 mm)
Vertical	± 0.45 in (± 11.4 mm)

Lateral distance between the blue beam and
the converged red and green beams . . . ± 0.25 in (± 6.4 mm)

21VAKP22

Radial convergence displacement excluding effects of dynamic convergence (each beam) ± 0.37 in (± 9.4 mm)

Maximum Required Correction for Register® (Including Effect of Earth's Magnetic Field when Using Recommended Components) as Measured at the Center of the Screen in any Direction 0.005 in (0.13 mm) max.

Typical Operation

Heater Voltage 6.3 V
Anode Voltage 25 kV
Grid No.3 Voltage Adjusted for focus
Color Temperature 9300° K + 27 M.P.C.D.
Raster Size 17.538 x 13.256 in
(445.47 x 336.70 mm)

Typical White-Light Output Measured within 5 in (127 mm) diameter area centered on tube face:

At anode current of 1000 μ A $\left. \begin{array}{l} 58 \text{ fL} \\ 200 \text{ Nit} \end{array} \right\}$

Limiting Circuit Values

High-Voltage Circuits:

Grid-No.3 circuit resistance 7.5 max. $M\Omega$

Low-Voltage Circuits:

Effective grid-No.1-to-cathode-circuit resistance (each gun) 0.75 max. $M\Omega$

X-Radiation Characteristic

Maximum Anode Voltage at which the X-radiation emitted will not exceed 0.5 mR/h at an anode current of 300 μ A 35 kV

The X-radiation emitted from this picture tube, as measured in accordance with the procedure of JEDEC Publication No.64A will not exceed 0.5 mR/h throughout the useful life of the tube when operated within the Design-Maximum ratings: 27.5 kV anode voltage and 1000 μ A anode current. The tube should not be operated beyond its Design-Maximum ratings stated above (such operation may shorten tube life or have other permanent adverse affects on its performance), but its X-radiation will not exceed 0.5 mR/h for anode voltage and current combinations given by the isodose-rate limit characteristics as shown in Figure 1. Operation above the values shown by the curve may result in failure of the television receiver to comply with the Federal Performance Standard for Television Receivers, Sub-Part C of Part 78 of Title 42, Code of Federal Regulations (PL90-602) as published in the Federal Register Vol.34, No. 247, Thursday, December 25, 1969. Maximum X-radiation as a function of anode voltage at 300 μ A anode current is shown by the curve in Figure 2. X-radiation at a constant anode voltage varies linearly with anode current.

- a The mating socket, including its associated, physically-attached hardware end circuitry, must not weigh more than one pound (one-half kilogram).
- b The short-term average anode current should be limited by circuitry to 1500 microamperes.
- c For maximum cathode life, it is recommended that the heater supply be regulated. The series impedance to any chassis connection in the dc biasing circuit for the heater should be between 100 kilohms and 1 megohm. The surge voltage across the heater must be limited to 9.5 volts rms.
- d The use of a 5-volt standby condition in conjunction with 6-volt operating conditions is recommended to improve the reliability of the color picture tube by extending the emission wear-out life and reducing other gun-related defects. A maximum heater voltage of 5.5 volts (Design-Maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.
- e Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

Notes For Dimensional Outline

Note 1— With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge (JEDEC No.G162) and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C' of the gauge with the glass funnel.

Note 2— Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with blub axis.

Note 3— The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

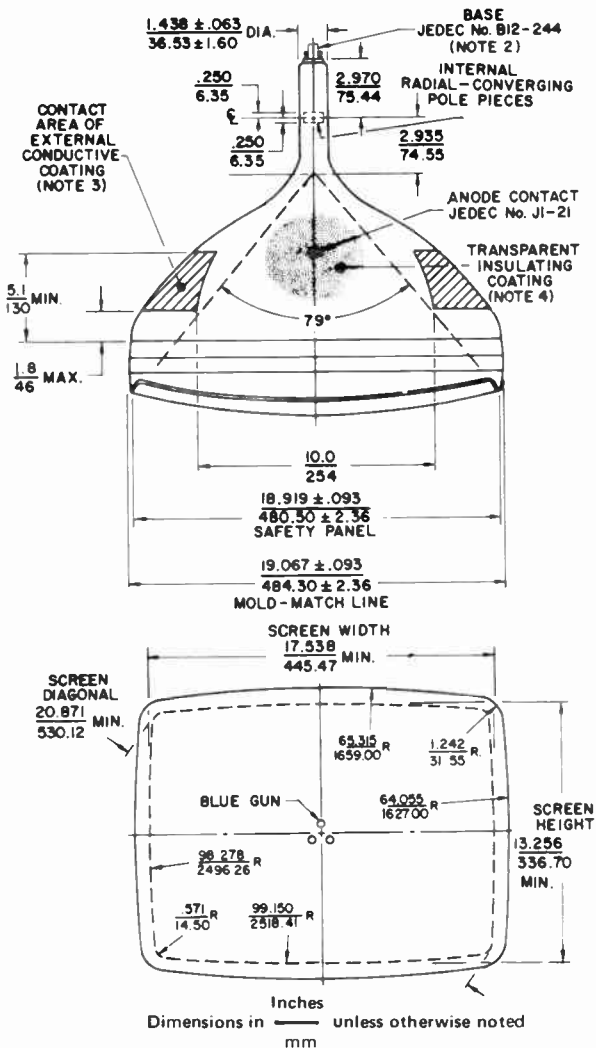
Note 4— To clean this area, wipe only with soft, dry, lintless cloth.

SAGITTAL HEIGHTS AT POINTS $\frac{.125}{3.18}$ BEYOND EDGE OF MIN. SCREEN

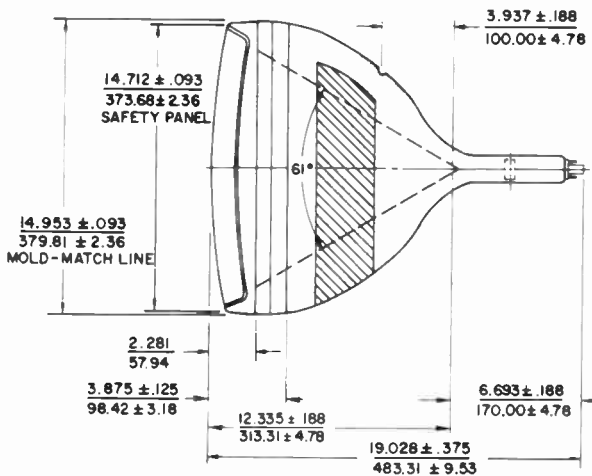
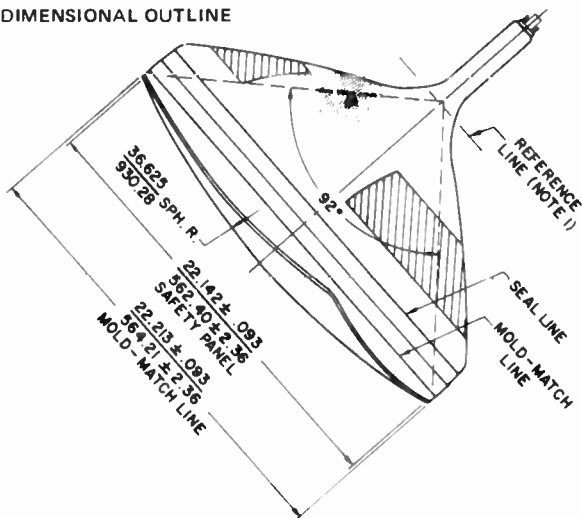
DIAGONAL $\frac{1.561}{39.65}$; HORIZONTAL $\frac{1.100}{27.94}$; VERTICAL $\frac{0.630}{16.00}$

21VAKP22

DIMENSIONAL OUTLINE



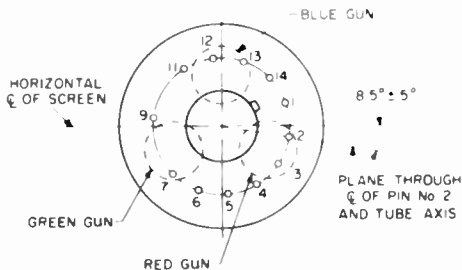
DIMENSIONAL OUTLINE



92LL-3171R3

21VAKP22

BOTTOM VIEW OF BASE

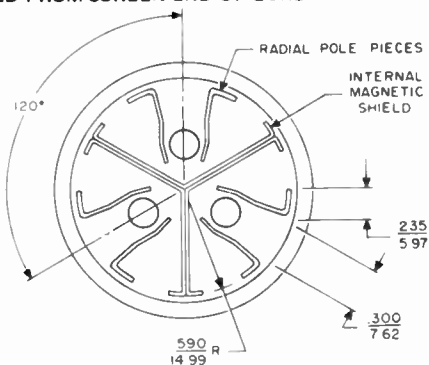


92 5 286

Base Specification — JEDEC No.14BE

- Pin 1— Heater
- Pin 2— Cathode of Red Gun
- Pin 3— Grid No.1 of Red Gun
- Pin 4— Grid No.2 of Red Gun
- Pin 5— Grid No.2 of Green Gun
- Pin 6— Cathode of Green Gun
- Pin 7— Grid No.1 of Green Gun
- Pin 9— Grid No.3
- Pin 11— Cathode of Blue Gun
- Pin 12— Grid No.1 of Blue Gun
- Pin 13— Grid No.2 of Blue Gun
- Pin 14— Heater
- Cap— Anode (Grid No.4, Screen, Collector)
- C— External Conductive Coating

LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



92CS-12835R4

**0.5 mR/h ISODOSE-RATE LIMIT CURVE
(JEDEC CURVE No.XC-4)**

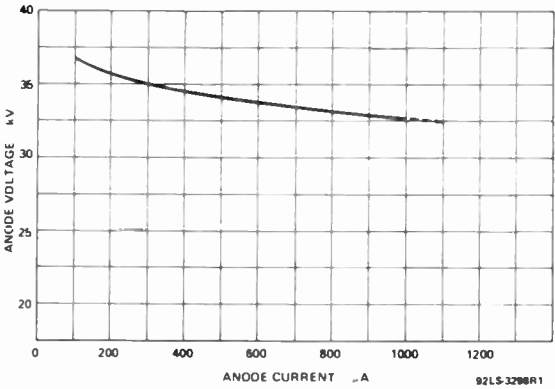


Figure 1

**X-RADIATION LIMIT CURVE AT A CONSTANT ANODE CURRENT OF 300 μA (X-RADIATION AT A CONSTANT ANODE VOLTAGE VARIES LINEARLY WITH ANODE CURRENT)
(JEDEC CURVE No.XC-3)**

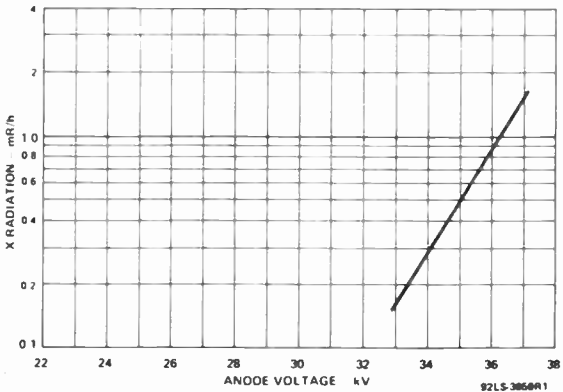
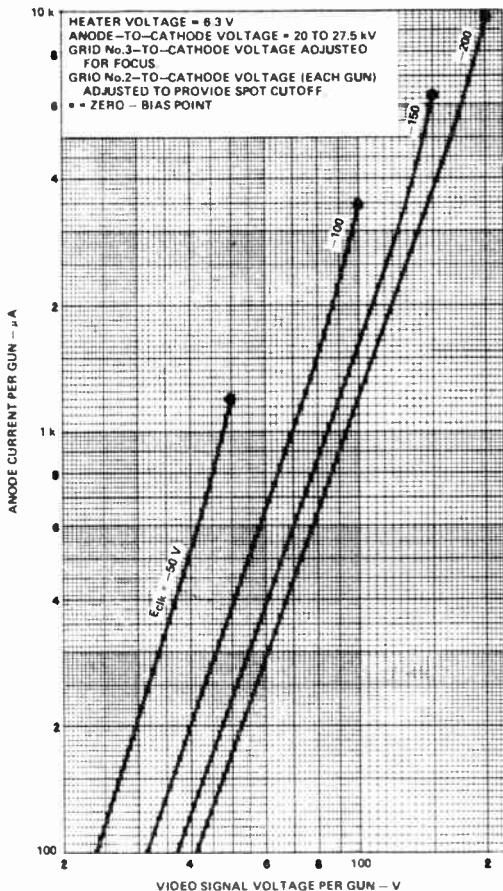


Figure 2

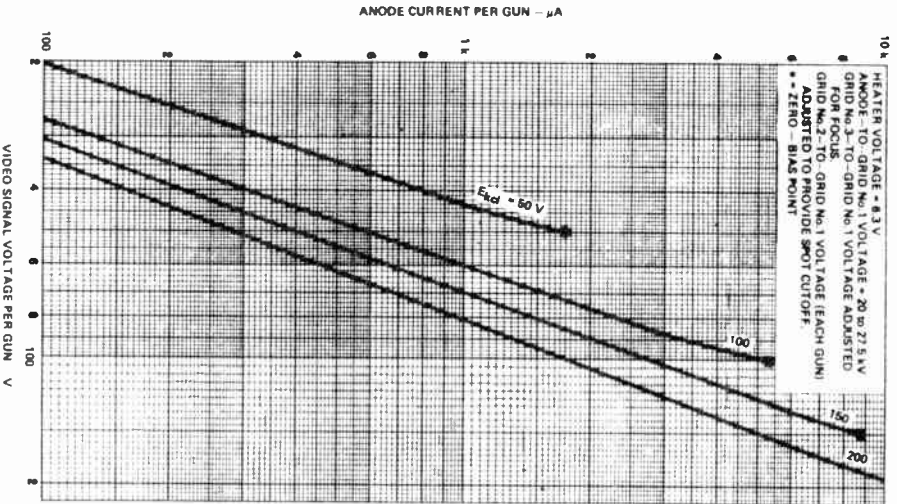
21VAKP22

TYPICAL DRIVE CHARACTERISTICS, GRID-DRIVE SERVICE



21VAKP22

TYPICAL DRIVE CHARACTERISTICS, CATHODE- DRIVE SERVICE



821LM 3884

21VAKP22

CUTOFF DESIGN CHART

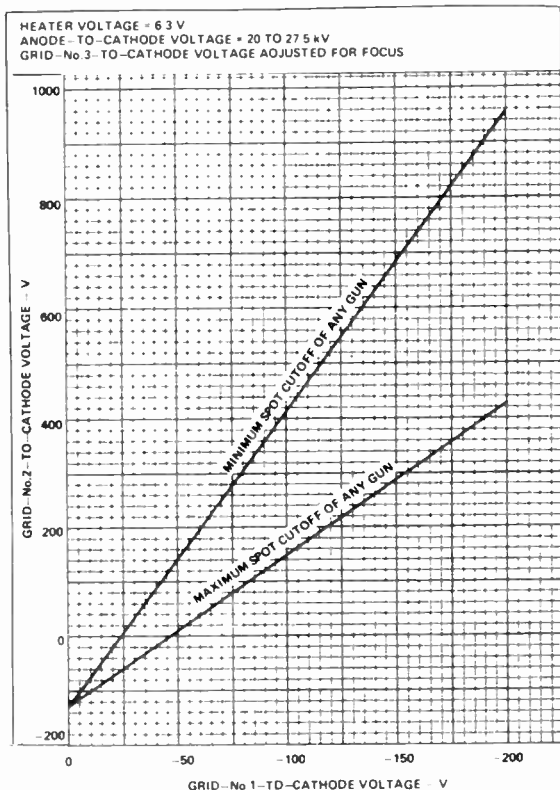


Figure 3

IMPORTANT: Refer to sheet Safety Precautions For Color Picture Tubes at front of this section.

21WP4B

Picture Tube

MAGNETIC FOCUS NO ION-TRAP MAGNET REQUIRED 70° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode	{ 750 max	pF
	{ 500 min	pF
Heater Current at 6.3 V.	600 ± 30	mA

Electron Gun Type Requiring No Ion-Trap Magnet

OPTICAL

Phosphor P4—Sulfide Type, Aluminized
For curves, see front of this section

Faceplate. Filterglass
Light Transmission (Approx.) 73%

MECHANICAL

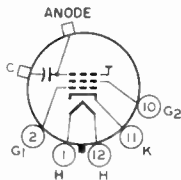
Weight (Approx.)	24	lb
Overall Length	22.438 ± 0.375	in
Neck Length	7.500 ± 0.188	in
Projected Area of Screen	224	sq in

External Conductive Coating
Type Regular-Band
Contact area for grounding Near Reference Line

For Additional Information on Coatings and Dimensions
See *Picture-Tube Dimensional-Outlines and Bulb J165 Z sheet*
at front of this section

Cap. Recessed Small Cavity (JEDEC No. J1-21)
Base Small-Shell Duodecal 5-Pin (JEDEC Group 4, No. 85-57)
Basing Designation for BOTTOM VIEW 12N

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater
- Cap—Anode (Grid No.3,
Screen
Collector)
- C—External
Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage.	20000	max	V
Grid-No.2 Voltage.	550	max	V
Grid-No.1 Voltage			
Negative peak value.	220	max	V
Negative bias value.	155	max	V
Positive bias value.	0	max	V
Positive peak value.	2	max	V



21WP4B

Heater Voltage	6.9 max	V
	5.7 min	V
Peak Heater-Cathode Voltage		
Heater positive with respect to cathode:		
During filament warm-up period not exceeding 10 seconds	450 max	V
After filament warm-up period	200 max	V
Heater positive with respect to anode:		
Combined A and C Voltages	200 max	V
DC Component	100 max	V

TYPICAL OPERATING CONDITIONS FOR GRID-DRIVE SERVICE

*Unless otherwise specified, voltage values
are positive with respect to cathode*

Anode Voltage	16000	V
Grid-No.2 Voltage	300	V
Grid-No.1 Voltage	-28 to -72	V
for visual extinction of focused raster		

MAXIMUM CIRCUIT VALUE

Grid-No.1-Circuit Resistance	1.5 max	MΩ
--	---------	----

For radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



21XP4B

Picture Tube

LOW-VOLTAGE ELECTROSTATIC FOCUS 70° MAGNETIC DEFLECTION
NO ION-TRAP MAGNET REQUIRED

ELECTRICAL

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid No. 1 to all other electrodes	6	pF
External conductive coating to	{ 2500 max 2000 min	pF
		pF

Heater Current at 6.3 V 600 ± 30 mA
Electron Gun Type Requiring No Ion-Trap Magnet

OPTICAL

Phosphor P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate Filterglass
Light transmission (approx.) 73%

MECHANICAL

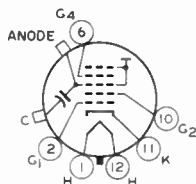
Weight (Approx.) 24 lb
Overall Length 22.438 ± 0.375 in
Neck Length 7.500 ± 0.188 in
Projected Area of Screen 224 sq in
External Conductive Coating

Type Regular-Band
Contact area for grounding Near Reference Line
For Additional Information on Coatings and Dimensions

See *Picture-Tube Dimensional-Outlines* in Bulb J165 Z, located at front of this section

Cap. Recessed Small Cavity (JEDEC No. J1-21)
Base Small-Shell Duodecal 6-Pin (JEDEC Group 4, No. 86-63)
Basing Designation for BOTTOM VIEW 12L

- Pin 1—Heater
- Pin 2—Grid No. 1
- Pin 3—Grid No. 4
- Pin 10—Grid No. 2
- Pin 11—Anode
- Pin 12—Heater
- Cap—Anode (Grid No. 3, Grid No. 7, Screen, Collector)
- C—External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	20000 max	V
Grid-No. 4 (Focusing) Voltage		
Positive value	1100 max	V
Negative value	550 max	V



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Electronic Components and Devices Harrison, N. J.

DATA
10-67

21XP4B

Grid-No.2 Voltage.	550 max	V
Grid-No.1 Voltage		
Negative peak value.	220 max	V
Negative bias value.	155 max	V
Positive bias value.	0 max	V
Positive peak value.	2 max	V
Heater Voltage	{ 6.9 max	V
	{ 5.7 min	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds.	450 max	V
After equipment warm-up period	200 max	V
Heater positive with respect to cathode:		
Combined AC and DC voltage.	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR GRID-DRIVE SERVICE

*Unless otherwise specified, voltage values
are positive with respect to cathode*

Anode Voltage.	16000	V
Grid-No.4 Voltage.	-64 to 352	V
Grid-No.2 Voltage.	300	V
Grid-No.1 Voltage.	-28 to -72	V

For visual extinction of focused raster

MAXIMUM CIRCUIT VALUE

Grid-No.1-Circuit Resistance	1.5 max	MΩ
--	---------	----

For X-radiation shielding considerations, see sheet
A-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



21YP4B

Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
70° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to anode.	{ 750 max.	pf
	{ 500 min.	pf
Heater Current at 6.3 volts	800 ± 80	ma
Electron Gun.	Type Requiring	No Ion-Trap Magnet

Optical:

Phosphor (for curves, see front of this section). P4—Sulfide Type, Aluminized
 Faceplate, Spherical. Filterglass
 Light transmission (Approx.). 75%

Mechanical:

Weight (Approx.). 24 lbs
 Overall Length. 23-1/32" ± 3/8"
 Neck Length. 7-1/2" ± 3/16"
 Projected Area of Screen. 248 sq. in.
 External Conductive Coating:

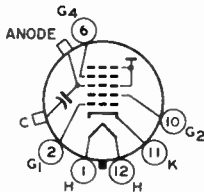
Type. Regular-Band
 Contact area for grounding. Near Reference Line
 For Additional Information on Coatings and Dimensions:

See *Picture-Tube Dimensional-Outlines and Bulb J170 B/D* sheets at front of this section

Cap. Recessed Small Cavity (JEDEC No. J1-21)
 Base. Small-Shell Duodecal 6-Pin (JEDEC Group 4, No. B6-63)

Basing Designation for BOTTOM VIEW. 12L

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 6 - Grid No.4
- Pin 10 - Grid No.2
- Pin 11 - Cathode
- Pin 12 - Heater



- Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
- C - External Conductive Coating

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE 20000 max. volts



21YP4B

GRID-No.4 (FOCUSING) VOLTAGE:

Positive value.	1100 max.	volts
Negative value.	550 max.	volts

GRID-No.2 VOLTAGE 550 max. volts

GRID-No.1 VOLTAGE:

Negative peak value	220 max.	volts
Negative bias value	1.5 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts

HEATER VOLTAGE. { 6.9 max. volts
5.7 min. volts

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds 450 max. volts		
After equipment warm-up period. 200 max. volts		

Heater positive with respect to cathode:		
Combined AC and DC voltage.	200 max.	volts
DC component.	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	16000	volts
Grid-No.4 Voltage	-64 to +350	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster.	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance. 1.5 max. megohms

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section



21ZP4C

Picture Tube

RECTANGULAR GLASS TYPE
MAGNETIC FOCUS

ALUMINIZED SCREEN
70° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to anode.	{ 750 max.	pf
	{ 500 min.	pf

Heater Current at 6.3 volts 800 ± 60 ma

Electron Gun. Type Requiring No. 10-11; Magnet

Optical:

Phosphor (for curves, see front of this section). P4—Sulfide Type, Aluminized

Faceplate, Spherical. Filterglass

Light transmission (Approx.). 75%

Mechanical:

Weight (Approx.). 24 lbs

Overall Length. 23-1/32" ± 3/8"

Neck Length 7-1/2" ± 3/16"

Projected Area of Screen. 248 sq. in.

External Conductive Coating:

Type. Regular-Band

Contact area for grounding. Near Reference Line

For Additional Information on Coatings and Dimensions:

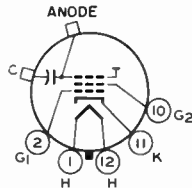
See *Picture-Tube Dimensional-Outlines and Bulb J170 B/D* sheets at front of this section

Cap. Recessed Small Cavity (JEDEC No. J1-21)

Base. Small-Shell Duodecal 5-Pin (JEDEC Group 4, No. B5-57)

Basing Designation for BOTTOM VIEW. 12N

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater



- Cap—Anode (Grid No.3, Screen, Collector)
- C—External Conductive Coating

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE	2000 max.	volts
GRID-NO.2 VOLTAGE	550 max.	volts



21ZP4C

GRID—No.1 VOLTAGE:

Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts

HEATER VOLTAGE.	{ 6.9 max.	volts
		5.7 min.	volts

PEAK HEATER—CATHODE VOLTAGE:

Heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage.	200 max.	volts
DC component.	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	16000	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster.	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1—Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section



Color Picture Tube

"PERMA-CHROME" ASSEMBLY FOR OPTIMUM FIELD PURITY AND
UNIFORMITY DURING WARM-UP

RECTANGULAR TUBE 90° MAGNETIC DEFLECTION

ALUMINIZED TRICOLOR PHOSPHOR-DOT *Hi-Lite* SCREEN
(Utilizing a New Improved Rare-Earth Red-Emitting Phosphor)

INTEGRAL FILTERGLASS PROTECTIVE WINDOW

MAGNETIC CONVERGENCE 3 ELECTROSTATIC-FOCUS GUNS

For Use in Color-TV Receivers

ELECTRICAL

Electron Guns, Three. Red, Blue, Green
Axes tilted forward 10°

Heater, of Each Gun
Series connected with heater of
each of the other two guns

Current at 6.3 volt a 900 mA

Focusing Method Electrostatic

Focus Lens. Bipotential

Convergence Method. Magnetic

Deflection Method Magnetic

Deflection Angles (Approx.)

Diagonal. 90°

Horizontal. 79°

Vertical. 63°

Direct Interelectrode Capacitances (Approx.)

Grid No. 1 of any gun to all other electrodes 6 pF

Grid No. 2 to all other electrodes 6.5 pF

All cathodes to all other electrodes 15 pF

External conductive coating to grid (2500 max pF
2000 min pF)

OPTICAL

Faceplate and Protective Window Filterglass

Light transmission (Approx.) 41%

Surface of Protective Window. Treated to minimize
specular reflection

Screen, on Inner Surface of Faceplate

Type. Aluminized, Tricolor, Phosphor-Dot

Phosphor (Three separate
triangular groups) P22—New Rare-Earth (Red),
Sulfide (Blue & Green) Type

Fluorescence of phosphor (each of
separate phosphor, respectively Red, Blue, Green

Persistence of group phosphor Medium Short

Dot arrangement Each triangular group consists of
a red, green, and blue dot

Spacing between centers of
adjacent dot trio (Approx.) 0.025 in (0.64 mm)



MECHANICAL

Tube Dimensions

Overall length	19.204 ± .375 in (487.8 ± 9.5 mm)
Heck length	6.693 ± .188 in (170.0 ± 4.8 mm)
Diagonal	21.721 ± .093 in (551.7 ± 2.4 mm)
Grid-to-cathode height	18.976 ± .093 in (482.0 ± 2.4 mm)
Grid-to-anode height	15.236 ± .093 in (387.0 ± 2.4 mm)

Minimum Screen Dimensions (Projected)

Overall length	20.233 in (513.9 mm)
Grid-to-cathode height	17.446 in (443.1 mm)
Grid-to-anode height	13.640 in (346.5 mm)
Area	.227 sq. in (1465 sq. cm)

Bulb Funnel Designation JEDEC No. J173-1/2 A1A

Bulb Panel Designation JEDEC No. FP173-3/4 B2

Protective Window Designation JEDEC No. FP172-1/2

Bulb Contact Designation Recessed Small Cavity Cap
(JEDEC No. J1-21)

Pin Position Alignment Pin No. 12 Aligns Approx.
with Anode Bulb Contact

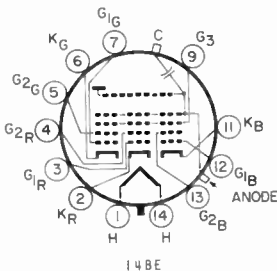
Operating Position Anode Bulb Contact on Top

Weight (Approx.) 32.5 lb (14.8 kg)

Base Small-Button Diheptar 12-pin (JEDEC No. B12-244)

TERMINAL DIAGRAM (Bottom View)

Pin 1 - Cathode
Pin 2 - Grid No. 2 (Focusing Electrode)
Pin 3 - Grid No. 1 (Control Grid)
Pin 4 - Grid No. 3 (Focusing Electrode)
Pin 5 - Grid No. 2 (Focusing Electrode)
Pin 6 - Grid No. 1 (Control Grid)
Pin 7 - Grid No. 1 (Control Grid)
Pin 8 - Anode
Pin 9 - Grid No. 3 (Focusing Electrode)
Pin 10 - Grid No. 2 (Focusing Electrode)
Pin 11 - Grid No. 1 (Control Grid)
Pin 12 - Anode
Pin 13 - Grid No. 2 (Focusing Electrode)
Pin 14 - Grid No. 1 (Control Grid)



MAXIMUM AND MINIMUM RATINGS. DESIGN-MAXIMUM VALUES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

Anode Voltage	27,500 max V
	20,000 min V
Typical Anode Current, Long-Term Average	1000 max A
Grid-No.3 (Focusing Electrode) Voltage	6000 max V
Peak Grid-No.2 Voltage, Including Video Signal Voltage	1000 max V



Grid-No.1 Voltage

Negative bias value	400 max	V
Negative operating cutoff value	200 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V

Heater Voltage (AC or DC)

Under operating conditions ^a	{ 6.9 max 5.7 min	V V
Under standby conditions ^b . . . . .			5.5 max	V

Peak Heater-Cathode Voltage

Heater positive with respect to cathode:		
During equipment warm-up period:		
not exceeding 10 seconds	450 max	V
After equipment warm-up period:		
combined AC and DC value	200 max	V
DC component value	200 max	V
Heater positive with respect to cathode:		
AC component value	200 max	V
DC component value	0 max	V

EQUIPMENT DESIGN RANGES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 20,000 and 27,500 V

Grid-No.3 (Focusing Electrode) Voltage.16.8% to 20%
of anode volts

Grid-No.2 and Grid-No.1 Voltages.See accompanying
For visual extinction of *Cutoff Design Chart*
focused spot

Maximum Ratio of Grid-No.2 Voltages 1.86
highest gun to lowest gun in any
tube (At grid-No.1 spot cutoff
voltage of -100 volts)

Grid-No.3 Current (Total) -45 to +15 μ A

Grid-No.2 Current -5 to +5 μ A

To Produce White 9300°K + 27 M.P.C.D.
(CIE Coordinates $x = 0.281, y = 0.311$)

Percentage of total anode
current supplied by each

	Red	Blue	Green	
gun (Average)	34	32	34	%

Ratio of cathode current:

	Min	Typ	Max
Red/blue	0.75	1.10	1.50
Red/green	0.65	1.00	1.50
Blue/green	0.60	0.91	1.30

Displacements, Measured at Center of Screen

Ratio centering displacement:	
Horizontal	± 0.47 in (± 11.9 mm)
Vertical	± 0.45 in (± 11.4 mm)
Lateral distance between the blue beam and the converged red and green beam	
	± 0.25 in (± 6.4 mm)
Radial convergence displacement excluding effect of dynamic convergence (each beam)	
	$+0.37$ in (± 9.4 mm)



Maximum Required Correction for
Register^c (Including Effect of
Earth's Magnet Field when
Using Recommended Components)

Maximum correction for 0.005 in (0.13 mm) max

EXAMPLES OF USE OF DESIGN RANGES

Unless otherwise specified, voltage values are for each gun and are positive with respect to cathode

Anode Voltage	25,000	V
Grid-No.3 (Focusing Electrode) Voltage.	4200 to 5000	V
Grid-No.2 Voltage when circuit design utilizes grid-No.1 voltage of -150 volts for visual extinction of focused spot.	285 to 685	V
Grid-No.1 Voltage for visual extinction of focused spot when circuit design utilizes grid-No.2 voltage of 400 volts	-95 to -190	V
Heater Voltage		
500-ohm filament voltage a	6.3	V
100-ohm filament voltage	5.0	V

LIMITING CIRCUIT VALUES

High-Voltage Circuits

Grid-No.3 circuit resistance. 7.5 max M Ω

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the high-voltage power supply and the grid-No.3 power supply be of the limited-energy type, in which the short-circuit current does not exceed 20 mA.

Low-Voltage Circuits

Effective grid-No.1-to-cathode-circuit resistance (Each gun). 0.75 max M Ω

The low-voltage circuits, including all heater circuits, should be analyzed by assuming the color picture tube heater is connected directly to the receiver chassis ground. Under these conditions the circuits to the elements of all tubes, including the color picture tube, operating from the same heater winding and all connections of any other circuits to the heater winding should each have an impedance such that their respective power sources in combination will not supply a continuous short circuit current of more than 750 mA total in the assumed picture tube heater ground connection. The leads from all other circuits must be separated from the picture tube leads by a minimum distance of 0.25 inch (6.4 mm) to prevent energy transfer to the picture tube circuits. Such current limitation will help prevent picture tube damage in case of momentary cascade arcing.



- a For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts. The series impedance to any chassis connection in the DC biasing circuit for the heater should be between 100,000 ohms and 1 megohm.
- b For curve, see JEDEC document E22-1, *Electron-Beam Deflection Tubes*, (Page 5 of 6) at front of this section.
- c For "instant on" applications, a maximum heater voltage of 5.5 volts (design-maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.
- d Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

GENERAL CONSIDERATIONS

X-Radiation Warning. Because the 22JP22 is designed to be operated at anode voltages as high as 27.5 kilovolts (design-maximum value), shielding of the 22JP22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

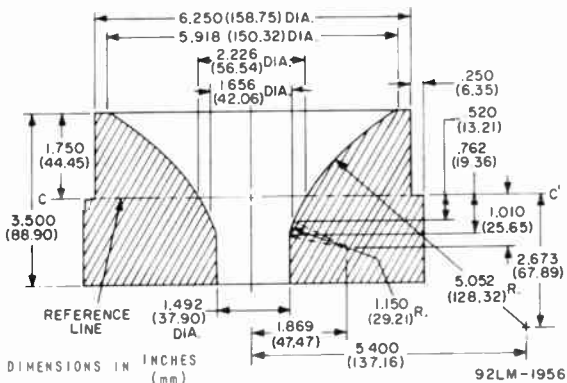
Orientation. The 22JP22 must be operated with tube axis in a horizontal position and with the blue gun uppermost (i.e., the anode contact button on top).

The Deflecting Yoke and tube axes must coincide and the yoke must be free to move along the neck for a distance of approximately 0.5 inch (13 mm) from its most forward position for adjustment purposes. The yoke mount should also provide for a small amount of rotational adjustment.

Contact to the external conductive coating should be made by multiple fingers to prevent possible damage to the tube from localized overheating due to poor contact.

Misregister Compensation. Proper operation of the 22JP22 requires compensation for the effects of extraneous magnetic fields, the earth's magnetic field, and other causes which may produce misregister. Compensation for these effects may be accomplished by the use of a purifying magnet.

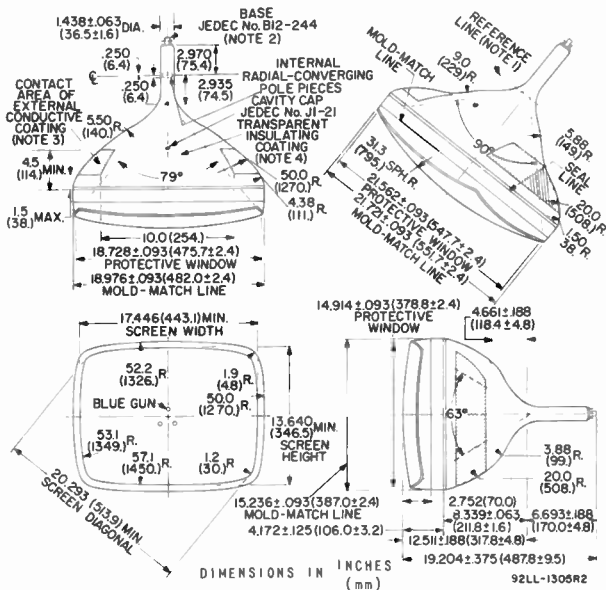
REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE JEDEC No. G162



Reference line is determined by plane C-C' when gauge is seated.



DIMENSIONAL OUTLINE



Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge and with tube seated in gauge, the reference line is determined by the intersection on the plane C-C' of the gauge with the glass funnel.

Note 2: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.

Note 3: The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

Note 4: To clean this area, wipe only with soft, dry, lintless cloth.

LOCATION OF RADIAL-CONVERGING POLE PIECES
VIEWED FROM SCREEN END OF GUNS

for type 22JP22 is the same as that shown for type 25XP22



Typical Light-Output Characteristic

HEATER VOLTAGE : 6.3 VOLTS
 ANODE-TO-CATHODE VOLTAGE : 25000 VOLTS
 GRID-No.3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
 DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE
 CURRENT TO PRODUCE 9300° K+27 M.C.P.D. WHITE-LIGHT OUTPUT.
 PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN
 TO PRODUCE 9300° K+27 M.P.C.D. WHITE:

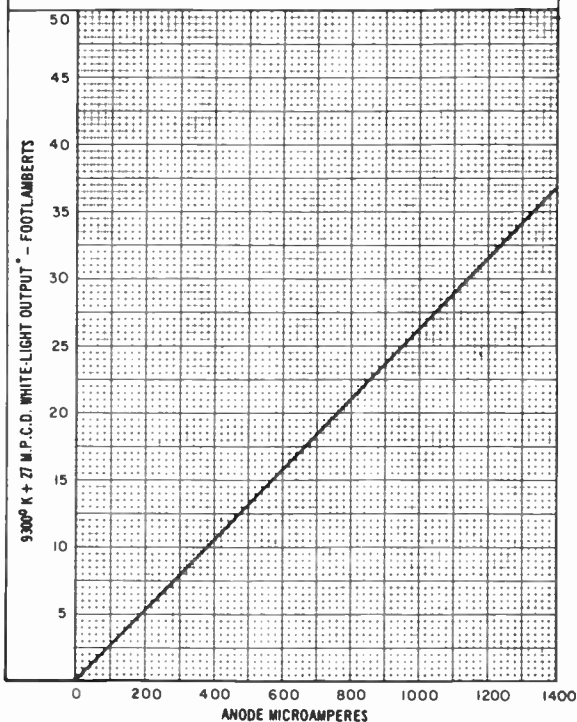
RED GUN : 34%

BLUE GUN : 32%

GREEN GUN : 34%

RASTER SIZE: 17.446" X 13.640" (443.1 mm X 346.5 mm)

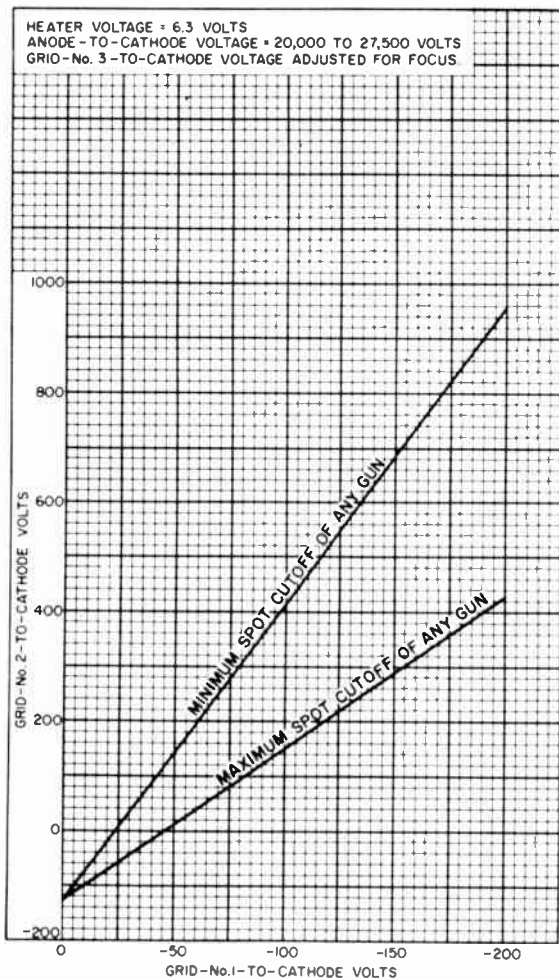
* MEASURED WITHIN 4" - DIAMETER AREA CENTERED ON TUBE FACE.



92LM-1989



Cutoff Design Chart

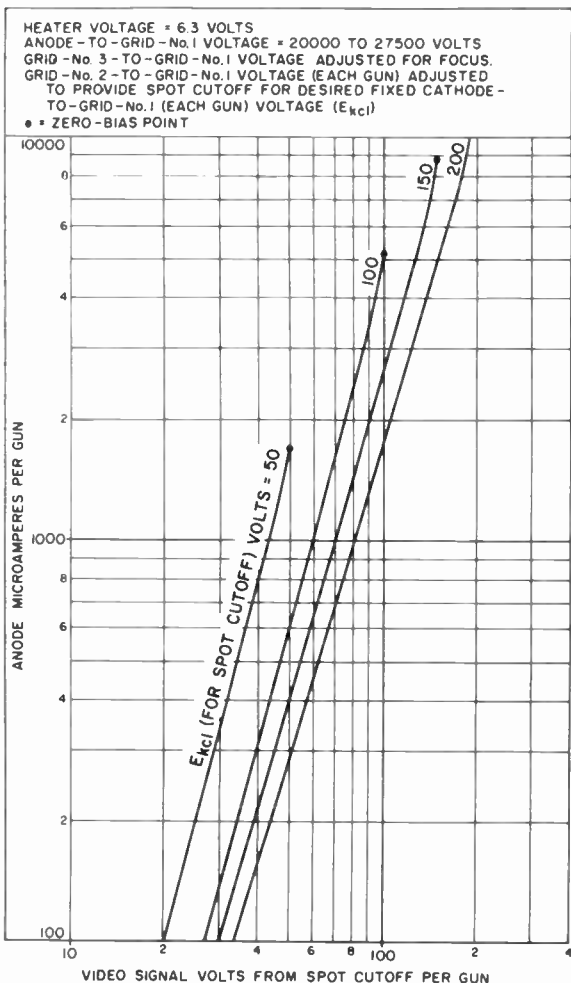


92CM-12803



Typical Drive Characteristics

Cathode-Drive Service



92CM-12806



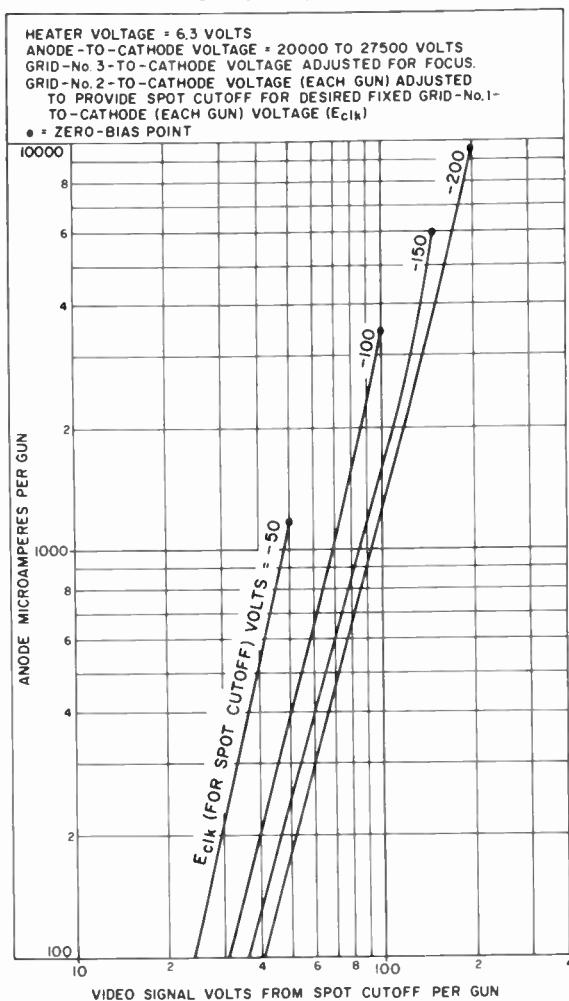
RADIO CORPORATION OF AMERICA
 Electronic Components and Devices

Harrison, N. J.

CAT. 5
 4-67

Typical Drive Characteristics

Grid-Drive Service



92CM-12807



Color Picture Tube

"PERMA-CHROME" ASSEMBLY FOR OPTIMUM FIELD PURITY AND UNIFORMITY DURING WARM-UP

RECTANGULAR TUBE 90° MAGNETIC DEFLECTION
 ALUMINIZED TRICOLOR PHOSPHOR-DOT "Hi-Lite" SCREEN
 (Utilizing an Improved Rare-Earth Red-Emitting Phosphor)
 MAGNETIC CONVERGENCE 3 ELECTROSTATIC-FOCUS GUNS

For Use in Color-TV Receivers

The 22KP22 is the same as the 22JP22 except for the following items:

OPTICAL

Faceplate **Filterglass**
 Light transmission (Approx.) **69%**
 Faceplate does not have an integral protective window.^a

MECHANICAL

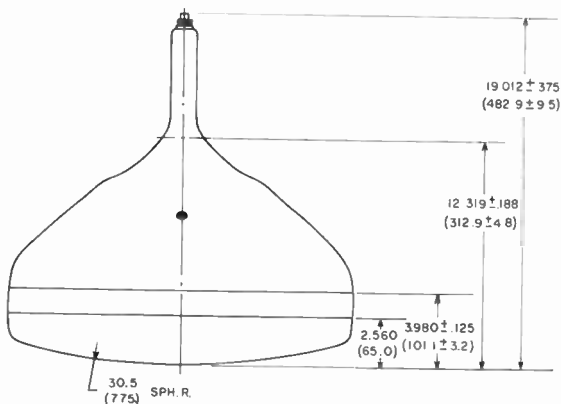
Tube Dimensions

Overall length **19.012 ± .375 in (482.9 ± 9.5 mm)**
 Weight (Approx.) **28 lb (12.7 kg)**

^a It is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of the 22KP22 to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide x-radiation protection when required.

DIMENSIONAL OUTLINE

Dimensions shown are only those which are different from the corresponding dimensions for the 22JP22



DIMENSIONS IN INCHES (mm)

92LS-1299RI



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

DATA
 4-67

Typical Light-Output Characteristic

HEATER VOLTAGE = 6.3 VOLTS

ANODE-TO-CATHODE VOLTAGE = 25000 VOLTS

GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS

DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE

CURRENT TO PRODUCE 9300° K + 27 M.P.C.D. WHITE-LIGHT OUTPUT.

PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN

TO PRODUCE 9300° K + 27 M.P.C.D. WHITE:

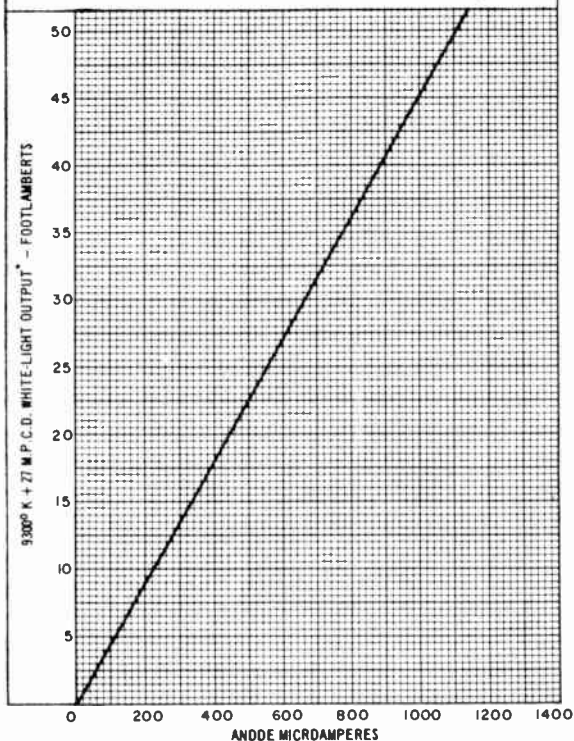
RED GUN : 34%

BLUE GUN : 32%

GREEN GUN : 34%

RASTER SIZE: 17.446" X 13.640" (443.1 mm X 346.5 mm)

*MEASURED WITHIN 4" - DIAMETER AREA CENTERED ON TUBE FACE.



92LM-1961



Color Picture Tube

Perma-Chrome Banded-Type Implosion Protection
 90° Rectangular HI-LITE Screen
 New Rare-Earth (Red) Phosphor Unity Current Ratios

ELECTRICAL

Electron Guns, Three with Axes Tilted Toward Tube Axis	Red, Blue, Green
Heater, of Each Gun Series Connected within Tube with Each of the Other Two Heaters:	
Current at 6.3 V ^a	900 mA
Focusing Method	Electrostatic
Focus Lens	Bipotential
Convergence Method	Magnetic
Deflection Method	Magnetic
Deflection Angles (Approx.):	
Diagonal	90 deg.
Horizontal	79 deg.
Vertical	63 deg.
Direct Interelectrode Capacitances (Approx.):	
Grid No.1 of any gun to all other electrodes	6 pF
Grid No.3 to all other electrodes	6.5 pF
All cathodes to all other electrodes	15 pF
External conductive coating to anode (Approx.)	{ 2500 max. pF 2000 min. pF

OPTICAL

Faceplate	Filterglass
Light transmission at center (Approx.)	42%
Surface	Polished
Screen, on Inner Surface of Faceplate:	
Type	Aluminized, Tricolor, Phosphor-Dot
Phosphor (three separate phosphors, collectively) ^b	P22—New Rare-Earth (Red), Sulfide (Blue & Green) Type
Fluorescence and phosphorescence of separate phosphors, respectively	Red, Blue, Green
Persistence of group phosphorescence	Medium Short
Dot Arrangement	Triangular group consisting of red dot, blue dot, and green dot
Spacing between centers of adjacent dot trios (Approx.)	0.025 in (0.64 mm)

22UP22

MECHANICAL

Minimum Screen Area (Projected):	227 sq. in (1465 sq. cm)
Bulb Funnel Designation	JEDEC No. J173-1/2 A1A
Bulb Panel Designation	JEDEC No. FP173-3/4
Base	Small-Button Diheptar 12-pin
Pin Position Alignment	Pin No. 12 Aligns Approx. with Anode Bulb Contact
Operating Position	Anode Bulb Contact on Top
Weight (Approx.)	29 lb (13.3 kg)

MAXIMUM AND MINIMUM RATINGS, Design - Maximum Values

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

Anode Voltage	} 27,500 max. V 20,000 min. V
Total Anode Current, Long-Term Average		1000 max. $\mu$A
Grid-No.3 (Focusing Electrode) Voltage	6000 max. V
Peak Grid-No.2 Voltage, Including Video Signal Voltage	1000 max. V
Grid-No.1 Voltage:	
Negative bias value	400 max. V
Negative operating cutoff value	200 max. V
Positive bias value	0 max. V
Positive peak value	2 max. V
Heater Voltage (ac or dc):	
Under operating conditions ^a	} 6.9 max. V 5.7 min. V
Under standby conditions ^c		5.5 max. V
Peak Heater-Cathode Voltage:	
Heater negative with respect to cathode:	
During equipment warm-up period not exceeding 15 seconds	450 max. V
After equipment warm-up period:	
Combined AC and DC value	200 max. V
DC component value	200 max. V
Heater positive with respect to cathode:	
AC component value	200 max. V
DC component value	0 max. V

EQUIPMENT DESIGN RANGES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 20,000 and 27,500 V

Grid-No.3 (Focusing Electrode) Voltage	16.8% to 20% of Anode Voltage
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Grid-No.2 and Grid-No.1 Voltages for
Visual Extinction of Focused
Spot See *CUTOFF DESIGN CHART*

Maximum Ratio of Grid-No.2 Voltages,
Highest Gun to Lowest Gun in Any
Tube (At grid-No.1 spot cutoff
voltage of -100 V) 1.86

Heater Voltage:

Under operating conditions ^a	6.3	V
Under standby conditions ^c	5.0	V

Grid-No.3 Current (Total) -45 to +15 μ A

Grid-No.2 Current -5 to +5 μ A

To Produce White 9300^o K + 27 M.P.C.D.
(CIE Coordinates $x = 0.281$, $y = 0.311$):

Percentage of total anode current supplied by each gun (average)	Red	Blue	Green	
	34	32	34	%

Ratio of cathode currents:	Min.	Typ.	Max.
Red/blue	0.75	1.10	1.50
Red/green	0.65	1.00	1.50
Blue/green	0.60	0.91	1.30

Displacements, Measured at Center of Screen:

Raster centering displacement:

Horizontal ± 0.47 in (± 11.9 mm)

Vertical ± 0.45 in (± 11.4 mm)

Lateral distance between the
blue beam and the converged
red and green beams ± 0.25 in (± 6.4 mm)

Radial convergence displacement
excluding effects of dynamic
convergence (each beam) ± 0.37 in (± 9.4 mm)

Maximum Required Correction for
Register^d (Including Effect of
Earth's Magnetic Field when
Using Recommended Components)
as Measured at the center of the
Screen in any Direction 0.005 in (0.13 mm) max.

LIMITING CIRCUIT VALUES:

High-Voltage Circuits:

Grid-No.3 circuit resistance 7.5 max. M Ω

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the *high-voltage power supply* and the *grid-No.3 power supply* be of the limited-energy type, in which the short-circuit current does not exceed 20 mA.

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Low-Voltage Circuits:

Effective grid-No.1-to-cathode-circuit resistance (each gun) 0.75 max. MΩ

The low-voltage circuits, including all heater circuits, should be analyzed by assuming the color picture tube heater is connected directly to the receiver chassis ground. Under these conditions the circuits to the elements of all tubes, including the color picture tube, operating from the same heater winding and all connections of any other circuits to the heater winding should each have an impedance such that their respective power sources in combination will not supply a continuous short circuit current of more than 750 mA total in the assumed picture tube heater ground connection. The leads from all other circuits must be separated from the picture tube leads by a minimum distance of 0.25 inch (6.4 mm) to prevent energy transfer to the picture tube circuits. Such current limitation will help prevent picture tube damage in case of momentary cascade arcing.

- ° For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts. The series impedance to any chassis connection in the DC biasing circuit for the heater should be between 100,000 ohms and 1 megohm.
- b For curve, see *Group Phosphor-P22-New Rare Earth (Red), Sulfide (Blue & Green)* at front of this section.
- c For "instant on" applications, a maximum heater voltage of 5.5 volts (design-maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.
- d Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

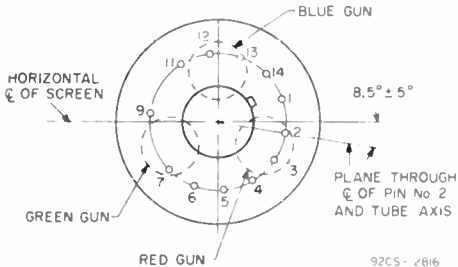
X-RADIATION WARNING

Because the 22UP22 is designed to be operated at anode voltages as high as 27.5 kilovolts (design-maximum value), shielding of the 22UP22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

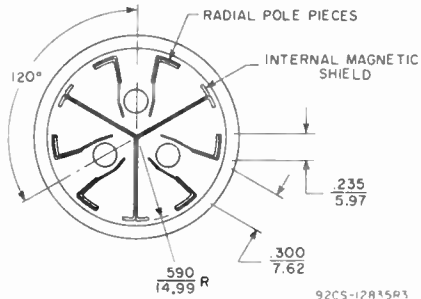
BASE SPECIFICATION - JEDEC No. 14BE

Pin 1: Heater	Pin 11: Cathode of Blue Gun
Pin 2: Cathode of Red Gun	Pin 12: Grid No.1 of Blue Gun
Pin 3: Grid No.1 of Red Gun	Pin 13: Grid No.2 of Blue Gun
Pin 4: Grid No.2 of Red Gun	Pin 14: Heater
Pin 5: Grid No.2 of Green Gun	Cap: Anode (Grid No.4, Screen, Collector)
Pin 6: Cathode of Green Gun	C: External Conductive Coating
Pin 7: Grid No.1 of Green Gun	
Pin 9: Grid No.3	

BOTTOM VIEW OF BASE



LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS

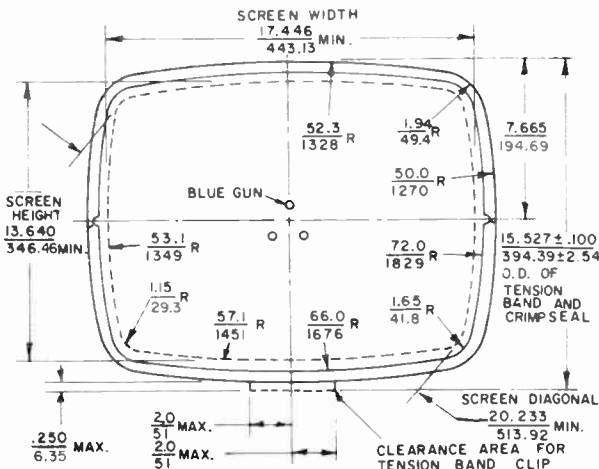
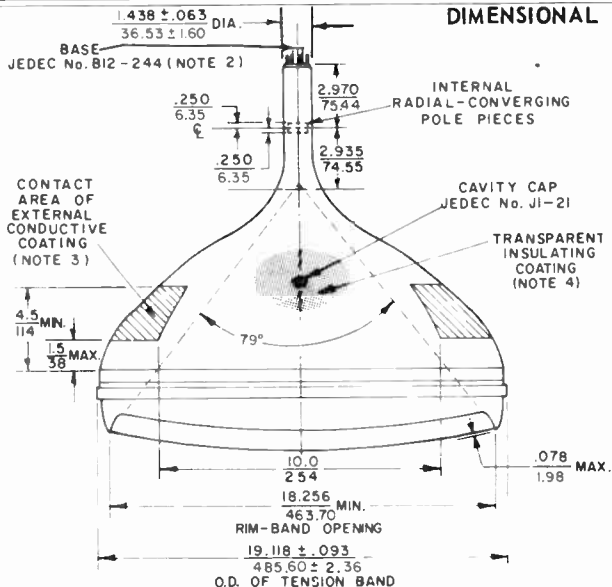


NOTES FOR DIMENSIONAL OUTLINE

- Note 1:** With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge JEDEC No.G162 and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C' of the gauge with the glass funnel.
- Note 2:** Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.
- Note 3:** The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.
- Note 4:** To clean this area, wipe only with soft, dry, lintless cloth.

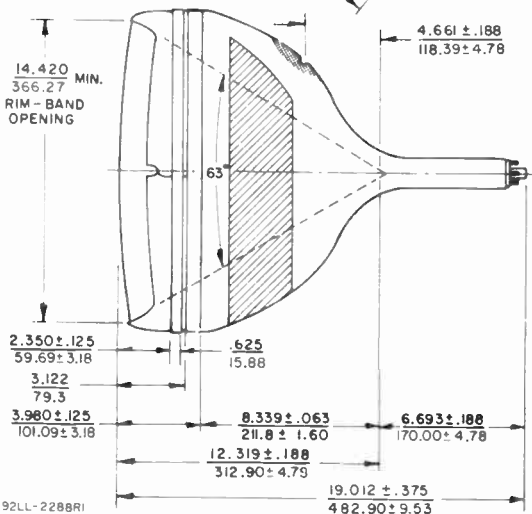
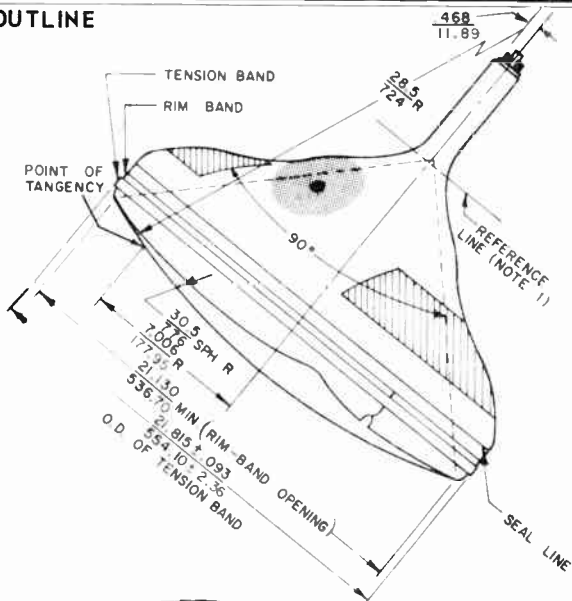
22UP22

DIMENSIONAL



Dimensions in Inches/mm

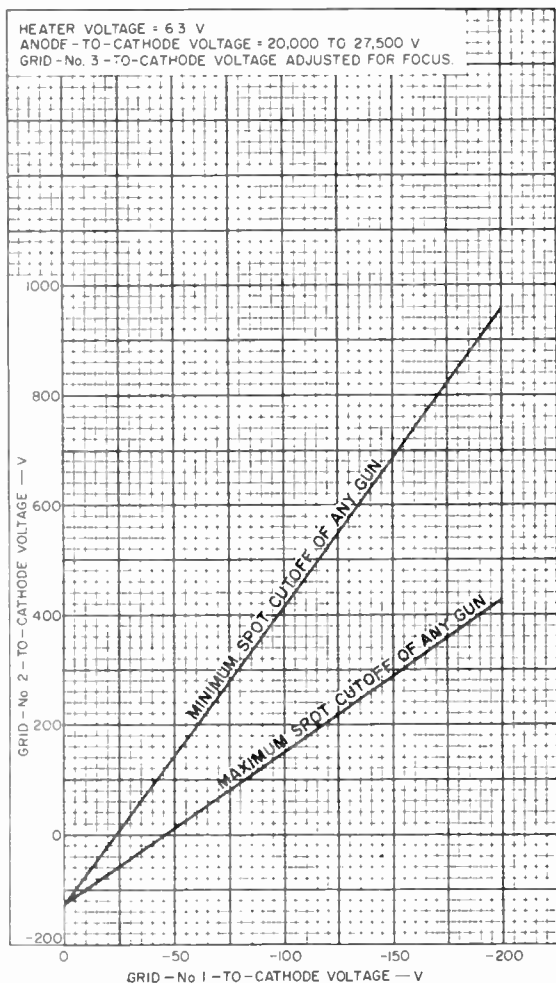
OUTLINE



92LL-2288RI

22UP22

CUTOFF DESIGN CHART



92CM-12803R1

Color Picture Tube

Perma-Chrome Banded-Type Implosion Protection
 90° Rectangular HI-LITE Screen
 New Rare-Earth (Red) Phosphor Unity Current Ratios

This data sheet is to be used in
 conjunction with data for RCA-22UP22.

For general data, maximum and minimum ratings, equipment design ranges, limiting circuit values, x-radiation warning, and base specification of the 22WP22, refer to the 22UP22 except as noted below.

MECHANICAL

Tube Dimensions (excluding mounting lugs):

Diagonal 21.971 ± .093 in (558.06 ± 2.36 mm)

Greatest

Width 19.118 ± .093 in (485.60 ± 2.36 mm)

Greatest Height (including tension-

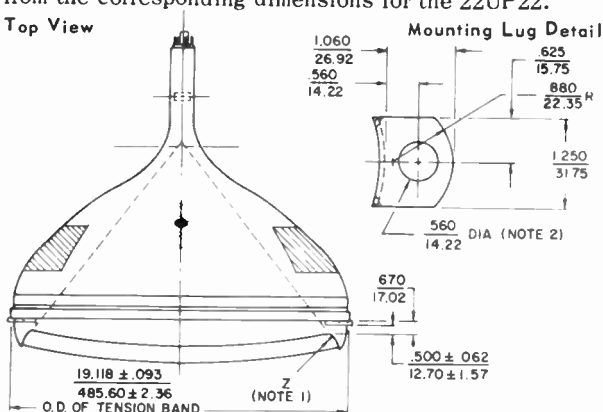
band clip) 15.527 ± .100 in (394.39 ± 2.54 mm)

Weight (Approx.) 29 lb (13.3 kg)

DIMENSIONAL OUTLINE

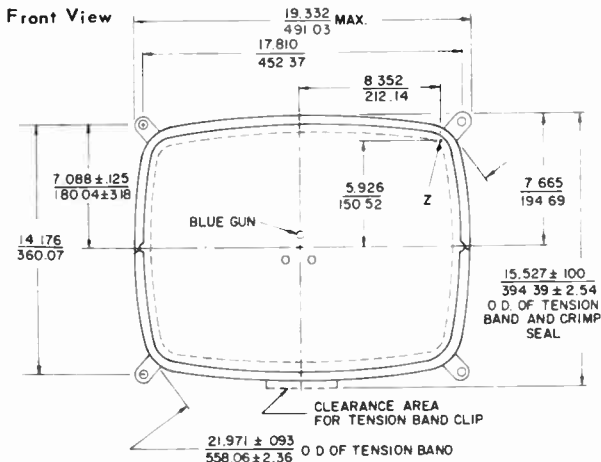
Dimensions shown are only those which are different from the corresponding dimensions for the 22UP22.

Top View

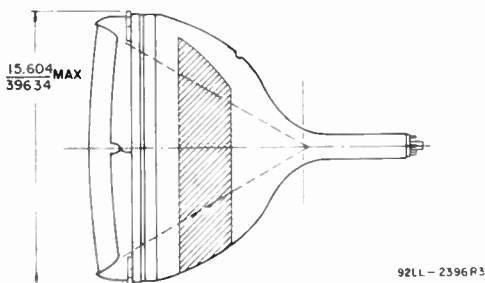


22WP22

DIMENSIONAL OUTLINE (Cont'd)



Front Side View



Dimensions in $\frac{\text{Inches}}{\text{mm}}$ unless otherwise noted

Note 1: "Z" is located on the outside surface of the faceplate, on the screen diagonal at a point .125" beyond the minimum screen. This point is used as a reference for the mounting lugs.

Note 2: The tolerance of the mounting lug holes will accommodate mounting screws up to 0.375 in (9.5 mm) in diameter when positioned on the true hole centers.

Picture Tube

**RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS**

**ALUMINIZED SCREEN
MAGNETIC DEFLECTION**

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts	600 ± 30	ma
Heater Warm-Up Time (Average)	11	seconds
Focusing Method	Electrostatic	
Deflection Method	Magnetic	
Deflection Anodes (Approx.):		
Diagonal		92°
Horizontal		80°
Vertical		65°
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	μf
Cathode to all other electrodes	5	μf
External conductive coating to ultor.	{ 2500 max.	μf
	{ 1700 min.	μf
Electron Gun	Type Requiring No Ion-Trap Magnet	

Optical:

Faceplate	Filterglass
Light transmission at center (Approx.)	78%
Phosphor (For Curves, see front of this Section)	P4—Sulfide Type Aluminized
Fluorescence	White
Phosphorescence	White
Persistence	Medium Short

Mechanical:

Tube Dimensions:	
Overall length	18" ± 3/8"
Greatest width	20-1/2" + 1/16" - 1/8"
Greatest height	16-1/2" ± 1/8"
Diagonal	23-25/64" + 3/32" - 1/8"
Neck length	5-1/2" ± 3/16"
Curvature of faceplate (Radii):	
Center	50"
Edge	36-3/4"
Screen Dimensions (Minimum):	
Greatest width	19-1/4"
Greatest height	15-1/8"
Diagonal	22-5/16"
Projected area	282 sq. in.
Weight (Approx.)	25 lbs
Operating Position	Any
Cap	Recessed Small Cavity (JEDEC No. J1-21)
Bulb	J187C1

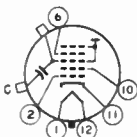


23AHP4

Base. Short Small-Shell Duodecal r Pin
(JEDEC Group 4, BC 203)

Basing Designation for BOTTOM VIEW. 12L

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 6 - Grid No.4
- Pin 10 - Grid No.2
- Pin 11 - Cathode
- Pin 12 - Heater



- Can - Ultor
(Grid No.3,
Grid No.5,
Collector)
- C - External
Conductive
Coating

GRID-DRIVE^A SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR VOLTAGE	{ 22000 max. volts 11000 min. volts
GRID-No.4 (FOCUSING) VOLTAGE:	
Positive value.	1100 max. volts
Negative value.	550 max. volts
GRID-No.2 VOLTAGE	{ 550 max. volts 200 min. volts
GRID-No.1 VOLTAGE:	
Negative-peak value	220 max. volts
Negative-bias value	154 max. volts
Positive-bias value	0 max. volts
Positive-peak value	2 max. volts
HEATER VOLTAGE.	{ 6.9 max. volts 5.7 min. volts
PEAK HEATER-CATHODE VOLTAGE:	
Heater negative with respect to cathode:	
During equipment warm-up period not exceeding 15 seconds.	450 max. volts
After equipment warm-up period.	200 max. volts
Heater positive with respect to cathode.	200 max. volts

Typical Operating Conditions:

With ultor voltage (E_{c5k}) of	18000	volts
and grid-No.2 voltage (E_{c2k}) of	400	volts
Grid-No.4 Voltage for focus	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster*	-36 to -94	volts
Field Strength of Adjustable Centering Magnet [†]	0 to 11	gausses

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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CATHODE-DRIVE[▲] SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR (0-GRID No. 1) VOLTAGE	{ 22000 max. volts 11000 min. volts
GRID No. 4-TO GRID No. 1 (FOCUSING) VOLTAGE:	
Positive value	400 max. volts
Negative value	400 max. volts
GRID-No. 2-TO-GRID-No. 1 VOLTAGE	{ 70 max. volts 100 min. volts
GRID-No. 1-TO-CATHODE VOLTAGE	100 max. volts
CATHODE-TO-GRID-No. 1 VOLTAGE:	
Positive-peak value	220 max. volts
Positive-trim value	24 max. volts
Negative-trim value	0 max. volts
Negative-peak value	2 max. volts
HEATER VOLTAGE	{ 6.9 max. volts 5.7 min. volts
PEAK HEATER-CATHODE VOLTAGE:	
Heater positive with respect to cathode:	
During equipment warm-up period not exceeding 15 seconds	450 max. volts
After equipment warm-up period	200 max. volts
Heater positive with respect to cathode	200 max. volts

Typical Operating Conditions:

With ultor-to-grid-No. 1 voltage (E_{c1g1}) of	1800	volts
and grid-No. 2-to-grid No. 1 voltage (E_{c2g1}) of	400	volts
Grid-No. 4-to Grid No. 1 Voltage for focus	0 to 400	volts
Cathode-to Grid-No. 1 Voltage for visual extinction of focused raster	36 to 78	volts
Field Strength of Adjustable Centering Magnet	0 to 11	gausses

Maximum Circuit Values:

Grid-No. 1-Circuit Resistance 1.5 max. megohms

- ▲ Grid drive is the operating condition in which the video signal varies the grid-No. 1 potential with respect to cathode.
- The grid-No. 4 (or grid-No. 4-to-grid-No. 1) voltage required for optimum focus of any individual tube will have a value anywhere between 0 and 400 volts, is independent of ultor current and will remain essentially constant for values of ultor (or ultor-to-grid-No. 1) voltage or grid-No. 2 (or grid-No. 2-to-grid-No. 1) voltage within design-maximum ratings shown for these items.
- * See Raster-Cutoff-Range Chart for Grid-Drive Service.
- ◆ Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/4". The specified centering magnet compensates only for the effect which mechanical tube tolerances may have on the location of the undeflected focused spot with respect to the center of the tube



23AHP4

face. Maximum field strength of adjustable centering magnet equals:

$$\sqrt{\frac{E_{C5K} \text{ or } E_{C5G1} \text{ (volts)}}{16000 \text{ (volts)}}} \times 10 \text{ gauss}$$

The equipment manufacturer must determine and supply additional compensation for the effects of the earth's magnetic field and extraneous fields due to choice of circuitry and components. The additional compensation should preferably be applied as part of the magnetic field of the deflecting yoke.

- Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.
- See *Raster-Cutoff-Range Chart for Cathode-Drive Service.*

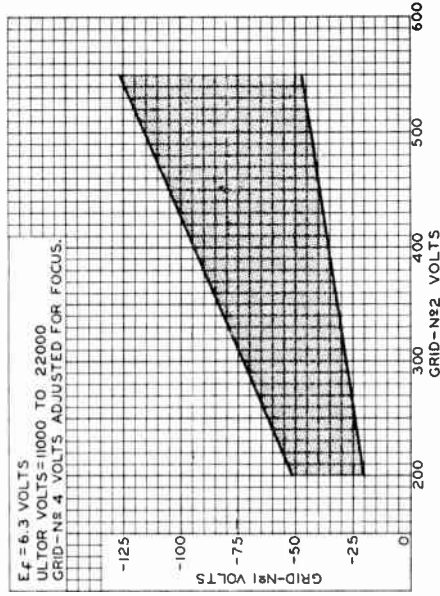
OPERATING CONSIDERATIONS

X-Ray Warning. When operated at ultra voltages up to 22 kilovolts, this picture tube does not produce any harmful X-ray radiation. However, because the rating of this type permits operation at voltages as high as 22 kilovolts (Design maximum value), shielding of this picture tube for X-ray radiation may be needed to protect against possible injury from prolonged exposure at close range whenever the operating conditions involve voltages in excess of 16 kilovolts.

Shatter-Proof Cover Over the Tube Face. Following conventional picture tube practice, it is recommended that the cabinet be provided with a shatterproof, glass cover over the face of this picture tube to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.

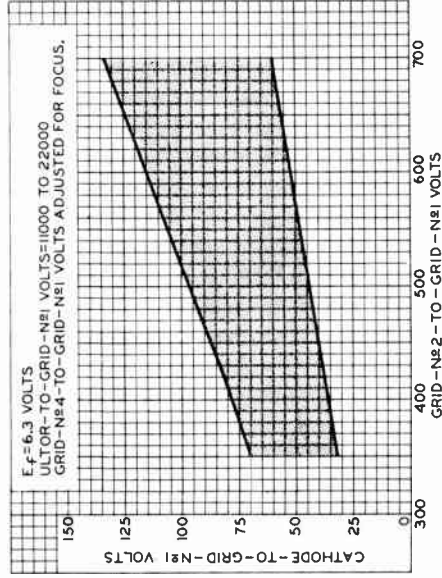


RASTER-CUTOFF-RANGE CHARTS Grid-Drive Service



92CS-10620RI

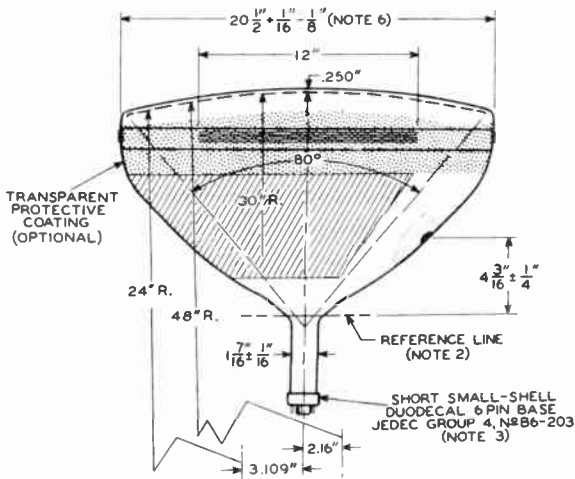
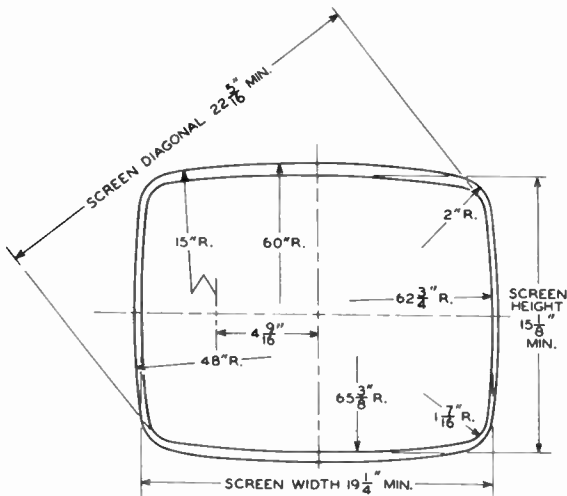
Cathode-Drive Service

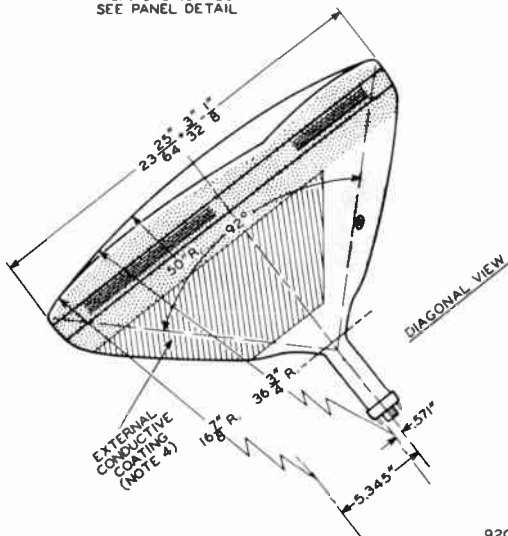
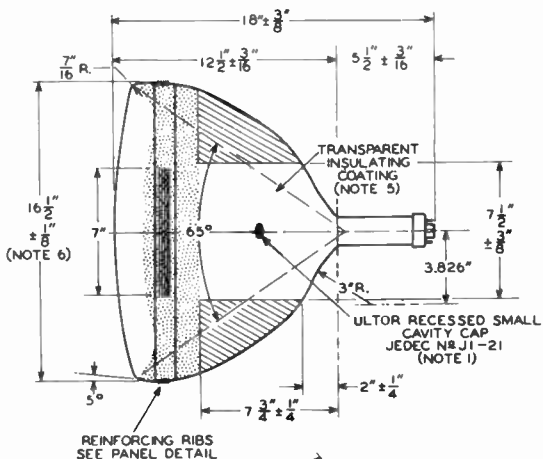


92CS-10625



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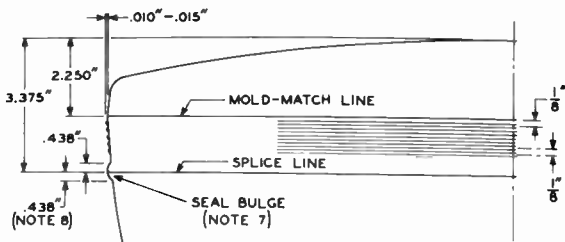




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23AHP4



DETAIL OF PANEL

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 30^\circ$. ULTOR TERMINAL IS ON SAME SIDE AS PIN 6.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No. G-116 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF $2-3/4''$.

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

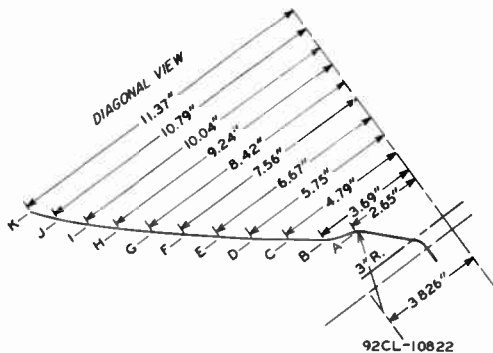
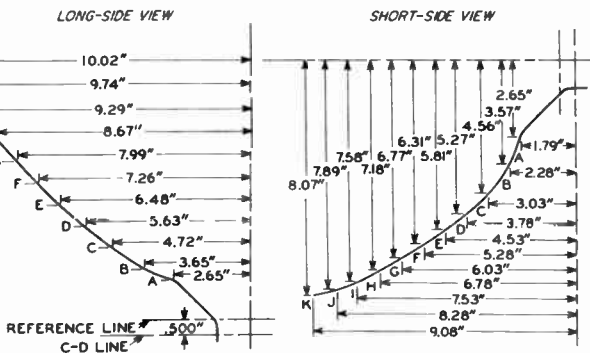
NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

NOTE 6: MEASURED AT THE MOLD-MATCH LINE.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN $1/8''$, BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN $1/16''$ BEYOND THE ENVELOPE SURFACE AT THE LOCATION SPECIFIED FOR DIMENSIONING THE ENVELOPE WIDTH, DIAGONAL, AND HEIGHT.

NOTE 8: AREA BETWEEN MOLD-MATCH LINE AND SEAL BULGE IS $1/2''$ MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF TUBE SUPPORT BAND. SUPPORTS MUST BE SPACED FROM THE TUBE BY THE USE OF CUSHIONING PADS MADE OF ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.

BULB-CONTOUR DIMENSIONS



NOTE: PLANES A THRU K ARE NORMAL TO THE TUBE AXIS AND AT FIXED LOCATIONS FROM THE C-D LINE. THESE COORDINATES DESCRIBE THE BULB EXTERNAL CONTOUR IN PLANES THROUGH THE TUBE AXIS AND THE RESPECTIVE FACEPLATE AXES.





Picture Tube

NO ION-TRAP MAGNET REQUIRED
 LOW-VOLTAGE ELECTROSTATIC FOCUS 110° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances

Cathode to all other electrode	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode	2500 max 1700 min	pF
		pF
Heater Current at 6.3 V.	600 ± 30	mA
Heater Warm-up Time (Average).	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

Phosphor	P4—Sulfide Type, Aluminized
For curves, see front of this section	
Faceplate.	Filterglass
Light transmission (Approx.)	76%

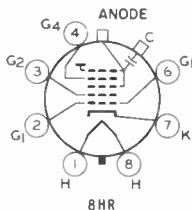
MECHANICAL

Weight (Approx.)	25 lb
Overall Length	14.875 ± 0.281 in
Neck Length.	5.125 ± 0.125 in
Projected Area of Screen	282 sq in
External Conductive Coating	
Type	Regular-Band
Contact area for grounding	Near Reference Line
For Additional Information on Coatings and Dimensions	
See <i>Picture-Tube Dimensional-Outlines</i> and <i>Bulb J187 E</i> sheets at front of this section	

Cap.	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1 (JEDEC No. B7-208)

TERMINAL DIAGRAM (Bottom View)

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 3—Grid No.2
- Pin 4—Grid No.4
- Pin 6—Grid No.1
- Pin 7—Cathode
- Pin 8—Heater
- Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)
- C—External Conductive Coating



23ARP4

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

*Unless otherwise specified, voltage values
are positive with respect to cathode*

Anode Voltage.	{ 22000 max 12000 min	V V
Grid-No.4 (Focusing) Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage.	{ 550 max 200 min	V V
Grid-No.1 Voltage		
Negative peak value.	220 max	V
Negative bias value.	155 max	V
Positive bias value.	0 max	V
Positive peak value.	2 max	V
Heater Voltage	{ 6.9 max 5.7 min	V V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max	V
After equipment warm-up period	200 max	V
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

*Unless otherwise specified, voltage values
are positive with respect to grid No.1*

Anode Voltage.	16000	V
Grid-No.4 Voltage.	0 to 400	V
Grid-No.2 Voltage.	400	V
Cathode Voltage.	43 to 78	V

For visual extinction of focused raster

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ
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Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

The 23ASP4 is the same as the 23AHP4 except for the following items:

Mechanical:

Tube Dimensions:

Overall length 1" \pm 3/8"
Neck length. 4-1/2" \pm 3/16"





23BDP4

Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
92° MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

The 23BDP4 is the same as the 23YP4 except for the following item:

Optical:

Surface of Protective Panel Treated to reduce specular reflection



RADIO CORPORATION OF AMERICA
Electron Tube Division

Harrison, N. J.

DATA
1-63



23BJP4

Picture Tube

RECTANGULAR GLASS TYPE
 LOW-VOLTAGE ELECTROSTATIC FOCUS
 LOW GRID-No.2 VOLTAGE

ALUMINIZED SCREEN
 92° MAGNETIC DEFLECTION
 CATHODE-DRIVE TYPE

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts.	600 ± 30	ma
Heater Warm-Up Time (Average).	11	seconds
Direct Inter-electrode Capacitances:		
Grid No.1 to all other electrodes.	0	μf
Cathode to all other electrodes.	5	μf
External conductive coating to ultor.	{ 2500 max. 1700 min.	{ μf μf
Electron Gun	Type Requiring No Ion-Trap Magnet	

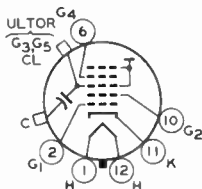
Optical:

Faceplate.	Filterglass
Light transmission (approx.)	78%
Phosphor (For Curve, see front of this Section)	P4—Sulfide Type, Aluminized

Mechanical:

Operating Position	Any
Weight (approx.)	25 lbs
Overall Length	18-1/8" ± 3/8"
Neck Length.	5-5/8" ± 3/16"
Projected Area of screen	282 sq. in.
External Conductive Coating:	
Type	Regular Band
Contact area for grounding	Near Reference Line
For Additional Information on Coatings and Dimensions: see <i>Picture-Tube Dimensional-Outlines</i> and <i>Bulb J187 C/F</i> sheets at the front of this section	
Cap.	Recessed Small Cavity (JEDEC No. J1-21)
Base	Short Small-shell Duodecal 6-Pin (JEDEC Group 4, No. B6-203)
Basing Designation for BOTTOM VIEW	12L

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 6—Grid No.4
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater



- Cap—Ultor
 (Grid No.3,
 Grid No.5,
 Collector)
- C—External
 Conductive
 Coating



23BJP4

Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR-TO-GRID-No.1 VOLTAGE.	{ 25000 max. 11000 min.	volts volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value.	1250 max.	volts
Negative value.	450 max.	volts
GRID-No.2 TO-GRID-No.1 VOLTAGE.	{ 225 max. 40 min.	volts volts
GRID-No.2-TO-CATHODE VOLTAGE.	70 max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive peak value	220 max.	volts
Positive bias value	154 max.	volts
Negative bias value	0 max.	volts
Negative peak value	2 max.	volts
HEATER VOLTAGE.	{ 6.9 max. 5.7 min.	volts volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Typical Operating Conditions:

With ultor-to-grid No.1 voltage of	20000	volts
and grid-No.2-to-grid-No.1 voltage of	50	volts
Grid-No.4-to-Grid-No.1 Voltage for focus.	0 to 400	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster.	36 to 54	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



23BKP4

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

ULTOR-TO-GRID-No.1 VOLTAGE.	{ 25000 max. volts	
	{ 15000 min. volts	
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value.	1250 max. volts	
Negative value.	400 max. volts	
GRID-No.2-TO-GRID-No.1 VOLTAGE.	{ 225 max. volts	
	{ 40 min. volts	
	{ 70 max. volts	
GRID-No.2 TO-CATHODE VOLTAGE.		
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive peak value	220 max. volts	
Positive bias value	154 max. volts	
Negative bias value	0 max. volts	
Negative peak value	2 max. volts	
HEATER VOLTAGE.	{ 6.9 max. volts	
	{ 5.7 min. volts	
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds.	450 max. volts	
After equipment warm-up period.	200 max. volts	
Heater positive with respect to cathode.	200 max. volts	

Typical Operating Conditions:

<i>With ultor-to-grid-No.1 voltage of</i>	20000	volts
<i>and grid-No.2-to-grid-No.1 voltage of</i>	50	volts
Grid-No.4-to-Grid-No.1 Voltage for focus.	0 to 400	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster . .	36 to 54	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max. megohms	
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



23BQP4

Picture Tube

**BI-PANEL RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS**

**ALUMINIZED SCREEN
110° MAGNETIC DEFLECTION**

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts.	450 ± 5%	ma
Heater Warm-Up Time (Average).	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes. . .	6	μf
Cathode to all other electrodes. . . .	5	μf
External conductive coating to ultor .	2500 max. 2000 min.	μf
Electron Gun Type Requiring			No Ion-Trap Magnet

Optical:

Faceplate and Protective Panel	Filterglass
Light transmission (Approx.)	40%
Phosphor (For Curves, see front of this Section)	P4—Sulfide Type, Aluminized

Mechanical:

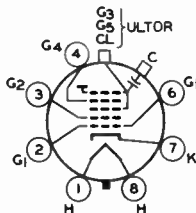
Operating Position	Any
Weight (Approx.)	32-1/2 lbs
Overall Length	15-3/16" ± 3/8"
Neck Length.	5-1/8" ± 1/8"
Projected Area of Screen	282 sq. in.
External Conductive Coating:	

Type Regular Band
 Contact area for grounding Near Reference Line
 For Additional Information on Coatings and Dimensions:

See *Picture-Tube Dimensional-Outlines* and *Bulb J187-A* sheets at the front of this section

Cap.	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1 (JEDEC No. B7-208)
Basing Designation for BOTTOM VIEW . . . . .	.8HR

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 3 - Grid No.2
- Pin 4 - Grid No.4
- Pin 6 - Grid No.1
- Pin 7 - Cathode
- Pin 8 - Heater



- Cap - Ultor
(Grid No.3,
Grid No.5,
Collector)
- C - External
Conductive
Coating



23BQP4

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

ULTOR VOLTAGE.	{ 23000 max. 12000 min.	volts volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
GRID-No.2 VOLTAGE.	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value.	220 max.	volts
Negative bias value.	154 max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With ultor voltage of	16000	volts
and grid-No.2 voltage of	300	volts
Grid-No.4 voltage for focus.	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster	-35 to -72	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



23BTP4

Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
92° MAGNETIC DEFLECTION

The 23BTP4 is the same as the 23YP4 except for the following item:

Maximum and Minimum Ratings, Design-Maximum Values:

Anode (Ultor) Voltage. { 25000 max. volts
15000 min. volts

23CBP4

Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
110° MAGNETIC DEFLECTION

The 23CBP4 is the same as the 23BQP4 except for the following item:

Optical:

Surface of Protective Panel. Treated to reduce specular reflection

23CGP4

Picture Tube

CONTROLLED HEATER WARM-UP TIME

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
92° MAGNETIC DEFLECTION

The 23CGP4 is the same as the 23AHP4 except for the following item:

Electrical:

Heater Current at 6.3 volts. 450 ± 20 ma





Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

DATA

General:

Heater, for Unipotential Cathode:

Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts.	0.6 ± 5%	amp
Warm-up time (Average).	11	sec

Direct interelectrode Capacitances:

Grid No.1 to all other electrodes . . .	6	μμf
Cathode to all other electrodes	5	μμf

External conductive coating to ultor. . .	{2500 max.	μμf
	{2000 min.	μμf

Faceplate and Protective Panel. Filterglass

Total light transmission (Approx.). 40%

Phosphor (For curves, see front of this section). . . P4-Sulfide Type
Aluminized

Fluorescence. White

Phosphorescence White

Persistence Medium Short

Focusing Method Electrostatic

Deflection Method Magnetic

Deflection Angles (Approx.):

Diagonal. 110°

Horizontal. 99°

Vertical. 82°

Electron Gun. Type Requiring No Ion-Trap Magnet

Tube Dimensions:

Overall length. 15-3/16" ± 3/8"

Greatest width. 21-5/16" + 1/8" - 1/16"

Greatest height 17-5/16" + 1/8" - 1/16"

Diagonal. 24-45/64" + 3/32" - 1/16"

Neck length 5-1/8" ± 1/8"

Radius of curvature of protective panel (External surface):

	Radius at center	Radius at edge
--	------------------	----------------

In plane of diagonal deflection.	50-1/4"	See Dimensional Outline
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In plane of horizontal deflection	50-1/4"	35-1/4"
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In plane of vertical deflection.	45-1/2"	35"
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Radius of curvature of faceplate (Internal surface):

	Radius at center	Radius at edge
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In plane of diagonal deflection.	39-1/2"	31-1/2"
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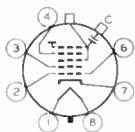
In plane of horizontal deflection	39-3/4"	26-1/2"
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23CP4

	Radius at center	Radius at edge
In plane of vertical deflection.	36-3/4"	18-1/2"
Screen Dimensions (Minimum):		
Greatest width. . . . .		.19-5/16"
Greatest height . . . . .		.15-1/4"
Diagonal. . . . .		.22-5/16"
Projected area.		282 sq. in.
Weight (Approx.).		33 lbs
Operating Position.		Any
Cap.	Recessed Small Cavity (JFDFC No. J1-21)	
Rulb.	J187 Fitted with Protective Panel FP198	
Base.	Small-Button Heoeightar 7-Pin, Arrangement 1, (JFDFC No. R7-208)	
Basing Designation for BOTTOM VIFA.		8HR

- Pin 1 - Heater
- Pin 2 - Grid No. 1
- Pin 3 - Grid No. 2
- Pin 4 - Grid No. 4
- Pin 6 - Grid No. 1
- Pin 7 - Cathode
- Pin 8 - Heater



- Cap - Filter (Grid No. 3, Grid No. 5, Collector)
- C - External Conductive Coating

GRID-DRIVE[▲] SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, Design-Center Values:

ULTOR VOLTAGE	{ 20000 max. volts 12000* min. volts
GRID-No. 4 (FOCUSING) VOLTAGE:	
Positive value.	1000 max. volts
Negative value.	500 max. volts
GRID-No. 2 VOLTAGE	500 max. volts
GRID-No. 1 VOLTAGE:	
Negative-peak value	200 max. volts
Negative-bias value	140 max. volts
Positive-bias value	0 max. volts
Positive-peak value	2 max. volts
PEAK HEATER-CATHODE VOLTAGE:	
Heater negative with respect to cathode:	
During equipment warm-up period not exceeding 15 seconds.	410 max. volts
After equipment warm-up period.	180 max. volts
Heater positive with respect to cathode	180 max. volts

Equipment Design Ranges:

With anyultor voltage (E_{c1k}) between 12000 and 20000 volts and grid-No. 2 voltage (E_{c2k}) between 200 and 500 volts*

Grid-No. 4 Voltage for focus*.	0 to 400	volts
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Grid-No.1 Voltage (E_{c1k}) for visual extinction of focused raster	<i>See Raster-Cutoff-Range Chart for Grid-Drive Service</i>	
Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value (Peak positive).	Same value as determined for E_{c1k} except video drive is a positive voltage	
Grid-No.4 Current.	-25 to 125	μa
Grid-No.2 Current.	-15 to +15	μa
Field Strength of Adjust- able Centering Magnet ∇	0 to 8	gausses

Examples of Use of Design Ranges:

<i>With ultor voltage of</i>	18000	volts
<i>and grid-No.2 voltage of</i>	400	volts
Grid-No.4 Voltage for focus*	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster	-44 to -94	volts
Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value.	44 to 94	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
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CATHODE-DRIVE¹ SERVICE

*Unless otherwise specified, voltage values
are positive with respect to grid No. 1*

Maximum and Minimum Ratings, Design-Center Values:

ULTOR-TO-GRID-No.1 VOLTAGE	{ 20000 max. 12000 min. •	volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value	1000 max.	volts
Negative value	500 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE	640 max.	volts
GRID-No.2-TO-CATHODE VOLTAGE	500 max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive-peak value.	200 max.	volts
Positive-bias value.	140 max.	volts
Negative-bias value.	0 max.	volts
Negative-peak value.	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode: During equipment warm-up period not exceeding 15 seconds	410 max.	volts



23CP4

After equipment warm-up period. . . . 180 max. volts
Heater positive with respect to cathode. . 180 max. volts

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage (E_{c5g1}) between 12000^{*}
and 20000 volts and grid-No.2-to-grid-No.1 voltage (E_{c2g1})
between 225 and 640 volts

Grid-No.4-to-Grid-No.1
Voltage for focus^{*}. 0 to 400 volts

Cathode-to-Grid-No.1 Volt-
age (E_{kg1}) for visual ex-
tinction of focused
raster. See Raster-Cutoff-Range Chart
for Cathode-Drive Service

Cathode-to-Grid-No.1 Video
Drive from Raster Cutoff
(Black level):
White-level value
(Peak negative) Same value as determined for
 E_{kg1} except video drive is a
negative voltage

Grid-No.4 Current -25 to +25 μ a

Grid-No.2 Current -15 to +15 μ a

Field Strength of Adjustable
Centering Magnet[♦]. 0 to 8 gauss

Examples of Use of Design Ranges:

With ultor-to-grid-
No.1 voltage of 18000 volts
and grid-No.2-to-grid-
No.1 voltage of 400 volts

Grid-No.4-to-Grid-No.1 Voltage
for focus^{*}. 0 to 400 volts

Cathode-to-Grid-No.1 Voltage
for visual extinction of
focused raster. 42 to 78 volts

Cathode-to-Grid-No.1 Video
Drive from Raster Cutoff
(Black level):
White-level value -42 to -78 volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance. 1.5 max. megohms

[▲] Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

[●] This value is a working design-center minimum. The equivalent absolute minimum ultor (or ultor-to-grid-no.1) voltage is 11,000 volts below which the serviceability of the 23CP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor (or ultor-to-grid-no.1) voltage is never less than 11,000 volts.

^{*} The grid-no.4 (or grid-no.4-to-grid-no.1) voltage required for optimum focus of any individual tube may have a value anywhere between 0 and 400 volts; is independent of ultor current; and will remain essentially constant for values of ultor (or ultor-to-grid-no.1) voltage, or grid-no.2 (or grid-no.2-to-grid-no.1) voltage, within design ranges shown for these items.

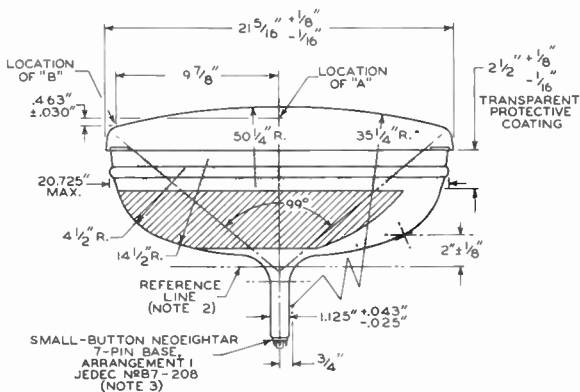
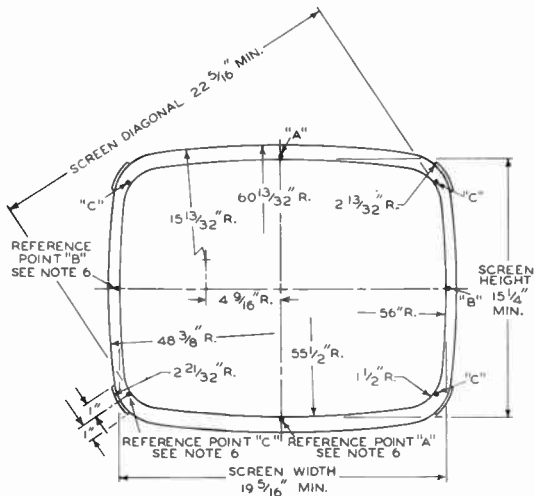


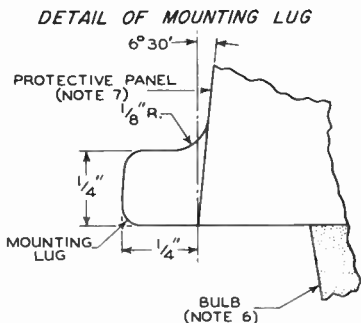
- Distance from *Reference Line* for suitable PM centering magnet should not exceed $2\frac{1}{4}$ ". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a $\frac{3}{8}$ -inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as $\frac{1}{2}$ -inch deflection of the spot from the center of the tube face.
- Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No. 1 and the other electrodes.

*For X-ray shielding considerations, see sheet
X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section*



23CP4





NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 30^\circ$. ULTOR TERMINAL IS ON SAME SIDE AS PIN 4.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No. G-126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS OF THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

NOTE 6: REFERENCE POINTS A, B, AND C ARE PROVIDED FOR USE IN DESIGN OF A MASK CONTOURED FOR CLOSE FIT TO THE PROTECTIVE PANEL.

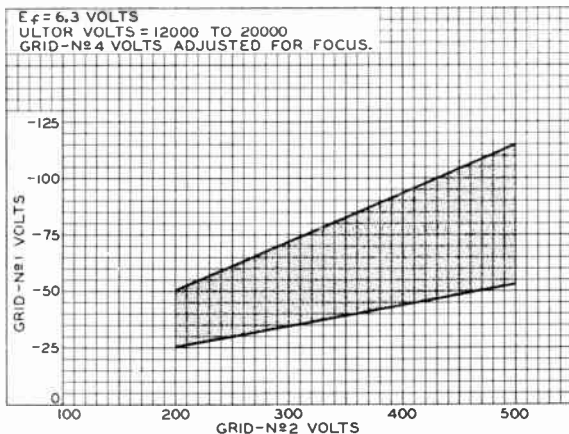
NOTE 7: THE CENTER OF THE PROTECTIVE PANEL MAY BE ECCENTRIC WITH RESPECT TO THE AXIS OF THE TUBE ENVELOPE. ASSOCIATED SHIFT OF THE PROTECTIVE PANEL ALONG ITS MINOR AND/OR MAJOR AXIS WILL NOT EXCEED 1/16".

NOTE 8: KEEP THIS CIRCUMFERENTIAL AREA FREE OF MOUNTING HARDWARE.

NOTE 9: ADEQUATE TUBE SUPPORT IS OBTAINED BY CLAMPING TO THE MOUNTING LUGS PROVIDED AT EACH CORNER OF THE PROTECTIVE PANEL. TUBE MOUNTING AND YOKE SUPPORT CLAMPS MUST BE SPACED FROM THE TUBE BY USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.

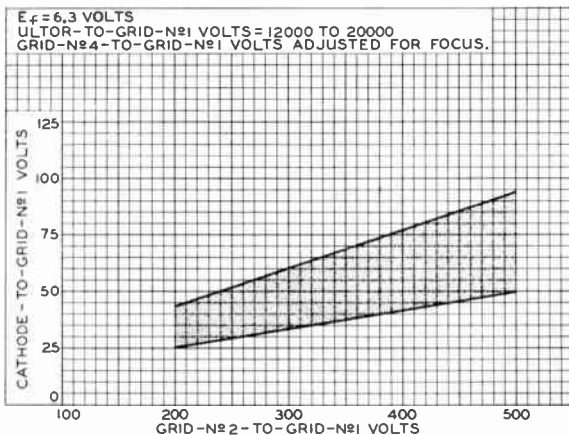
RASTER-CUTOFF-RANGE CHARTS

Grid-Drive Service



92CS-10312

Cathode-Drive Service



92CS-10313



23CP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE

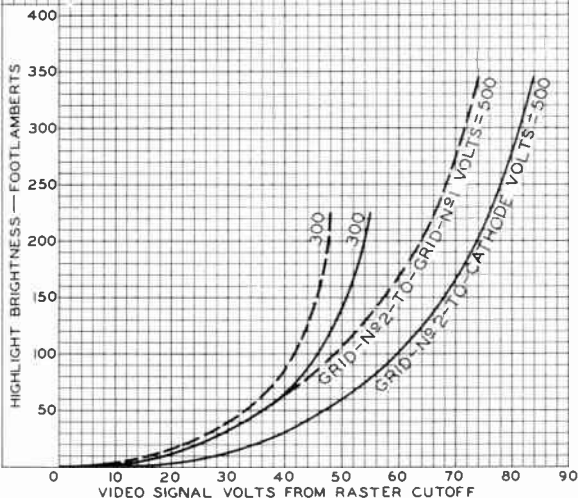
$E_f = 6.3$ VOLTS
ULTOR-TO-GRID- N_{g1} VOLTS = 16000
CATHODE BIASED POSITIVE WITH
RESPECT TO GRID N_{g1} TO GIVE
FOCUSED RASTER CUTOFF.
RASTER FOCUSED
AT AVERAGE BRIGHTNESS.
RASTER SIZE = 18" x 13 1/2"

GRID-DRIVE SERVICE

$E_f = 6.3$ VOLTS
ULTOR VOLTS = 16000
GRID N_{g1} BIASED NEGATIVE WITH
RESPECT TO CATHODE TO GIVE
FOCUSED RASTER CUTOFF.
RASTER FOCUSED
AT AVERAGE BRIGHTNESS.
RASTER SIZE = 18" x 13 1/2"

I.C.I. COORDINATES OF SCREEN: X=0.287, Y=0.315

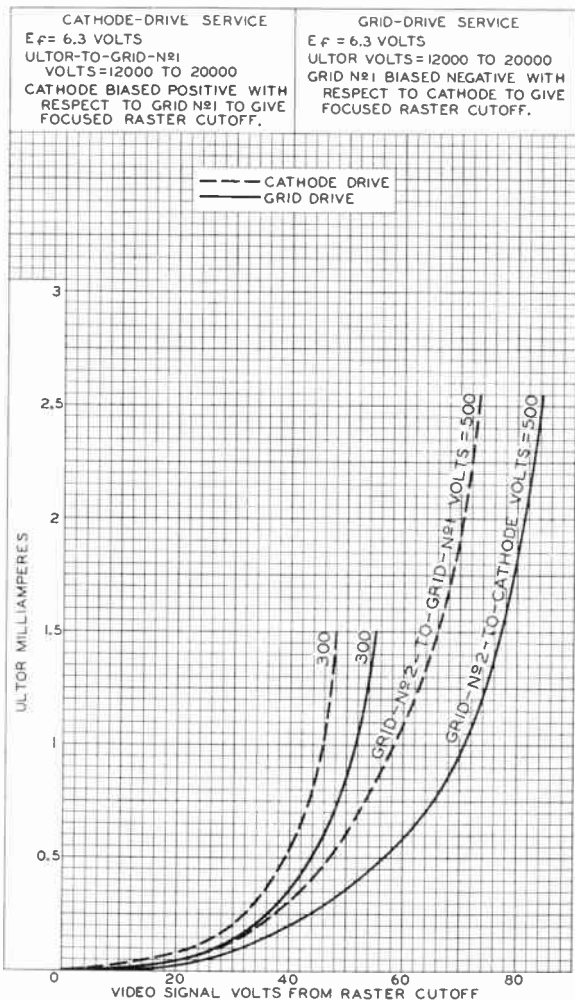
--- CATHODE DRIVE
— GRID DRIVE



92CM-10318



AVERAGE DRIVE CHARACTERISTICS



92CM-10317





Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
94° MAGNETIC DEFLECTION

Low-Grid-No.2-Voltage Type
for Cathode-Drive Operation

GENERAL DATA

Electrical:

Direct Inter-electrode Capacitance:	
Cathode to all other electrodes	1 pf
Grid No.1 to all other electrode	1 pf
External conductive coating to anode	$\left\{ \begin{array}{l} 2500 \text{ pF,} \\ 110 \text{ min.} \end{array} \right.$ pf
Heater Current at 6.3 volt	600 ± 30 ma
Heater Warm-Up Time (Average)	11 seconds
Electron Gun	Type Requiring No. for-Trip Magnet

Optical:

Phosphor (For curves, see front of this section)	P4—Sulfide Type, Aluminized
Faceplate	Filterglass
Light transmission (Approx.)	78%

Mechanical:

Weight (Approx.)	27 lbs
Overall Length	$17\text{--}5/64" \pm 5/16"$
Neck Length	$5" \pm 1/8"$
Projected Area of Screen	292 sq. in.

External conductive coating:

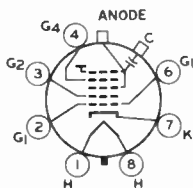
Type	Regular-Band
Contact area for grounding	Near Reference Line

For Additional Information on Coating, Dimensions, and Deflection Angles:

See *Picture-Tube Dimensional-Outlines and Bulb J187 H1* sheets at the front of this section.

Cap	Recessed Small Cavity (JEDEC No.11-21)
Bise	Small-Button No-eight or 7-Pin, Arrangement 1, (JEDEC No. B7-208)
Basing Designation for BOTTOM VIEW	8HR

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 3—Grid No.2
- Pin 4—Grid No.4
- Pin 6—Grid No.1
- Pin 7—Cathode
- Pin 8—Heater



Cap—Anode
(Grid No.3,
Grid No.5,
Screen,
Collector)
C—External
Conductive
Coating



23DAP4

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

ANODE VOLTAGE	{23000 max. 10000 min.	volts volts
GRID-No.4 VOLTAGE:		
Positive value.	1100 max.	volts
Negative value.	550 max.	volts
GRID-No.2 VOLTAGE	{70 max. 40 min.	volts volts
CATHODE VOLTAGE:		
Negative peak value	2 max.	volts
Negative bias value	0 max.	volts
Positive bias value	100 max.	volts
Positive peak value	150 max.	volts
HEATER VOLTAGE.	{6.9 max. 5.7 min.	volts volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode:		
Combined AC & DC voltage.	200 max.	volts
DC Component.	100 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	18000	volts
Grid-No.4 Voltage ^a	100	volts
Grid-No.2 Voltage	50	volts
Cathode Voltage for visual		
extinction of focused raster.	35 to 55	volts
Field Strength of required		
adjustable Centering Magnet	0 to 12	gausses

Maximum Circuit Value:

Grid-No.1 Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet

X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section

^a The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between -100 and +300 volts.



23DBP4

Picture Tube

LOW-VOLTAGE ELECTROSTATIC FOCUS

NO ION-TRAP MAGNET REQUIRED

ALUMINIZED SCREEN

RECTANGULAR GLASS TYPE

110° MAGNETIC DEFLECTION

Low-Grid-No.2-Voltage—for Cathode-Drive Operation

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes.	5	pf
Grid No.1 to all other electrodes.	6	pf
External conductive coating to anode.	} 2500 max. 2000 min.	pf
		600 ± 30	ma

Heater Current at 6.3 volts. 11 ma

Heater Warm-Up Time (Average). 11 seconds

Electron Gun Type Requiring No Ion-Trap Magnet

Optical:

Phosphor (For curves, see front of this section) .P4—sulfide Type, Aluminized

Faceplate. Filterglass

Light transmission (Approx.) 75%

Mechanical:

Weight (Approx.) 25 lbs

Overall length 14.875" ± .281"

Neck length. 5.125" ± .125"

Projected Area of Screen 282 sq. in.

External Conductive Coating:

Type Regular-Band

Contact area for grounding Near Reference Line

For Additional Information on Coatings and Dimensions:

See Picture-Tube *Dimensional-Outlines and Bulb J187 E* at front on this section

Cap. Recessed Small Cavity (JEDEC No. J1-21)

Base Small-Button Neonightar 7-Pin, Arrangement 1, (JEDEC No. F7-208) or (JEDEC No. B7-237)

Basing Designation for BOTTOM VIEW BHR

Pin 1—Heater

Pin 2—Grid No.1

Pin 3—Grid No.2

Pin 4—Grid No.4

Pin 6—Grid No.1

Pin 7—Cathode

Pin 8—Heater

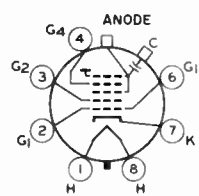
Cap—Anode (Grid No.3,

Grid No.5, Screen,

Collector)

C—External Conductive

Coating



23DBP4

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to Grid No. 1

Anode Voltage	{ 22000 max. volts 15000 min. volts
Grid-No.4 (Focusing) Voltage:	
Positive value	1250 max. volts
Negative value	400 max. volts
Grid-No.2 Voltage	250 max. volts
Grid-No.2 to Cathode Voltage	{ 100 max. volts 40 min. volts
Cathode Voltage:	
Positive peak value	220 max. volts
Positive bias value	155 max. volts
Negative bias value	0 max. volts
Negative peak value	2 max. volts
Heater Voltage	{ 6.9 max. volts 5.7 min. volts
Peak Heater-Cathode Voltage:	
Heater negative with respect to cathode:	
During equipment warm-up period not exceeding 15 seconds	450 max. volts
After equipment warm-up period	300 max. volts
Heater positive with respect to cathode	200 max. volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	18000	volts
Grid-No.4 Voltage	250	volts
Grid-No.2 Voltage	50	volts
Cathode Voltage for visual extinction of focused raster	34 to 52	volts

Maximum Circuit Value:

Grid-No.1 Circuit Resistance	1.5 max. megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front on this Section



23EKP4

Picture Tube

PAN-O-PLY — INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands around Periphery of Tube Panel—No Separate Safety-Glass or Integral Protective Window Required)

RECTANGULAR GLASS TYPE ALUMINIZED SCREEN
 LOW-VOLTAGE ELECTROSTATIC FOCUS 92° MAGNETIC DEFLECTION
 NO ION-TRAP MAGNET REQUIRED

Electrical:

Direct Interelectrode Capacitances:			
Cathode to all other electrodes.	b		pf
Grid No.1 to all other electrodes.	b		pf
External conductive coating to anode ^a	} 2500 max. { 1700 min.		pf
			pf
Heater Current at 4.5 volts.	10 ± 20		ma
Heater Warm-up Time (Average).	11		seconds
Electron Gun	Line Requiring No Ion-Trap Magnet		

Optical:

Phosphor (for curves, see front of this section)	P1—Sublimed Type, Aluminized
Facoplate	Filterglass
Light transmission at center (Approx.)	42%

Mechanical:

Weight (Approx.)	29 lb.
Overall Length	18.000" ± .075"
Neck Length	6.500" ± .198"
Projected Area of Screen	282 sq. in.

External Conductive Coating:

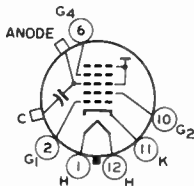
Type	Regular-Band
Contact area for grounding	Near Reference Line

For Additional Information on Coatings, Dimensions, and Deflection Angles:
 See *Picture-Tube Dimensional-Outlines and Bulb J167 J* sheets at the front of this section.

Cap.	Recessed Small Cavity (JEFC No. J1-21)
Bas.	Short Small-Shell Duocetal Pin, (JEDEC Group 1, No. MC-203)

Basing Designation for BOTTOM VIEW 12L

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 6—Grid No.4
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater



- Cap—Anode,
(Grid No.3,
Grid No.5,
Screen,
Collector)
- C—External
Conductive
Coating



23EKP4

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage.	{ 25000 max. volts 11000 min. volts
Grid-No.4 Voltage:	
Positive value	1100 max. volts
Negative value	550 max. volts
Grid-No.2 Voltage.	{ 550 max. volts 200 min. volts
Grid-No.1 Voltage:	
Negative peak value.	220 max. volts
Negative bias value.	155 max. volts
Positive bias value.	0 max. volts
Positive peak value.	2 max. volts
Heater Voltage	{ 6.9 max. volts 5.7 min. volts
Peak Heater-Cathode Voltage:	
Heater negative with respect to cathode:	
During equipment warm-up period not exceeding 15 seconds	450 max. volts
After equipment warm-up period	300 max. volts
Heater positive with respect to cathode:	
Combined AC & DC voltage	200 max. volts
DC Component	100 max. volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage.	20000	volts
Grid-No.4 Voltage ^b	200	volts
Grid-No.2 Voltage.	400	volts
Cathode Voltage for visual extinction of focused raster	36 to 78	volts
Field Strength of required adjustable Centering Magnet.	0 to 12	gauss

Maximum Circuit Value:

Grid-No.1 Circuit Resistance	1.5 max. megohms
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^a Includes implosion protection hardware.

^b The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13-1/2-inch by 18-inch pattern from an RCA-2F21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front on this Section



23ENP4

Picture Tube

PAN-O-PLY — INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands around Periphery of Tube Panel—No Separate Safety-Glass or Integral Protective Window Required)

RECTANGULAR GLASS TYPE **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS **92° MAGNETIC DEFLECTION**
NO ION-TRAP MAGNET REQUIRED

Low-Grid-No.2-Voltage—for Cathode-Drive Operation

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes.	5	pf
Grid No.1 to all other electrodes.	6	pf
External conductive coating to anode ^a	$\left\{ \begin{array}{l} 2500 \text{ max.} \\ 1700 \text{ min.} \end{array} \right.$	pf
		ma

Heater Current at 6.3 volts. 600 ± 30 ma

Heater Warm-up Time (Average). 11 seconds

Electron Gun. Type Requiring No Ion-Trap Magnet

Optical:

Phosphor (for curves, see front of this section) . . .P4-Sulfide Type, Aluminized

Faceplate Filterglass

Light transmission at center (Approx.). 42%

Mechanical:

Weight (Approx.). 29 lbs

Overall Length. 18.125" ± .375"

Neck Length. 5.625" ± .125"

Projected Area of Screen. 282 sq. in.

External Conductive Coating:

Type. Regular-Band

Contact area for grounding. Near Reference Line

For Additional Information on Coatings, Dimensions, and Deflection Angles:

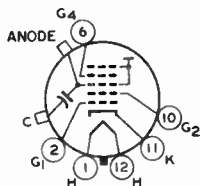
See *Picture-Tube Dimensional-Outlines and Bulb J187 J* sheets at the front of this section.

Cap Recessed Small Cavity (JEDEC No. J1-21)

Base. Short Small-Shell Duodecal 6-Pin, (JEDEC Group 4, No. B6-203)

Basing Designation for BOTTOM VIFW. 12L

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 6—Grid No.4
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater



- Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)
- C—External Conductive Coating



23ENP4

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	{ 25000 max. 1000 min.	volts volts
Grid-No. 4 voltage:		
Positive value	1250 max.	volts
Negative value	400 max.	volts
Grid-No. 2 Voltage	{ 70 max. 40 min.	volts volts
Cathode Voltage:		
Negative peak value	2 max.	volts
Negative bias value	0 max.	volts
Positive bias value	100 max.	volts
Positive peak value	150 max.	volts
Heater voltage	{ 6.9 max. 5.7 min.	volts volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	300 max.	volts
Heater positive with respect to cathode:		
Combined AC & DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode voltage	20000	volts
Grid-No. 4 voltage ^b	200	volts
Grid-No. 2 Voltage	50	volts
Cathode voltage for visual extinction of focused raster	36 to 4	volts
Field strength of required adjustable centering magnet	0 to 12	gauss

Maximum Circuit Value:

Grid-No. 1 Circuit Resistance	1.5 max.	megohms
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^a Includes implosion protection hardware.

^b The grid-No. 4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No. 1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13-1/2-inch by 18-inch pattern from an RCA-2F21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section

Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
LOW GRID-No.2 VOLTAGE

ALUMINIZED SCREEN
MAGNETIC DEFLECTION
CATHODE-DRIVE TYPE

With Heater Having Controlled Warm-Up Time

DATA

General:

Heater, for Unipotential Cathode:

Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Warm-up time (Average)	11	sec

Direct Interelectrode Capacitances:

Grid No.1 to all other electrodes.	6	μf
Cathode to all other electrodes.	5	μf

External conductive coating to ultor
 { 2500 max. μf
 { 1700 min. μf

Faceplate and Protective Panel Filterglass

Total light transmission (Approx.) 40%

Phosphor (For curves, see front of this section) P4-Sulfide Type

Aluminized

Fluorescence White

Phosphorescence. White

Persistence. Medium Short

Focusing Method. Electrostatic

Deflection Method. Magnetic

Deflection Angles (Approx.):

Diagonal 110°

Horizontal 99°

Vertical 82°

Electron Gun Type Requiring No Ion-Trap Magnet

Tube Dimensions:

Overall length 15-3/16" ± 3/8"

Greatest width 21-5/16" + 1/8" - 1/16"

Greatest height. 17-5/16" + 1/8" - 1/16"

Diagonal 24-45/64" + 3/32" - 1/16"

Neck length. 5-1/8" ± 1/8"

Radius of curvature of protective panel

(External surface):

Radius at center Radius at edge

In plane of diagonal deflection 50-1/4" See Dimensional Outline

In plane of horizontal deflection. 50-1/4" 35-1/4"

In plane of vertical deflection 45-1/2" 35"

Radius of curvature of faceplate (Internal surface):

Radius at center Radius at edge

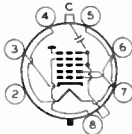
In plane of diagonal deflection 39-1/2" 31-1/2"



23EP4

	Radius at center	Radius at edge
In plane of horizontal deflection . . .	39-3/4"	26-1/2"
In plane of vertical deflection.	36-3/4"	18-1/2"
Screen Dimensions (Minimum):		
Greatest width.		19-5/16"
Greatest height		15-1/4"
Diagonal.		22-5/16"
Projected area.		282 sq. in.
Weight (Approx.).		33 lbs
Operating Position.		Any
Cap	Recessed Small Cavity (JEDEC No. J1-21)	
Bulb.	J187 Fitted with Protective Panel FP198	
Base.	Small-Button Neoeightar 7-Pin Arrangement 2, (JEDEC No. B7-219)	
Basing Designation for BOTTOM VIEW.		8KP

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



- Pin 8 - Grid No. 4
- Cap - Ultor
(Grid No. 3,
Grid No. 5,
Collector)
- C - External
Conductive
Coating

CATHODE-DRIVE[▲] SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Maximum and Minimum Ratings, Design-Center Values:

ULTOR-TO-GRID-No. 1 VOLTAGE.	{	20000	max.	volts
		12000	min.	volts
GRID-No. 4-TO-GRID-No. 1 (FOCUSING) VOLTAGE:				
Positive value.		1000	max.	volts
Negative value.		500	max.	volts
GRID-No. 2-TO-GRID-No. 1 VOLTAGE.		64	max.	volts
CATHODE-TO-GRID-No. 1 VOLTAGE:				
Positive-peak value		200	max.	volts
Positive-bias value		140	max.	volts
Negative-bias value		0	max.	volts
Negative-peak value		2	max.	volts
PEAK HEATER-CATHODE VOLTAGE:				
Heater negative with respect to cathode:				
During equipment warm-up period not exceeding 15 seconds.				
		410	max.	volts
After equipment warm-up period.				
		180	max.	volts
Heater positive with respect to cathode.				
		180	max.	volts



Equipment Design Ranges:

With any ultor-to-grid-No. 1 voltage (E_{c5g1}) between 12000[•] and 20000 volts and grid-No. 2-to-grid No. 1 voltage (E_{c2g1}) between 40 and 64 volts

Grid-No. 4-to-Grid-No. 1 Voltage for focus [★]	0 to 400	volts
Cathode-to-Grid-No. 1 Voltage (E_{k1}) for visual extinction of focused raster	See Raster-Cutoff-Range Chart	
Cathode-to-Grid-No. 1 Video Drive from Raster Cutoff (Black level): White-level value (Peak negative).	Same value as determined for E_{k1} except video drive is a negative voltage	
Grid-No. 4 Current.	-25 to +25	μ a
Grid-No. 2 Current.	-15 to +15	μ a
Field Strength of Adjustable Centering Magnet \blacklozenge	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor-to-grid-No. 1 voltage of	16000	18000	volts
and grid-No. 2-to-grid-No. 1 voltage of	50	50	volts
Grid-No. 4-to-Grid-No. 1 Voltage for focus [★]	0 to 400	0 to 400	volts
Cathode-to-Grid-No. 1 Voltage for visual extinction of focused raster	32 to 47	34 to 49	volts
Cathode-to-Grid-No. 1 Video Drive from Raster Cutoff (Black level): White-level value.	-32 to -47	-34 to -49	volts

Maximum Circuit Values:

Grid-No. 1-Circuit Resistance	1.5 max.	megohms
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[▲] Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid no. 1 and the other electrodes.

[•] This value is a working design-center minimum. The equivalent absolute minimum ultor-to-grid-no. 1 voltage is 11,000 volts below which the serviceability of the 23EP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor-to-grid-no. 1 voltage is never less than 11,000 volts.

[★] The grid-no. 4-to-grid-no. 1 voltage required for focus of any individual tube may have a value anywhere between 0 and 400 volts.

\blacklozenge Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 3/8-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

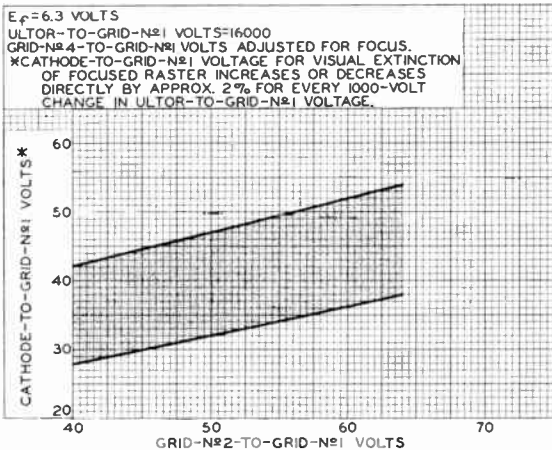


*For X-ray shielding considerations, see sheet
X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section*



RASTER-CUTOFF-RANGE CHART

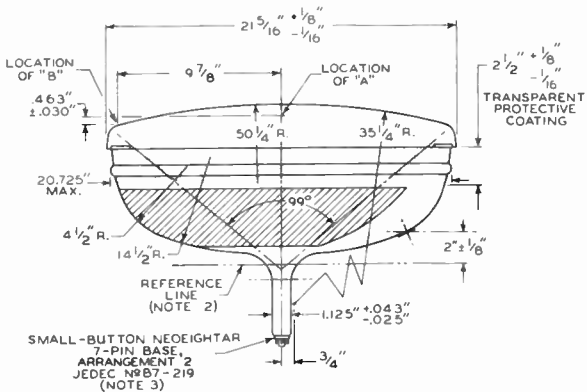
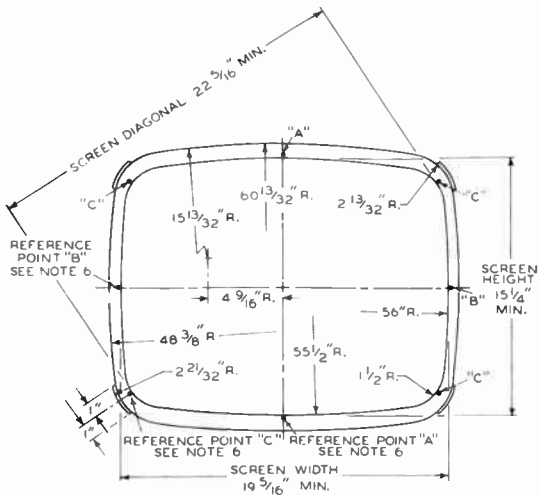
Cathode-Drive Service



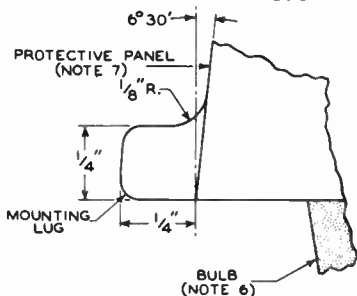
92CS-9945RI



23EP4



DETAIL OF MOUNTING LUG



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN B MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 30^\circ$. ULTOR TERMINAL IS ON SAME SIDE AS PIN B.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No. G-126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS OF THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

NOTE 6: REFERENCE POINTS A, B, AND C ARE PROVIDED FOR USE IN DESIGN OF A MASK CONTOURED FOR CLOSE FIT TO THE PROTECTIVE PANEL.

NOTE 7: THE CENTER OF THE PROTECTIVE PANEL MAY BE ECCENTRIC WITH RESPECT TO THE AXIS OF THE TUBE ENVELOPE. ASSOCIATED SHIFT OF THE PROTECTIVE PANEL ALONG ITS MINOR AND/OR MAJOR AXIS WILL NOT EXCEED 1/16".

NOTE 8: KEEP THIS CIRCUMFERENTIAL AREA FREE OF MOUNTING HARDWARE.

NOTE 9: ADEQUATE TUBE SUPPORT IS OBTAINED BY CLAMPING TO THE MOUNTING LUGS PROVIDED AT EACH CORNER OF THE PROTECTIVE PANEL. TUBE MOUNTING AND YOKE SUPPORT CLAMPS MUST BE SPACED FROM THE TUBE BY USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.

CATHODE-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS

ULTOR-TO-GRID- $N_{\#1}$ VOLTS=16000

GRID- $N_{\#2}$ -TO-GRID- $N_{\#1}$ VOLTS=50

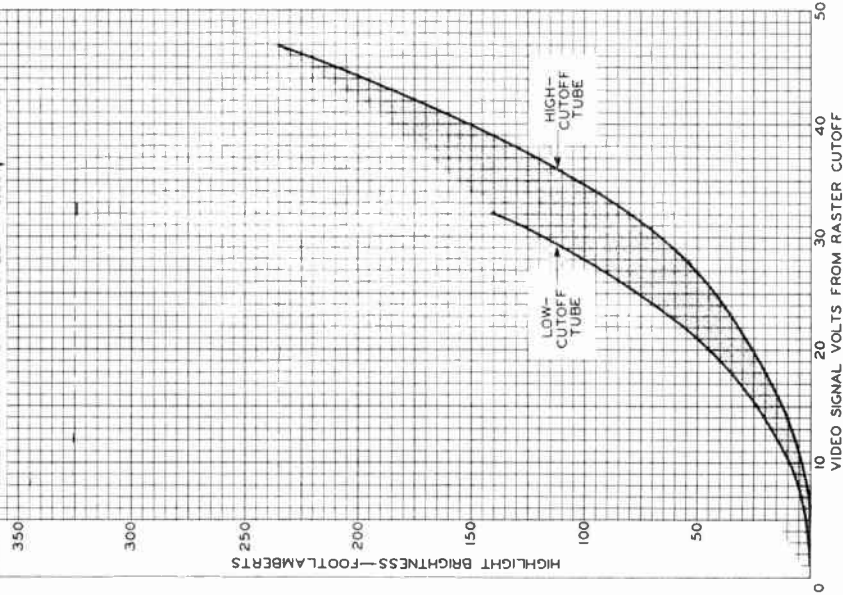
CATHODE BIASED POSITIVE WITH RESPECT TO

GRID $N_{\#1}$ TO GIVE FOCUSED RASTER CUTOFF.

RASTER FOCUSED AT AVERAGE BRIGHTNESS.

RASTER SIZE= $18'' \times 13'' - 1/2''$

I.C.I. COORDINATES OF SCREEN: X=0.287, Y=0.315



92CM-10314RI



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Electron Tube Division

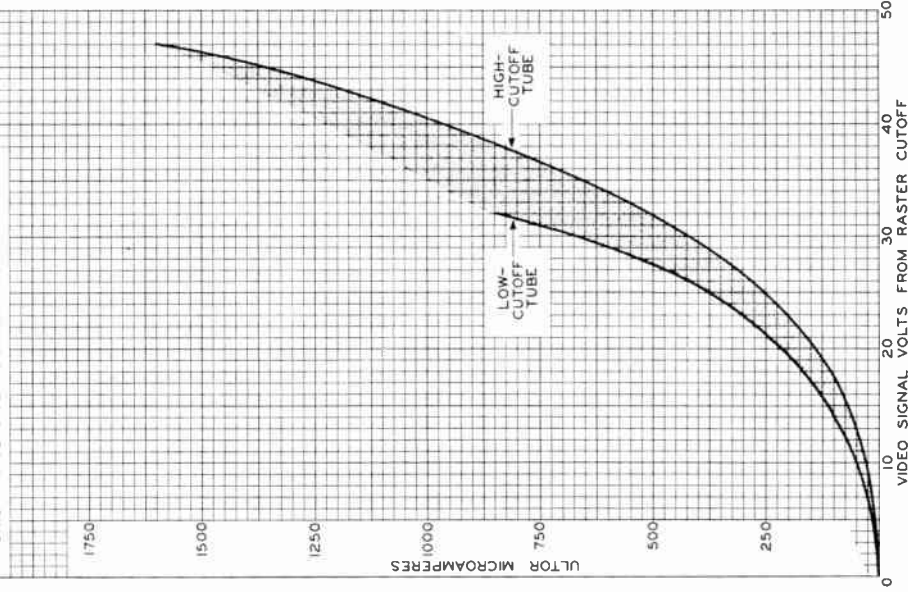
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8-60

Harrison, N. J.

CATHODE-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS
 ULTOR-TO-CR1D-N81 VOLTS = 16000
 GRID-N82-TO-GRID-N81 VOLTS = 50
 CATHODE BIASED POSITIVE WITH RESPECT TO
 GRID N81 TO GIVE FOCUSED RASTER CUTOFF.



92CM-9946R1

23EQP4

Picture Tube

PAN-O-PLY—INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands Around Periphery of Tube Panel—No Separate Safety-Glass or Integral Protective Window Required)

LOW-VOLTAGE ELECTROSTATIC FOCUS 114° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid No. 1 to all other electrodes	6	pF
External conductive coating to anode	1700 min—2500 max	pF
Heater Current at 6.3 volts	450 ± 20	mA
Heater Warm-Up Time (Average)	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

Phosphor	P4—Sulfide Type, Aluminized
Faceplate	Filterglass
Light Transmission (Approx.)	42%

MECHANICAL

Weight (Approx.)	28 lb
Overall Length	14.531 ± 0.281 in
Neck Length	5.125 ± .125 in
Projected Area of Screen	282 sq in
External Conductive Coating ^a	

Type Modified-Band
 Contact area for grounding Near Reference Line

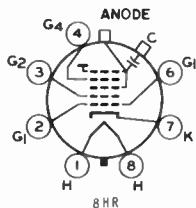
For Additional Information on Coatings and Dimensions

See *Picture-Tube Dimensional Outlines* for Bulb J187L at front of this section

Cap	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No. B7-208)

TERMINAL DIAGRAM (Bottom View)

- Pin 1—Heater
- Pin 2—Grid No. 1
- Pin 3—Grid No. 2
- Pin 4—Grid No. 4
- Pin 6—Grid No. 1
- Pin 7—Cathode
- Pin 8—Heater
- Cap—Anode (Grid No. 3, Grid No. 5, Screen, Collector)
- C—External Conductive Coating



← Indicates a change.



23EQP4

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	11000 min—23000 max	V
Grid-No.4 (Focusing) Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage	200 min—550 max	V
Grid-No.1 Voltage		
Negative peak value	220 max	V
Negative bias value	155 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V
Heater Voltage	5.7 min—6.9 max	V
Peak Heater-Cathode Voltage		
Heater positive with respect to cathode:		
During equipment warm-up period not		
exceeding 15 second	450 max	V
After equipment warm-up period	300 max	V
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max	V
Component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	18000	V
Grid-No.4 Voltage ^b	200	V
Grid-No.2 Voltage	300	V
Cathode Voltage for visual extinction of		
focused raster	28 to 62	V
Field Strength of required adjustable		
centering magnet	0 to 12	G

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ
--	---------	----

^a External conductive coating and implosion protection hardware must be grounded.

^b The grid-No.1 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 and video-signal-voltage adjusted to give a 200-microampere anode current.

For irradiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
 at front of this section



23ERP4

Picture Tube

PAN-O-PLY TYPE

114° MAGNETIC DEFLECTION

LOW GRID-NO.2 VOLTAGE

The 23ERP4 is the same as the 23EQ4 except for the following items:

ELECTRICAL

Heater Current at 6.3 V. 600 ± 30 mA

MECHANICAL

External Conductive Coating

Type (see CRT OUTLINE 1 at front of this section) . . Regular-Band
Contact area for grounding Near Reference Line



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DATA
12-66



Picture Tube

PAN-O-PLY — INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands around Periphery of Tube Panel—No Separate Safety-Glass or Integral Protective Window Required)

RECTANGULAR GLASS TYPE

ALUMINIZED SCREEN

LOW-VOLTAGE ELECTROSTATIC FOCUS

110° MAGNETIC DEFLECTION

NO ION-TRAP MAGNET REQUIRED

Electrical:

Direct Inter-electrode Capacitance:

Cathode to all other electrodes 5 pf

Grid No.1 to all other electrodes 8 pf

External conductive coating to anode^a { 2500 max. pf

1700 min. pf

Heater Current at 6.3 volts 600 ± 30 ma

Heater Warm-up Time (Average) 12 seconds

Electron Gun Type Requiring No Ion-Trap Magnet

Optical:

Phosphor (for curves, see front of this section) .P4—Sulfide Type, Aluminized

Faceplate Filterglass

Light Transmission at center (Approx.) 42%

Mechanical:

Weight (Approx.) 28 lbs

Overall length 14.875" ± .281"

Mark length125" ± .125"

Projected Area of Screen 282 sq. in.

External Conductive Coating:

Type Regular-Band

Contact area for grounding Near Reference Line

For Additional Information on Coatings and Dimensions:

See *Picture-Tube Dimensional-Outlines* and *Bulb J187 K* sheets at front of this section

Cap. Peccased Small Cavity (JEFC No. J1-21)

Base Small-Ribbon Neoeightar 7-Pin, Arrangement 1, (JEDEC No. R7-208)

Basing Designation for BOTTOM VIEW 8HR

Pin 1—Heater

Pin 2—Grid No.1

Pin 3—Grid No.2

Pin 4—Grid No.4

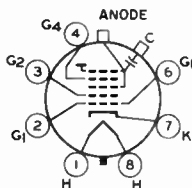
Pin 6—Grid No.1

Pin 7—Cathode

Pin 8—Heater

Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)

C—External conductive Coating



23ETP4

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	{ 23000 max. 11000 min.	volts volts
Grid-No.4 Voltage:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
Grid-No.2 Voltage	{ 550 max. 200 min.	volts volts
Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	150 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage	{ 6.9 max. 5.7 min.	volts volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	300 max.	volts
Heater positive with respect to cathode:		
Combined AC & DC Voltage	200 max.	volts
DC Component	100 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	18000	volts
Grid-No.4 Voltage ^b	200	volt
Grid-No.2 Voltage	300	volts
Cathode voltage ^a for visual		
extinction of focused raster	28 to 62	volts
Field Strength of required		
adjustable centering Magnet	0 to 12	gauss

Maximum Circuit Value:

Grid-No.1 Circuit Resistance	1.5 max.	megohms
--	----------	---------

^a Includes implosion protection hardware.

^b The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13-1/2-inch by 19-inch pattern from an RCA-2F21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section

23EZP4

Picture Tube

PAN-O-PLY TYPE WITH MOUNTING LUGS
 94° MAGNETIC DEFLECTION
 LOW-VOLTAGE ELECTROSTATIC FOCUS
 LOW-GRID-No.2 VOLTAGE
 CATHODE-DRIVE TYPE

ELECTRICAL

Direct Interelectrode Capacitances		
Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to probe	1700 min—2500 max	pF
Heater Current at 6.3 V.	450 ± 20	mA
Heater Warm-Up Time (Average).	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

Phosphor	P4—Sulfide Type, Aluminized
For curves, see front of this section	
Faceplate.	Filterglass
Light transmission at center (unpro.)	42%

MECHANICAL

Weight (Approx.)	30 lb
Overall Length	17.080 ± .312 in
Neck Length.	5.000 ± .125 in
Projected Area of Screen	282 sq in
External Conductive Coating ^a	

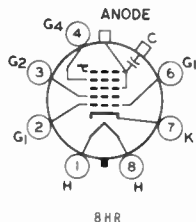
^a Type Regular-Band
 Contact areas for grounding. Near Reference Line

For Additional Information on Coatings and Dimensions
 see Picture-Tube Dimensional-Outlines and Bulb J187M, both
 in front of this section

Cap.	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Noveightar 7-Pin, Arrangement 1, (JEDEC No. B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1—Anode
 Pin 2—Grid No.1
 Pin 3—Grid No.
 Pin 4—Grid No.4
 Pin 5—Grid No.2
 Pin 6—Cathode
 Pin 7—Heater
 Pin 8—Heater
 Pin 9—Anode (Grid No.3,
 Grid No.1, other,
 collector)
 Pin 10—External conductive
 coating



23EZP4

MAXIMUM AND MINIMUM RATINGS. DESIGN-MAXIMUM VALUES

Voltages are positive with respect to Grid No. 1

Anode Voltage	11000 min—23500 max	V
Grid-No.4 Voltage		
Positive peak value	1250 max	V
Negative peak value	400 max	V
Grid-No.2 Voltage	20 min—70 max	V
Cathode Voltage		
Negative peak value	2 max	V
Positive peak value	0 max	V
Positive r-f value	100 max	V
Positive d-c value	150 max	V
Heater Voltage	5.7 min—6.9 max	V
Peak Heater-Cathode Voltage		
Heater positive with respect to cathode:		
during warm-up with $\tau \leq 1.5$ s	450 max	V
after equipment warm-up period	300 max	V
Heater to tube with respect to cathode:		
optimum A-K voltage	200 max	V
normal	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No. 1

Anode Voltage	18000	V
Grid-No.4 Voltage ^b	200	V
Grid-No.2 Voltage	50	V
Cathode Voltage	34 to 52	V

For full details refer to 23EZP4-101.

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	M Ω
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^a Includes explosion protection hardware.

^b The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +100 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13-1/2-inch by 18-inch pattern from an RCA-2E21 monoscope (or equivalent).

For more information, contact your nearest RCA representative.

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Picture Tube

PAN-O-PLY — INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands around Periphery of Tube Panel—No Separate Safety-Glass or Integral Protective Window Required)

RECTANGULAR GLASS TYPE

ALUMINIZED SCREEN

LOW-VOLTAGE ELECTROSTATIC FOCUS

110° MAGNETIC DEFLECTION

NO ION-TRAP MAGNET REQUIRED

Low-Grid-No.2-Voltage—for Cathode-Drive Operation

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes.	5	pf
Grid No.1 to all other electrodes.	6	pf
External conductive coating to anode ^a	{ 2500 max. 1700 min.	pf
		pf

Heater Current at 6.3 volts. 450 ± 20 ma

Heater Warm-Up Time (Average). 11 seconds

Electron Gun Type Requiring No Ion-Trap Magnet

Optical:

Phosphor (For curves, see front of this section) .P4—Sulfide Type, Aluminized

Faceplate. Filterglass

Light transmission at center (Approx.) 42%

Mechanical:

Weight (Approx.) 28 lbs

Overall Length 14.875" ± .281"

Neck Length. 5.125" ± .125"

Projected Area of Screen 282 sq. in.

External Conductive Coating:

Type Regular-Band

Contact area for grounding Near Reference Line

For Additional Information on Coatings, Dimensions, and Deflection Angles:

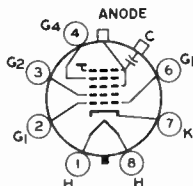
See *Picture-Tube Dimensional-Outlines and Bulb J187 K* sheets at the front of this section.

Cap Recessed Small Cavity (JEDEC No. J1-21)

Base. Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No. B7-208)

Basing Designation for BOTTO™ VIEW. 8HR

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 3—Grid No.2
- Pin 4—Grid No.4
- Pin 6—Grid No.1
- Pin 7—Cathode
- Pin 8—Heater



- Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)
- C—External Conductive Coating



23FDP4

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage.	{ 23000 max. 11000 min.	volts volts
Grid-No. 4 Voltage:		
Positive value	1250 max.	volts
Negative value	400 max.	volts
Grid-No. 2 Voltage.	{ 70 max. 40 min.	volts volts
Cathode Voltage:		
Negative peak value.	2 max.	volts
Negative bias value.	0 max.	volts
Positive bias value.	100 max.	volts
Positive peak value.	150 max.	volts
Heater Voltage	{ 6.9 max. 5.7 min.	volts volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	300 max.	volts
Heater positive with respect to cathode:		
Combined AC & DC voltage	200 max.	volts
DC Component	100 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage.	18000	volts
Grid-No. 4 Voltage ^b	200	volts
Grid-No. 2 Voltage.	50	volts
Cathode Voltage for visual extinction of focused raster	34 to 52	volts
Field Strength of required adjustable Centering Magnet.	0 to 12	gauss

Maximum Circuit Value:

Grid-No. 1 Circuit Resistance	1.5 max.	megohms
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^a Includes implosion protection hardware.

^b The grid-No. 4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No. 1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13-1/2-inch by 18-inch pattern from an RCA-2F21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section





23FRP4

Picture Tube

FILLED-RIM TYPE

110° MAGNETIC DEFLECTION

LOW GRID-No.2 VOLTAGE

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode ^a 1700 min—2500 max		pF
Heater Current at 6.3 V.	450 ± 20	mA
Heater Warm-Up Time (Average).	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

Phosphor	P4—Sulfide Type, Aluminized
For curves, see front of this section	
Faceplate.	Filterglass
Light transmission at center (Approx.) 42 %	

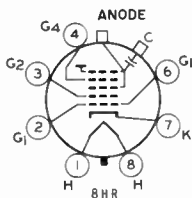
MECHANICAL

Weight (Approx.)	29 lb
Overall Length	14.250 ± .281 in
Neck Length	4.500 ± .125 in
Projected Area of Screen	282 sq in
External Conductive Coating	

Type (see OUTLINE at front of this section)	Regular-Band
Contact for motor grounding	Near Reference Line
Cap.	Recessed Small Cavity (JEDEC No.J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 3—Grid No.2
- Pin 4—Grid No.4
- Pin 6—Grid No.1
- Pin 7—Anode
- Pin 8—Heater
- Cap—Anode (Grid No.3, Grid No.4, Screen, Collector)
- C—External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to grid No.1

Anode Voltage	11000 min—23000 max	V
Grid-No.4 Voltage		
Positive value	1250 max	V
Negative value	400 max	V
Grid-No.2 Voltage	25 min—60 max	V
Cathode Voltage		
Negative peak value	2 max	V
Negative bias value	0 max	V
Positive bias value	100 max	V
Positive peak value	150 max	V
Heater Voltage.	5.7 min—6.9 max	V



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2-67

23FRP4

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:		
During equipment warm-up period ≤ 10 s.	450 max	V
After equipment warm-up period.	300 max	V
Heater positive with respect to cathode:		
Combined AC & DC voltage.	200 max	V
DC component.	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No. 1

Anode Voltage	16000	V
Grid-No.4 Voltage	0 to 400	V
Grid-No.2 Voltage	50	V
Cathode Voltage	32 to 50	V
Field Strength.	0 to 10	G

For visual extinction of focus raster

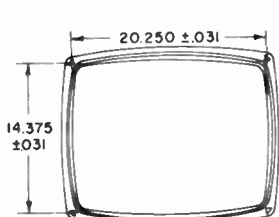
Of required adjustable centering magnet

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance.	1.5 max	M Ω
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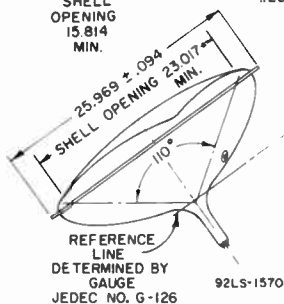
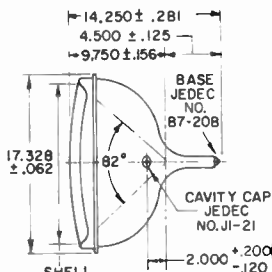
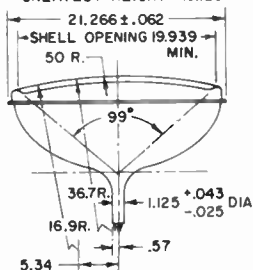
^a Includes implosion protection hardware.

DIMENSIONAL OUTLINE (Bulb J187 K)



MINIMUM SCREEN

DIAGONAL	22.312
GREATEST WIDTH	19.250
GREATEST HEIGHT	15.125



DIMENSIONS IN INCHES



23FSP4

Picture Tube

FILLED-RIM TYPE

110° MAGNETIC DEFLECTION

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid-No.2 to all other electrodes	6	pF
External conductive coating to anode ^a	1700 min—2500 max	pF
Heater Current at 6.3 V	600 ± 30	mA
Heater Warm-Up Time (Average)	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

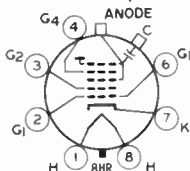
Phosphor	P4—Sulfide Type, Alumined
For data on effect of this condition	
Filterglass	Filterglass
Light transmission at center (approx.)	42%

MECHANICAL

Weight (Approx.)	29 lb
Overall Length	14.875 ± .281 in
Neck Length	5.125 ± .125 in
Projected Area of Screen	282 sq in
External Conductive Coating	
Type (see PART OUTLINES at front of this section) . .	Regular-Band
Contact area to ground pin	Near Reference Line
Cap	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No. B7-20B)

TERMINAL DIAGRAM (Bottom View)

Pin 1—Heater
Pin 2—Grid-No.1
Pin 3—Grid-No.2
Pin 4—Grid-No.3
Pin 5—Grid-No.4
Pin 6—Cathode
Pin 7—Heater



C—Cathode
C1—Cathode
G1—Grid-No.1
G2—Grid-No.2
G3—Grid-No.3
G4—Grid-No.4
COL—Collector
C—External
Conductive
Coating

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage	11000 min—23000 max	V
Grid-No.4 Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage	200 min—550 max	V
Grid-No.1 Voltage		
Positive peak value	220 max	V
Negative peak value	155 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V
Heater Voltage	5.7 min—6.9 max	V



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DATA
2-7

23FSP4

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:	
During equipment warm-up period ≤ 15 s.	450 max V
After equipment warm-up period.	300 max V
Heater positive with respect to cathode:	
Combined AC & DC voltage.	200 max V
DC component.	100 max V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage	18000 V
Grid-No.4 Voltage	0 to 400 V
Grid-No.2 Voltage	300 V
Cathode Voltage	28 to 62 V

For visual extinction of focused raster
 Field Strength. 0 to 12 G
 Of required adjustable centering magnet

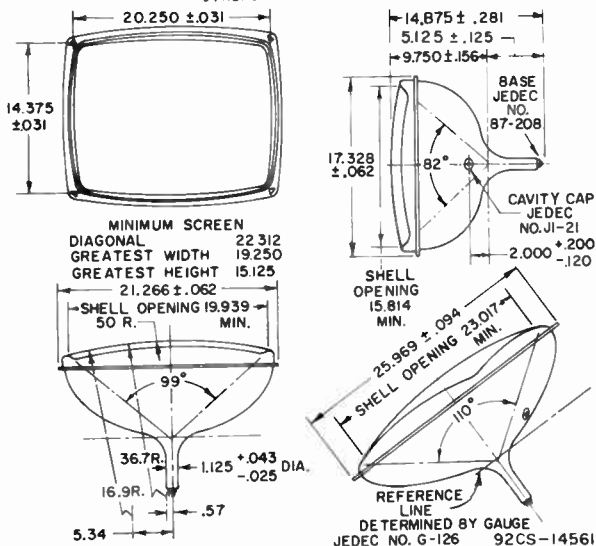
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance. 1.5 max M Ω

^a Includes implosion protection hardware.

DIMENSIONAL OUTLINE (Bulb J187 K)

DIMENSIONS IN INCHES



Picture Tube

**SHORT RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS**

**ALUMINIZED SCREEN
114° MAGNETIC DEFLECTION**

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to anode	{ 2500 max. 1700 min.	{ pf pf
Heater Current at 6.3 volts	600 ± 60	ma
Heater Warm-Up Time (Average)	11	seconds
Electron Gun	Type Requiring No Ion-Trap Magnet	

Optical:

Phosphor (For curves, see front of this section). P4—Sulfide Type, Aluminized
Faceplate Filterglass
Light transmission (Approx.) 78%

Mechanical:

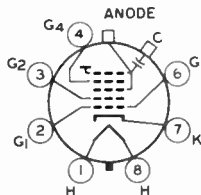
Weight (Approx.) 24 lbs
Overall Length 13- 11/16" + 5/16" - 1/4"
Neck Length 4-3/8" ± 1/8"
Projected Area of Screen 282 sq. in.
External Conductive Coating:

Type Regular-Band
Contact area for grounding Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines and Bulb J187 B* sheets at front of this section

Cap Recessed Small Cavity (JEDEC No. J1-21)
Base Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No. B7-208)

Basing Designation for BOTTOM VIEW 8HR

Pin 1—Heater
Pin 2—Grid No.1
Pin 3—Grid No.2
Pin 4—Grid No.4
Pin 6—Grid No.1
Pin 7—Cathode
Pin 8—Heater



Cap—Anode
(Grid No.3,
Grid No.5,
Screen,
Collector)
C—External
Conductive
Coating



23FP4A

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE	{ 23500 max.	volts
	{ 11000 min.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value.	1100 max.	volts
Negative value.	550 max.	volts
GRID-No.2 VOLTAGE	{ 550 max.	volts
	{ 200 min.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	200 max.	volts
Negative bias value	154 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE.	{ 6.9 max.	volts
	{ 5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage.	200 max.	volts
DC component.	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	14000	volts
Grid-No.4 Voltage	0 to 400	volts
Grid-No.2 Voltage	450	volts
Grid-No.1 Voltage for visual extinction of focused raster	-45 to -105	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section



23GSP4

Picture Tube

PAN-O-PLY TYPE LOW-VOLTAGE ELECTROSTATIC FOCUS
NO ION-TRAP MAGNET REQUIRED 110° MAGNETIC DEFLECTION

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid-No.1 to all other electrodes	6	pF
External conductive coating to anode	1700 min — 2500 max	pF
Heater Current at 6.3 V	600 ± 30	mA
Heater Warm-Up Time (Average)	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

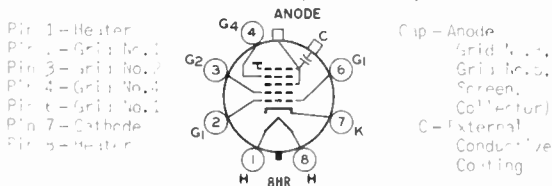
Phosphor	P4—Sulfide Type, Aluminized
For curves, see front of this section	
Faceplate	Filterglass
Light transmission at center (Approx.) 42%	

MECHANICAL

Weight (Approx.)	28 lb
Overall Length	14.875 + .281 in
Neck Length	5.125 + .125 in
Projected Area of Screen	282 sq in
External Conductive Coating ^a	

Type (See NET OUTLINES at front of this section)	Regular-Band
Contact area for grounding	Near Reference Line
Cap	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Neeeightar 7-Pin, Arrangement 1, (JEDEC No. B7-208)

TERMINAL DIAGRAM (BOTTOM VIEW)



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage	11000 min — 23000 max	V
Grid-No.4 Voltage		
Positive peak value	1100 max	V
Positive bias value	550 max	V
Grid-No.2 Voltage	200 min — 550 max	V
Grid-No.1 Voltage		
Negative peak value	220 max	V
Negative bias value	155 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V
Heater Voltage	5.7 min — 6.9 max	V



23GSP4

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:		
During equipment warm-up period ≤ 15 s.	450 max	V
After equipment warm-up period.	300 max	V
Heater positive with respect to cathode:		
Combined AC & DC voltage.	200 max	V
DC component.	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage	18000	V
Grid-No.4-Voltage ^b	200	V
Grid-No.2 Voltage	300	V
Cathode Voltage	28 to 62	V
For visual extinction of focused raster		
Field Strength.	0 to 12	G
Of required adjustable centering magnet		

MAXIMUM CIRCUIT VALUE

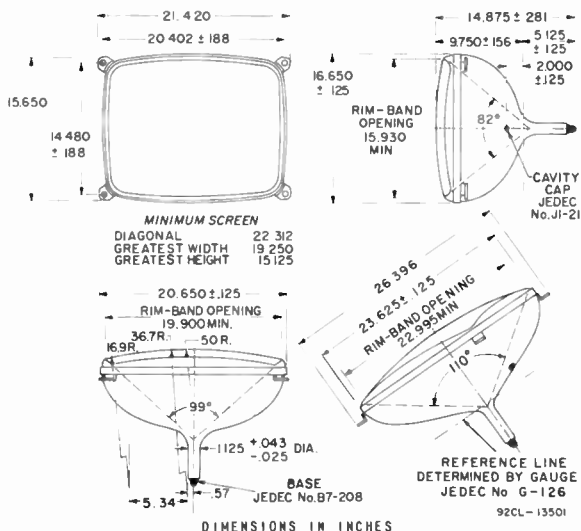
Grid-No.1 Circuit Resistance.	1.5 max	M Ω
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^a Includes implosion protection hardware.

^b The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13-1/2-inch by 18-inch pattern from an RCA 2F21 monoscope, or equivalent.

DIMENSIONAL OUTLINE

FOR PICTURE TUBE UTILIZING BULB JIB7K WITH MOUNTING LUGS



23HFP4A

Picture Tube

PAN-O-PLY—INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands Around
Periphery of Tube Panel—No Separate Safety-Glass or
Integral Protective Window Required)

LOW-VOLTAGE ELECTROSTATIC FOCUS 110° MAGNETIC DEFLECTION
NO ION-TRAP MAGNET REQUIRED

The 23HFP4A is the same as the 23ETP4 except for the following items:

ELECTRICAL

Heater current at 6.3 volts. 450 ± 20 mA

MECHANICAL

External Conductive Coating

Type Special
Contact for grounding Near Reference Line





23HGP4

Picture Tube

PAN-O-PLY TYPE WITH MOUNTING LUGS
 110° MAGNETIC DEFLECTION LOW-VOLTAGE ELECTROSTATIC FOCUS

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode	1700 min—2500 max	pF
Heater Current at 6.3 V	450 ± 20	mA
Heater Warm-Up Time (Average)	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

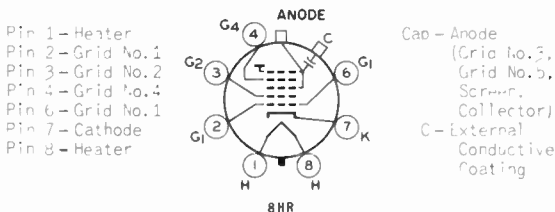
Phosphor	P4—Sulfide Type, Aluminized	
For curves, see front of this section		
Faceplate	Filterglass	
Light transmission at center (Approx.) 42%		

MECHANICAL

Weight (Approx.)	28.5 lb
Overall Length	14.875 ± .281 in
Neck Length	5.125 ± .125 in
Projected Area of Screen	282 sq in
External Conductive Coating ^a	

Type (See CRT OUTLINES 1 at front of this section) Regular-8and
 Contact area for grounding Near Reference Line
 Cap Recessed Small Cavity (JEDEC No. J1-21)
 Base Small-Button Neoeightar 7-Pin,
 Arrangement 1, (JEDEC No. 87-208)

TERMINAL DIAGRAM (Bottom View)



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage	11000 min—23000 max	V
Grid-No.4 Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage	200 min—550 max	V
Grid-No.1 Voltage		
Negative peak value	220 max	V
Negative bias value	155 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V
Heater Voltage	5.7 min—6.9 max	V



23HGP4

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:		
During equipment warm-up period ≤ 15 s . . .	450 max	V
After equipment warm-up period	300 max	V
Heater positive with respect to cathode:		
Combined AC & DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage	18000	V
Grid-No.4 Voltage ^b	200	V
Grid-No.2 Voltage	300	V
Cathode Voltage	28 to 62	V
Field Strength	0 to 12	G

Of required adjustable centering magnet

MAXIMUM CIRCUIT VALUE

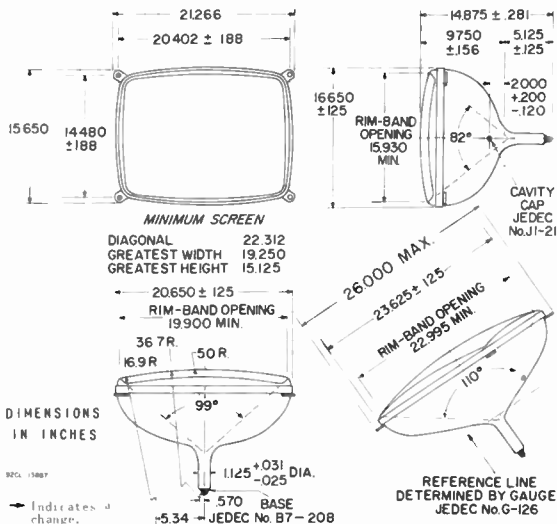
Grid-No.1 Circuit Resistance	1.5 max	M.
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^a Includes implosion protection hardware.

^b The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13-1/2-inch by 18-inch pattern from an RCA-2F21 monoscope, or equivalent.

X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES

DIMENSIONAL OUTLINE (Bulb J187 K With Mounting Lugs)



23HUP4A

Picture Tube

PAN-O-PLY TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

LOW-GRID-No.2 VOLTAGE
110° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External focus coil-coil to coil	1700 min—2500 max	pF
Heater Current at 6.3 volts	450 ± 20	mA
Heater Warm-Up Time (Average)	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet Focus Lens.Unipotential	

OPTICAL

Phosphor.	P4—Sulfide Type, Aluminized
For uses, see front of this section	
Faceplate	Filterglass
Light transmission (approx.) 42%	

MECHANICAL

Weight (Approx.)	28 lb
Overall Length	14.125 ± .281 in ←
Neck Length	4.375 ± .125 in ←
Projected Area of Screen	282 sq in
External Conductive Coating ^a	

^a Regular-Band
Control grid for grounding Near Reference Line

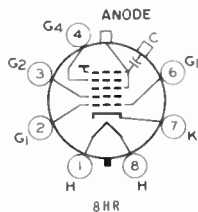
For Additional Information on Coatings and Dimensions

See *Picture-Tube Dimensional-Outlines* for Bulb J187K here at the front of this section

Cap	Recessed Small Cavity (JEDEC No. J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No. B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1—Heater
Pin 2—Grid No.1
Pin 3—Grid No.2
Pin 4—Grid No.3
Pin 5—Grid No.4
Pin 6—Cathode
Pin 7—Heater
Pin 8—Anode (Grid No.5, Grid No.6, Grid No.7, Collector)
C—External conductive coating



23HUP4A

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage.	12000 min—23500 max	V
Grid-No. 4 (Focusing) Voltage		
Positive value.	1250 max	V
Negative value.	400 max	V
Grid-No. 2 Voltage.	20 min—60 max	V
Cathode Voltage		
Negative peak value.	2 max	V
Negative bias value.	0 max	V
Positive bias value.	100 max	V
Positive peak value.	150 max	V
Heater Voltage.	5.7 min—6.9 max	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period:		
not exceeding 15 seconds.	450 max	V
After equipment warm-up period.	300 max	V
Heater positive with respect to cathode:		
Combined AC and DC voltage.	200 max	V
DC component.	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage.	18000	V
Grid-No. 4 Voltage ^b	200	V
Grid-No. 2 Voltage.	30	V
Cathode Voltage.	22 to 45	V
For visual extinction of focused raster		
Field Strength of required adjustable centering magnet.	0 to 12	G

MAXIMUM CIRCUIT VALUE

Grid-No. 1-Circuit Resistance.	1.5 max	M Ω
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^a Includes implosion protection hardware.

^b The grid-No. 4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No. 1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 14.5-inch by 18-inch pattern from an RCA-2F21 monoscope, or equivalent.

For γ -radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



23HWP4A

Picture Tube

PAN-O-PLY TYPE WITH MOUNTING LUGS
 110° MAGNETIC DEFLECTION LOW GRID-No.2 VOLTAGE

ELECTRICAL

Direct Interelectrode Capacitances

Cathode to all other electrodes . . .	5	pF
Grid No.1 to all other electrodes . . .	6	pF
External conductive coating to anode	1700 min—2500 max	pF
Heater Current at 6.3 V.	450 ± 20	mA
Heater Warm-Up Time (Average).	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

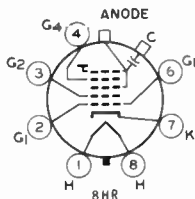
Phosphor	P4—Sulfide Type, Aluminized
for curve at front of this section	
Faceplate.	Filterglass
Light transmission at center (Approx.) 42%	

MECHANICAL

Weight (Approx.)	28 lb
Overall Length	14.875 ± .281 in
Neck Length	5.125 ± .125 in
Projected Area of Screen	282 sq in
External Conductive Coating	
Type: (See CRT OUTLINES 1 at front of this section) . . . Regular-Band	
Contact area for grounding Near Reference Line	
Cap.	Recessed Small Cavity (JEDEC no. J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1. (JEDEC No.87-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1—Heater
 Pin 2—Grid No.1
 Pin 3—Grid No.2
 Pin 4—Grid No.3
 Pin 5—Grid No.4
 Pin 6—Grid No.5
 Pin 7—Cathode
 Pin 8—Heater



Pin 1—Heater
 Pin 2—Grid No.1
 Pin 3—Grid No.2
 Pin 4—Grid No.3
 Pin 5—Grid No.4
 Pin 6—Grid No.5
 Pin 7—Cathode
 Pin 8—Heater

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to grid No.1

Anode Voltage.	12000 min—22000 max	V
Grid-No.4 Voltage		
Positive value	1250 max	V
Negative value	400 max	V
Grid-No.2 Voltage.	30 min—70 max	V
Cathode Voltage		
Positive value	2 max	V
Negative value	0 max	V
Positive bias value	100 max	V
Positive peak value	150 max	V



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23HWP4A

Heater Voltage.	5.7 min—6.9 max	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up periods ≤ 15 s	450 max	V
After equipment warm-up period.	300 max	V
Heater positive with respect to cathode:		
Combined AC & DC voltage.	200 max	V
DC component.	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No. 1

Anode Voltage	16000	V
Grid-No.4 Voltage	0 to 400	V
Grid-No.2 Voltage	50	V
Cathode Voltage	32 to 50	V
For visual extinction of focused raster		
Field Strength.	0 to 10	G
Of required adjustable centering magnet		

MAXIMUM CIRCUIT VALUE

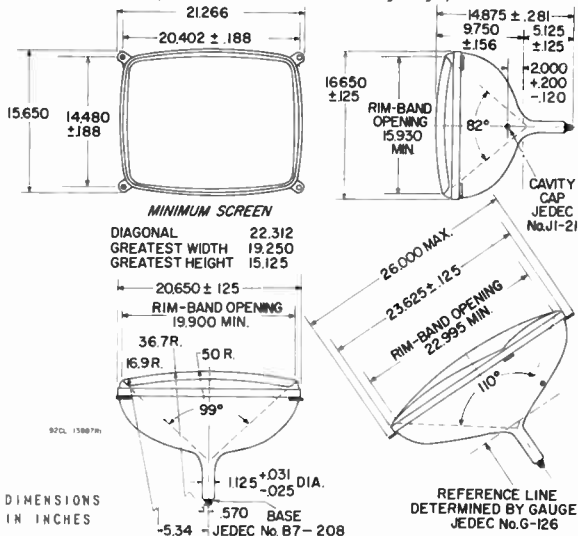
Grid-No.1 Circuit Resistance.	1.5 max	M Ω
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a Includes explosion protection hardware.

For X radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
 at front of this section

DIMENSIONAL OUTLINE

(Bulb J187K with Mounting Lugs)



Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE
 LOW-VOLTAGE ELECTROSTATIC FOCUS
 LOW-GRID-NO.2 VOLTAGE

ALUMINIZED SCREEN
 110° MAGNETIC DEFLECTION
 CATHODE-DRIVE TYPE

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to anode.	{ 2500 max. 2000 min.	pf

Heater Current at 6.3 volts	450 ± 25	ma
Heater Warm-Up Time (Average)	11	seconds
Electron Gun.	Type Requiring No Ion-Trap Magnet	

Optical:

Phosphor (for curves, see front of this section). P4—Sulfide Type, Aluminized	
Faceplate and Protective Panel.	Filterglass
Light transmission (Approx.).	40%

Mechanical:

Weight (Approx.).	32-1/2 lbs
Overall Length.	15-7/16" ± 7/16"
Neck Length	5-3/8" ± 3/16"
Projected Area of Screen.	282 sq. in.

External Conductive Coating:

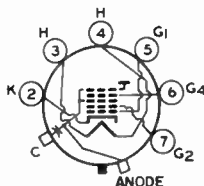
Type.	Regular-Band
Contact area for grounding.	Near Reference Line

For Additional Information on Coatings and Dimensions:

See *Picture-Tube Dimensional-Outlines and Bulb J187 A* sheets at front of this section

Cap	Recessed Small Cavity (JEDEC No. J1-21)
Base.	JEDEC No. B6-214
Basing Designation for BOTTOM VIEW.	7FA

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



- Cap - Anode
 (Grid No.3,
 Grid No.5,
 Screen,
 Collector)
- C - External
 Conductive
 Coating



23JP4

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

ANODE VOLTAGE	{ 22000 max. 15000 min.	volts volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value.	1100 max.	volts
Negative value.	550 max.	volts
GRID-No.2 VOLTAGE	{ 70 max. 44 min.	volts volts
CATHODE VOLTAGE:		
Negative peak value	2 max.	volts
Negative bias value	0 max.	volts
Positive bias value	100 max.	volts
Positive peak value	150 max.	volts
HEATER VOLTAGE.	{ 6.9 max. 5.7 min.	volts volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage.	200 max.	volts
DC component.	100 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	16000	volts
Grid-No.4 Voltage	0 to 500	volts
Grid-No.2 Voltage	50	volts
Cathode Voltage for visual extinction of focused raster.	35 to 50	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section



Picture Tube

**RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS**

**ALUMINIZED SCREEN
MAGNETIC DEFLECTION**

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts.	600 ± 30	ma
Heater Warm-Up Time (Average).	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes.	6	μμf
Cathode to all other electrodes.	5	μμf
External conductive coating to ultor	{ 2500 max. 1700 min.	{ μμf μμf
Focusing Method.	Electrostatic	
Deflection Method.	Magnetic	
Deflection Angles (Approx.):		
Diagonal	114°	
Horizontal	102°	
Vertical	84°	
Electron Gun	Type Requiring No Ion-Trap Magnet	

Optical:

Faceplate.	Filterglass
Light transmission at center (Approx.)	78%
Phosphor (for curves, see front of this section)	P4—Sulfide Type Aluminized
Fluorescence	White
Phosphorescence.	White
Persistence.	Medium Short

Mechanical:

Tube Dimensions:			
Overall length	14-3/8" ± 5/16"		
Greatest width	20-1/2" + 1/16" - 1/8"		
Greatest height.	16-1/2" ± 1/8"		
Diagonal	23-25/64" + 3/32" - 1/8"		
Neck length.	5-1/8" ± 1/8"		
Curvature of faceplate (Radii):			
	Center	Intermediate	Edge
External surface	50"	-	36-3/4"
Internal surface	30"	48"	24"
Screen Dimensions (Minimum):			
Greatest width	19-1/4"		
Greatest height.	15-1/8"		
Diagonal	22-5/16"		
Projected area . . . . .	.282 sq. in.		
Weight (Approx.)	24 lbs		
Operating Position	Any		
Cap.	Recessed Small Cavity (JEDEC No. J1-21)		
Bulb	J187 (114°)		

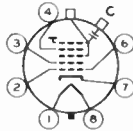


23MP4

Base. Small-Button Neoeightar 7-Pin, Arrangement 1,
(JEDEC No. R7-208)

Basing Designation for BOTTOM VIEW. 8HR

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 3 - Grid No.2
- Pin 4 - Grid No.4
- Pin 6 - Grid No.1
- Pin 7 - Cathode
- Pin 8 - Heater



Cap - Ultor
(Grid No.3,
Grid No.5,
Collector)
C - External
Conductive
Coating

GRID-DRIVE[▲] SERVICE

*Unless otherwise specified, voltage values
are positive with respect to cathode*

Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR VOLTAGE	}	22000 max.	volts
		11000 min.	volts
GRID-No.4 (FOCUSING) VOLTAGE:			
Positive value.		1100 max.	volts
Negative value.		550 max.	volts
GRID-No.2 VOLTAGE	}	550 max.	volts
		200 min.	volts
GRID-No.1 VOLTAGE:			
Negative-peak value		220 max.	volts
Negative-bias value		154 max.	volts
Positive-bias value		0 max.	volts
Positive-peak value		2 max.	volts
HEATER VOLTAGE.	}	6.9 max.	volts
		5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds.		450 max.	volts
After equipment warm-up period.		200 max.	volts
Heater positive with respect to cathode.		200 max.	volts

Equipment Design Ranges:

*With any ultor voltage (E_{C5k}) between 11000 and 22000 volts
and grid-No.2 voltage (E_{C2k}) between 220 and 550 volts*

Grid-No.4 Voltage for focus.	0 to 400	volts
Grid-No.1 Voltage (E_{C1k}) for visual extinction of focused raster	See Raster-Cutoff-Range Chart for Grid-Drive Service	
Grid-No.1 Video Drive from Raster Cutoff (Black level):		
White level value (Peak positive)	Same value as determined for E_{C1k} except video drive is a positive voltage	



Grid-No.4 Current	-25 to +25	μ a
Grid-No.2 Current	-15 to +15	μ a
Field Strength of Adjustable Centering Magnet*	0 to 8	gausses

Examples of Use of Design Ranges:

<i>With ultor voltage of</i>	18000	volts
<i>and grid-No.2 voltage of</i>	400	volts
Grid-No.4 Voltage for focus*	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster	-36 to -94	volts
Grid-No.1 Video Drive from Raster Cutoff (Black level):		
White level value	36 to 94	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
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CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR-TO-GRID-No.1 VOLTAGE	{ 22000 max. 11000 max.	volts volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value	1250 max.	volts
Negative value	400 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE	{ 700 max. 350 min.	volts volts
GRID-No.2-TO-CATHODE VOLTAGE	550 max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive-peak value	220 max.	volts
Positive-bias value	154 max.	volts
Negative-bias value	0 max.	volts
Negative-peak value	2 max.	volts
HEATER VOLTAGE	{ 6.9 max. 5.7 min.	volts volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage (E_{c5g1}) between 11000 and 22000 volts and grid-No.2-to-grid-No.1 voltage (E_{c2g1}) between 225 and 700 volts

Grid-No.4-to-Grid-No.1 Voltage for focus*	0 to 400	volts
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23MP4

Cathode-to-Grid-No.1 Voltage
(E_{kg1}) for visual extinction
of focused raster. See *Raster-Cutoff-Range Chart*
for Cathode-Drive Service

Cathode-to-Grid-No.1 Video
Drive from Raster Cutoff
(Black level):
White-level value
(Peak negative). Same value as determined for
 E_{kg1} except video drive is a
negative voltage

Grid-No.4 Current. -25 to +25 μ a

Grid-No.2 Current. -15 to +15 μ a

Field Strength of Adjustable
Centering Magnet*. 0 to 8 gauss

Examples of Use of Design Ranges:

With *ultor-to-grid-*
No.1 voltage of 18000 volts
and *grid-No.2-to-*
grid-No.1 voltage of 400 volts

Grid-No.4-to-Grid-No.1
Voltage for focus*. 0 to 400 volts

Cathode-to-Grid-No.1 Voltage
for visual extinction
of focused raster. 36 to 78 volts

Cathode-to-Grid-No.1 Video
Drive from Raster Cutoff
(Black level):
White-level value. -36 to -78 volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance 1.5 max. megohms

- ▲ Grid drive is the operating condition in which the video signal varies the grid-no.1 potential with respect to cathode.
- Individual tubes will have satisfactory focus at some value of grid-no.4 (or grid-no.4-to-grid-no.1) voltage between 0 and 400 volts under conditions with the combined bias voltage and video-signal voltage adjusted to produce an ultor current of 200 microamperes.
- ★ Distance from *Reference-Line* for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 3/8-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.
- ◆ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid no.1 and the other electrodes.

OPERATING CONSIDERATIONS

X-Ray Warning. When operated at ultor voltages up to 16 kilovolts, this picture tube does not produce any harmful X-ray radiation. However, because the rating of this type permits operation at voltages as high as 22 kilovolts (Design-maximum value), shielding of this picture tube for X-ray radiation may be needed to protect against possible injury from prolonged

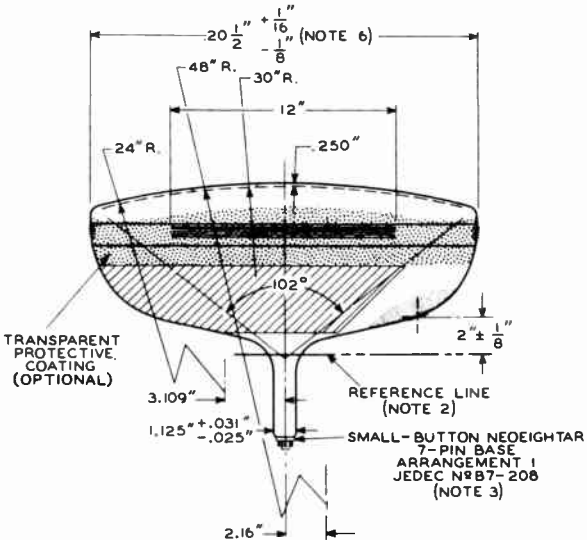
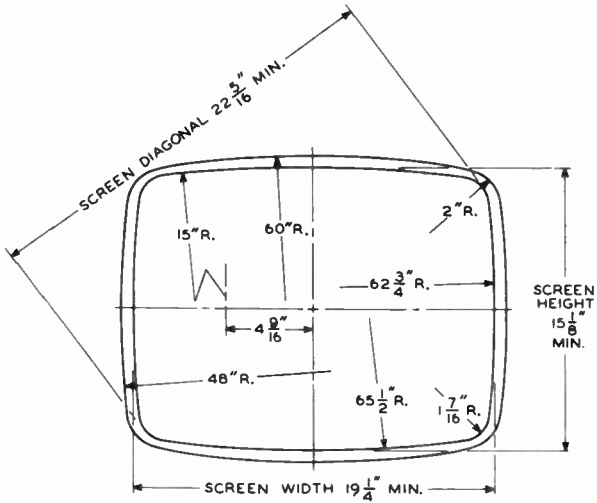


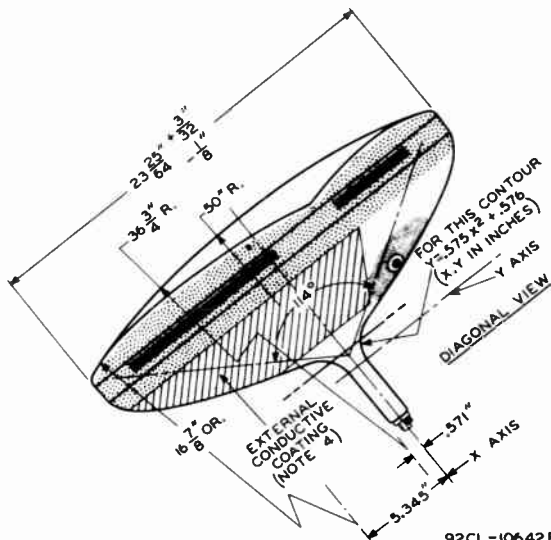
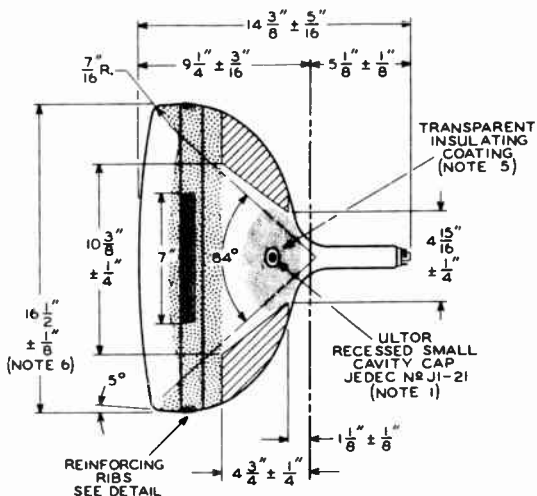
exposure at close range whenever the operating conditions involve voltages in excess of 16 kilovolts.

Shatter-Proof Cover Over the Tube Face. Following conventional picture-tube practice, it is recommended that the cabinet be provided with a shatterproof, glass cover over the face of this picture tube to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.



23MP4

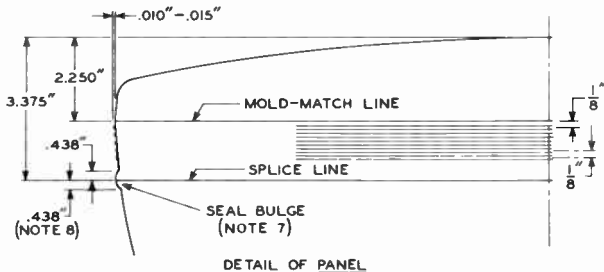




92CL-10642R1



23MP4



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 30^\circ$. ULTOR TERMINAL IS ON SAME SIDE AS PIN 4.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No. G-126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUITRY CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF $1-3/4''$.

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

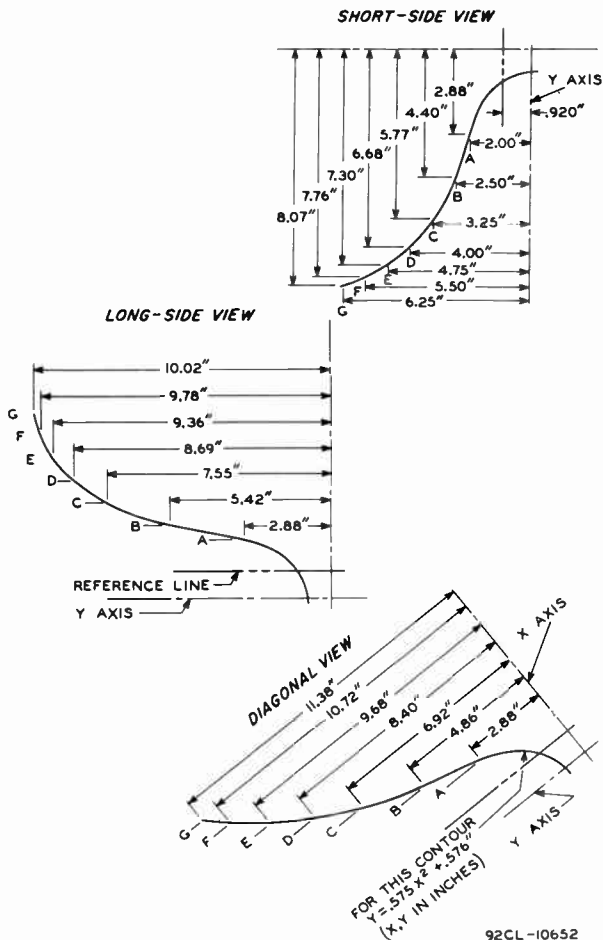
NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

NOTE 6: MEASURED AT THE MOLD-MATCH LINE.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN $1/8''$, BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN $1/16''$ BEYOND THE ENVELOPE SURFACE AT THE LOCATION SPECIFIED FOR DIMENSIONING THE ENVELOPE WIDTH, DIAGONAL, AND HEIGHT.

NOTE 8: AREA BETWEEN MOLD-MATCH LINE AND SEAL BULGE IS $1/2''$ MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF TUBE SUPPORT BAND. SUPPORTS MUST BE SPACED FROM THE TUBE BY THE USE OF CUSHIONING PADS MADE OF ASPHALT, IMPREGNATED FELT OR EQUIVALENT.

BULB-CONTOUR DIMENSIONS

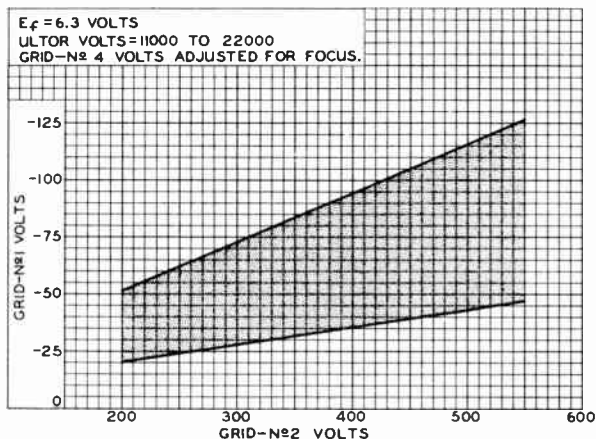


NOTE: PLANES A THRU G ARE NORMAL TO THE TUBE AXIS AND AT FIXED LOCATIONS FROM THE Y AXIS. THESE COORDINATES DESCRIBE THE BOGIE-BULB EXTERNAL CONTOUR IN PLANES THROUGH THE TUBE AXIS AND THE RESPECTIVE FACEPLATE AXES.



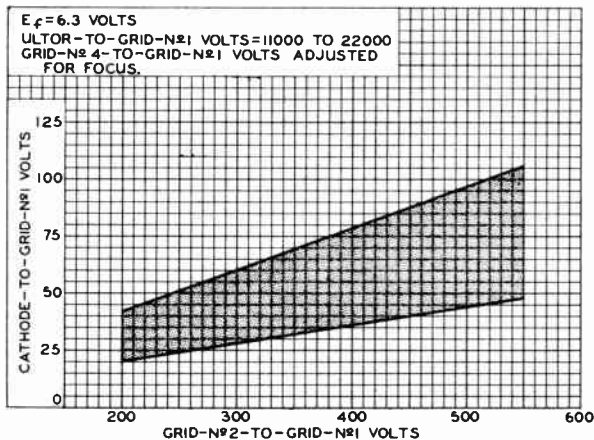
23MP4

RASTER-CUTOFF-RANGE CHARTS Grid-Drive Service



92CS-10620RI

Cathode-Drive Service



92CS-10621RI

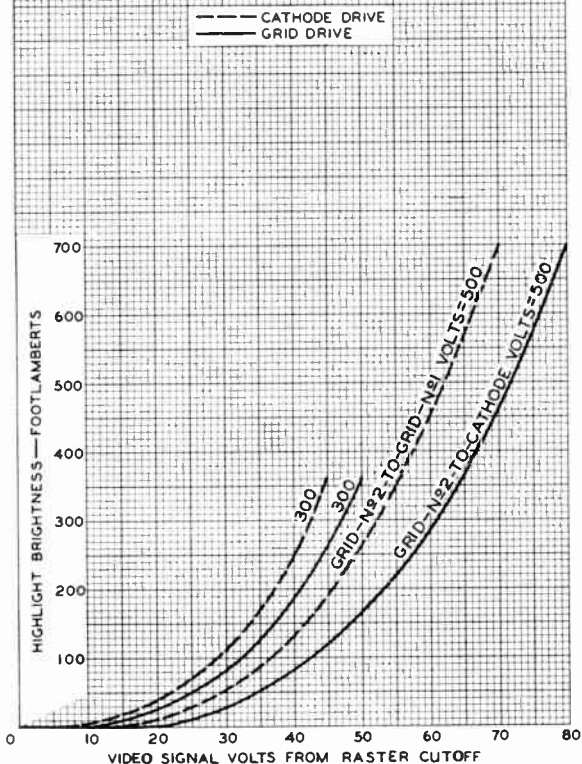


AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE
 $E_f = 6.3$ VOLTS
 ULTOR-TO-GRID-N₂ VOLTS = 16000
 CATHODE BIASED POSITIVE WITH
 RESPECT TO GRID N₂ TO GIVE
 FOCUSED RASTER CUTOFF.
 RASTER FOCUSED
 AT AVERAGE BRIGHTNESS.
 RASTER SIZE = 18" x 13½"

GRID-DRIVE SERVICE
 $E_f = 6.3$ VOLTS
 ULTOR VOLTS = 16000
 GRID N₂ BIASED NEGATIVE WITH
 RESPECT TO CATHODE TO GIVE
 FOCUSED RASTER CUTOFF.
 RASTER FOCUSED
 AT AVERAGE BRIGHTNESS.
 RASTER SIZE = 18" x 13½"

CIE COORDINATES OF SCREEN: X=0.287, Y=0.315



92CM-10625



23MP4

AVERAGE DRIVE CHARACTERISTICS

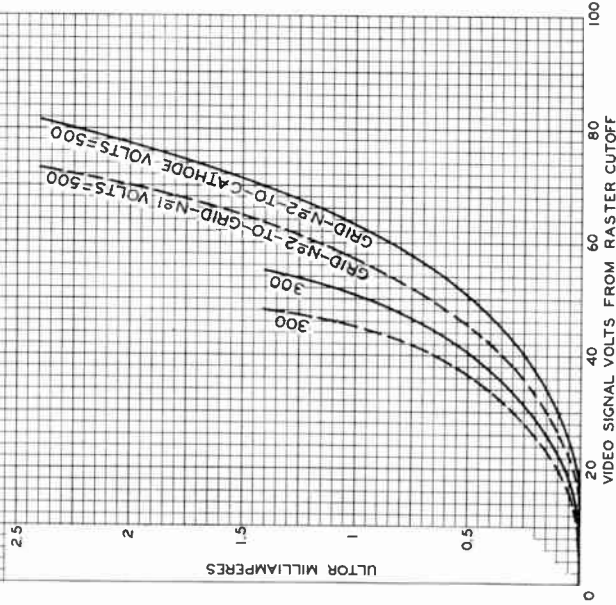
CATHODE-DRIVE SERVICE

$E_f = 6.3$ VOLTS
ULTOR-TO-GRID-N#1
VOLTS = 11000 TO 22000
CATHODE BIASED POSITIVE WITH
RESPECT TO GRID N#1 TO GIVE
FOCUSED RASTER CUTOFF.

GRID-DRIVE SERVICE

$E_f = 6.3$ VOLTS
ULTOR VOLTS = 11000 TO 22000
GRID N#1 BIASED NEGATIVE WITH
RESPECT TO CATHODE TO GIVE
FOCUSED RASTER CUTOFF.

--- CATHODE DRIVE
--- GRID DRIVE



92CM-10618

23NP4

Picture Tube

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE
 LOW-VOLTAGE ELECTROSTATIC FOCUS
 LOW GRID-No.2 VOLTAGE

ALUMINIZED SCREEN
 114° MAGNETIC DEFLECTION
 CATHODE-DRIVE TYPE

Electrical:

Direct Interelectrode Capacitances:
 Grid No.1 to all other electrodes. 6 pf
 Cathode to all other electrodes. 5 pf
 External conductive coating to anode $\begin{cases} 2500 \text{ max.} \\ 1700 \text{ min.} \end{cases}$ pf
 Heater Current at 6.3 volts. 600 ± 30 ma
 Heater Warm-up Time (Average). 11 seconds
 Electron Gun Type Requiring No Ion-Trap Magnet

Optical:

Phosphor (For curves, see front of this section). . . P4—Sulfide Type
 Aluminized
 Faceplate. Filterglass
 Light transmission at center (Approx.) 78%

Mechanical:

Weight (Approx.) 24 lbs
 Overall Length $14.531" \pm .281"$
 Neck Length. $5.125" \pm .125"$
 Projected Area of Screen 282 sq. in.

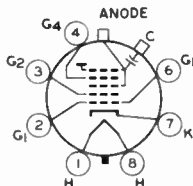
External Conductive Coating:
 Type Regular-Band
 Contact area for grounding Near Reference Line
 For Additional Information on Coatings and Dimensions:

See *Picture-Tube Dimensional-Outlines and Bulb J187 B* sheets at front of this section

Cap. Recessed Small Cavity (JEDEC No.J1-21)
 Base Small-Button Neoeightar 7-Pin, Arrangement 1 (JEDEC No.B7-208)

Basing Designation for BOTTOM VIEW. 8HR

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 3—Grid No.2
- Pin 4—Grid No.4
- Pin 6—Grid No.1
- Pin 7—Cathode
- Pin 8—Heater
- Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)
- C—External Conductive Coating



23NP4

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	{ 22000 max. -1000 min.	volts volts
Grid-No. 4 (Focusing) Voltage:		
Positive value	1250 max.	volts
Negative value	400 max.	volts
Grid-No. 2 Voltage	{ 70 max. 40 min.	volts volts
Cathode Voltage:		
Negative peak value	2 max.	volts
Negative bias value	0 max.	volts
Positive bias value	155 max.	volts
Positive peak value	220 max.	volts
Heater Voltage	{ 6.9 max. 5.7 min.	volts volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	300 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	18000	volts
Grid-No. 4 Voltage	200	volts
Grid-No. 2 Voltage	50	volts
Cathode Voltage for visual extinction of focused raster	3:1 to 5:2	volts

Maximum Circuit Value:

Grid-No. 1 Circuit Resistance	1.5 max.	megohms
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For X-radiation shielding consideration, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section



Picture Tube

**BI-PANEL RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS**

**ALUMINIZED SCREEN
92° MAGNETIC DEFLECTION**

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts	600 ± 5%	ma
Heater Warm-Up Time (Average)	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor.	} 2500 max. 2000 min.	μμf
Electron Gun. . . . .			Type Requiring No Ion-Trap Magnet

Optical:

Faceplate and Protective Panel.	Filterglass
Light transmission (Approx.).	40%
Phosphor (for curves, see front of this section). P4—Sulfide Type.	Aluminized

Mechanical:

Operating Position.	Any
Weight (Approx.).	34-1/2 lbs
Overall Length.	18-5/16" ± 7/16"
Neck Length.	5-1/2" ± 3/16"
Projected Area of Screen.	282 sq. in.
External Conductive Coating:	

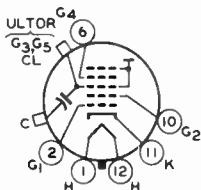
Type.	Regular Band
Contact area for grounding.	Near Reference Line

For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines* and *Bulb J187 D G* sheets at the front of this section

Cap	Recessed Small Cavity (JEDEC No. J1-21)
Base.	Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No. B6-203)

Basing Designation for BOTTOM VIEW. 12L

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 6 - Grid No.4
- Pin 10 - Grid No.2
- Pin 11 - Cathode
- Pin 12 - Heater



Cap - Ultor
(Grid No.3,
Grid No.5,
Collector)
C - External
Conductive
Coating



23YP4

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

ULTOR VOLTAGE	{ 22000 max. 12000 min.	volts volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

<i>With ultor voltage of</i>	16000	volts
<i>and grid-No.2 voltage of</i>	300	volts
Grid-No.4 Voltage for focus	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster	-35 to -72	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
90° MAGNETIC DEFLECTION

GENERAL DATA

Electrical:

Heater Current at 6.3 volts	600 ± 10%	ma
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor.	{ 2500 max.	μμf
	{ 2000 min.	μμf
Electron Gun.	Type Requiring No Ion-Trap Magnet	

Optical:

Faceplate, Spherical.	Filterglass
Light transmission (Approx.).	75%
Phosphor (For curves, see front of this section).	P4—Sulfide Type, Aluminized

Mechanical:

Operating Position.	Any
Weight (Approx.).	35 lbs
Overall Length.	19-1/8" ± 3/8"
Neck Length.	5-1/2" ± 3/16"
Projected Area of Screen.	332 sq. in.
External Conductive Coating:	

Type Special
 Contact area for grounding. Near Reference Line
 For Additional Information on Coatings and Dimensions:

See *Picture-Tube Dimensional-Outlines* and *Bulb J192 A/B* sheets at the front of this section

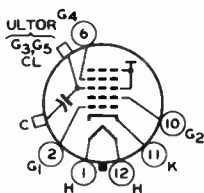
Cap Recessed Small Cavity (JEDEC No. J1-21)
 Bases (Alternates):

Short Small-Shell Duodecal 6-Pin
 (JEDEC Group 4, No. B6-203)

Small-Shell Duodecal 6-Pin, Arrangement 1
 (JEDEC Group 4, No. B6-63)

Basing Designation for BOTTOM VIEW. 12L

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 6—Grid No.4
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater



Cap—Ultor
 (Grid No.3,
 Grid No.5,
 Collector)
 C—External
 Conductive
 Coating



24AEP4

Maximum Ratings, Design-Maximum Values:

ULTOR VOLTAGE	22000 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value.	1100 max.	volts
Negative value.	550 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Typical Operating Conditions:

With ultor voltage of	18000	volts
and grid-No.2 voltage of	300	volts
Grid-No.4 Voltage for focus	-50 to +350	volts
Grid-No.1 Voltage for visual extinction of focused raster.	-28 to -72	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section





24AHP4

PICTURE TUBE

24AHP4

RECTANGULAR GLASS TYPE
LOW-VOLTAGE FOCUS

ALUMINIZED SCREEN
MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

Voltage 6.3 ac or dc volts
Current 0.6 ± 10% amp

Direct Interelectrode Capacitances:

Grid No.1 to all other electrodes 6 $\mu\mu\text{f}$
Cathode to all other electrodes 5 $\mu\mu\text{f}$
External conductive coating to ultor. { 2500 max. $\mu\mu\text{f}$
2000 min. $\mu\mu\text{f}$

Faceplate, Spherical, Filterglass

Light transmission (Approx.) 76%

Phosphor (For curves, see front of this section). P4—Sulfide Type
Aluminized

Fluorescence White

Phosphorescence White

Persistence Short

Focusing Method Electrostatic

Deflection Method Magnetic

Deflection Angles (Approx.):

Diagonal 110°
Horizontal 105°
Vertical 87°

Electron Gun Type Requiring No Ion-Trap Magnet

Tube Dimensions:

Overall length 15-7/8" ± 5/16"
Greatest width 22-11/16" ± 1/8"
Greatest height 18-1/2" ± 1/8"
Diagonal 24" ± 1/8"
Neck length 5-7/16" ± 1/8"

Screen Dimensions (Minimum):

Greatest width 21-7/16"
Greatest height 16-7/8"
Diagonal 22-13/16"
Projected area 332 sq. in.

Weight (Approx.) 28 lbs

Mounting Position Any

Cap Recessed Small Cavity (JETEC No. J1-21)

Bulb J192 (110°)

Base Small-Button Eightar 7-Pin,
Arrangement 2, (JETEC No. B7-183)

Basing Designation for BOTTOM VIEW 8HR

Pin 1 - Heater

Pin 2 - Grid No. 1

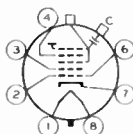
Pin 3 - Grid No. 2

Pin 4 - Grid No. 4

Pin 5 - Grid No. 3

Pin 7 - Cathode

Pin 8 - Heater



Cap - Ultor

(Grid No. 3,
Grid No. 5,
Collector)

C - External
Conductive
Coating

24AHP4



24AHP4

PICTURE TUBE

GRID-DRIVE[▲] SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum Ratings, Design-Center Values:

ULTOR VOLTAGE	{ 20000 max. volts	
GRID-No.4 VOLTAGE:	{ 12000*min. volts	
Positive value	1000 max. volts	
Negative value	500 max. volts	
GRID-No.2 VOLTAGE	500 max. volts	
GRID-No.1 VOLTAGE:		
Negative peak value	200 max. volts	
Negative bias value	140 max. volts	
Positive bias value	0 max. volts	
Positive peak value	2 max. volts	
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds	410 max. volts	
After equipment warm-up period	180 max. volts	
Heater positive with respect to cathode.	180 max. volts	

Equipment Design Ranges:

With any ultor voltage (E_{C5k}) between 12000 and 20000 volts and grid-No.2 voltage (E_{C2k}) between 200 and 500 volts

Grid-No.4 Voltage for Focus [§]	-50 to +350	volts
Grid-No.1 Voltage (E_{C1k}) for Visual Extinction of Focused Raster.	See Raster-Cutoff-Range Chart for Grid-Drive Service	
Grid-No.1 Video Drive from Raster Cutoff (Black Level):		
White-level value (Peak positive)	Same value as determined for E_{C1k} except video drive is a positive voltage	
Grid-No.4 Current	-25 to +25	μ a
Grid-No.2 Current	-15 to +15	μ a
Field Strength of Adjustable Centering Magnet*	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor voltage of	14000	16000	volts
and grid-No.2 voltage of	300	400	volts
Grid-No.4 Voltage for Focus	-50 to +350	-50 to +350	volts

▲ Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

§, * : See next page.



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PICTURE TUBE

Grid-No.1 Voltage for Visual Extinction of Focused Raster	-28 to -72	-36 to -94	volts
Grid-No.1 Video Drive from Raster Cutoff (Black Level):			
White-level value.	28 to 72	36 to 94	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
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CATHODE-DRIVE[■] SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Maximum Ratings, Design-Center Values:

ULTOR-TO-GRID-No.1 VOLTAGE	{ 20000 max. volts 12000 [*] min. volts
GRID-No.4-TO-GRID-No.1 VOLTAGE:	
Positive value	1000 max. volts
Negative value	500 max. volts
GRID-No.2-TO-GRID-No.1 VOLTAGE	640 max. volts
GRID-No.2-TO-CATHODE VOLTAGE	500 max. volts
CATHODE-TO-GRID-No.1 VOLTAGE:	
Positive peak value.	200 max. volts
Positive bias value.	140 max. volts
Negative bias value.	0 max. volts
Negative peak value.	2 max. volts
PEAK HEATER-CATHODE VOLTAGE:	
Heater negative with respect to cathode:	
During equipment warm-up period	
not exceeding 15 seconds	410 max. volts
After equipment warm-up period	180 max. volts
Heater positive with respect to cathode.	180 max. volts

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage ($E_{c_5g_1}$) between 12000 and 20000 volts and grid-No.2-to-grid-No.1 voltage ($E_{c_2g_1}$) between 225 and 640 volts

Grid-No.4-to-Grid-No.1 Voltage for Focus [§]	-50 to +350	volts
---	-------------	-------

[■] Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

^{*} This value is a working design-center minimum. The equivalent absolute minimum ultor-or ultor-to-grid-No.1 voltage is 11000 volts, below which the serviceability of the 24AHP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor-or ultor-to-grid-No.1 voltage is never less than 11000 volts.

[§]: See next page.



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PICTURE TUBE

Cathode-to-Grid-No.1 Voltage (E _{kg1}) for Visual Extinction of Focused Raster.	See Raster-Cutoff-Range Chart for Cathode-Drive Service
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level): White-level value (Peak negative).	Same value as determined for E _{kg1} except video drive is a negative voltage
Grid-No.4 Current.	-25 to +25 μ a
Grid-No.2 Current.	-15 to +15 μ a
Field Strength of Adjust- able Centering Magnet*	0 to 8 gauss(es)

Examples of Use of Design Ranges:

With ultor-to-grid-No.1 voltage of	14000	16000	volts
and grid-No.2-to-grid-No.1 voltage of	300	400	volts

Grid-No.4-to-Grid- No.1 Voltage for Focus	-50 to +50	-50 to +350	volts
Cathode-to-Grid-No.1 Voltage for Visual Extinction of Focus: Raster	28 to 60	36 to 78	volt
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level): White-level value.	-28 to -60	-36 to -78	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
---------------------------------------	----------	---------

* Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 7/16-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

§ The grid-no.4 voltage or grid-no.4-to-grid-no.1 voltage required for focus of any individual tube is independent of ultor current and will remain essentially constant for values of ultor voltage (or ultor-to-grid-no.1 voltage) or grid-no.2 voltage (or grid-no.2-to-grid-no.1 voltage) within design ranges shown for these items.

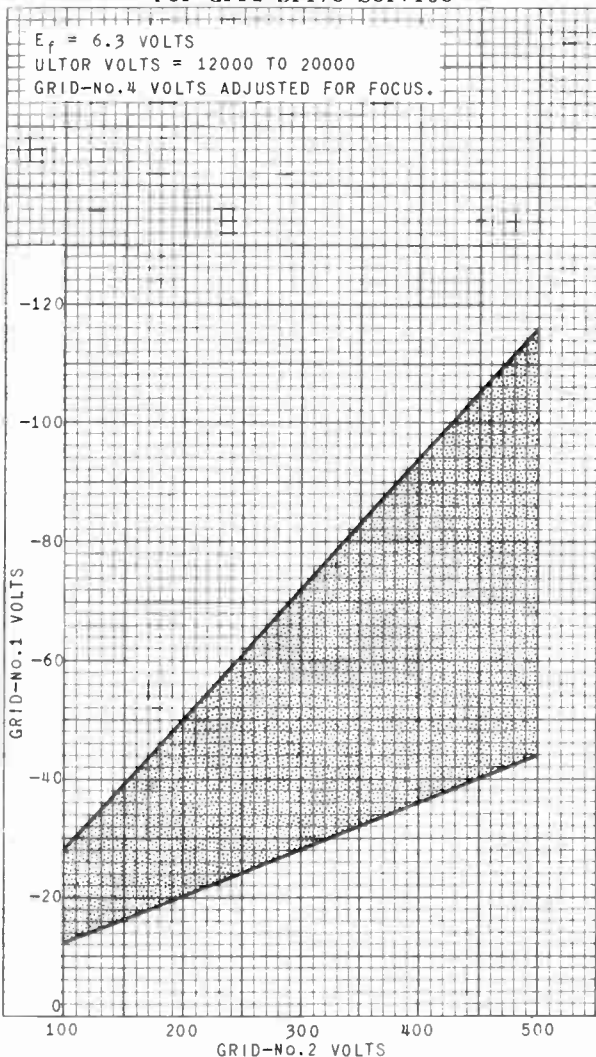
For X-ray shielding considerations, see sheet
X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section



24AHP4

RASTER-CUTOFF-RANGE CHART For Grid-Drive Service

24AHP4



ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

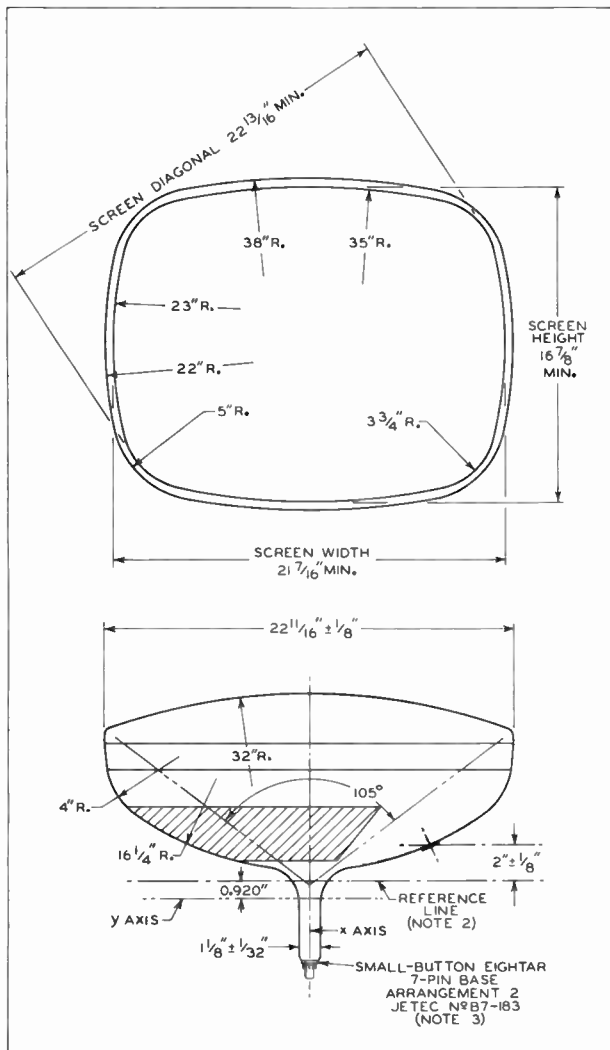
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24AHP4



24AHP4

PICTURE TUBE

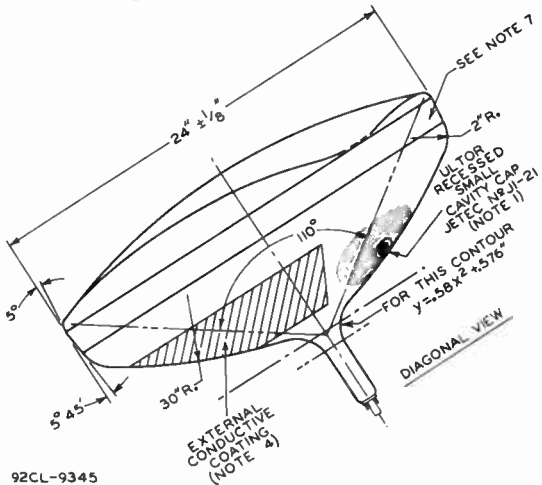
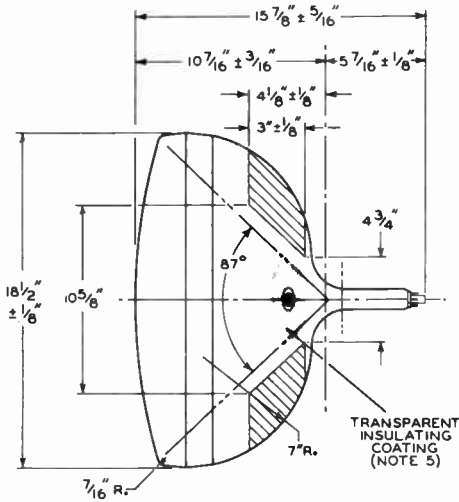




24AHP4

PICTURE TUBE

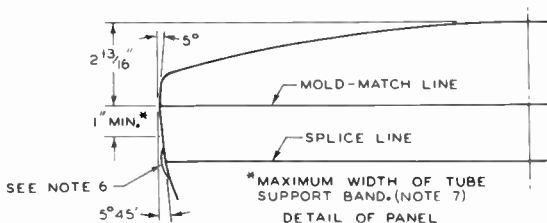
24AHP4



92CL-9345



24AHP4 PICTURE TUBE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 30^\circ$. ULTOR TERMINAL IS ON SAME SIDE AS PIN 4.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No. 126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF $1-3/4"$.

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

NOTE 6: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN $1/8"$, BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN $1/16"$ BEYOND THE ENVELOPE SURFACE AT THE MOLD-MATCH LINE.

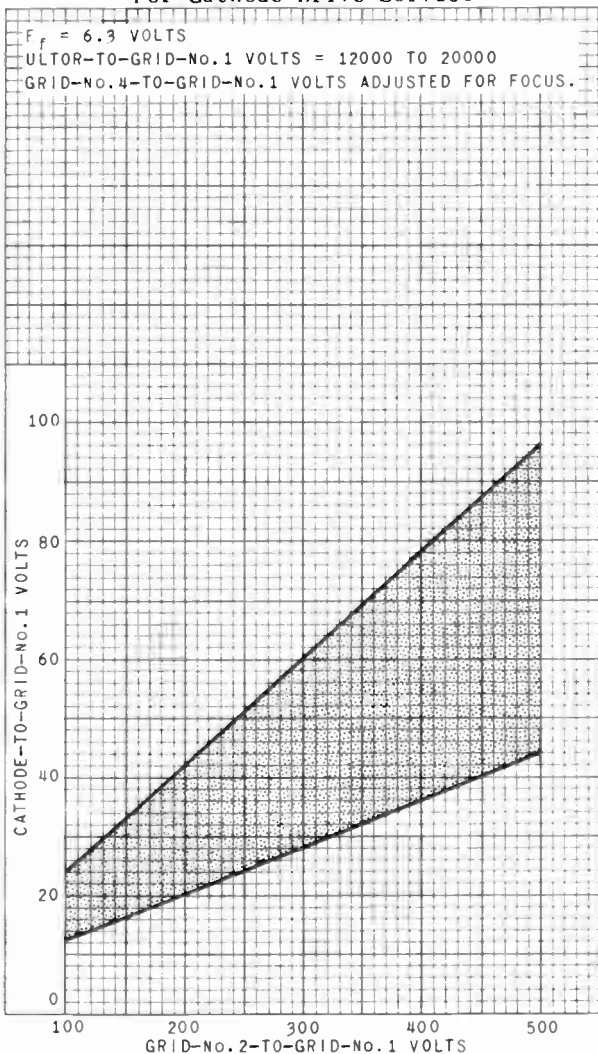
NOTE 7: UNDISTURBED AREA BETWEEN MOLD-MATCH LINE AND SPLICE LINE IS 1" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF TUBE SUPPORT BAND.



24AHP4

24AHP4

RASTER-CUTOFF-RANGE CHART For Cathode-Drive Service



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

92CS-9350

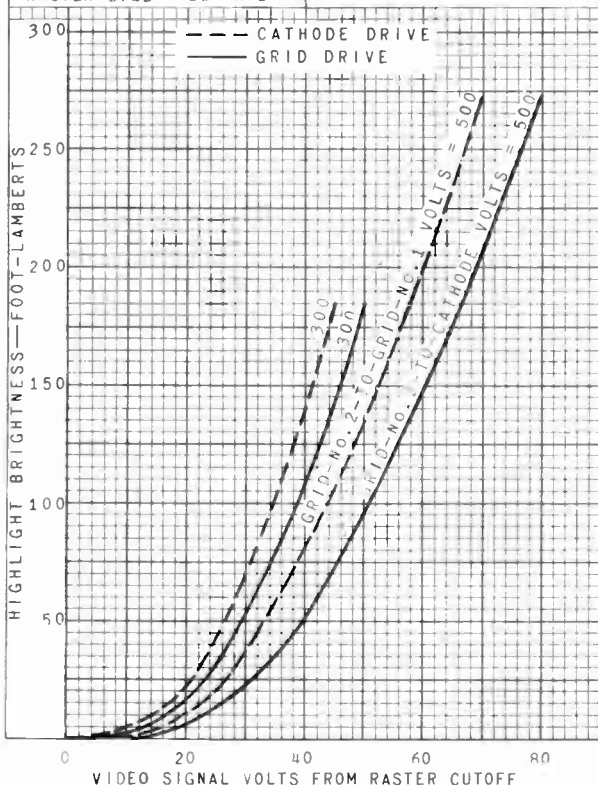


24AHP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE
 $E_f = 6.3$ VOLTS
 ULTOR-TO-GRID-No.1
 VOLTS = 16000
 CATHODE BIASED POSITIVE
 WITH RESPECT TO GRID
 No.1 TO GIVE FOCUSED
 RASTER CUTOFF.
 RASTER FOCUSED
 AT AVERAGE BRIGHTNESS.
 RASTER SIZE = 21" x 16"

GRID-DRIVE SERVICE
 $E_f = 6.3$ VOLTS
 ULTOR VOLTS = 16000
 GRID No.1 BIASED NEGA-
 TIVE WITH RESPECT TO
 CATHODE TO GIVE
 FOCUSED RASTER CUTOFF.
 RASTER FOCUSED
 AT AVERAGE BRIGHTNESS.
 RASTER SIZE = 21" x 16"



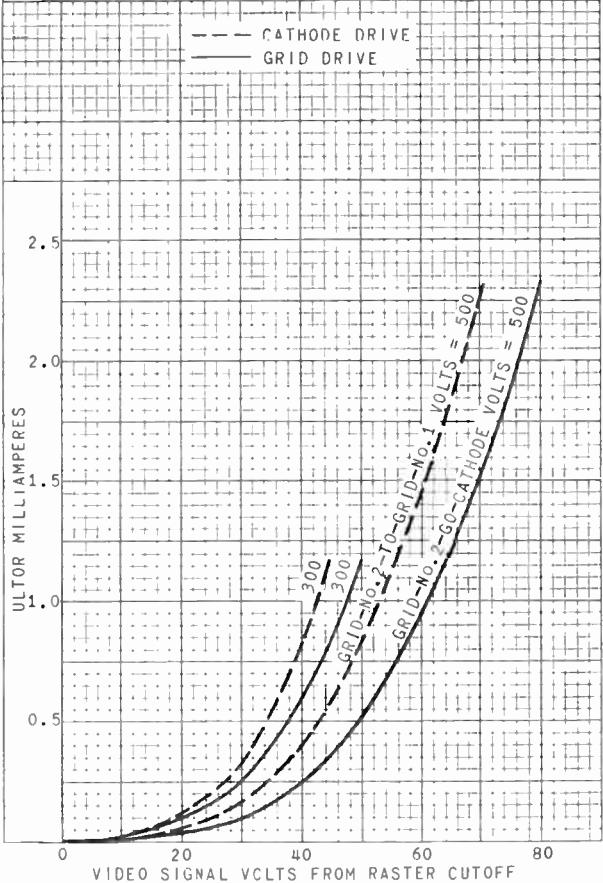


24AHP4

24AHP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
$E_f = 6.3$ VOLTS	$E_f = 6.3$ VOLTS
ULTOR-TO-GRID-No.1 VOLTS = 12000 TO 20000	ULTOR VOLTS = 12000 TO 20000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID No.1 TO GIVE FOCUSED RASTER CUTOFF.	GRID No.1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.







24AUP4

24AUP4 PICTURE TUBE

RECTANGULAR GLASS TYPE ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS MAGNETIC DEFLECTION
With heater having controlled warm-up time

DATA

General:

Heater, for Unipotential Cathode:

Voltage 6.3 ac or dc volts
Current 0.6 ± 5% amp
Warm-up time (Average) 11 sec.

For definition of heater warm-up time and method of determining it, see sheet HEATER WARM-UP TIME MEASUREMENT at front of Receiving Tube Section.

Direct Interelectrode Capacitances:

Grid No.1 to all other electrodes 6 μ f
Cathode to all other electrodes 5 μ f
External conductive coating to ultor { 2500 max. μ f
1700 min. μ f

Faceplate, Spherical Filterglass

Light transmission (Approx.) 74%

Phosphor (For curves, see front of this section). . . P4—Sulfide Type
Aluminized

Fluorescence White

Phosphorescence White

Persistence Short

Focusing Method Electrostatic

Deflection Method Magnetic

Deflection Angles (Approx.):

Diagonal 90°

Horizontal 85°

Vertical 68°

Electron Gun Type Requiring No Ion-Trap Magnet

Tube Dimensions:

Overall length 18-1/8" ± 3/8"

Greatest width 22-11/16" ± 1/8"

Greatest height 18-7/16" ± 1/8"

Diagonal 24" ± 1/8"

Neck length 4-1/2" ± 3/16"

Radius of curvature of faceplate (External surface). . . 40"

Screen Dimensions (Minimum):

Greatest width 21-7/16"

Greatest height 16-7/8"

Diagonal 22-13/16"

Projected area 332 sq. in.

Weight (Approx.) 32-1/2 lbs

Operating Position Any

Cap. Recessed Small Cavity (JEDEC No. J1-21)

Bulb J192A/B

Base Short Small-Shell Duodecal 6-Pin

(JEDEC Group 4, No. B6-203), or

Small-Shell Duodecal 6-Pin, Arrangement 1

(JEDEC Group 4, No. B6-63)

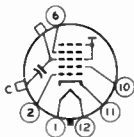


24AUP4

PICTURE TUBE

Basing Designation for BOTTOM VIEW12L

Pin 1-Heater
 Pin 2-Grid No.1
 Pin 6-Grid No.4
 Pin 10-Grid No.2
 Pin 11-Cathode
 Pin 12-Heater



Cap-Ultor
 (Grid No.3,
 Grid No.5,
 Collector)
 C-External
 Conductive
 Coating

GRID-DRIVE[▲] SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum Ratings, Design-Center Values:

ULTOR VOLTAGE.	{ 20000 max. volts 12000* min. volts
GRID-No.4 (FOCUSING) VOLTAGE:	
Positive value	1000 max. volts
Negative value	500 max. volts
GRID-No.2 VOLTAGE.	500 max. volts
GRID-No.1 VOLTAGE:	
Negative-peak value.	200 max. volts
Negative-bias value.	140 max. volts
Positive-bias value.	0 max. volts
Positive-peak value.	2 max. volts
PEAK HEATER-CATHODE VOLTAGE:	
Heater negative with respect to cathode:	
During equipment warm-up period	
not exceeding 15 seconds	410 max. volts
After equipment warm-up period	180 max. volts
Heater positive with respect to cathode.	180 max. volts

Equipment Design Ranges:

With any ultor voltage (E_{C5k}) between 12000 and 20000 volts and grid-No.2 voltage (E_{C2k}) between 200 and 500 volts

Grid-No.4 Voltage for focus [§]	-75 to +400 volts
Grid-No.1 Voltage (E_{C1k}) for visual extinction of focused raster	See Raster-Cutoff-Range Chart for Grid-Drive Service
Grid-No.1 Video Drive from Raster Cutoff (Black Level):	
White-level value (Peak positive).	Same value as determined for E_{C1k} except video drive is a positive voltage
Grid-No.4 Current.	-25 * +25 μ a

* , §: See next page.



24AUP4

24AUP4

PICTURE TUBE

Grid-No.2 Current.	-15 to +15	μa
Field Strength of Adjustable Centering Magnet†.	0 to 8	gausses

Examples of Use of Design Ranges:

<i>With ultor voltage of</i>	18000	volts
<i>and grid-No.2 voltage of</i>	300	volts
Grid-No.4 Voltage for focus . . .	-75 to +400	volts
Grid-No.1 Voltage for visual extinction of focused raster. .	-35 to -72	volts
Grid-No.1 Video Drive from Raster Cutoff (Black Level):		
White-level value	35 to 72	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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CATHODE-DRIVE[®] SERVICE

*Unless otherwise specified, voltage values are positive
with respect to grid No.1*

Maximum Ratings, Design-Center Values:

ULTOR-TO-GRID-No.1 VOLTAGE.	{ 20000 max. volts 12000 [®] min. volts
GRID-No.4-TO-GRID-No.1 VOLTAGE:	
Positive value.	1000 max. volts
Negative value.	500 max. volts
GRID-No.2-TO-GRID-No.1 VOLTAGE.	640 max. volts
GRID-No.2-TO-CATHODE VOLTAGE.	500 max. volts
CATHODE-TO-GRID-No.1 VOLTAGE:	
Positive-peak value	200 max. volts
Positive-bias value	140 max. volts
Negative-bias value	0 max. volts
Negative-peak value	2 max. volts
PEAK HEATER-CATHODE VOLTAGE:	
Heater negative with respect to cathode:	
During equipment warm-up period not exceeding 15 seconds.	410 max. volts
After equipment warm-up period.	180 max. volts
Heater positive with respect to cathode.	180 max. volts

Equipment Design Ranges:

*With any ultor-to-grid-No.1 voltage (E_{c5g1}) between 12000
and 20000 volts and grid-No.2-to-grid-No.1 voltage (E_{c2g1})
between 225 and 640 volts*

Grid-No.4-to-Grid-No.1 Voltage for focus.	-75 to +400	volts
Cathode-to-Grid-No.1 Voltage (E_{kg1}) for visual extinction of focused raster	See Raster-Cutoff-Range Chart for Cathode-Drive Service	

▲, †, §, †, ■: See next page.



24AUP4

PICTURE TUBE

Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level):		
White-level value (Peak negative)	Same value as determined for E_{kg1} except video drive is a negative voltage	
Grid-No.4 Current	-25 to +25	μ a
Grid-No.2 Current	-15 to +15	μ a
Field Strength of Adjustable Centering Magnet† 0 to 8 gauss		

Examples of Use of Design Ranges:

<i>With ultor-to-grid-No.1 voltage of</i>		
<i>and grid-No.2-to-grid-No.1 voltage of</i>	<i>18000</i>	<i>volts</i>
Grid-No.4-to-Grid-No.1 Voltage for focus	-75 to +40C	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster	33 to 60	volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level):		
White-level value	-33 to -60	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
---------------------------------------	----------	---------

▲ Grid drive is the operating condition in which the video signal varies the grid-no.1 potential with respect to cathode.

* This value is a working design-center minimum. The equivalent absolute minimum ultor-or ultor-to-grid-No.1 voltage is 11,000 volts, below which the serviceability of the 24AUP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor-or ultor-to-grid-No.1 voltage is never less than 11,000 volts.

§ The grid-no.4 voltage or grid-no.4-to-grid-no.1 voltage required for focus of any individual tube is independent of ultor current and will remain essentially constant for values of ultor voltage (or ultor-to-grid-No.1 voltage) or grid-No.2 voltage (or grid-No.2-to-grid-No.1 voltage) within design ranges shown for these items.

† Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 1/2-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

■ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid no.1 and other electrodes.

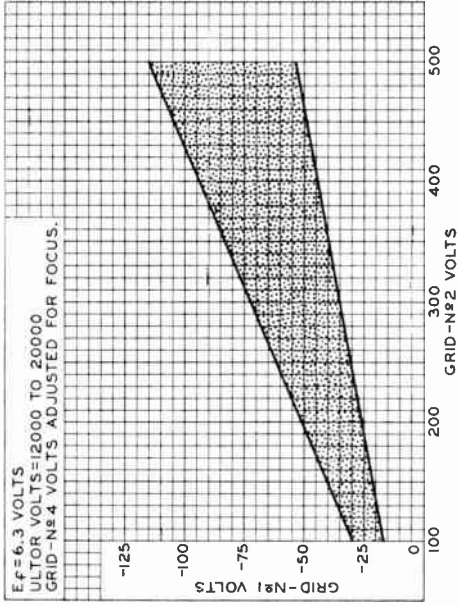
*For X-ray shielding considerations, see sheet
X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section*



24AUP4

24AUP4

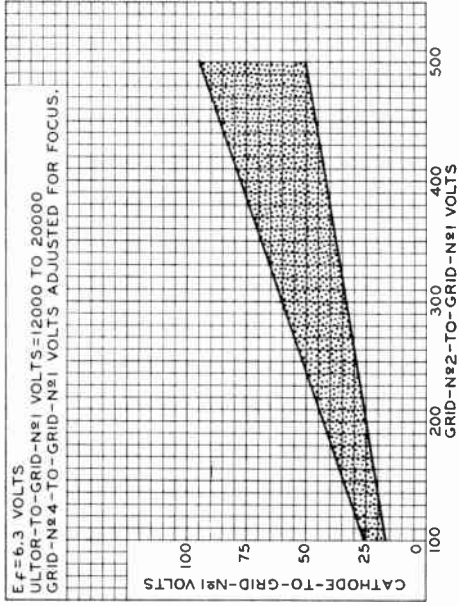
RASTER-CUTOFF-RANGE CHARTS GRID-DRIVE SERVICE



World Radio History

92CS-9919

CATHODE-DRIVE SERVICE

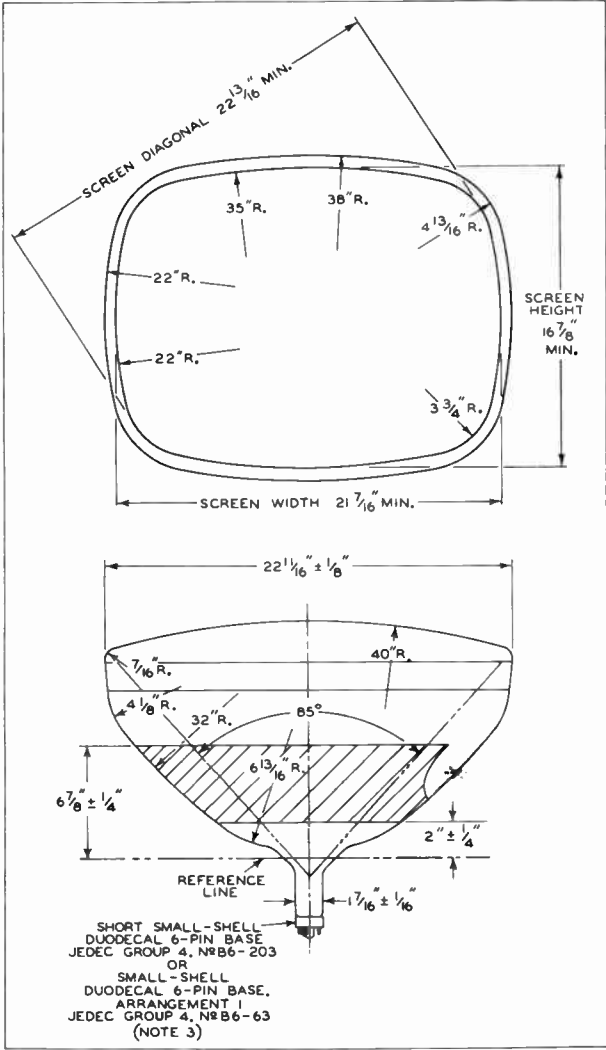


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24AUP4



24AUP4 PICTURE TUBE

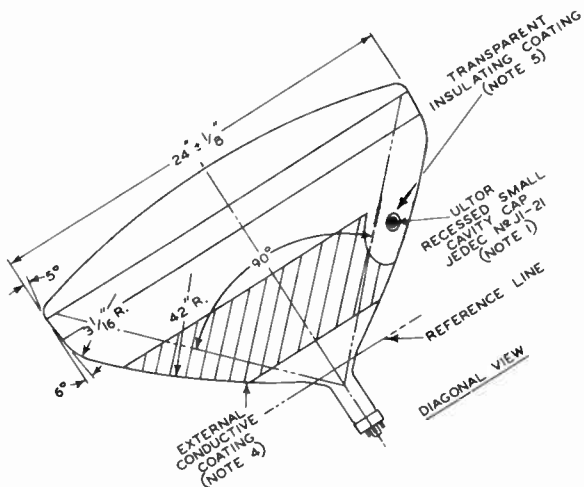
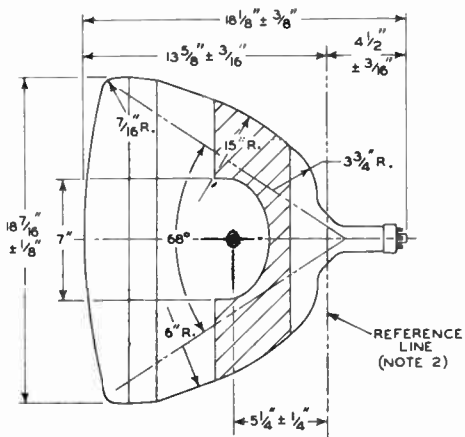




24AUP4

PICTURE TUBE

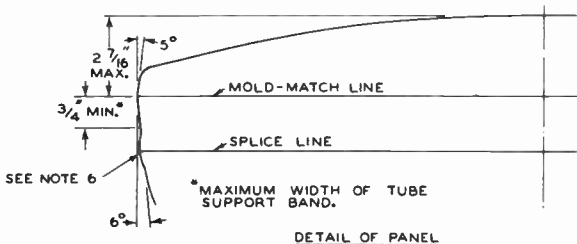
24AUP4



92CL-9917



24AUP4 PICTURE TUBE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 30^\circ$. ULTOR TERMINAL IS ON SAME SIDE AS PIN 6.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No. G-116 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 3".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

NOTE 6: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN $1/8$ ", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN $1/16$ " BEYOND THE ENVELOPE SURFACE AT THE MOLD-MATCH LINE.



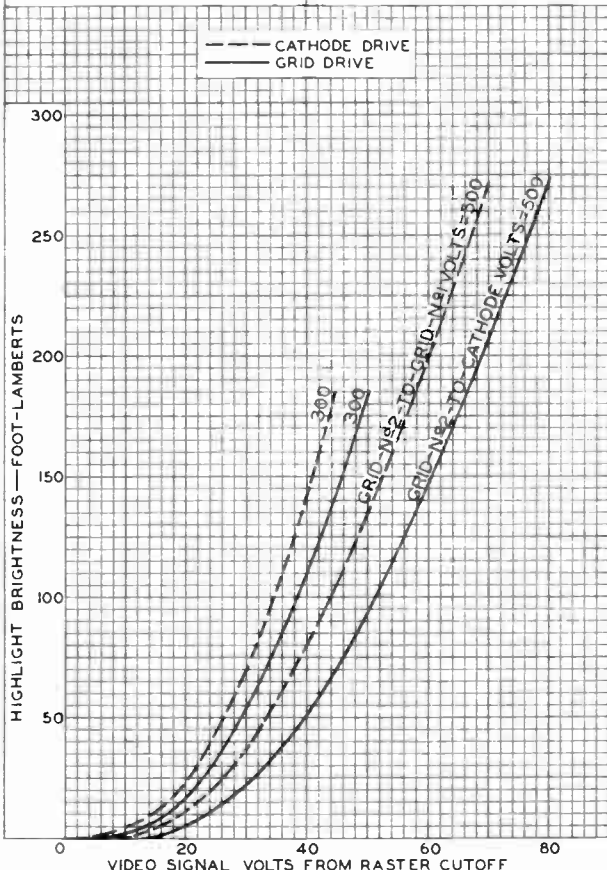
24AUP4

24AUP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE
 $E_f = 6.3$ VOLTS
 ULTOR-TO-GRID-№1 VOLTS = 16000
 CATHODE BIASED POSITIVE WITH
 RESPECT TO GRID №1 TO GIVE
 FOCUSED RASTER CUTOFF.
 RASTER FOCUSED
 AT AVERAGE BRIGHTNESS.
 RASTER SIZE = 21" x 16"

GRID-DRIVE SERVICE
 $E_f = 6.3$ VOLTS
 ULTOR VOLTS = 16000
 GRID №1 BIASED NEGATIVE WITH
 RESPECT TO CATHODE TO GIVE
 FOCUSED RASTER CUTOFF.
 RASTER FOCUSED
 AT AVERAGE BRIGHTNESS.
 RASTER SIZE = 21" x 16"



24AUP4



24AUP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE

$E_f = 6.3$ VOLTS

ULTOR - TO-GRID- N_{s1} VOLTS = 12000 TO 20000

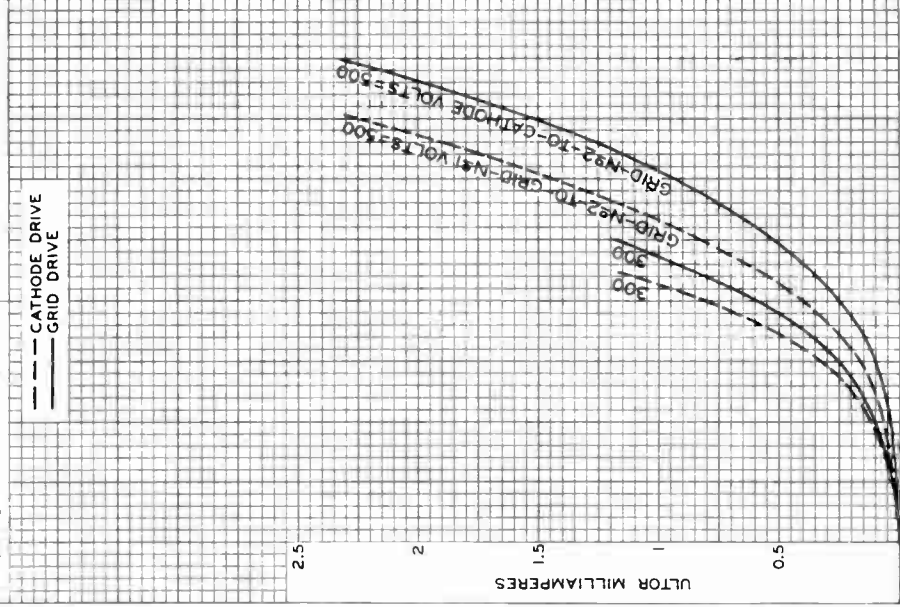
CATHODE BIASED POSITIVE WITH RESPECT TO GRID N_{s1} TO GIVE FOCUSED RASTER CUTOFF.

GRID-DRIVE SERVICE

$E_f = 6.3$ VOLTS

ULTOR VOLTS = 12000 TO 20000
GRID N_{s1} BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.

--- CATHODE DRIVE
— GRID DRIVE



VIDEO SIGNAL VOLTS FROM RASTER CUTOFF

24BEP4

Picture Tube

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
110° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes.	5	pf
Grid No.1 to all other electrodes.	6	pf
External conductive coating to anode	{ 2500 max. 1700 min.	pf
		pf

Heater Current at 6.3 volts. 600 ± 30 ma

Heater Warm-up Time (Average). 11 seconds

Electron Gun Type Requiring No Ion-Trap Magnet

Optical:

Phosphor (For curves, see front of this section) P4—Sulfide Type,
Aluminized

Faceplate. Filterglass

Light transmission (Approx.) 74%

Mechanical:

Weight (Approx.) 26-1/2 lbs

Overall Length 14.812" ± .312"

Neck Length. 4.375" ± .125"

Projected Area of Screen 332 sq. in.

External Conductive Coating:

Type Modified-Band

Contact area for grounding Near Reference Line

For Additional Information on Coatings and Dimensions:

See *Picture-Tube Dimensional-Outlines and Bulb J192 C/D* sheets at front of this section.

Cap. Recessed Small Cavity (JEDEC No. J1-21)

Base Small-Button Neoeightar 7-Pin,
Arrangement 1, (JEDEC No. B7-208)

Basing Designation for BOTTOM VIEW 8KW

Pin 1—Heater

Pin 3—Grid No.1

Pin 4—Grid No.4

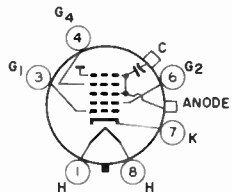
Pin 6—Grid No.2

Pin 7—Cathode

Pin 8—Heater

Cap—Anode (Grid No.3,
Grid No.5, Screen,
Collector)

C—External Conductive
Coating



Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, voltage values
are positive with respect to cathode

Anode Voltage. 20000 max. volts

Grid-No.4 (Focusing) Voltage:

Positive value 1100 max. volts

Negative value 550 max. volts



24BEP4

Grid-No.2 Voltage.	550 max.	volts
Grid-No.1 Voltage:		
Negative peak value.	220 max.	volts
Negative bias value.	154 max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts
Heater Voltage	{ 6.9 max.	volts
	{ 5.7 min.	volts
Peak Heater-Cathode Voltage.		
Heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage.	16000	volts
Grid-No.4 Voltage.	200	volts
Grid-No.2 Voltage.	400	volts
Cathode Voltage for		
visual extinction of		
focused raster	42 to 78	volts

Maximum Circuit Value:

Grid-No.1 Circuit Resistance	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet

X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES

At front of this section



Picture Tube

**RECTANGULAR GLASS TYPE
MAGNETIC FOCUS**

**ALUMINIZED SCREEN
90° MAGNETIC DEFLECTION**

Electrical:

Heater Current at 6.3 volts.	600 ± 10% ma
Direct Interelectrode Capacitance:	
Grid No.1 to all other electrodes.	6 pf
Cathode to all other electrodes.	5 pf
External conductive coating to anode	{ 2500 max. pf 2000 min. pf
Electron Gun	Type Requiring No Ion-Trap Magnet

Optical:

Faceplate, Spherical	Filterglass
Light transmission (Approx.)	75%
Phosphor (for curves, see front of this section).	P4—Sulfide Type, Aluminized

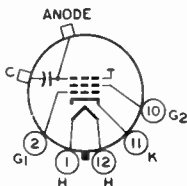
Mechanical:

Operating Position	Any
Weight (Approx.)	35 lbs
Overall Length	21-1/8" ± 3/8"
Neck Length.	7-1/2" ± 3/16"
Projected Area of Screen	332 sq. in.

External Conductive Coating:
 Type Regular-Band
 Contact area for grounding Near Reference Line
 For Additional Information on Coatings, Dimensions, and Deflection Angles:

See *Picture-Tube Dimensional-Outlines* and *Bulb J192 A/B* sheets at the front of this section
 Cap. Recessed Small Cavity (JEDEC No. J1-21)
 Base . . . Small-Shell Duodecal 5-Fin (JEDEC Group 4, No. B5-57)
 Basing Designation for BOTTOM VIEW 12N

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 10 - Grid No.2
- Pin 11 - Cathode
- Pin 12 - Heater



Cap-Anode
 (Grid No.3,
 Collector)
 C-External
 Conductive
 Coating

Maximum Ratings, Design-Maximum Values:

Anode Voltage.	22000 max. volts
Grid-No.2 Voltage.	550 max. volts



24CP4B

Grid-No.1 Voltage:

Negative peak value.	220 max.	volts
Negative bias value.	15+ max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts

Peak Heater-Cathode Voltage:

Heater negative with respect to cathode:

During equipment warm-up period

not exceeding 15 seconds 450 max. volts

After equipment warm-up period 200 max. volts

Heater positive with respect to cathode. 200 max. volt

Typical Operating Conditions:

With anode voltage of	16000	volts
and grid-No.2 voltage of	400	volts

Grid-No.1 Voltage for

visual extinction of

focused raster -7.4 to -7.2 volts

Maximum Circuit Values:

Grid-No.1-Circuit resistance 1.5 max. megohms

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



Color Picture Tube

Permo-Chrome Bonded-Type Implosion Protection
 90° Rectangular HI-LITE Screen
 New Rare-Earth (Red) Phosphor Unity Current Ratios

ELECTRICAL

Electron Guns, Three with Axes Tilted Toward Tube Axis	Red, Blue, Green
Heater, of Each Gun Series Connected within Tube with Each of the Other Two Heaters:	
Current at 6.3 V ^a	900 mA
Focusing Method	Electrostatic
Focus Lens	Bipotential
Convergence Method	Magnetic
Deflection Method	Magnetic
Deflection Angles (Approx.):	
Diagonal	89 deg.
Horizontal	78 deg.
Vertical	63 deg.

Direct Interelectrode Capacitances (Approx.):

Grid No. 1 of any gun to all other electrodes	6 pF
Grid No. 3 to all other electrodes	6.5 pF
All cathodes to all other electrodes	15 pF
External conductive coating to anode (Approx.)	{ 2500 max. pF 2000 min. pF

OPTICAL

Faceplate	Filterglass
Light transmission at center (Approx.)	42%
Surface	Polished
Screen, on Inner Surface of Faceplate:	
Type	Aluminized, Tricolor, Phosphor-Dot Phosphor (three separate phosphors, collectively) ^b
Fluorescence and phosphorescence of separate phosphors, respectively	P22-New Rare-Earth (Red), Sulfide (Blue & Green) Type
Persistence of group phosphorescence	Red, Blue, Green
Medium Short	
Dot Arrangement	Triangular group consisting of red dot, blue dot, and green dot
Spacing between centers of adjacent dot trios (Approx.)	0.029 in (0.74 mm)

25AJP22

MECHANICAL

Minimum Screen Area (Projected): . . . 295 sq. in (1905 sq. cm)
Bulb Funnel Designation JEDEC No.J195-1/2 A1
Bulb Panel Designation JEDEC No.FP196-1/2
Base Small-Button Diheptar 12-pin
Basing Designation^c JEDEC No.14BE
Pin Position Alignment Pin No.12 Aligns Approx.
with Anode Bulb Contact

Operating Position Anode Bulb Contact on Top
Weight (Approx.) 38 lb (17.4 kg)

MAXIMUM AND MINIMUM RATINGS, Design-Maximum Values

*Unless otherwise specified, values are for each gun
and voltage values are positive with respect to cathode*

Anode Voltage	{ 27,500 max. V 20,000 min. V
Total Anode Current, Long-Term Average	1000 max. μ A
Grid-No.3 (Focusing Electrode) Voltage	6000 max. V
Peak Grid-No.2 Voltage, Including Video Signal Voltage	1000 max. V
Grid-No.1 Voltage:	
Negative bias value	400 max. V
Negative operating cutoff value	200 max. V
Positive bias value	0 max. V
Positive peak value	2 max. V
Heater Voltage (ac or dc):	
Under operating conditions ^a	{ 6.9 max. V 5.7 min. V
Under standby conditions ^d	5.5 max. V
Peak Heater-Cathode Voltage:	
Heater negative with respect to cathode:	
During equipment warm-up period not exceeding 15 seconds	450 max. V
After equipment warm-up period:	
Combined AC and DC value	200 max. V
DC component value	200 max. V
Heater positive with respect to cathode:	
AC component value	200 max. V
DC component value	0 max. V

EQUIPMENT DESIGN RANGES

*Unless otherwise specified, values are for each gun
and voltage values are positive with respect to cathode*

For anode voltages between 20,000 and 27,500 V

Grid-No.3 (Focusing Electrode) Voltage 16.8% to 20%
of Anode voltage

Grid-No.2 and Grid-No.1 Voltages for
Visual Extinction of Focused
Spot See *CUTOFF DESIGN CHART*

Maximum Ratio of Grid-No.2 Voltages,
Highest Gun to Lowest Gun in Any
Tube (At grid-No.1 spot cutoff
voltage of -100 V) 1.86

Heater Voltage:

Under operating conditions^a 6.3 V

Under standby conditions^c 5.0 V

Grid-No.3 Current (Total) -45 to +15 μ A

Grid-No.2 Current -5 to +5 μ A

To Produce White of 9300^o K + 27 M.P.C.D.
(CIE Coordinates $x=0.281$, $y=0.311$):

Percentage of total anode current supplied by each gun (average)	Red	Blue	Green	
	34	32	34	%

Ratio of cathode currents:	Min.	Typ.	Max.
Red/blue	0.75	1.10	1.50
Red/green	0.65	1.00	1.50
Blue/green	0.60	0.91	1.30

Displacements, Measured at Center of Screen:

Raster centering displacement:

Horizontal ± 0.47 in (± 11.9 mm)

Vertical ± 0.45 in (± 11.4 mm)

Lateral distance between
the blue beam and the con-
verged red and green beams ± 0.25 in (± 6.4 mm)

Radial convergence displacement
excluding effects of dynamic
convergence (each beam) ± 0.37 in (± 9.4 mm)

Maximum Required Correction for
Register^e (Including Effect of
Earth's Magnetic Field when
Using Recommended Components)
as Measured at the Center of the
Screen in any Direction 0.005 in (0.13 mm) max.

LIMITING CIRCUIT VALUES

High-Voltage Circuits:

Grid-No.3 circuit resistance 7.5 max. $M\Omega$

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the *high-voltage power supply* and the *grid-No.3 power supply* be of the limited-energy type, in which the short-circuit current does not exceed 20 milliamperes.

Low-Voltage Circuits:

Effective grid-No.1-to-cathode-
circuit resistance (each gun) 0.75 max. $M\Omega$

25AJP22

The low-voltage circuits, including all heater circuits, should be analyzed by assuming the color picture tube heater is connected directly to the receiver chassis ground. Under these conditions the circuits to the elements of all tubes, including the color picture tube, operating from the same heater winding and all connections of any other circuits to the heater winding should each have an impedance such that their respective power sources in combination will not supply a continuous short circuit current of more than 750 milliamperes total in the assumed picture tube heater ground connection. The leads from all other circuits must be separated from the picture tube leads by a minimum distance of 0.25 inch (6.4 mm) to prevent energy transfer to the picture tube circuits. Such current limitation will help prevent picture tube damage in case of momentary cascade arcing.

- ^a For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts. The series impedance to any chassis connection in the DC biasing circuit for the heater should be between 100,000 ohms and 1 megohm.
- ^b For curve, see *Group Phosphor-P22-New Rare-Earth (Red), Sulfide (Blue & Green)* at front of this section.
- ^c The mating socket, including its associated, physically-attached hardware and circuitry, must not weigh more than one pound.
- ^d For "instant on" applications, a maximum heater voltage of 5.5 volts (design-maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.
- ^e Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

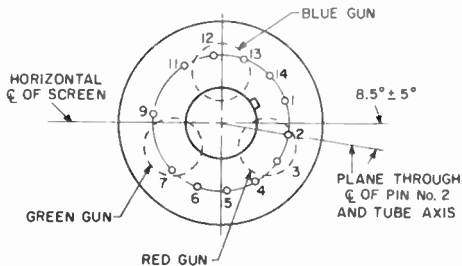
X-RADIATION WARNING

Because the 25AJP22 is designed to be operated at anode voltages as high as 27.5 kilovolts (design-maximum value), shielding of the 25AJP22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

BASE SPECIFICATION - JEDEC No. 14BE

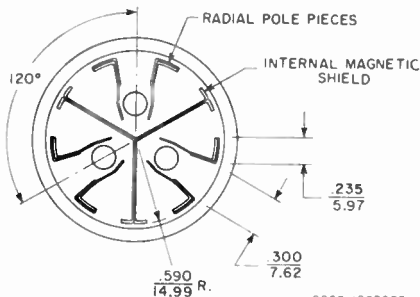
Pin 1: Heater	Pin 11: Cathode of Blue Gun
Pin 2: Cathode of Red Gun	Pin 12: Grid No.1 of Blue Gun
Pin 3: Grid No.1 of Red Gun	Pin 13: Grid No.2 of Blue Gun
Pin 4: Grid No.2 of Red Gun	Pin 14: Heater
Pin 5: Grid No.2 of Green Gun	Cap: Anode (Grid No.4, Screen, Collector)
Pin 6: Cathode of Green Gun	C: External Conductive Coating
Pin 7: Grid No.1 of Green Gun	
Pin 9: Grid No.3	

BOTTOM VIEW OF BASE



92CS-12816

LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS

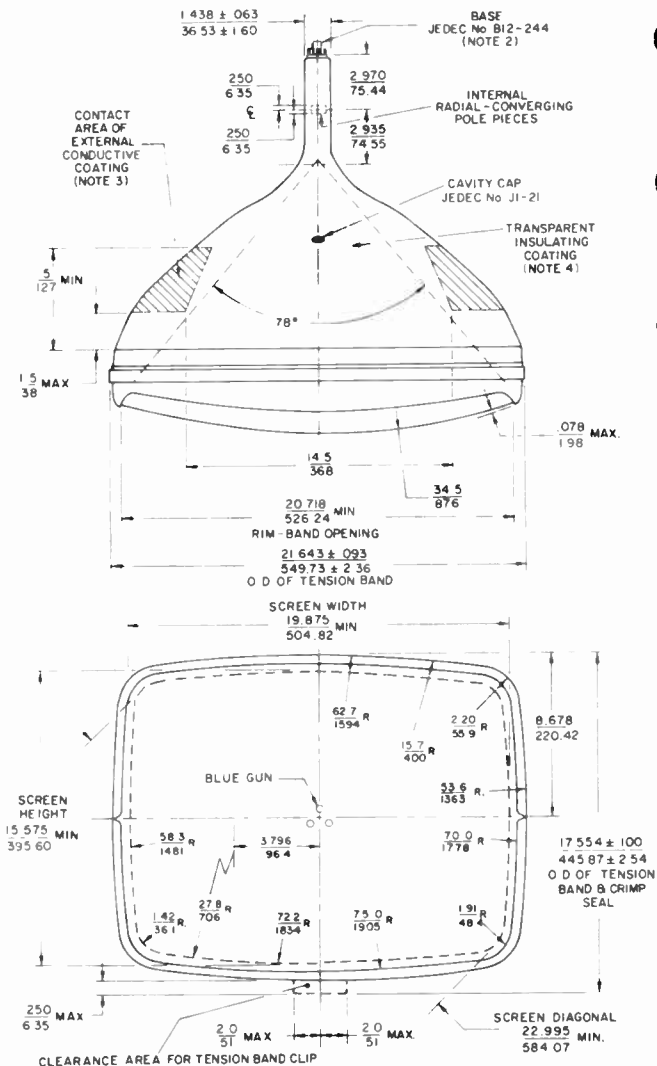


92CS-12835R3

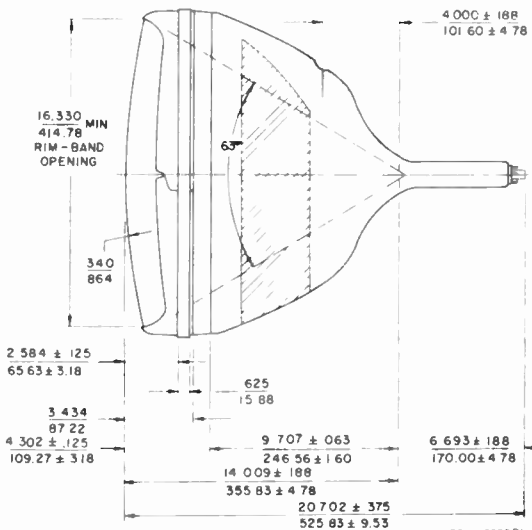
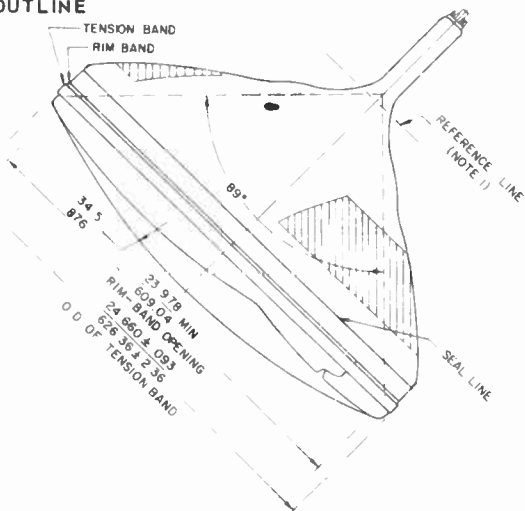
NOTES FOR DIMENSIONAL OUTLINE

- Note 1:** With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge JEDEC No. G162 and with tube seated in gauge, the reference line is determined by the intersection on the plane C-C' of the gauge with the glass funnel.
- Note 2:** Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.
- Note 3:** The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.
- Note 4:** To clean this area, wipe only with soft, dry, lintless cloth.

DIMENSIONAL



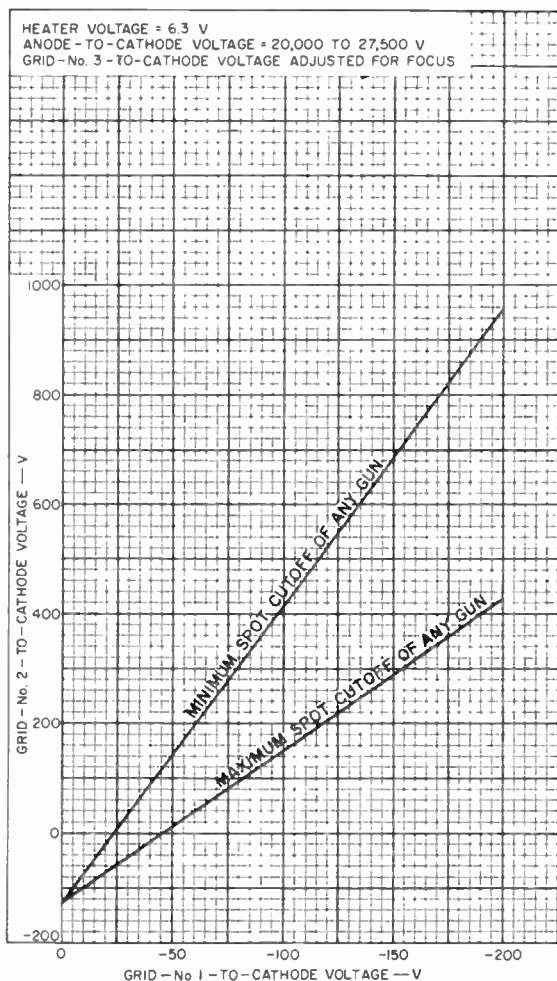
OUTLINE



Dimensions in Inches/mm

25AJP22

CUTOFF DESIGN CHART



92CM-12803R1

Color Picture Tube

Hi-Lite Matrix Screen

90° Rectangular

New Green Phosphor

Permo-Chrome

High-Resolution Gun

Unity Current Ratios

Antiglare Integral Protective Window

ELECTRICAL

Electron Guns, Three with Axes

Tilted Toward Tube Axis Red, Blue, Green

Heater, of Each Gun Series

Connected within Tube with

Each of the Other two Heaters:

Current at 6.3 V^a 900 mA

Focusing Method Electrostatic

Focus Lens Bipotential

Convergence Method Magnetic

Deflection Method Magnetic

Deflection Angles:

Diagonal 89 deg.

Horizontal 78 deg.

Vertical 63 deg.

Direct Interelectrode Capacitances (Approx.):

Grid No. 1 of any gun
to all other electrodes 7.5 pF

Grid No. 3 to all other electrodes 6.5 pF

All cathodes to all other electrodes 15 pF

External conductive coating
to anode $\left\{ \begin{array}{l} 2500 \text{ max. pF} \\ 2000 \text{ min. pF} \end{array} \right.$

OPTICAL

Faceplate and Protective Window Filterglass

Light transmission at center (Approx.) 67.5%

Surface of Protective Window Treated to minimize
specular reflection

Screen Aluminized

Matrix Black opaque material

Phosphor, rare-earth (red),
sulfide (blue & green) P22

Persistence Medium-Short

Array 422,550 Dot trios

Spacing between centers of
adjacent dot trios (approx.) 0.029 in (0.74 mm)

25BCP22

MECHANICAL

Minimum Screen Area (Projected)	295 sq. in (1905 sq. cm)
Bulb Funnel Designation	JEDEC No.J195-1/2
Bulb Panel Designation	JEDEC No.FP196-1/2
Protective Window Designation	JEDEC No.SP196-1/2
Base ^b	Small-Button Diheptar 12-pin
Pin Position Alignment	Pin No.12 Aligns Approx. with Anode Bulb Contact
Operating Position	Anode Bulb Contact on Top
Weight (Approx.)	42 lb (19.1 kg)

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

Anode Voltage	{	27,500 max. V
		20,000 min. V
Total Anode Current, Long-Term Average		1000 max. μ A
Grid-No.3 (Focusing Electrode) Voltage		6000 max. V
Peak-Grid-No.2 Voltage, Including Video Signal Voltage		1000 max. V
Grid-No.1 Voltage:		
Negative bias value		400 max. V
Negative operating cutoff value		200 max. V
Positive bias value		0 max. V
Positive peak value		2 max. V
Heater Voltage (ac or dc):		
Under operating conditions ^a	5.7 min. —	6.9 max. V
Under standby conditions ^d		5.5 max. V
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds		450 max. V
After equipment warm-up period:		
Combined AC and DC value		200 max. V
DC component value		200 max. V
Heater positive with respect to cathode:		
AC component value		200 max. V
DC component value		0 max. V

EQUIPMENT DESIGN RANGES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 20,000 and 27,500 V	
Grid-No.3 (Focusing Electrode) Voltage	16.8% to 20% of Anode voltage

Grid-No.2 and Grid-No.1 Voltages for
Visual Extinction of Focused

Spot See CUTOFF DESIGN CHART

Maximum Ratio of Grid-No.2 Voltages,
Highest Gun to Lowest Gun in Any

Tube (At grid-No.1 spot cutoff
voltage of -100 V) 1.86

Heater Voltage:

Under operating conditions:^a

When standby operation is not
utilized 6.3 V

When 5.0-V standby operation
is utilized 6.0 V

Under standby conditions^d 5.0 V

Grid-No.3 Current (Total) -45 to +15 μ A

Grid-No.2 Current -5 to +5 μ A

To Produce White of 9300^o K + 27
M.P.C.D. (CIE Coordinates $x = 0.281$,
 $y = 0.311$):

Percentage of total anode current supplied by each gun (average)	<i>Red</i>	<i>Blue</i>	<i>Green</i>	
	34	32	34	%

Ratio of cathode currents:	<i>Min.</i>	<i>Typ.</i>	<i>Max.</i>
----------------------------	-------------	-------------	-------------

Red/blue	0.75	1.10	1.50
--------------------	------	------	------

Red/green	0.65	1.00	1.50
---------------------	------	------	------

Blue/green	0.60	0.91	1.30
----------------------	------	------	------

Displacements, Measured at Center of Screen:

Raster centering displacement:

Horizontal	± 0.45 in (± 11.4 mm)
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Vertical	± 0.45 in (± 11.4 mm)
--------------------	--------------------------------

Lateral distance between the blue beam and the con- verged red and green beams	± 0.25 in (± 6.4 mm)
--	-------------------------------

Radial convergence displacement excluding effects of dynamic convergence (each beam)	± 0.37 in (± 9.4 mm)
--	-------------------------------

Maximum Required Correction for
Register^e (Including Effect of
Earth's Magnetic Field when
Using Recommended Components)
as Measured at the Center of the
Screen in any Direction 0.005 in (0.13 mm) max.

LIMITING CIRCUIT VALUES

High-Voltage Circuits:

Grid-No.3 circuit resistance	7.5 max. M Ω
--	---------------------

25BCP22

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the high-voltage power supply and the grid-No.3 power supply be of the limited-energy type, in which the short-circuit current does not exceed 20 milliamperes.

Low-Voltage Circuits:

Effective grid-No.1-to-cathode-circuit resistance (each gun) 0.75 max. M Ω

The low-voltage circuits, including all heater circuits, should be analyzed by assuming the color picture tube heater is connected directly to the receiver chassis ground. Under these conditions the circuits to the elements of all tubes, including the color picture tube, operating from the same heater winding and all connections of any other circuits to the heater winding should each have an impedance such that their respective power sources in combination will not supply a continuous short circuit current of more than 750 milliamperes total in the assumed picture tube heater ground connection. The leads from all other circuits must be separated from the picture tube leads by a minimum distance of 0.25 inch (6.4 mm) to prevent energy transfer to the picture tube circuits. Such current limitation will help prevent picture tube damage in case of momentary cascade arcing.

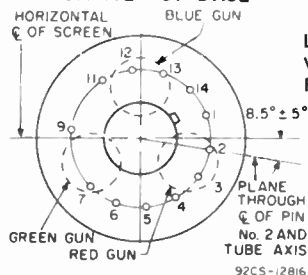
- o For maximum cathode life, it is recommended that the heater supply be regulated. The series impedance to any chassis connection in the dc biasing circuit for the heater should be between 100,000 ohms and 1 megohm.
- b The mating socket, including its associated, physically-attached hardware and circuitry, must not weigh more than one pound.
- d The use of a 5-volt standby condition in conjunction with 6-volt operating condition is recommended to improve the reliability of the color picture tube by extending the emission wear-out life and reducing other gun-related defects. A maximum heater voltage of 5.5 volts (Design-Maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.
- e Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

X-RADIATION WARNING: Because the 25BCP22 is designed to be operated at anode voltages as high as 27.5 kilovolts (Design-Maximum value), shielding of the 25BCP22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

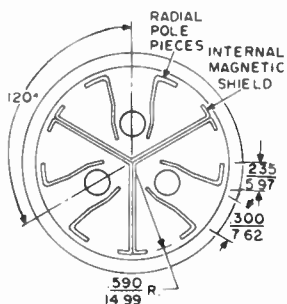
BASE SPECIFICATION - JEDEC No. 14BE

Pin 1: Heater	Pin 11: Cathode of Blue Gun
Pin 2: Cathode of Red Gun	Pin 12: Grid No.1 of Blue Gun
Pin 3: Grid No.1 of Red Gun	Pin 13: Grid No.2 of Blue Gun
Pin 4: Grid No.2 of Red Gun	Pin 14: Heater
Pin 5: Grid No.2 of Green Gun	Cap: Anode (Grid No.4, Screen, Collector)
Pin 6: Cathode of Green Gun	C: External Conductive Coating
Pin 7: Grid No.1 of Green Gun	
Pin 9: Grid No.3	

BOTTOM VIEW OF BASE



LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



NOTES FOR DIMENSIONAL OUTLINE

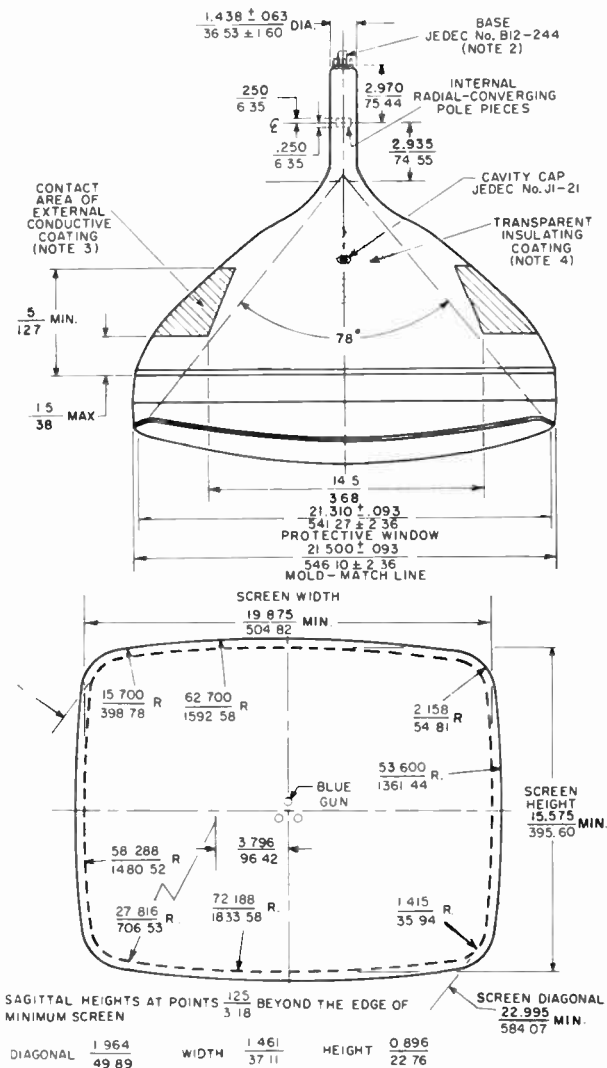
Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge (JEDEC No.G162) and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C' of the gauge with the glass funnel.

Note 2: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.

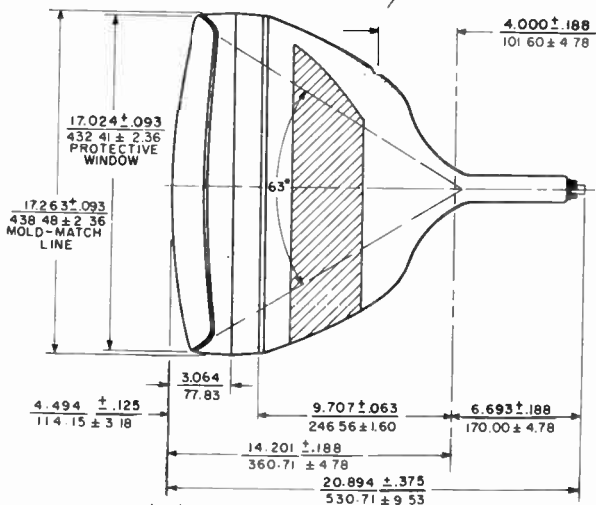
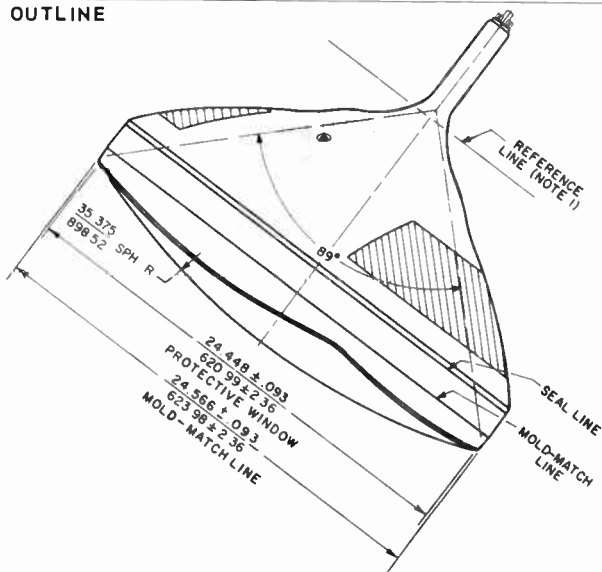
Note 3: The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

Note 4: To clean this area, wipe only with soft, dry, lintless cloth.

DIMENSIONAL



OUTLINE



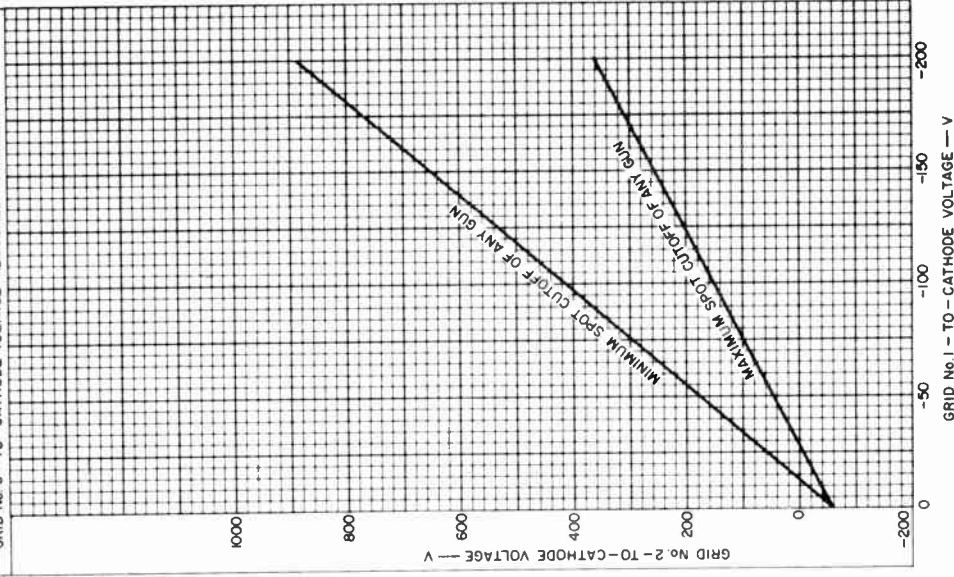
Dimensions in $\frac{\text{Inches}}{\text{mm}}$ unless otherwise shown

92CL-12838R3

25BCP22

CUTOFF DESIGN CHART

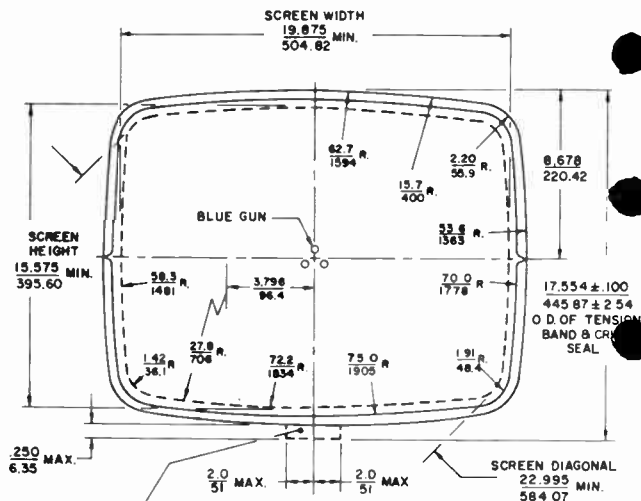
HEATER VOLTAGE = 6.3 V
ANODE - TO - CATHODE VOLTAGE = 20,000 TO 27,500 V
GRID No. 3 - TO - CATHODE VOLTAGE ADJUSTED FOR FOCUS.



92LM-3161

25BDP22

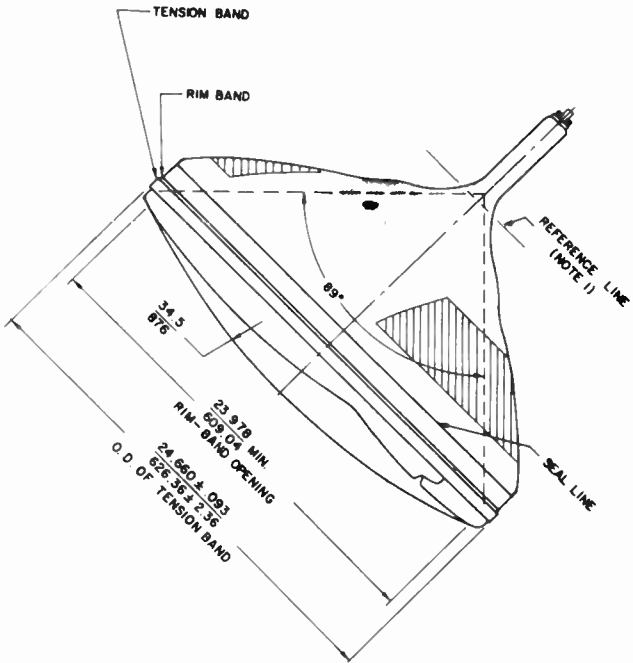
DIMENSIONAL OUTLINE (Front View)



SAGITTAL HEIGHTS AT POINTS $\frac{125}{318}$ BEYOND
THE EDGE OF MINIMUM SCREEN

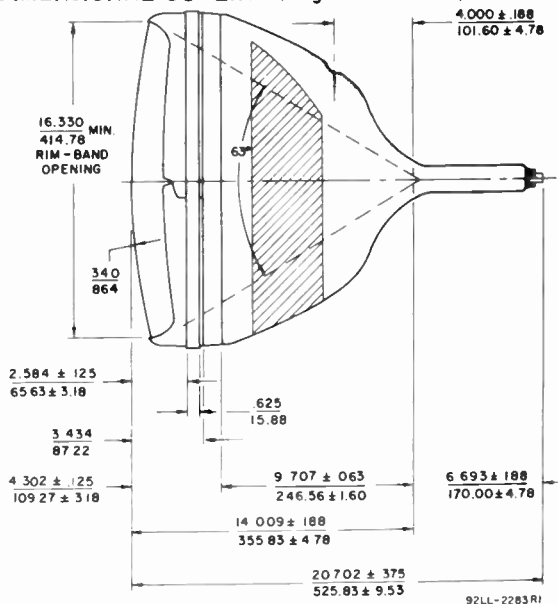
DIAGONAL	2.063 52.40
WIDTH	1.524 38.71
HEIGHT	0.950 24.13

DIMENSIONAL OUTLINE (Right Oblique View)



25BDP22

DIMENSIONAL OUTLINE (Right Side View)



Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge (JEDEC No.G162) and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C' of the gauge with the glass funnel.

Note 2: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.

Note 3: The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

Note 4: To clean this area, wipe only with soft, dry, lintless cloth.

Dimensions in $\frac{\text{Inches}}{\text{mm}}$ unless otherwise shown

25BGP22

Color Picture Tube

PERMA-CHROME

HI-LITE Screen

Rare-Earth (Red) Phosphor

Antiglare Integral Protective Window

**This data sheet is to be used in conjunction
with data for RCA-25XP22.**

For general data, terminal diagram, maximum and minimum ratings, equipment design ranges, limiting circuit values, x-radiation warning, and general considerations of the 25BGP22, refer to the 25XP22 except as noted below.

MECHANICAL

Bulb Panel Designation JEDEC No.FP196-1/2A3

OPTICAL

Faceplate and Protective Window

Light Transmission at center (Approx.) 52.5%

EQUIPMENT DESIGN RANGES

To Product White of 9300° K + 27 M.P.C.D.
(CIE Coordinates $x = 0.281$, $y = 0.311$):

Percentage of total anode current supplied by each gun (average)	Red 30	Blue 31	Green 39	%
Ratio of cathode currents:		Min	Typ	Max
Red/blue		0.75	0.95	1.25
Red/green		0.60	0.75	1.10
Blue/green		0.60	0.80	1.10

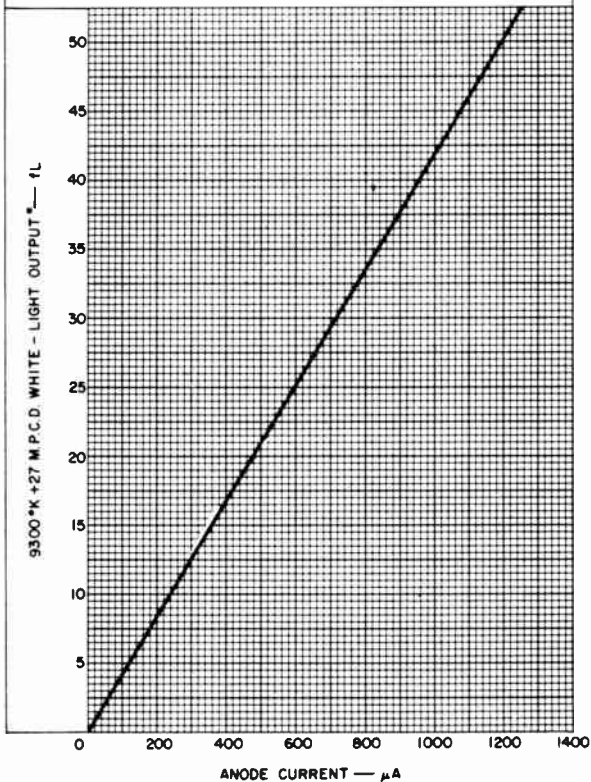
25BGP22

TYPICAL LIGHT-OUTPUT CHARACTERISTIC

HEATER VOLTAGE = 6.3 V
ANODE - TO - CATHODE VOLTAGE = 25,000 V
GRID No. 3 - TO - CATHODE VOLTAGE ADJUSTED FOR FOCUS.
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE CURRENT
TO PRODUCE 9300°K 27 M.P.C.D. WHITE - LIGHT OUTPUT.
PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN TO
PRODUCE 9300°K + 27 M.P.C.D. WHITE:

RED GUN:	30 %
BLUE GUN:	31 %
GREEN GUN:	39 %

RASTER SIZE: 19.875" x 15.575" (504.82 mm x 395.60 mm)
* MEASURED WITHIN 5" (127 mm) DIAMETER AREA CENTERED ON
TUBE FACE.



92LM - 3430

25BHP22

Color Picture Tube

PERMA-CHROME

HI-LITE Screen

Rare-Earth (Red) Phosphor

Integral Implosion Protection – Banded Type

**This data sheet is to be used in conjunction with
data for RCA-25AJP22.**

For general data, maximum and minimum ratings, equipment design ranges, limiting circuit values, x-radiation warning and base specification of the 25BHP22, refer to the 25AJP22 except as noted below.

MECHANICAL

Bulb Panel Designation JEDEC No.FP196-1/2HI

OPTICAL

Faceplate:

Light transmission at center (Approx.) 52%

EQUIPMENT DESIGN RANGES

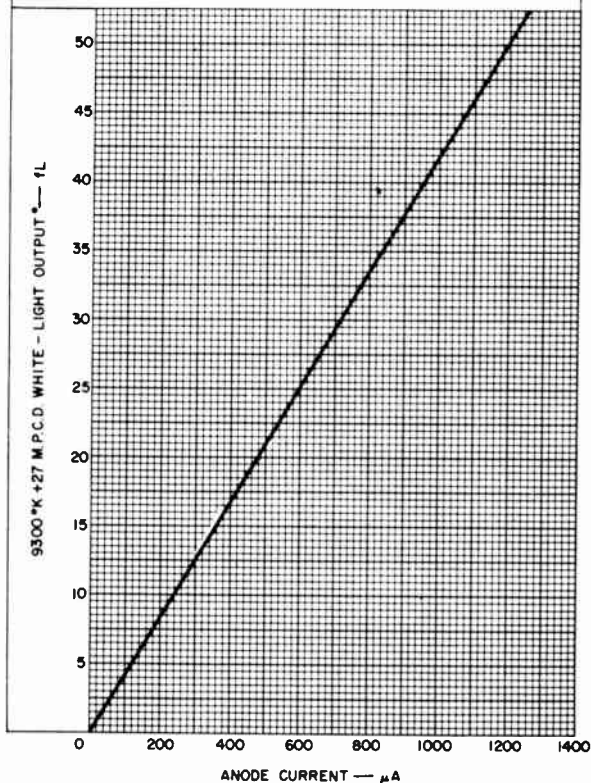
To Product White of 9300° K + 27 M.P.C.D.
(CIE Coordinates $x = 0.281$, $y = 0.311$):

Percentage of total anode current supplied by each gun (average)	Red 30	Blue 31	Green 39	%
Ratio of cathode currents:		Min	Typ	Max
Red/blue		0.75	0.95	1.25
Red/green		0.60	0.75	1.10
Blue/green		0.60	0.80	1.10

25BHP22

TYPICAL LIGHT-OUTPUT CHARACTERISTIC

HEATER VOLTAGE = 6.3 V
ANODE - TO - CATHODE VOLTAGE = 25,000 V
GRID No. 3 - TO - CATHODE VOLTAGE ADJUSTED FOR FOCUS
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE CURRENT
TO PRODUCE 9300°K 27 M.P.C.D. WHITE - LIGHT OUTPUT.
PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN TO
PRODUCE 9300°K + 27 M.P.C.D. WHITE:
RED GUN: 30%
BLUE GUN: 31%
GREEN GUN: 39%
RASTER SIZE: 19.875" x 15.575" (504.82 mm x 395.60 mm)
* MEASURED WITHIN 5" (127 mm) DIAMETER AREA CENTERED ON
TUBE FACE.



92LM - 3430

Color Picture Tube

Ultra-Rectangular
4 x 3 Aspect Ratio

Hi-Lite Matrix Screen
Light-Neutral Screen Appearance

Electrical:

Electron Guns, Three with Axes
Tilted Toward Tube Axis Red, Blue, Green

Heater, of Each Gun Series Connected within
Tube with Each of the Other Two Heaters:
Current at 6.3 V 900 mA

Focusing Method Electrostatic

Focus Lens Bipotential

Convergence Method Magnetic

Deflection Method Magnetic

Deflection Angles (Approx.):
Diagonal 90 deg
Horizontal 78 deg
Vertical 60 deg

Direct Interelectrode Capacitance (Approx.):
Grid No.1 of any gun to all other electrodes 7.5 pF
Grid No.3 to all other electrodes 6.5 pF
All cathodes to all other electrodes 15 pF

Capacitance Between Anode and External
Conductive Coating { 2500 max. pF
2000 min. pF

Optical:

Faceplate and Safety Panel Filterglass
Light transmission at center (Approx.) 66%

Surface of Safety Panel Treated to minimize
specular reflection

Screen Aluminized
Matrix Black opaque material
Phosphor, rare-earth (red) sulfide (blue & green) P22
Persistence Medium-Short
Array 566,000 Dot trios
Spacing between centers of adjacent
dot trios (approx.) 0.026 in (0.66 mm)

Mechanical:

Minimum Screen Area (Projected) 315 sq. in (2032 sq. cm)

Bulb Funnel Designation JEDEC No.J208-3/4 B1/D1

Bulb Panel Designation JEDEC No.FP209-3/4 W2

Base Designation^a Small-Button Diheptar 12-Pin
(JEDEC No.B12-244)

Basing Designation JEDEC No.14BE

Pin Position Alignment Pin No.12 Aligns Approx. with
Anode Bulb Contact

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Operating Position, preferred Anode Bulb Contact on Top
Gun Configuration Delta
Weight (Approx.) 49 lb (22.3 kg)

Implosion Protection:

Integral Safety Panel JEDEC No.SP209-1/4A1

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode.

Anode Voltage	}	27.5 max.	kV
		20 min.	kV
Anode Current, Long-Term Average ^b		1000 max.	μA
Grid-No.3 (Focusing Electrode) Voltage		6000 max.	V
Peak-Grid-No.2 Voltage, Including Video Signal Voltage		1000 max.	V
Grid-No.1 Voltage:			
Negative bias value		400 max.	V
Negative operating cutoff value		200 max.	V
Positive bias value		0 max.	V
Positive peak value		2 max.	V
Heater Voltage (ac or dc): ^c			
Under operating conditions	}	6.9 max.	V
		5.7 min.	V
Under standby conditions ^d		5.5 max.	V
Heater-Cathode Voltage:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds		450 max.	V
After equipment warm-up period:			
DC component value		200 max.	V
Peak value		200 max.	V
Heater positive with respect to cathode:			
DC component value		0 max.	V
Peak value		200 max.	V

Equipment Design Ranges:

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 20 and 27.5 kV

Grid-No.3 (Focusing Electrode) Voltage 16.8% to 20% of
Anode voltage

Grid-No.2 Voltage for Visual Extinction
of Undelected Focused Spot . . . See CUTOFF DESIGN CHART
in Figure 3

At Grid No.1 voltage of -75 V	95 to 295 V
At Grid No.1 voltage of -125 V	205 to 535 V
At Grid No.1 voltage of -175 V	315 to 780 V

Maximum Ratio of Grid-No.2 Voltages, Highest Gun to
Lowest Gun in Any Tube (At grid-No.1 spot cutoff
voltage of -100 V) 1.86

Heater Voltage: C

Under operating conditions:

When standby operation is not utilized 6.3 V

When 5.0-V standby operation is utilized^d 6.0 V

Under standby conditions^d 5.0 V

Grid-No.3 Current (Total) $\pm 15 \mu\text{A}$

Grid-No.2 Current $\pm 5 \mu\text{A}$

Grid-No.1 Current $\pm 5 \mu\text{A}$

To Produce White Light of	Illum.D 6550°K + 7 M.P.C.D.	Color 9300°K + 27 M.P.C.D.
CIE Coordinates:		
X	0.313	0.281
Y	0.329	0.311
Percentage of total anode current supplied by each gun (average):		
Red	41	30 %
Blue	24	31 %
Green	35	39 %
Ratio of cathode currents:		
Red/blue:		
Minimum	1.35	0.75
Typical	1.70	0.95
Maximum	2.20	1.25
Red/green:		
Minimum	0.95	0.60
Typical	1.15	0.75
Maximum	1.70	1.10
Blue/green:		
Minimum	0.50	0.60
Typical	0.70	0.80
Maximum	0.95	1.10

Displacements, Measured at Center of Screen:

Raster centering displacement:

 Horizontal ± 0.45 in (± 11.4 mm)

 Vertical ± 0.45 in (± 11.4 mm)

Lateral distance between the blue beam and
the converged red and green beams . . ± 0.25 in (± 6.4 mm)

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Radial convergence displacement excluding effects of dynamic convergence (each beam) ± 0.37 in (± 9.4 mm)

Maximum Required Correction for Register^e (Including Effect of Earth's Magnetic Field when Using Recommended Components) as Measured at the Center of the Screen in any Direction 0.005 in (0.13 mm) max.

Typical Operation:

Heater Voltage 6.3 V
Anode Voltage 25 kV
Grid No.3 Voltage Adjusted for focus
Color Temperature 9300° K + 27 M.P.C.D.
Raster Size 20.776 x 15.582 in
(527.71 x 395.78 mm)

Typical White-Light Output Measured within 5 in (127 mm) diameter area centered on tube face:

At anode current of 1000 μ A $\left. \begin{array}{l} 54 \text{ fL} \\ 185 \text{ Nit} \end{array} \right\}$

Limiting Circuit Values:

High-Voltage Circuits:

Grid-No.3 circuit resistance 7.5 max. $M\Omega$

Low-Voltage Circuits:

Effective grid-No.1-to-cathode-circuit resistance (each gun) 0.75 max. $M\Omega$

X-Radiation Characteristic:

Maximum Anode Voltage at which the X-radiation emitted will not exceed 0.5 mR/h at an anode current of 300 μ A 35 kV

The X-radiation emitted from this picture tube, as measured in accordance with the procedure of JEDEC Publication No.64A will not exceed 0.5 mR/h throughout the useful life of the tube when operated within the Design-Maximum ratings: 27.5 kV anode voltage and 1000 μ A anode current. The tube should not be operated beyond its Design-Maximum ratings stated above (such operation may shorten tube life or have other permanent adverse affects on its performance), but its X-radiation will not exceed 0.5 mR/h for anode voltage and current combinations given by the isodose-rate limit characteristics as shown in Figure 1. Operation above the values shown by the curve may result in failure of the television receiver to comply with the Federal Performance Standard for Television Receivers, Sub-Part C of Part 78 of Title 42, Code of Federal Regulations (PL90-602) as published in the Federal Register Vol.34, No. 247, Thursday, December 25, 1969. Maximum X-radiation as a function of anode voltage at 300 μ A anode current is shown by the curve in Figure 2. X-radiation at a constant anode voltage varies linearly with anode current.

- a The mating socket, including its associated, physically-attached hardware and circuitry, must not weigh more than one pound (one-half kilogram).
- b The short-term average anode current should be limited by circuitry to 1500 microamperes.
- c For maximum cathode life, it is recommended that the heater supply be regulated. The series impedance to any chassis connection in the dc biasing circuit for the heater should be between 100 kilohms and 1 megohm. The surge voltage across the heater must be limited to 9.5 volts rms.
- d The use of a 5-volt standby condition in conjunction with 6-volt operating conditions is recommended to improve the reliability of the color picture tube by extending the emission wear-out life and reducing other gun-related defects. A maximum heater voltage of 5.5 volts (Design-Maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.
- e Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

Notes for Dimensional Outline

Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge (JEDEC No.G162) and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C' of the gauge with the glass funnel.

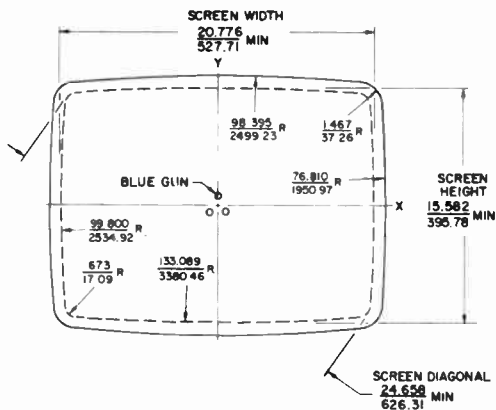
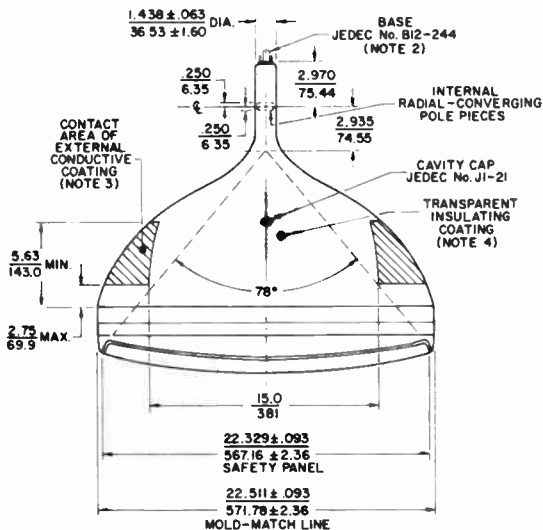
Note 2: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.

Note 3: The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

Note 4: To clean this area, wipe only with soft, dry, lintless cloth.

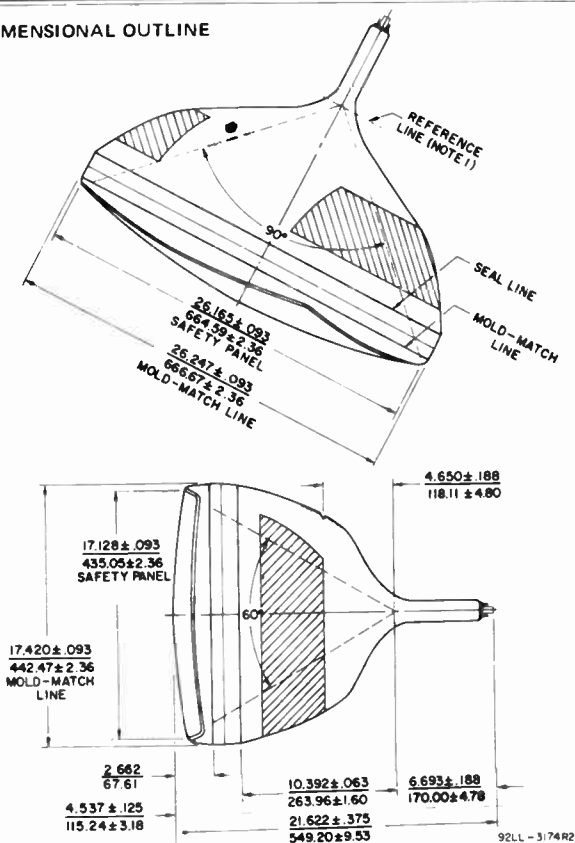
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DIMENSIONAL OUTLINE



Dimensions in inches/mm unless otherwise noted

DIMENSIONAL OUTLINE



Sagittal Heights with Reference to Centerface at Points (3.18 mm) Beyond Edge of Minimum Screen.

Station No.	Coordinates		Sagittal Height
	X in (mm)	Y in (mm)	in (mm)
1 (Minor)	0 (0)	7.916 (201.07)	.680 (17.27)
2	1.000 (25.40)	7.912 (200.96)	.692 (17.58)
3	2.000 (50.80)	7.901 (200.69)	.730 (18.54)
4	3.000 (76.20)	7.882 (220.20)	.791 (20.09)
5	4.000 (101.60)	7.856 (199.54)	.877 (22.28)
6	5.000 (127.00)	7.822 (198.68)	.987 (25.07)

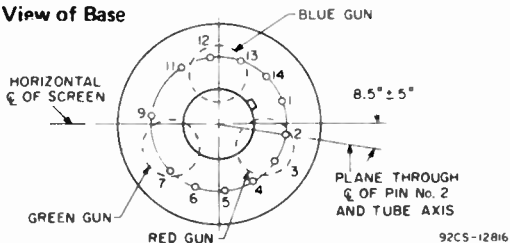
(continued on next page.)

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Sagittal Heights (Cont'd)

7	6.000 (152.40)	7.781 (197.64)	1.121 (28.47)
8	7.000 (177.80)	7.732 (196.39)	1.279 (32.49)
9	8.000 (203.20)	7.676 (194.97)	1.461 (37.11)
10	9.000 (228.60)	7.612 (193.34)	1.668 (42.37)
11	9.540 (242.32)	7.574 (192.38)	1.790 (45.47)
12 (Diagonal)	10.132 (257.35)	7.242 (183.95)	1.878 (47.70)
13	10.279 (261.09)	6.832 (173.53)	1.841 (46.76)
14	10.333 (262.46)	6.000 (152.40)	1.720 (43.69)
15	10.388 (263.86)	5.000 (127.00)	1.595 (40.51)
16	10.433 (265.00)	4.000 (101.60)	1.492 (37.90)
17	10.468 (265.89)	3.000 (76.20)	1.412 (35.86)
18	10.493 (266.52)	2.000 (50.80)	1.355 (34.42)
19	10.508 (266.90)	1.000 (25.40)	1.320 (33.53)
20 (Major)	10.513 (267.03)	0 (0)	1.308 (33.22)

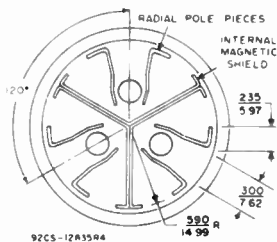
Bottom View of Base



Base Specification — JEDEC No.14BE

Pin 1:	Heater	Pin 11:	Cathode of Blue Gun
Pin 2:	Cathode of Red Gun	Pin 12:	Grid No.1 of Blue Gun
Pin 3:	Grid No.1 of Red Gun	Pin 13:	Grid No.2 of Blue Gun
Pin 4:	Grid No.2 of Red Gun	Pin 14:	Heater
Pin 5:	Grid No.2 of Green Gun	Cap:	Anode (Grid No.4, Screen, Collector)
Pin 6:	Cathode of Green Gun	C:	External Conductive Coating
Pin 7:	Grid No.1 of Green Gun		
Pin 9:	Grid No.3		

Location of Radial-Converging Pole Pieces Viewed from Screen End of Guns



0.5 mR/h ISODOSE - RATE LIMIT CURVE

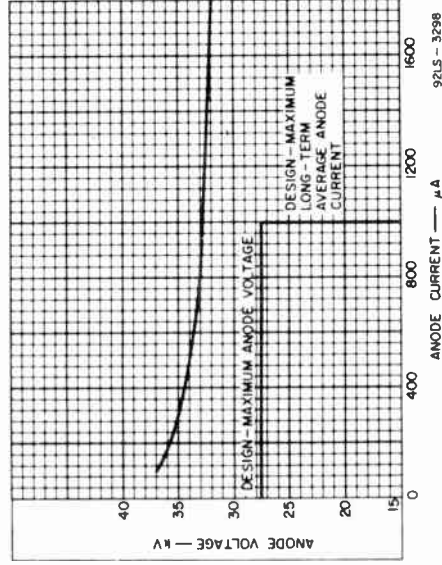


Figure 1

X-RADIATION LIMIT CURVE AT A CONSTANT ANODE CURRENT OF 300 μA (X-RADIATION AT A CONSTANT ANODE VOLTAGE VARIES LINEARLY WITH ANODE CURRENT)

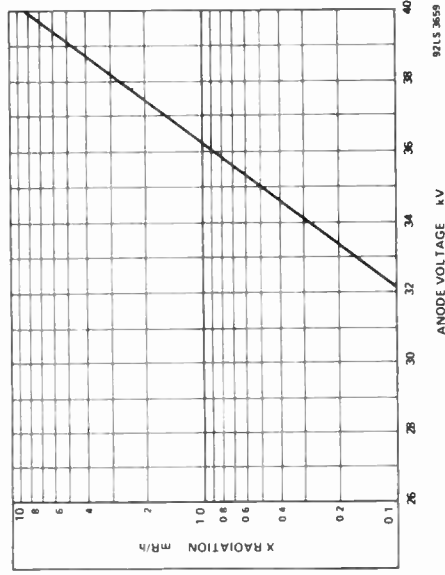
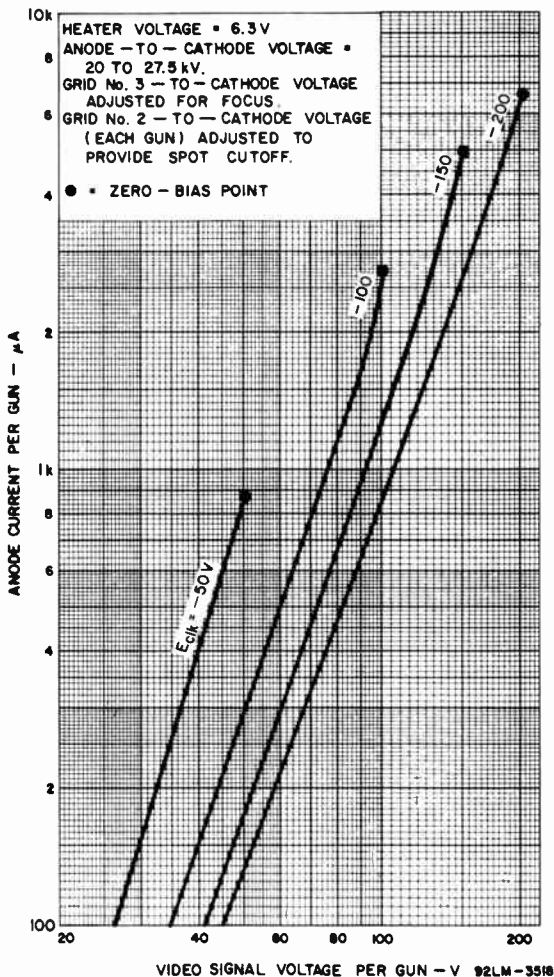


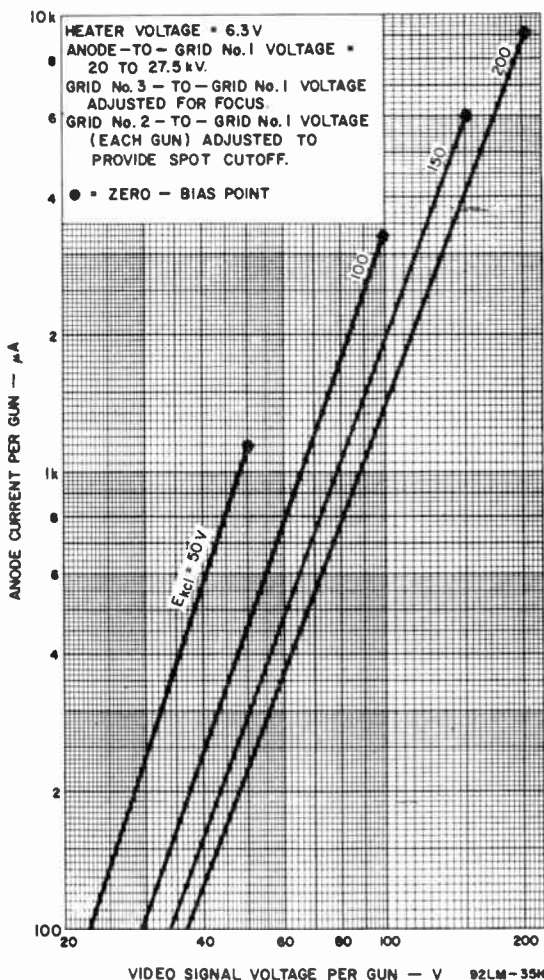
Figure 2

25VABP22

TYPICAL DRIVE CHARACTERISTICS, GRID-DRIVE SERVICE

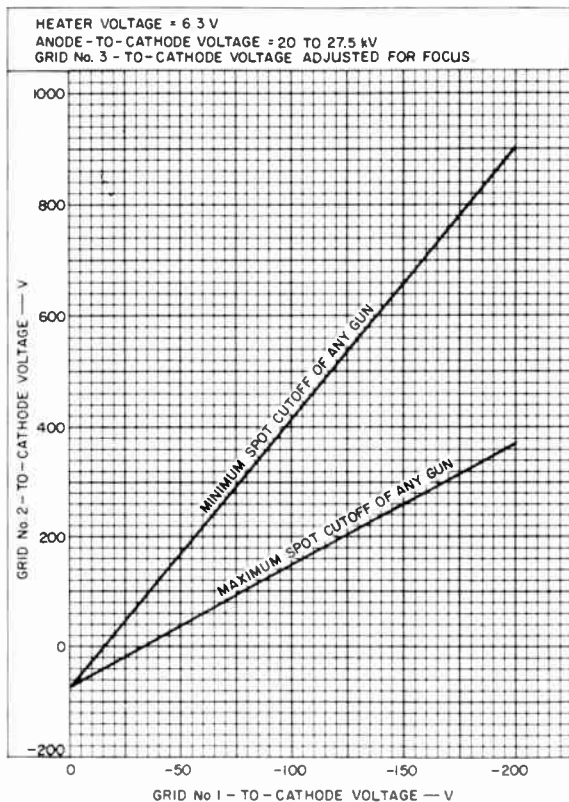


TYPICAL DRIVE CHARACTERISTICS,
CATHODE-DRIVE SERVICE



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CUTOFF DESIGN CHART



92LM-3161R1

IMPORTANT: Refer to sheet Safety Precautions for Color Picture Tubes at front of this section.

Figure 3

Color Picture Tube

"PERMA-CHROME" ASSEMBLY FOR OPTIMUM FIELD PURITY AND
UNIFORMITY DURING WARM-UP

RECTANGULAR TUBE 90° MAGNETIC DEFLECTION

ALUMINIZED TRICOLOR PHOSPHOR-DOT *H₁-Lite* Screen
(Utilizing a New Improved Rare-Earth Red-Emitting Phosphor)
INTEGRAL FILTERGLASS PROTECTIVE WINDOW

MAGNETIC CONVERGENCE 3 ELECTROSTATIC-FOCUS GUNS

For Use in Color-TV Receivers

ELECTRICAL

Electron Guns, Three Red, Blue, Green
Axial tilt of outer tube gun 1°

Heater, of Each Gun

Current, on tube with other two heaters
of the other two heaters 1.00 A

Current, at 100 V, 50 Hz 900 mA

Focusing Method Electrostatic

Focus Lens Bipotential

Convergence Method Magnetic

Deflection Method Magnetic

Deflection Angles (Approx.)

Diagonal 89°

Horizontal 78°

Vertical 63°

Direct Interelectrode Capacitances (Approx.)

Grid No. 1 of any gun to all other electrodes 6 pF

All cathodes to all other electrodes 15 pF

Grid No. 2 to all other electrodes 6.5 pF

External conductive coating to anode $\left\{ \begin{array}{l} 2500 \text{ max pF} \\ 2000 \text{ min pF} \end{array} \right.$

OPTICAL

Faceplate and Protective Window Filterglass

Light transmission at center (Approx.) 41%

Surface of Protective Window Treated to minimize
specular reflection

Screen, on Inner Surface of Faceplate

Type Aluminized, Tricolor, Phosphor-Dot

Phosphor (Three separate
phosphors, collectively)^b P22—New Rare-Earth (Red),
Sulfide (Blue & Green) Type

Fluorescence and phosphorescence of

separate phosphors, respectively Red, Blue, Green

Persistence of group phosphorescence Medium Short

Dot arrangement Each triangular group consists of a
red, green, and blue dot

Spacing between centers of

adjacent dot trios (Approx.)0.029 in (0.74 mm)



25XP22

MECHANICAL

Tube Dimensions

Overall length	20.924 ± .375 in (531.5 ± 9.5 mm)
Back length	6.693 ± .188 in (170.0 ± 4.8 mm)
Diameter	24.566 ± .093 in (624.0 ± 2.4 mm)
Greatest width	21.500 ± .093 in (546.1 ± 2.4 mm)
Greatest height	17.263 ± .093 in (438.5 ± 2.4 mm)

Minimum Screen Dimensions (Projected)

Diameter	22.995 in (584.1 mm)
Greatest width	19.875 in (504.8 mm)
Greatest height	15.575 in (395.6 mm)
Area . . . . .	.295 sq. in (1905 sq. cm)

Bulb Funnel Designation JEDEC No. J195-1/2 A1

Bulb Panel Designation JEDEC No. FP196-1/2 A3

Protective Window Designation JEDEC No. FP196-1/2 C1

Bulb Contact Designation Recessed Small Cavity Cap
(JEDEC No. J1-21)

Pin Position Alignment Pin No. 12 Aligns Approx.
with Anode Bulb Contact

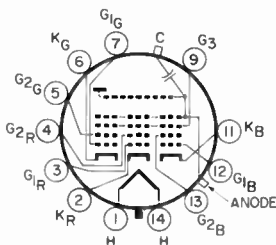
Operating Position Anode Bulb Contact on Top

Weight (Approx.) 42 lb (19.1 kg)

Base Small-Button Diheptar 12-pin (JEDEC No. B12-244)

TERMINAL DIAGRAM (Bottom View)

- Pin 1 - Heater
- Pin 2 - Cathode of Red Gun
- Pin 3 - Grid No. 1 of Red Gun
- Pin 4 - Grid No. 2 of Red Gun
- Pin 5 - Grid No. 3 of Red Gun
- Pin 6 - Cathode of Green Gun
- Pin 7 - Grid No. 1 of Green Gun
- Pin 8 - Grid No. 2
- Pin 9 - Grid No. 3
- Pin 10 - Cathode of Blue Gun
- Pin 11 - Grid No. 1 of Blue Gun
- Pin 12 - Grid No. 2 of Blue Gun
- Pin 13 - Grid No. 3 of Blue Gun
- Pin 14 - Heater



- Cir - Anode (Grid No. 4,
Grid No. 5, Screen,
Collector)
- C - External Conductive
Coating

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

Anode Voltage	(27,500 max V 20,000 min V)
Total Anode Current, Long-Term Average	1000 max A
Grid-No.3 (Focusing Electrode) Voltage	6000 max V
Peak Grid-No.2 Voltage, Including Video Signal Voltage	1000 max V



Grid-No.1 Voltage

Negative bias value	400 max	V
Negative operating cutoff value	200 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V

Heater Voltage (AC or DC)

Under operating conditions ^a	{ 6.9 max	V
	{ 5.7 min	V
Under standby conditions ^b	5.5 max	V

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:

During equipment warm-up period not exceeding 15 seconds.	450 max	V
After equipment warm-up period:		
Combined AC and DC value.	200 max	V
DC component value.	200 max	V

Heater positive with respect to cathode:

AC component value.	200 max	V
DC component value.	0 max	V

EQUIPMENT DESIGN RANGES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 20,000 and 27,500 V

Grid-No.3 (Focusing Electrode Voltage) 16.8% to 20%
of anode volts

Grid-No.2 and Grid-No.1 Voltages. See accompanying
For visual extinction of focused spot *Cutoff Design Chart*

Maximum Ratio of Grid-No.2 Voltages 1.86
Highest gun to lowest gun in any tube (At grid-No.1 spot cutoff voltage of -100 volts)

Grid-No.3 Current (Total) -45 to +15 μ A

Grid-No.2 Current -5 to +5 μ A

To Produce White of 9300°K +27 M.P.C.D.

(CIE Coordinates $x = 0.281, y = 0.311$)

Percentage of total anode current supplied by each gun (Average)	Red	Blue	Green	
	34	32	34	%
Ratio of cathode currents:		Min	Typ	Max
Red/blue.	0.75	1.10	1.50	
Red/green	0.65	1.00	2.50	
Blue/green.	0.60	0.91	1.30	

Displacement, Measured at Center of Screen

Raster centering displacement:

Horizontal.	± 0.47 in (± 11.9 mm)
Vertical.	± 0.45 in (± 11.4 mm)

Lateral distance between the blue beam and the converged red and green beams. ± 0.25 in (± 6.4 mm)

Radial convergence displacement excluding effects of dynamic convergence (Each beam). ± 0.37 in (± 9.4 mm)



25XP22

Maximum Required Correction for Register^c (Including Effect of Earth's Magnetic Field when Using Recommended Components)

Measurement at the center of the screen in any direction. 0.005 in (0.13 mm) max

EXAMPLES OF USE OF DESIGN RANGES

Unless otherwise specified, voltage values are for each gun and are positive with respect to cathode

Anode Voltage	25,000	V
Grid-No.3 (Focusing Electrode) Voltage	4200 to 5000	V
Grid-No.2 Voltage when circuit design utilizes grid-No.1 voltage of -150 volts for visual extinction of focused spot.	285 to 685	V
Grid-No.1 Voltage for visual extinction of focused spot when circuit design utilizes grid-No.2 voltage of 400 volts.	-95 to -190	V
Heater Voltage		
Heater operating conditions ^a	6.3	V
Heater start-up condition	5.0	V

LIMITING CIRCUIT VALUES

High-Voltage Circuits

Grid-No.3 Circuit Resistance. 7.5 max M Ω

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the high-voltage power supply and the grid-No.3 power supply be of the limited-energy type, in which the short-circuit current does not exceed 20 mA.

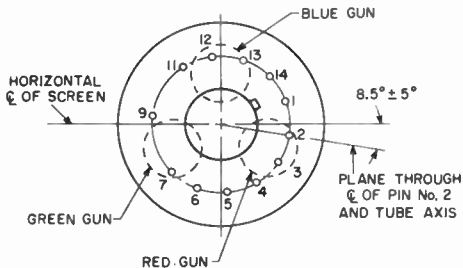
Low-Voltage Circuits

Effective grid-No.1-to-cathode-circuit resistance (Each gun). 0.75 max M Ω

The low-voltage circuits, including all heater circuits, should be analyzed by assuming the color picture tube heater is connected directly to the receiver chassis ground. Under these conditions the circuits to the elements of all tubes, including the color picture tube, operating from the same heater winding and all connections of any other circuits to the heater winding should each have an impedance such that their respective power sources in combination will not supply a continuous short circuit current of more than 750 mA total in the assumed picture tube heater ground connection. The leads from all other circuits must be separated from the picture tube leads by a minimum distance of 0.25 inch (6.4 mm) to prevent energy transfer to the picture tube circuits. Such current limitation will help prevent picture tube damage in case of momentary cascade arcing.

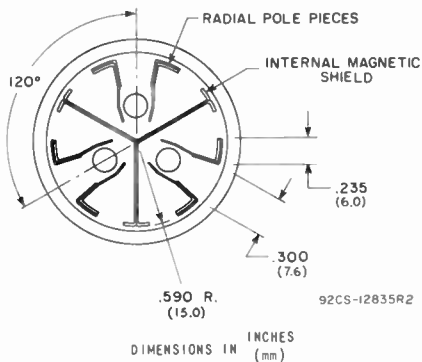


BOTTOM VIEW OF BASE



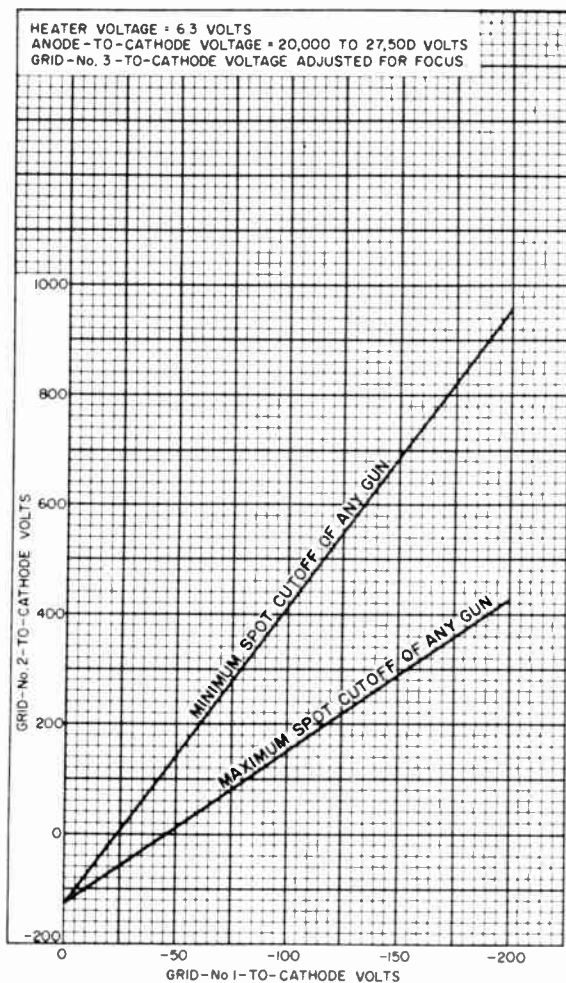
92CS-12816

LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



92CS-12835R2

Cutoff Design Chart

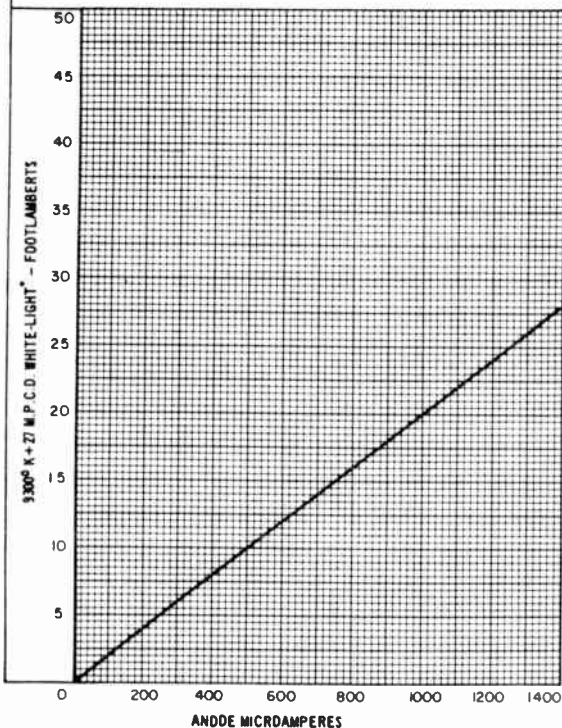


92CM-12803



Typical Light-Output Characteristic

HEATER VOLTAGE • 6.3 VOLTS
 ANODE-TO-CATHODE VOLTAGE • 25000 VOLTS
 GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
 DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE
 CURRENT TO PRODUCE 9300° K + 27 M.P.C.D. WHITE-LIGHT OUTPUT.
 PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN
 TO PRODUCE 9300° K + 27 M.P.C.D. WHITE:
 RED GUN: 34%
 BLUE GUN: 32%
 GREEN GUN: 34%
 RASTER SIZE: 19.875" X 15.575" (504.8 mm X 395.6 mm)
 *MEASURED WITHIN 5" - DIAMETER AREA CENTERED ON TUBE FACE.



92LM-195H



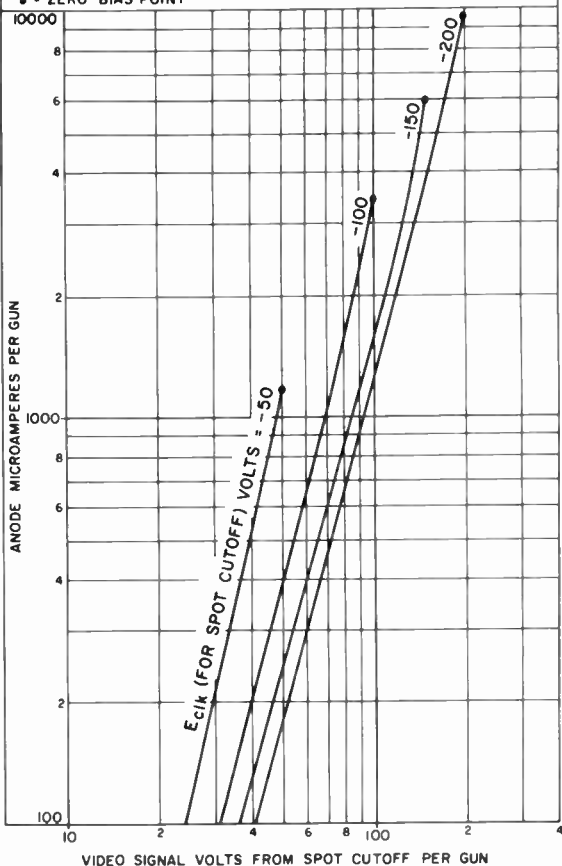
RADIO CORPORATION OF AMERICA
 Electronic Components and Devices Harrison, N. J.

DATA 2
 1-17

Typical Drive Characteristics

Grid-Drive Service

HEATER VOLTAGE = 6.3 VOLTS
 ANODE-TO-CATHODE VOLTAGE = 20000 TO 27500 VOLTS
 GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
 GRID-No. 2-TO-CATHODE VOLTAGE (EACH GUN) ADJUSTED
 TO PROVIDE SPOT CUTOFF FOR DESIRED FIXED GRID-No. 1-
 TO-CATHODE (EACH GUN) VOLTAGE (E_{c1k})
 • = ZERO-BIAS POINT



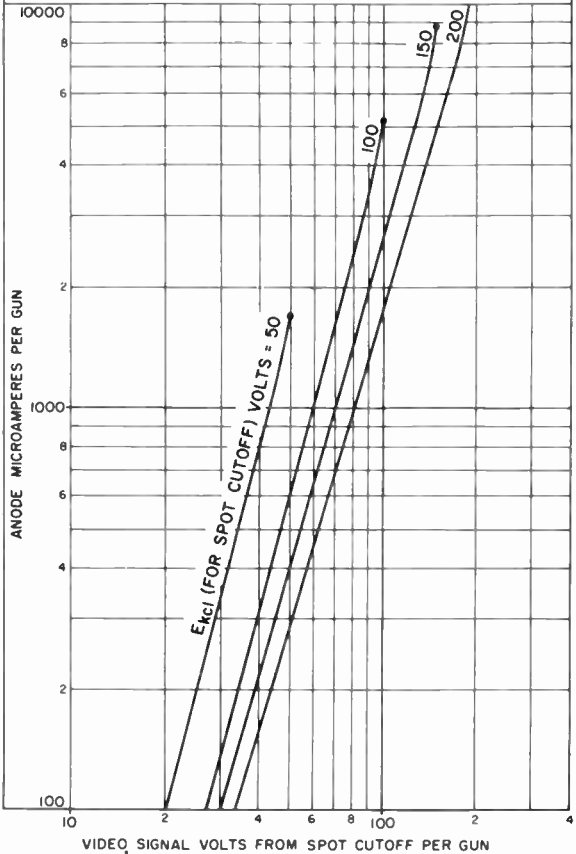
92CM-12807



Typical Drive Characteristics

Cathode-Drive Service

HEATER VOLTAGE = 6.3 VOLTS
 ANODE - TO - GRID - No.1 VOLTAGE = 20000 TO 27500 VOLTS
 GRID - No. 3 - TO - GRID - No.1 VOLTAGE ADJUSTED FOR FOCUS.
 GRID - No. 2 - TO - GRID - No.1 VOLTAGE (EACH GUN) ADJUSTED
 TO PROVIDE SPOT CUTOFF FOR DESIRED FIXED CATHODE-
 TO - GRID - No.1 (EACH GUN) VOLTAGE (E_{kc1})
 ● = ZERO-BIAS POINT



92CM-12806



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DATA 6
 4-67



Color Picture Tube

"PERMA-CHROME" ASSEMBLY FOR OPTIMUM FIELD
 PURITY AND UNIFORMITY DURING WARM-UP

RECTANGULAR TUBE
 MAGNETIC CONVERGENCE

90° MAGNETIC DEFLECTION
 3 ELECTROSTATIC-FOCUS GUNS

ALUMINIZED TRICOLOR PHOSPHOR-DOT Hi-Lite SCREEN
 (Utilizing a New, Improved Rare-Earth Red-Emitting Phosphor)

For Use in Color-TV Receivers

The 25YP22 is the same as the 25AP22 except for the following items:

OPTICAL

Faceplate. Filterglass
 Light transmission (Approx.) 69%
 Faceplate does not have an integral protective window^a

MECHANICAL

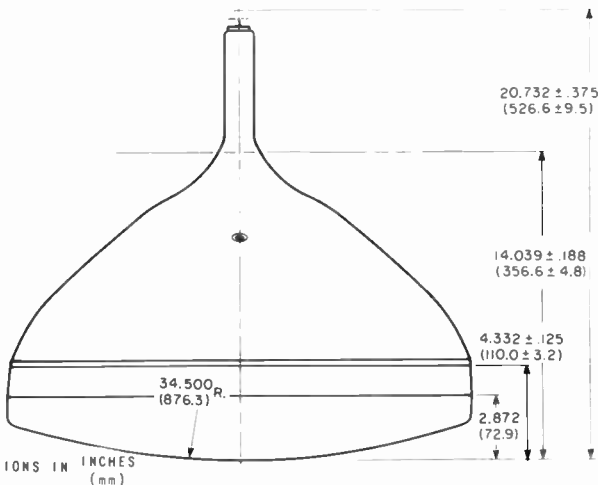
Tube Dimensions

Overall length $20.732 \pm .375$ in (526.6 ± 9.5 mm)
 Weight (Approx.) 37 lb (16.8 kg.)

^a It is recommended that the cabinet be provided with a shatter-proof glass cover over the face of the 25YP22 to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide x-radiation protection when required.

DIMENSIONAL OUTLINE

Dimensions shown are only those which are different from the corresponding dimensions for the 25AP22



Note: In side view, spherical radius = 34.000 in (863.6 mm).



Typical Light-Output Characteristic

HEATER VOLTAGE : 6.3 VOLTS
 ANODE-TO-CATHODE VOLTAGE : 25000 VOLTS
 GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS
 DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE
 CURRENT TO PRODUCE 9300⁰ K+27 M.P.C.D. WHITE-LIGHT OUTPUT.
 PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN
 TO PRODUCE 9300⁰ K+27 M.P.C.D. WHITE:

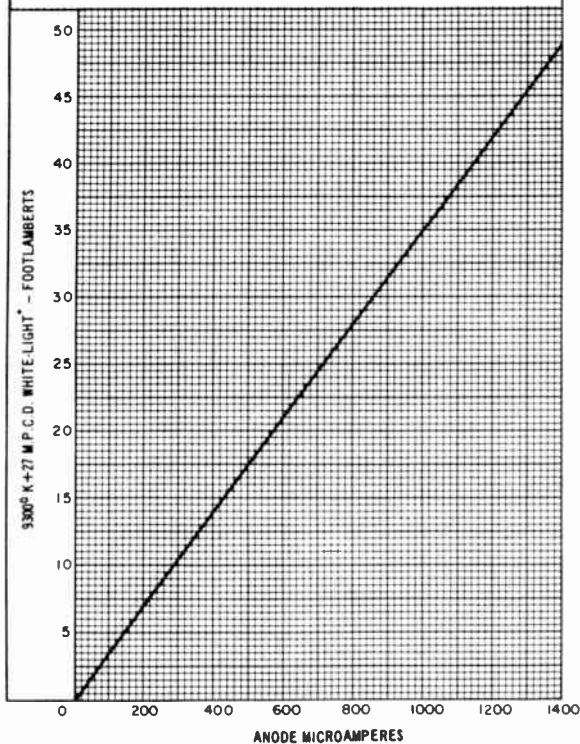
RED GUN: 34%

BLUE GUN: 32%

GREEN GUN: 34%

RASTER SIZE: 19.875" X 15.575" (504.8 mm X 395.6 mm)

*MEASURED WITHIN 5" - DIAMETER AREA CENTERED ON TUBE FACE.



92LM-1955



27MP4

PICTURE TUBE

27MP4

RECTANGULAR METAL-SHELL TYPE
MAGNETIC FOCUS

ALUMINIZED SCREEN
MAGNETIC DEFLECTION

DATA

General:

Heater, for Unirotential Cathode:

Voltage 6.3 ac or dc volts

Current 0.6 ± 10% amp

Faceplate, Compound Spherical Frosted Filterglass

Phosphor (For Curves, see front of this Section) . . P4—Sulfide Type
Aluminized

Deflection Angles (Approx.):

Diagonal 90°

Horizontal 85°

Vertical 69°

Electron Gun Ion-Trap Type Requiring
External Single-Field Magnet

Tube Dimensions:

Maximum overall length 22-3/16"

Greatest width at lip 25-1/4" ± 3/16"

Greatest height at lip 19-15/16" ± 3/16"

Diagonal at lip 26-7/8" ± 1/4"

Neck length 7-1/2" ± 3/16"

Radius of curvature of faceplate (External surface) ♦

Screen Dimensions (Minimum):

Greatest width 23-7/16"

Greatest height 18-1/8"

Diagonal 25-1/16"

Operating Position Any

Ultor Terminal Metal-Shell Lip

Base . . Small-Shell Duodecal 5-Pin (JEDEC Group 4, No. B5-57)

Basing Designation for BOTTOM VIEW 12D

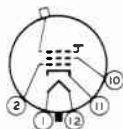
Pin 1—Heater

Pin 2—Grid No.1

Pin 10—Grid No.2

Pin 11—Cathode

Pin 12—Heater



Metal-Shell Lip —
Ultor
(Grid No.3,
Collector)

Maximum Ratings, Design-Center Values:

ULTOR VOLTAGE 18000 max. volts

GRID-No.2 VOLTAGE 500 max. volts

GRID-No.1 VOLTAGE:

Negative-bias value 125 max. volts

Positive-bias value 0 max. volts

Positive-peak value 2 max. volts

♦: See next page.

← Indicates a change.

27MP4



27MP4

PICTURE TUBE

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode:

During equipment warm-up period

not exceeding 15 seconds 410 max. volts

After equipment warm-up period 180 max. volts

Heater positive with respect to cathode. 180 max. volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance 1.5 max. megohms

Within major area, the radius of curvature is 40". The curvature of the surface at the boundary of this area blends into the rim and has a perimetrical shape conforming to the surface of a sphere having a 50" radius.

*For X-ray shielding considerations, see sheet
X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section*

Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
90° MAGNETIC DEFLECTION

GENERAL DATA

Electrical:

Heater Current at 6.3 volts	100	ma.
Direct Interelectrode Capacitances:		
Grid No. 1 to all other electrodes	5	$\mu\mu\text{f}$
Cathode to all other electrodes	5	$\mu\mu\text{f}$
External conductive coating to ultor.	1.50 max. / 200 min.	$\mu\mu\text{f}$
Electron Gun	Type Requiring No Ion-Trap Magnet	

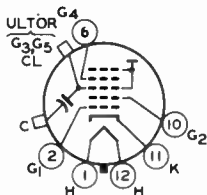
Optical:

Faceplate	Filterglass
Light transmission (Approx.)	72%
Phosphor (For Curves, see front of this section)	P4—Sulfide Type, Aluminized

Mechanical:

Operating Position	Any
Weight (Approx.)	44 lbs
Overall Length	21-1/16" \pm 3/8"
Neck Length	5-1/2" \pm 3/16"
Projected Area of Screen	425 sq. in.
External Conductive Coating:	
Type	Regular Band
Contact Area for grounding	Near Reference Line
For additional information on Coatings and Dimensions:	
See Picture Tube Dimensional-Outlines and Bulb J214 1 2 A	
located at the front of this section	
Coating	Recessed Small Cavity (JFDEC No. J1 21)
Mounting	Small-Shell Duodecapole Fin, Arrangement 1 (JFDEC Group 4, No. FF-t-1)
Basing Designation for BOTTOM VIEW	121

Pin 1 - Heater
Pin 2 - Grid No. 1
Pin 6 - Grid No. 4
Pin 10 - Grid No. 2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Ultor
(Grid No. 3,
Grid No. 5,
Collector)
C - Cathode
Coating

Maximum Ratings, Design-Maximum Values:

ULTOR VOLTAGE	2000	max.	volts
GRID-NO. 4 (FOCUSING) VOLTAGE:			
Pos. +ve. value	1100	max.	volts
Negat. ve. value	500	max.	volts
GRID-NO. 2 VOLTAGE	750	max.	volts



27VP4

GRID-NO.1 VOLTAGE:

Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Typical Operating Conditions:

With ultor voltage of	16000	volts
and grid-No.2 voltage of	300	volts
Grid-No.4 Voltage for focus	-72 to +396	volts
Grid-No.1 Voltage for visual extinction		
of focused raster	-28 to -72	volts

Maximum Circuit Values:

Grid-No.1 Circuit Resistance:	1.5 max.	megohms
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For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section



Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts	600 ± 30	ma
Heater Warm-Up Time (Average)	11	seconds
Focusing Method	Electrostatic	
Deflection Method	Magnetic	
Deflection Angles (Approx.):		
Diagonal	95°	
Horizontal	85°	
Vertical	68°	
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	μf
Cathode to all other electrodes	5	μf
External conductive coating to ultor.	{ 2500 max. 1700 min.	{ μf μf
Electron Gun	Type Requiring No Ion-Trap Magnet	

Optical:

Faceplate, Spherical	Filterglass
Light transmission at center (Approx.)	72%
Phosphor (For Curves, see front of this Section)	P4—Sulfide Type Aluminized
Fluorescence	White
Phosphorescence	White
Persistence	Medium Short

Mechanical:

Tube Dimensions:	
Overall length	20-1/16" ± 3/8"
Greatest width	25-9/32" ± 1/8"
Greatest height	20-7/32" ± 1/8"
Diagonal	26-13/16" ± 1/8"
Neck length	4-1/2" ± 3/16"
Curvature of faceplate (External Radius):	
Center	40"
Screen Dimensions (Minimum):	
Greatest width	24-1/4"
Greatest height	18-5/8"
Diagonal	25-3/4"
Projected area	425 sq. in.
Weight (Approx.)	44 lbs
Operating Position	Any
Cap	Recessed Small Cavity (JEDEC No. J1-21)
Bulb	J214-1/2A2

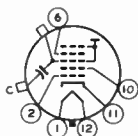


27XP4

Base. Short Small-Shell Duodecal 6-Pin
(JEDEC Group 4, No. B6-203)

Basing Designation for BOTTOM VIEW. 12L

- Pin 1-Heater
- Pin 2-Grid No.1
- Pin 6-Grid No.4
- Pin 10-Grid No.2
- Pin 11-Cathode
- Pin 12-Heater



- Cap-Ultor
(Grid No.3,
Grid No.5,
Collector)
- C-External
Conductive
Coating

GRID-DRIVE^a SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR VOLTAGE	{ 23000 max. 11000 min.	volts volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value.	1100 max.	volts
Negative value.	550 max.	volts
GRID-No.2 VOLTAGE	{ 550 max. 200 min.	volts volts
GRID-No.1 VOLTAGE:		
Negative-peak value	220 max.	volts
Negative-bias value	154 max.	volts
Positive-bias value	0 max.	volts
Positive-peak value	2 max.	volts
HEATER VOLTAGE.	{ 6.9 max. 5.7 min.	volts volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Typical Operating Conditions:

With ultor voltage (E_{c5k}) of	18000	volts
and grid-No.2 voltage (E_{c2k}) of	400	volts
Grid-No.4 Voltage for focus ^b	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster ^c	-36 to -94	volts
Field Strength of Adjustable Centering Magnet ^d	0 to 11	gausses

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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CATHODE-DRIVE^a SERVICE

Unless otherwise specified, voltage values are positive with respect to grid-No.1

Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR-TO-GRID-No.1 VOLTAGE.	{ 23000 max. 11000 min.	volts volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value.	1250 max.	volts
Negative value.	400 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE.	{ 700 max. 350 min.	volts volts
GRID-No.2-TO-CATHODE VOLTAGE.	550 max.	voltc
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive-peak value	220 max.	volts
Positive-bias value	154 max.	volts
Negative-bias value	0 max.	volts
Negative-peak value	2 max.	volts
HEATER VOLTAGE.	{ 6.9 max. 5.7 min.	volts volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period.	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage (E_{c2g1}) of	18000	volts
and grid-No.2-to-grid-No.1 voltage (E_{c2g1}) of	400	volts
Grid-No.4-to-Grid-No.1 Voltage for focus ^b	0 to 400	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster ^f	36 to 78	volts
Field Strength of Adjustable Centering Magnet ^d	0 to 11	gausses

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
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^a Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

^b The grid-No.4 (or grid-No.4-to-grid-No.1) voltage required for optimum focus of any individual tube will have a value anywhere between 0 and 400 volts, is independent of ultor current and will remain essentially constant for values of ultor (or ultor-to-grid-No.1) voltage or grid-No.2 (or grid-No.2-to-grid-No.1) voltage within design-maximum ratings shown for these items.

^c See Raster-Cutoff-Range Chart for Grid-Drive Service.

^d Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/4". The specified centering magnet compensates only for the effect which mechanical tube tolerances may have on the



27XP4

location of the undeflected focused spot with respect to the center of the tube face. Maximum field strength of adjustable centering magnet equals:

$$\sqrt{\frac{E_{c_5k} \text{ or } E_{c_5g_1} \text{ (volts)}}{16000 \text{ (volts)}}} \times 11 \text{ gauss}$$

The equipment manufacturer must determine and supply additional compensation for the effects of the earth's magnetic field and extraneous fields due to choice of circuitry and components. The additional compensation should preferably be applied as part of the magnetic field of the deflecting yoke.

e Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

f See *Raster-Cutoff-Range Chart for Cathode-Drive Service.*

OPERATING CONSIDERATIONS

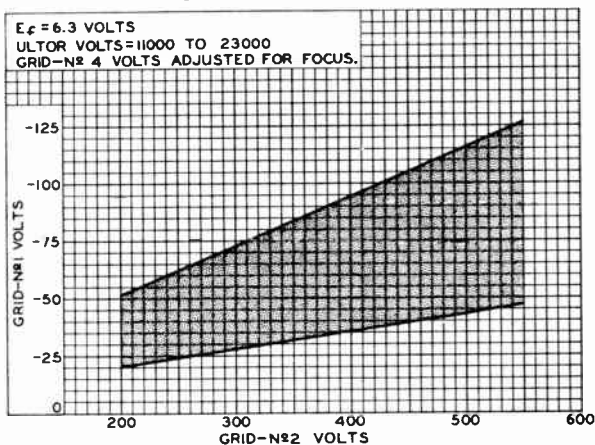
X-Ray Warning. When operated at ultor voltages up to 16 kilovolts, this picture tube does not produce any harmful X-ray radiation. However, because the rating of this type permits operation at voltages as high as 23 kilovolts (Design-maximum value), shielding of this picture tube for X-ray radiation may be needed to protect against possible injury from prolonged exposure at close range whenever the operating conditions involve voltages in excess of 16 kilovolts.

Shatter-Proof Cover Over the Tube Face. Following conventional picture tube practice, it is recommended that the cabinet be provided with a shatterproof, glass cover over the face of this picture tube to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.



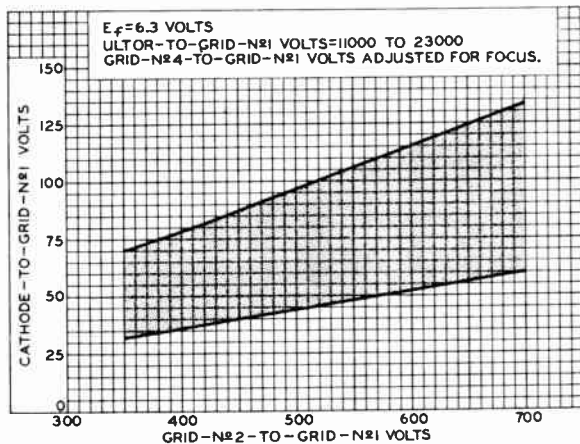
RASTER-CUTOFF-RANGE CHARTS

Grid-Drive Service



92CS-10912

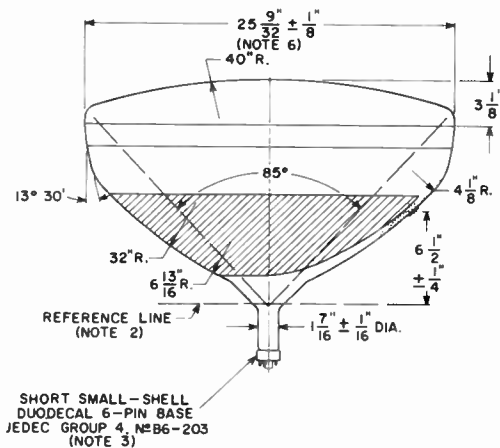
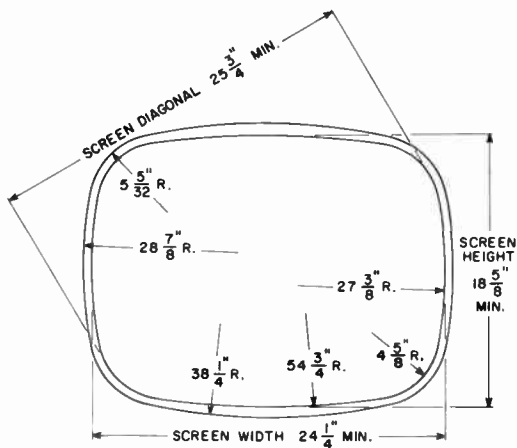
Cathode-Drive Service

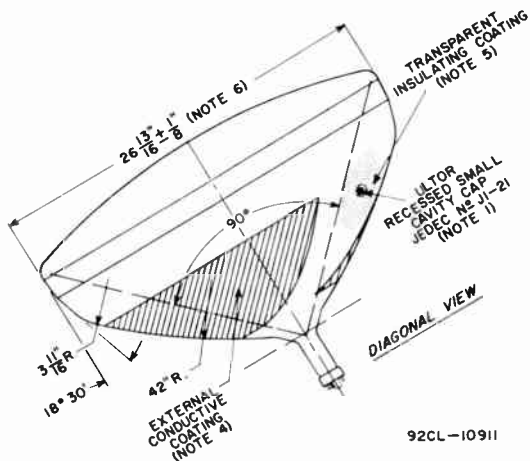
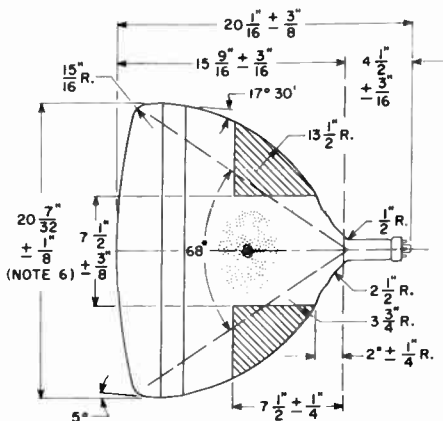


92CS-10904



27XP4

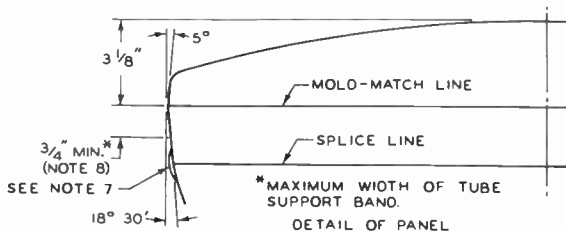




92CL-10911



27XP4



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 30^\circ$. ULTOR TERMINAL IS ON SAME SIDE AS PIN 6.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No. G-116 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 3".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

NOTE 6: MEASURED AT THE MOLD-MATCH LINE.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN $1/8"$, BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN $1/16"$ BEYOND THE ENVELOPE SURFACE AT THE LOCATION SPECIFIED FOR DIMENSIONING THE ENVELOPE WIDTH, DIAGONAL, AND HEIGHT.

NOTE 8: AREA BETWEEN MOLD-MATCH LINE AND SEAL BULGE IS $3/4"$ MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF TUBE SUPPORT BAND. SUPPORTS MUST BE SPACED FROM THE TUBE BY THE USE OF CUSHIONING PADS MADE OF ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.



902-A

902-A

HIGH-VACUUM CATHODE-RAY TUBE*Supersedes Type 902***General:**

Heater, for Unipotential Cathode:

Voltage 6.3 ± 10% ac or dc volts
Current 0.6 amp.

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to All Other Electrodes 7.5 μf
DJ₁ to All Other Electrodes 8.5 μf
DJ₄ to All Other Electrodes 6.0 μfPhosphor (For Curves, see front of this Section) No.1
Fluorescence Green
Persistence Medium

Focusing Method Electrostatic

Deflection Method Electrostatic

Overall Length 7-7/16" ± 3/16"

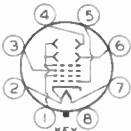
Greatest Diameter of Bulb 2" ± 1/16"

Minimum Useful Screen Diameter 1-3/4"

Mounting Position Any

Base Medium Shell Octal 8-Pin

Basing Designation for BOTTOM VIEW 8CD

Pin 1- Grid No.2, Anode No.2, Deflecting Electrode DJ ₂ , Deflecting Electrode DJ ₃		Pin 3- Anode No.1
Pin 2- Heater, Cathode		Pin 4- Deflecting Electr. DJ ₁
		Pin 5- Grid No.1
		Pin 6- Deflecting Electr. DJ ₄
		Pin 7- Heater
		Pin 8- No Connection

*DJ₁ and DJ₂ are nearer the screen**DJ₃ and DJ₄ are nearer the base*

With DJ₁ positive with respect to DJ₂, the spot is deflected toward pin 3. With DJ₃ positive with respect to DJ₄, the spot is deflected toward pin 1.

The angle between the trace produced by DJ₃ and DJ₄ and its intersection with the plane through the tube axis and pin 1 does not exceed 10°.

The angle between the trace produced by DJ₃ and DJ₄ and the trace produced by DJ₁ and DJ₂ is 90° ± 40°.

Maximum Ratings, Absolute Values:

ANODE-NO.2 & GRID NO.2 VOLTAGE	660	max.	volts
ANODE-NO.1 VOLTAGE	330	max.	volts
GRID-NO.1 (CONTROL ELECTRODE) VOLTAGE:			
Negative Value	125	max.	volts
Positive Value	0	max.	volts
PEAK VOLTAGE BETWEEN ANODE NO.2 AND DEFLECTING ELECTRODE DJ ₁ OR DJ ₄	385	max.	volts

JULY 1, 1945

RCA VICTOR DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

DATA 1



HIGH-VACUUM CATHODE-RAY TUBE

(continued from preceding page)

Typical Operation:

Anode No.2 & Grid No.2 Voltage [*]	400	600	volts
Anode No.1 Voltage for Focus at 75% of Grid-No.1 Voltage for Cutoff [*]	100	150	volts
Grid-No.1 Volt. for Visual Cutoff [#]	-40	-60	volts
Max. Anode-No.1 Current Range [▲]	Between -50 and +10		μamp.

Deflection Sensitivity:

DJ ₁ and DJ ₂	0.273	0.183	mm/v dc
DJ ₃ and DJ ₄	0.326	0.217	mm/v dc

Deflection Factor:^{**}

DJ ₁ and DJ ₂	93	139	v dc/in.
DJ ₃ and DJ ₄	78	117	v dc/in.

^{*} Brilliance and definition decrease with decreasing anode-No.2 voltage. In general, anode-No.2 voltage should not be less than 400 volts.

[●] Individual tubes may require between +20% and -35% of the values shown with grid-No.1 voltages between zero and cutoff.

[#] Visual extinction of stationary focused spot. Supply should be adjustable to ± 50% of these values.

[▲] See curve for average values.

^{**} Individual tubes may vary from these values by ± 20%.

Spot Position:

The undeflected focused spot will fall within a 10-mm square centered at the geometric center of the tube face and having one side parallel to the trace produced by DJ₁ and DJ₂. Suitable test conditions are: anode-No.2 voltage, 600 volts; anode-No.1 voltage, adjusted for focus; deflecting-electrode resistors, 1 megohm each for DJ₁ and DJ₄, connected to anode No.2; the tube shielded from all extraneous fields. To avoid damage to the tube, grid-No.1 voltage should be near cutoff before application of anode voltages.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Impedance of Any Deflecting-Electrode Circuit at Heater-Supply Frequency	1.0 max.	megohms
Resistance in Any Deflecting- Electrode Circuit ^{▲▲}	5.0 max.	megohms

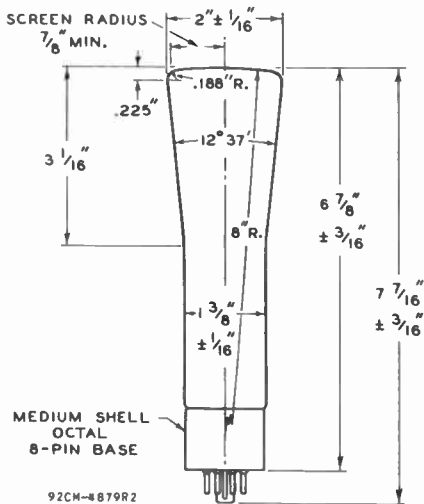
^{▲▲} It is recommended that both deflecting-electrode-circuit resistances be approximately equal.

902-A



902-A

HIGH-VACUUM CATHODE-RAY TUBE



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

JULY 1, 1945

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

DATA 2



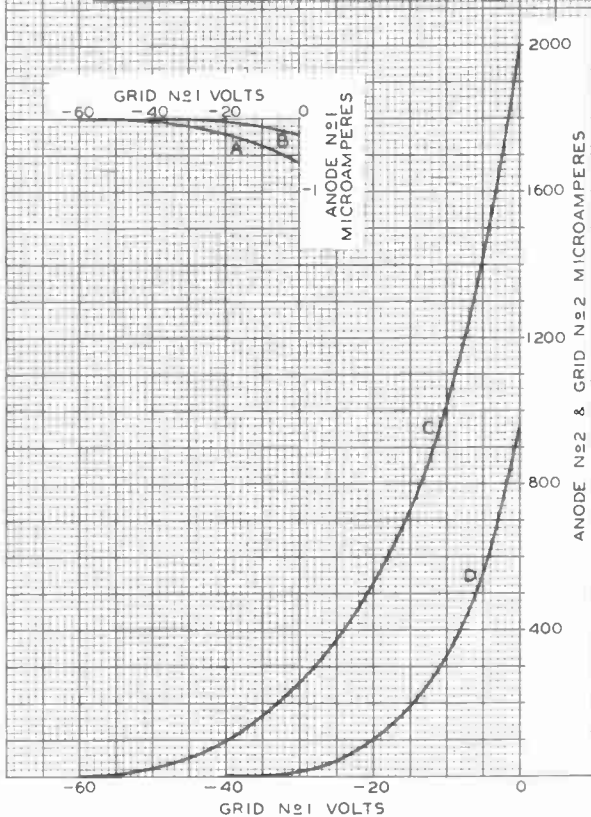
902-A

902-A

AVERAGE CHARACTERISTICS

 $E_f = 6.3$ VOLTSANODE N^o1 VOLTS ADJUSTED TO GIVE FOCUS

CURVE	ELECTRODE CURRENT	ANODE N ^o 2 & GRID N ^o 2 VOLTS
A	ANODE N ^o 1	600
B	ANODE N ^o 1	400
C	ANODE N ^o 2 & GRID N ^o 2	600
D	ANODE N ^o 2 & GRID N ^o 2	400



APR. 13, 1945

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-4895RI





905-A

905-A

HIGH-VACUUM CATHODE-RAY TUBE

Superseals Type 905

General:

Heater, for Unipotential Cathode:

Voltage.	2.5 ± 10%	ac or dc volts
Current.	2.1	amp.

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to All Other Electrodes	9.0	μf
DJ1 to DJ2	2.0	μf
DJ3 to DJ4	1.0	μf

Phosphor (For Curves, see front of this Section)	No.1
Fluorescence	Green
Persistence.	Medium

Focusing Method. Electrostatic

Deflection Method. Electrostatic

Overall Length 16-1/2" ± 3/8"

Greatest Diameter of Bulb. 5-1/4" + 1/16"
- 3/32"

Minimum Useful Screen Diameter 4-1/2"

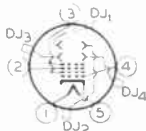
Mounting Position. Any

Caps (Four). Small

Base Long-Shell Medium 5-Pin, Micanol

Basing Designation for BOTTOM VIEW SBR

Pin 1-Heater	Cap over Pins 1 and 5	} Defl'g Electr. DJ2
Pin 2-Anode No.1		
Pin 3-Anode No.2, Grid No.2	Cap over Pin 2	} Deflecting Electrode DJ3
Pin 4-Grid No.1		
Pin 5-Heater, Cathode	Cap over Pin 4	} Deflecting Electrode DJ4
Cap over Pin 3		



*DJ₁ and DJ₂ are nearer the screen
DJ₃ and DJ₄ are nearer the base*

With DJ₁ positive with respect to DJ₂, the spot is deflected toward pin 3. With DJ₃ positive with respect to DJ₄, the spot is deflected toward pin 2.

The angle between the trace produced by DJ₁ and DJ₂ and its intersection with the plane through the tube axis and pin 3 does not exceed 10°.

The angle between the trace produced by DJ₃ and DJ₄ and the trace produced by DJ₁ and DJ₂ is 90° ± 6°.

Maximum Ratings, Absolute Values:

ANODE-No.2 & GRID-No.2 VOLTAGE.	2200 max.	volts
ANODE-No.1 VOLTAGE.	660 max.	volts
GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:		
Negative Value.	125 max.	volts
Positive Value.	0 max.	volts
PEAK VOLTAGE BETWEEN ANODE No.2 AND ANY DEFLECTING ELECTRODE	1100 max.	volts

JULY 1, 1945

RCA VICTOR DIVISION

DATA 1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History



HIGH-VACUUM CATHODE-RAY TUBE

(continued from preceding page)

Typical Operation:

Anode-No.2 & Grid-No.2 Voltage*	1500	2000	volts
Anode-No.1 Volt. for Focus at 75% of Grid-No.1 Volt. for Cutoff [•]	338	450	volts
Grid-No.1 Volt. for Visual Cutoff [#]	-26	-35	volts
Max. Anode-No.1 Current Range [▲]	Between -50 and +10		μamp.

Deflection Sensitivity:

DJ ₁ and DJ ₂	0.295	0.221	mm/v dc
DJ ₃ and DJ ₄	0.348	0.262	mm/v dc

Deflection Factor:^{**}

DJ ₁ and DJ ₂	86	115	v dc/in.
DJ ₃ and DJ ₄	73	97	v dc/in.

[•] Brilliance and definition decrease with decreasing anode-No.2 voltage. In general, anode-No.2 voltage should not be less than 1500 volts.

[•] Individual tubes may require between -30% and +25% of the values shown with grid-No.1 voltages between zero and cutoff.

[#] Visual extinction of stationary focused spot. Supply should be adjustable to $\pm 50\%$ of these values.

[▲] See curve for average values.

^{**} Individual tubes may vary from these values by $\pm 20\%$.

Spot Position:

The undeflected focused spot will fall within a 12-mm square centered at the geometric center of the tube face and having one side parallel to the trace produced by DJ₁ and DJ₂. Suitable test conditions are: anode-No.2 voltage, 1500 volts; anode-No.1 voltage, adjusted for focus; deflecting-electrode resistors, 1 megohm each, connected to anode-No.2; the tube shielded from all extraneous fields. To avoid damage to the tube, grid-No.1 voltage should be near cutoff before application of anode voltages.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max. megohms
Resistance in Any Deflecting- Electrode Circuit ^{▲▲}	5.0 max. megohms

^{▲▲} It is recommended that all deflecting-electrode-circuit resistances be approximately equal.

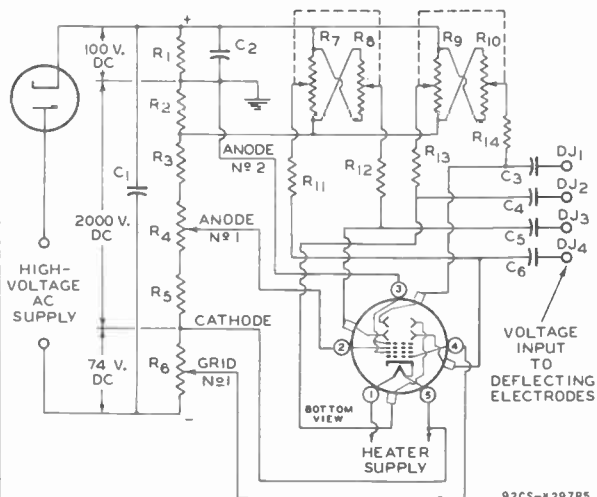


905-A

905-A

HIGH-VACUUM CATHODE-RAY TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



97C5-297R5

C1: 0.1 μ f
 C2: 1.0 μ f
 C3 C4 C5 C6: 0.05- μ f Blocking
 Capacitors *

R1 R2: 2 Megohms
 R3: 6 Megohms

R4: 2-Megohm Potentiometer
 R5: 1.0 Megohm
 R6: 0.35-Megohm Potentiometer
 R7 R8: Dual 5-Megohm Potentiometer
 R9 R10: Dual 5-Megohm Potentiometer
 R11 R12 R13 R14: 2 Megohms

* When cathode is grounded, capacitors should have high voltage rating; when anode No. 2 is grounded, they may have low voltage rating. For dc amplifier service, deflecting electrodes should be connected direct to amplifier output. In this service, it is preferable usually to remove deflecting-electrode resistors to minimize loading effect on amplifier. In order to minimize spot defocusing, it is essential that anode No. 2 be returned to a point in the amplifier system which will give the lowest possible potential difference between anode No. 2 and the deflecting electrodes.

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JULY 1, 1945

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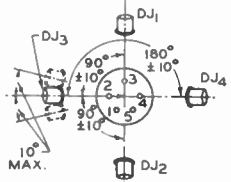
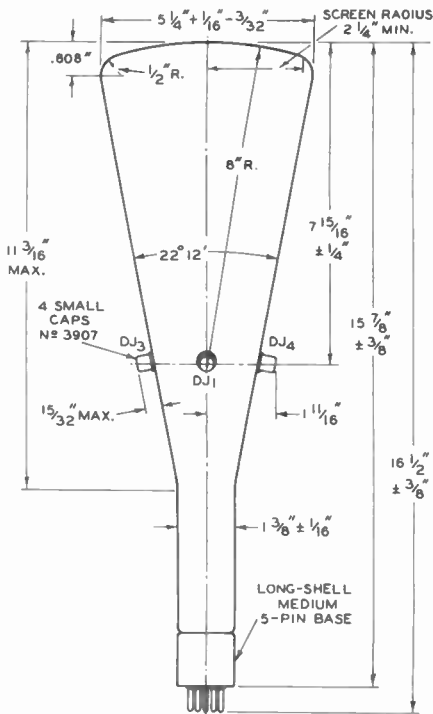
DATA 2

905-A



905-A

HIGH-VACUUM CATHODE-RAY TUBE



92CM-4283R8

BOTTOM VIEW OF TUBE

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



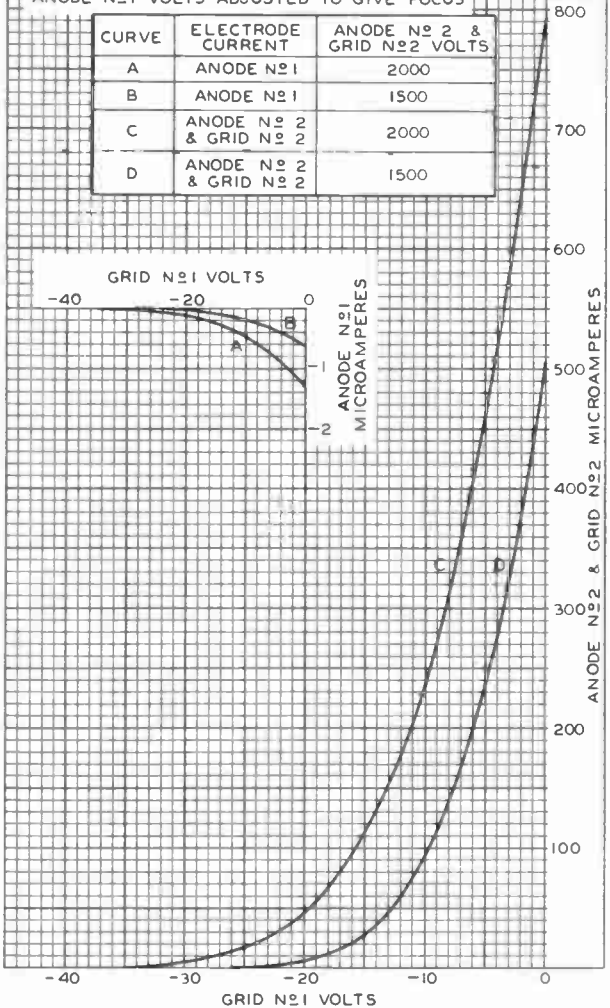
905-A

905-A

AVERAGE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ANODE N^o1 VOLTS ADJUSTED TO GIVE FOCUS

CURVE	ELECTRODE CURRENT	ANODE N ^o 2 & GRID N ^o 2 VOLTS
A	ANODE N ^o 1	2000
B	ANODE N ^o 1	1500
C	ANODE N ^o 2 & GRID N ^o 2	2000
D	ANODE N ^o 2 & GRID N ^o 2	1500



APR. 27, 1945

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY
World Radio History

92CM-5409R4





908-A

908-A

OSCILLOGRAPH TUBE

Supersedes Type 908

General:

Heater, for Unipotential Cathode:

Voltage	2.5 ± 10%	ac or dc volts
Current	2.1	amp.

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to All Other Electrodes	9.0	μf
DJ ₁ to All Other Electrodes	8.5	μf
DJ ₃ to All Other Electrodes	6.5	μf

Phosphor (For Curves, see front of this Section) No.5

Fluorescence Blue
Persistence Very Short

Focusing Method Electrostatic

Deflection Method Electrostatic

Overall Length 11-1/2" ± 3/8"

Greatest Diameter of Bulb 3" ± 1/16"

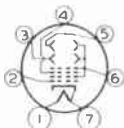
Minimum Useful Screen Diameter 2-3/4"

Mounting Position Any

Base Medium 7-Pin

Basing Designation for BOTTOM VIEW 7CE

- | | |
|---|---|
| Pin 1-Heater | Pin 6-Grid No.2,
Anode No.2,
Deflecting
Electr.DJ ₂ , |
| Pin 2-Grid No.1 | Deflecting
Electr.DJ ₄ |
| Pin 3-Deflecting
Electrode DJ ₃ | Pin 7-Heater,
Cathode |
| Pin 4-Anode No.1 | |
| Pin 5-Deflecting
Electrode DJ ₁ | |



*DJ₁ and DJ₂ are nearer the screen
DJ₃ and DJ₄ are nearer the base*

With DJ₂ positive with respect to DJ₁, the spot is deflected toward pin 1. With DJ₄ positive with respect to DJ₃, the spot is deflected toward pin 6.

The angle between the trace produced by DJ₃ and DJ₄ and its intersection with the plane through the tube axis and pin 6 does not exceed 10°.

The angle between the trace produced by DJ₃ and DJ₄ and the trace produced by DJ₁ and DJ₂ is 90° ± 3°.

Maximum Ratings, Design-Center Values:

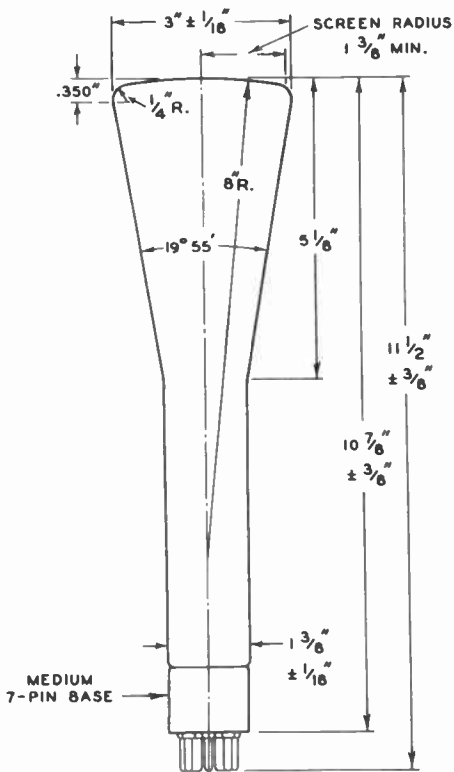
ANODE-No.2 & GRID No.2 VOLTAGE	1500 max.	volts
ANODE-No.1 VOLTAGE	1000 max.	volts
GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:		
Negative Value	125 max.	volts
Positive Value	0 max.	volts
PEAK VOLTAGE BETWEEN ANODE No.2 AND DEFLECTING ELECTRODE DJ ₁ OR DJ ₃	500 max.	volts

908-A



908-A

OSCILLOGRAPH TUBE



92CH-4284R7

\angle OF BULB WILL NOT DEVIATE MORE THAN 2°
 IN ANY DIRECTION FROM PERPENDICULAR
 ERECTED AT CENTER OF BOTTOM OF BASE



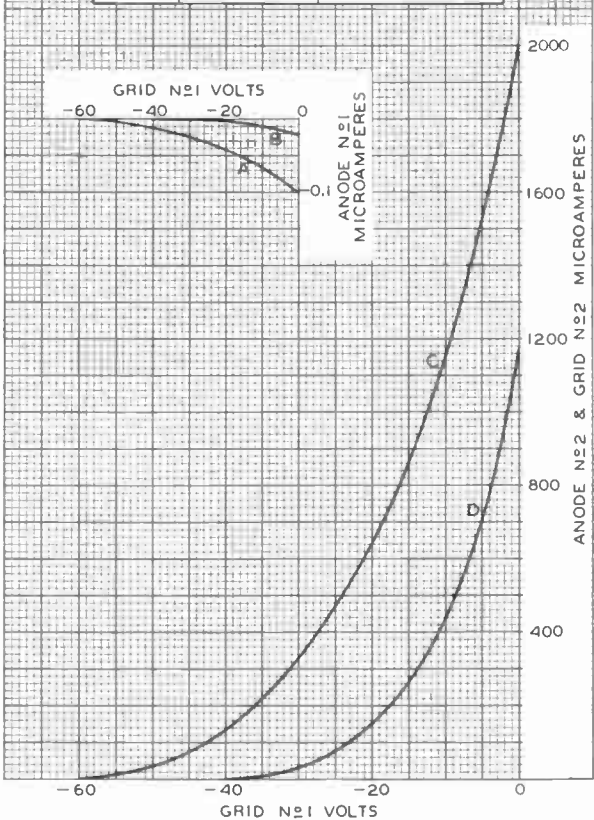
908-A

908-A

AVERAGE CHARACTERISTICS

 $E_f = 6.3$ VOLTSANODE N^o1 VOLTS ADJUSTED TO GIVE FOCUS

CURVE	ELECTRODE CURRENT	ANODE N ^o 2 & GRID N ^o 2 VOLTS
A	ANODE N ^o 1	1500
B	ANODE N ^o 1	1000
C	ANODE N ^o 2 & GRID N ^o 2	1500
D	ANODE N ^o 2 & GRID N ^o 2	1000



APR. 18, 1945

TUBE DIVISION

92CM-5415R5

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History





912

912

HIGH-VACUUM CATHODE-RAY TUBEHIGH-INTENSITY ELECTROSTATIC-DEFLECTION TYPE
WITH 5" MEDIUM-PERSISTENCE SCREEN FOR OSCILLOGRAPHIC USE

Heater	Coated Unipotential Cathode	
Voltage	2.5	a-c or d-c volts
Current	2.1	amp.

Fluorescent Screen:	
Material	Phosphor No.1
Pattern Color	Greenish

Direct Interelectrode Capacitances:	
Grid to all other electrodes	14 max. μf
DJ ₁ to DJ ₂	3 max. μf
DJ ₃ to DJ ₄	1.5 max. μf

Overall Length	16-1/2" \pm 3/8"
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Maximum Diameter	5-1/4" + 1/16" - 3/32"
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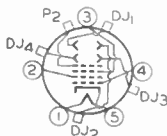
Bulb	J-42
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Caps:	
Anode No.2	Medium Metal
Deflecting Electrodes (Four)	Small Metal

Base	Medium 5-Pin Micanol
------	----------------------

BOTTOM VIEW

Pin 1 - Heater
 Pin 2 - Grid No.2
 Pin 3 - Anode No.1
 Pin 4 - Grid No.1
 Pin 5 - Heater,
 Cathode
 Single Medium Cap
 Anode No.2
 Cap } Deflecting
 Over } Electrode
 Pin 3 } DJ₁



Cap	} Deflecting
Over	
Pins	} Electrode
1 & 5	
Cap	} Deflecting
Over	
Pin 2	} Electrode
Cap	
Over	} Deflecting
Pin 4	
Cap	} Electrode
Over	
Pin 4	} Electrode
Cap	
Over	} Electrode
Pin 4	

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

Maximum Ratings Are Based on a Line-Voltage Design Center of 117 Volts

High-Voltage Electrode (Anode #2) Voltage	15000 max.	volts
Focusing Electrode (Anode #1) Voltage	4500 max.	volts
Accelerating Electrode (Grid #2) Voltage	250 max.	volts
Control Electrode (Grid #1) Voltage	Never positive	
Grid Voltage for Current Cut-off*	-125 approx.	volts
Peak Voltage Between Anode #2 and any deflecting electrode	7000 max.	volts

Typical Operation:

Heater Voltage	2.5	2.5	2.5	volts
Anode #2 Voltage	5000	10000	15000	volts
Anode #1 Voltage	1000	2000	3000	approx. volts
Grid #2 Voltage	250	250	250	volts
Grid #1 Voltage	Adjusted to give suitable luminous spot			

Deflection Sensitivity:

DJ ₁ to DJ ₂	0.083	0.041	0.028	mm/volt d.c.
DJ ₃ to DJ ₄	0.102	0.051	0.034	mm/volt d.c.

* With maximum voltages on Anode #1 and Grid #2.

← Indicates a change.

JUNE 20, 1947

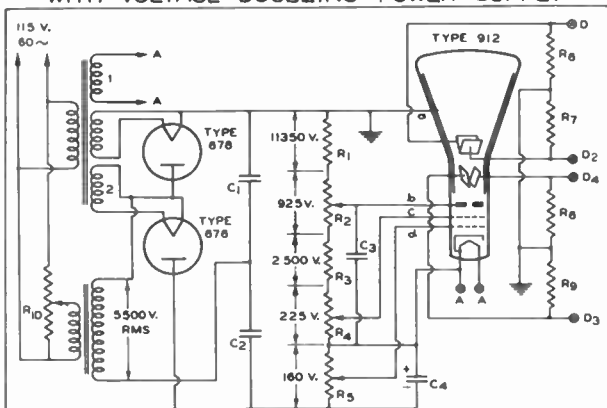
TUBE DEPARTMENT

DATA

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY



TYPICAL OSCILLOGRAPH CIRCUIT USING THE 912 WITH VOLTAGE-DOUBLING POWER SUPPLY



$C_1, C_2 = 0.5 \mu\text{f}, 10000 \text{ v.}$

$C_3 = 1.0 \mu\text{f}, 5000 \text{ v.}$

$C_4 = 18 \mu\text{f}, 200 \text{ v.}$

$R_1 = 2.5 \text{ MEGOHMS}, 75\text{-WATT}$

$R_2 = 0.2 \text{ MEGOHM}, 10\text{-WATT}$

$R_3 = 0.55 \text{ MEGOHM}, 20\text{-WATT}$

$R_4 = 50000 \text{ OHMS}, 2\text{-WATT}$

$R_5 = 35000 \text{ OHMS}, 2\text{-WATT}$

$R_6, R_7, R_8, R_9 = 2 \text{ TO } 5 \text{ MEGOHMS}$

$R_{10} = 100 \text{ OHMS}, 600\text{-WATT}$

a = ANODE N# 2

b = ANODE N# 1

c = GRID N# 2

d = GRID N# 1

NOTE: AS THE TOTAL VOLTAGE ACROSS THE BLEEDER IS REDUCED BY MEANS OF R_{10} , THE ELECTRODE VOLTAGES ARE REDUCED IN CORRECT PROPORTION, EXCEPT FOR GRID NO. 2 VOLTAGE. THIS MAY HAVE TO BE READJUSTED BY THE USE OF DIFFERENT VALUES FOR R_6 AND R_9 , THEIR TOTAL RESISTANCE BEING KEPT THE SAME. CONDENSERS C_1 AND C_3 CAN BE OMITTED IF GRID-VOLTAGE SWITCHING (FOR HIGH-SPEED PHOTOGRAPHY) IS NOT CONTEMPLATED. FILAMENT WINDINGS NOS. 1 AND 2 SHOULD BE INSULATED FOR 20000 VOLTS.

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

92C-4621R1

FLUORESCENT-SCREEN CHARACTERISTICS

CURVES SHOWING THE AVERAGE CHARACTERISTICS, SPECTRAL ENERGY CHARACTERISTIC, AND PERSISTENCE CHARACTERISTIC OF PHOSPHOR No. 1 ARE SHOWN AT THE BEGINNING OF THIS SECTION.

← Indicates a change.

AUG. 15, 1946

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

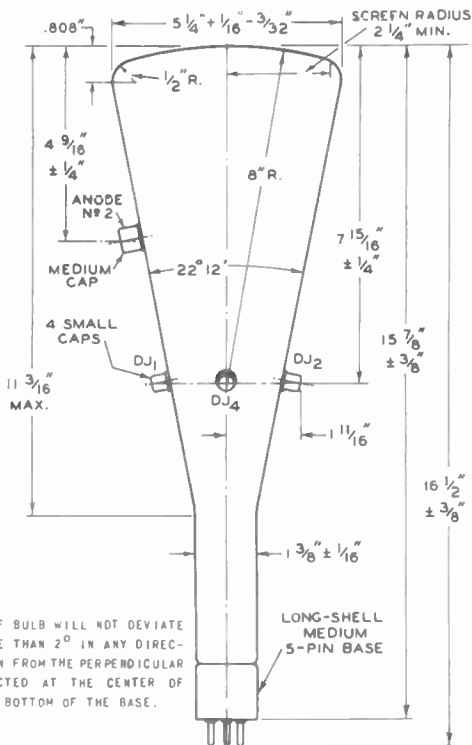
DATA



912

912

HIGH-VACUUM CATHODE-RAY TUBE



92CM-4619R3

BOTTOM VIEW OF TUBE

DJ₁ AND DJ₂ ARE NEARER THE SCREEN; DJ₃ AND DJ₄ ARE NEARER THE BASE. ANGLE BETWEEN DJ₁ - DJ₂ TRACE AND DJ₃ - DJ₄ TRACE IS $90^\circ \pm 6^\circ$.

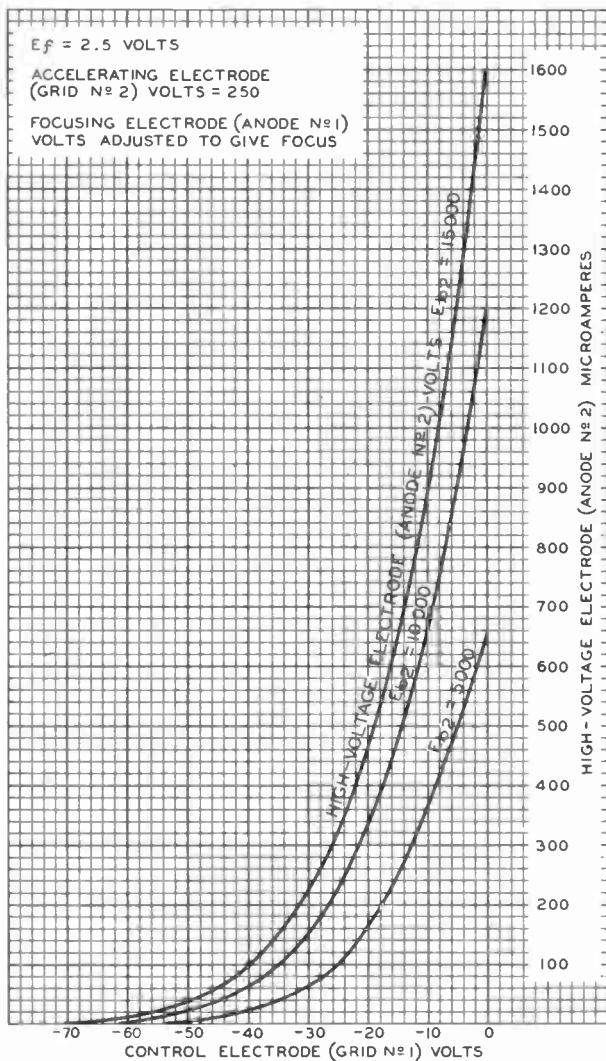
AUG. 15, 1946

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-4619R3



AVERAGE CHARACTERISTICS





HIGH-VACUUM CATHODE-RAY TUBE

Heater	Coated Unipotential Cathode	
Voltage	6.3	a-c or d-c volts
Current	0.6	amp.
Focus		Electrostatic ←
Deflection		Electrostatic ←
Electrodes DJ_1 and DJ_2 (upper):	nearest to screen	
Electrodes DJ_3 and DJ_4 (lower):	nearest to base	
DJ_1 is on the same side of tube as pins No.2 and No.4		
DJ_3 is on the same side of tube as pins No.2 and No.8		
Phosphor		No.1
Fluorescence		Green ←
Persistence		Medium ←
Direct Interelectrode Capacitances:		
Control Electrode (Grid) to All Other Electrodes		8 μf
Deflecting Electrode DJ_1 to Deflecting Electrode DJ_2		2.5 μf
Deflecting Electrode DJ_3 to Deflecting Electrode DJ_4		2.5 μf
Maximum Overall Length		4-3/4" ←
Maximum Diameter		1-5/8" ←
Bulb		Metal Shell, MT-10 ←
Base		Small Wafer Octal 8-Pin ←

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

Maximum Ratings Are Based on a Line-Voltage Design Center of 117 Volts ←

High-Voltage Electrode (Anode No.2) Volt.	500 max.	volts	←
Focusing Electrode (Anode No.1) Volt.	200 max.	volts	←
Control Electrode (Grid) Volt.	Never positive		
Peak Voltage Between Anode No.2 and Any Deflecting Electrode	250 max.	volts	←
Grid Circuit Resistance	1.5 max.	megohms	←
Impedance of Any Deflecting-Electrode Circuit at Heater-Supply Frequency	1.0 max.	megohm	←
Typical Operation:			
Anode No.2 Voltage	250	500	volts
Anode No.1 Voltage \square	50	100 approx.	volts
Grid Voltage \square	Adjusted to give suitable luminous spot		
Deflection Sensitivity:			
Electrodes DJ_1 & DJ_2	0.15	0.07	mm/volt d.c.
Electrodes DJ_3 & DJ_4	0.21	0.10	mm/volt d.c.

NOTE 1: Brilliance and definition decrease with decreasing anode voltages. In general the anode No.2 voltage should not be less than 250 volts. ←

NOTE 2: The d-c potential of each deflecting electrode is maintained essentially equivalent to that of anode No.2 by connecting resistors having values not greater than 10 megohms between each deflecting electrode and anode No.2. This arrangement by suitable choice of resistor values minimizes pattern distortion and pattern drift resulting from unbalanced potentials on the deflecting electrodes. The smaller the resistor values, the less the distortion for a given beam current. ←

\square , \circ : See next page.

← indicates a change.



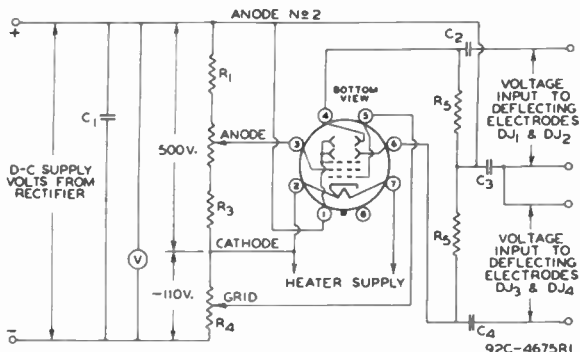
HIGH-VACUUM CATHODE-RAY TUBE

(continued from preceding page)

- Supply should be adjustable to $\pm 30\%$ of the value shown.
 → Approximately 80% of Anode No.1 voltage is required for current cut-off when, in some applications, it is necessary to use the maximum permissible grid-circuit resistance.

Characteristic Curves of phosphor No.1 are shown at the beginning of this section.

TYPICAL OSCILLOGRAPH CIRCUIT



C_1 = FILTER CONDENSER
 C_2, C_3, C_4 = SEE NOTE 3
 $R_1 + R_2 + R_3 + R_4$ = BLEEDER POTENTIOMETER
 R_1 = 0.200 MEGOHM
 R_2 = 0.050 MEGOHM

R_3 = 0.030 MEGOHM
 R_4 = 0.050 MEGOHM
 R_5 = SEE NOTE 2
 AT END OF DATA
 V = VOLTMETER

NOTE 3: When the cathode or the negative end of the cathode-ray high-voltage supply is grounded, blocking capacitors C_2 , C_3 , and C_4 should have a high voltage rating. When anode No.2 is grounded, C_3 may be omitted and C_2 and C_4 may be low-voltage capacitors.

For d-c amplifier service, the deflecting electrodes should be coupled direct to the output of the amplifier by omitting the blocking capacitors. In addition, it will usually be preferably to remove the associated deflecting electrode resistor in order to minimize the loading effect of the resistor on the d-c amplifier. With the resistor removed, it is essential, in order to minimize spot defocusing, that anode No.2 be returned to some point in the d-c amplifier circuit such that the potential difference between anode No.2 and the average voltage across the deflecting electrodes will be as low as possible.

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

← Indicates a change.

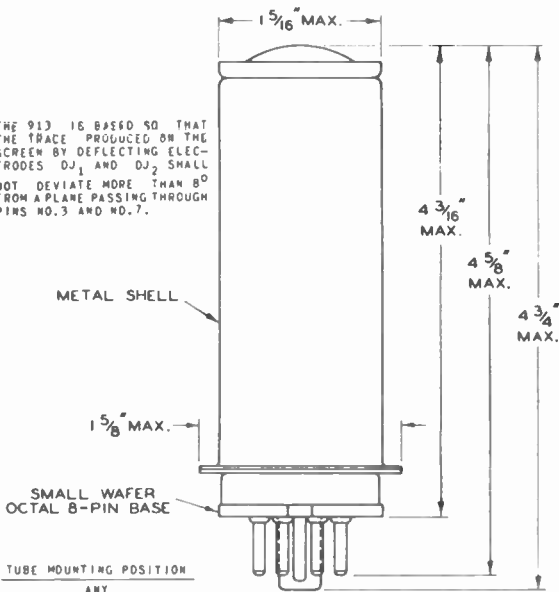


913

913

HIGH-VACUUM CATHODE-RAY TUBE

THE 913 IS BASED SO THAT THE TRACE PRODUCED ON THE SCREEN BY DEFLECTING ELECTRODES DJ_1 AND DJ_2 SHALL NOT DEVIATE MORE THAN 8° FROM A PLANE PASSING THROUGH PINS NO. 3 AND NO. 7.



BOTTOM VIEW OF SOCKET CONNECTIONS

DJ_1 to DJ_4 = Deflecting Electrodes

P_2 = Anode No. 2

P_1 = Anode No. 1

G_1 = Grid No. 2

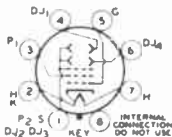
G_2 = Control (Grid No. 1) Electrodes

H = Heater

K = Cathode

S = Shell

NC = No Connection



Jan. 30, 1942

RCA RADIOTRON DIVISION

RCA MANUFACTURING COMPANY INC.

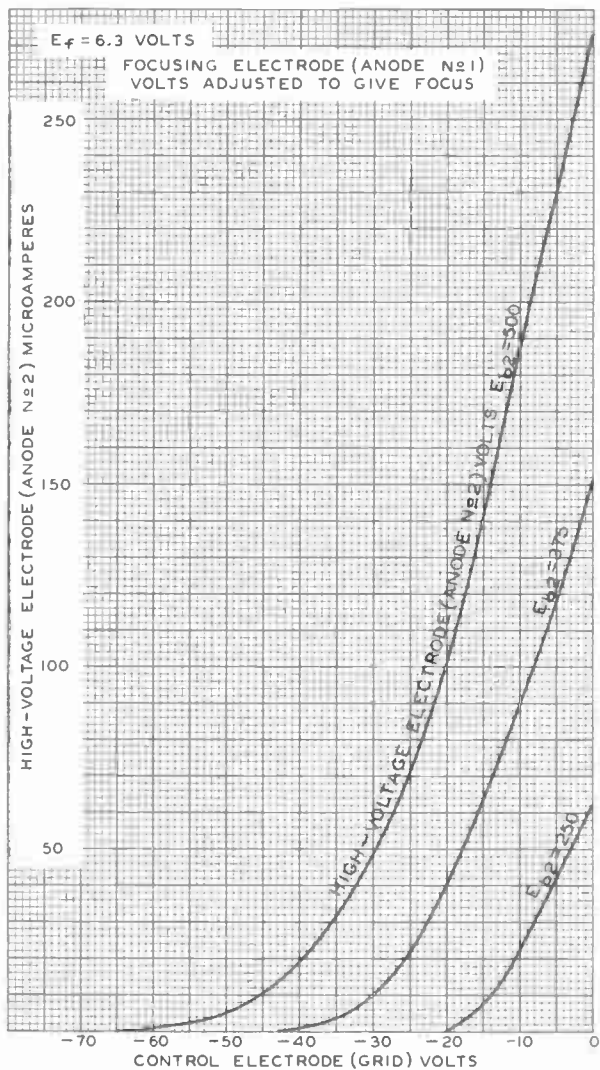
World Radio History

92C-4679R2



913

AVERAGE CHARACTERISTICS





914-A

914-A

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

General:

DATA

Heater, for Unipotential Cathode:

Voltage. 2.5 ac or dc volts
 Current. 2.1 amp

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to All Other Electrodes. . . 10.5 μf
 DJ₁ to DJ₂ 2.0 μf
 DJ₃ to DJ₄ 1.0 μf

Phosphor (For Curves, see front of this Section) No.1

Fluorescence Green

Persistence. Medium

Focusing Method. Electrostatic

Deflection Method. Electrostatic

Overall Length 20-1/16" \pm 3/8"Greatest Diameter of Bulb. 9-1/4" \pm 1/8"

Minimum Useful Screen Diameter 8-1/4"

Mounting Position. Any

Caps:

Anode No.2 Medium

Deflecting Electrodes (Four) Small

Base Long Medium-Shell Small 6-Pin

BOTTOM VIEW

Pin 1 - Heater

Pin 2 - Anode No.1

Pin 3 - Grid No.2

Pin 4 - Grid No.1

Pin 5 - Cathode

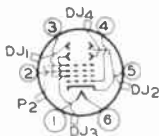
Pin 6 - Heater

Single Medium Cap-

Anode No.2

Cap } { Deflecting

over } { Electrode

Pin 2) { DJ₁

Cap } { Deflecting

over } { Electrode

Pin 5) { DJ₂

Cap } { Deflecting

over } { Electrode

Pins } { DJ₃

1 & 6) { Deflecting

Cap } { Electrode

over } { DJ₄Pins } { DJ₄DJ₁ and DJ₂ are nearer the screenDJ₃ and DJ₄ are nearer the base

With DJ₁ positive with respect to DJ₂ the spot is deflected toward pin 2. With DJ₃ positive with respect to DJ₄, the spot is deflected toward pins 1 and 6.

The angle between the trace produced by DJ₁ and DJ₂ and its intersection with the plane through the tube axis and pin 2 does not exceed 10°.

The angle between the trace produced by DJ₃ and DJ₄ and the trace produced by DJ₁ and DJ₂ is 90° \pm 6°.

Maximum Ratings, Design-Center Values:

ANODE-NO.2 VOLTAGE^o 7000 max. volts

ANODE-NO.1 VOLTAGE. 1900 max. volts

^o The product of anode-No.2 voltage and average anode-No.2 current should never exceed 6 watts.

MAY 1, 1950

TUBE DEPARTMENT

DATA 1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History



OSCILLOGRAPH TUBE

GRID No. 2 VOLTAGE.	300 max.	volts
→ GRID No. 1 VOLTAGE:		
Negative bias value.	125 max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts
PEAK VOLTAGE BETWEEN ANODE No. 2 AND ANY DEFLECTING ELECTRODE	3000 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 anode-No. 2 voltage (E_{b2}) between 1500 and 7000 volts**

Anode-No. 1 Voltage. . .	15% to 26% of E_{b2}	. . . .	volts
Grid-No. 2 Voltage . . .	250	. . . .	volts
Max. Grid-No. 1 Voltage for Visual Cutoff.	30% of E_{b2}	. . . .	volts
Max. Anode-No. 1 Current Range.	-15 to + 10	. . . .	μ amp
Deflection Factors:			
DJ ₁ to DJ ₂	38 to 54	v dc/in./kv of E_{b2}	
DJ ₃ to DJ ₄	30 to 44	v dc/in./kv of E_{b2}	

→ Examples of Use of Design Ranges:

<i>For Anode-No. 2 Volt. of</i>	1500	2500	5000	7000	volts
Anode-No. 1 Voltage. .	225-390	375-650	750-1300	1050-1800	volts
Grid-No. 2 Voltage . .	250	250	250	250	volts
Max. Grid-No. 1 Volt. for Visual Cutoff	-75	-75	-75	-75	volts
Deflection Factors:					
DJ ₁ to DJ ₂	57-81	93-135	190-270	266-378	v dc/in
DJ ₃ to DJ ₄	45-66	75-110	150-220	210-308	v dc/in

Maximum Circuit Values:

Grid-No. 1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting-Electrode Circuit [□]	5 max.	megohms

→ Minimum Circuit Values:

The power supply should be of the limited-energy type with inherent regulation to limit the continuous short-circuit current to 5 milliamperes. If the supply permits the instantaneous short-circuit current to exceed 1 ampere, or is capable of storing more than 250 microcoulombs, the effective resistance in circuit between indicated electrode and the output

* Brilliance and definition decrease with decreasing anode-No. 2 voltage. In general, anode-No. 2 voltage should not be less than 1500 volts.

□ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

→ Indicates a change.



914-A

914-A

OSCILLOGRAPH TUBE

capacitor should be as follows:

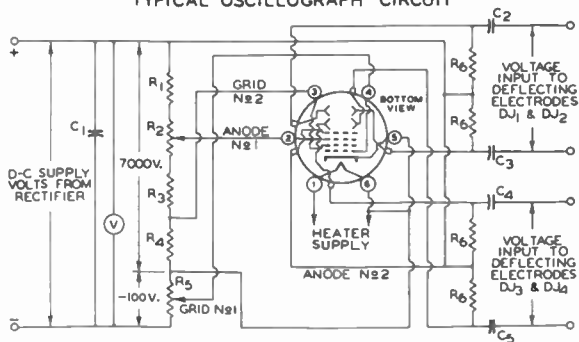
Grid-No.1 - Circuit Resistance	150 min.	ohms
Grid-No.2 - Circuit Resistance	330 min.	ohms
Anode-No.1 - Circuit Resistance	2000 min.	ohms
Anode-No.2 - Circuit Resistance	8200 min.	ohms

The resistors should be capable of withstanding the applied voltages.



OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



92CS-4754R3

C_1 = FILTER CAPACITOR 0.5 to 2.0 μ f

C_2, C_3, C_4, C_5 = SEE NOTE

$R_1 + R_2 + R_3 + R_4 + R_5$ = BLEEDER POTENTIOMETER

R_1 = 2.5 MEGOHMS

R_2 = 0.5 MEGOHM

R_3 = 0.375 MEGOHM

R_4 = 0.125 MEGOHM

R_5 = 0.050 MEGOHM

R_6 = SEE \square ON

V = BACK OF DATA 1

V = VOLTMETER

NOTE: When the cathode or the negative end of the cathode-ray high-voltage supply is grounded, blocking capacitors $C_2, C_3, C_4,$ and C_5 should have a high voltage rating. When anode No. 2 is grounded, $C_2, C_3, C_4,$ and C_5 may be low-voltage capacitors.

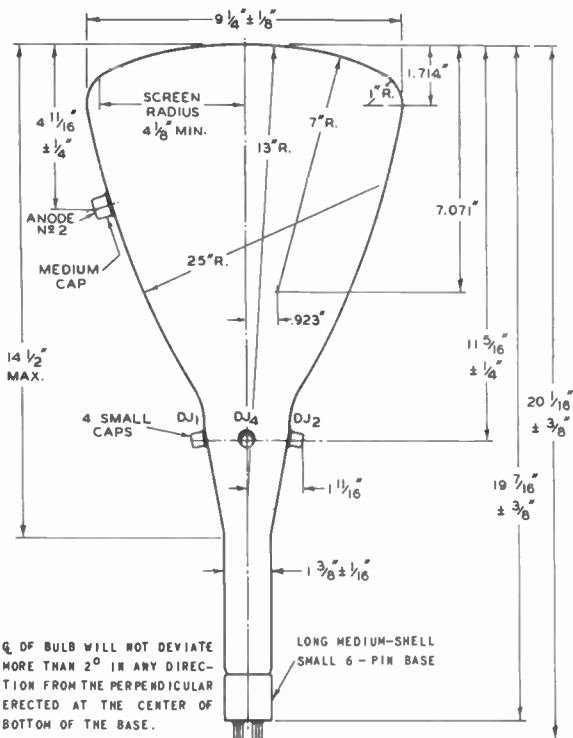
For dc amplifier service, the deflecting electrodes should be coupled direct to the output of the amplifier by omitting the blocking capacitors. In addition, it will usually be preferable to remove the associated deflecting-electrode resistor in order to minimize the loading effect of the resistor on the dc amplifier. With the resistor removed, it is essential, in order to minimize spot defocusing, that anode No. 2 be returned to some point in the dc amplifier circuit such that the potential difference between anode No. 2 and the average voltage across the deflecting electrodes will be as low as possible.

Devices and arrangements shown or described herein may use patents of RCA or others. Information contained herein is furnished without responsibility by RCA for its use and without prejudice to RCA's patent rights.

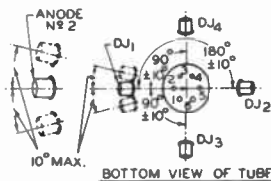


914-A

914-A OSCILLOGRAPH TUBE



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



92CM-4718R3

MAY 1, 1950

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

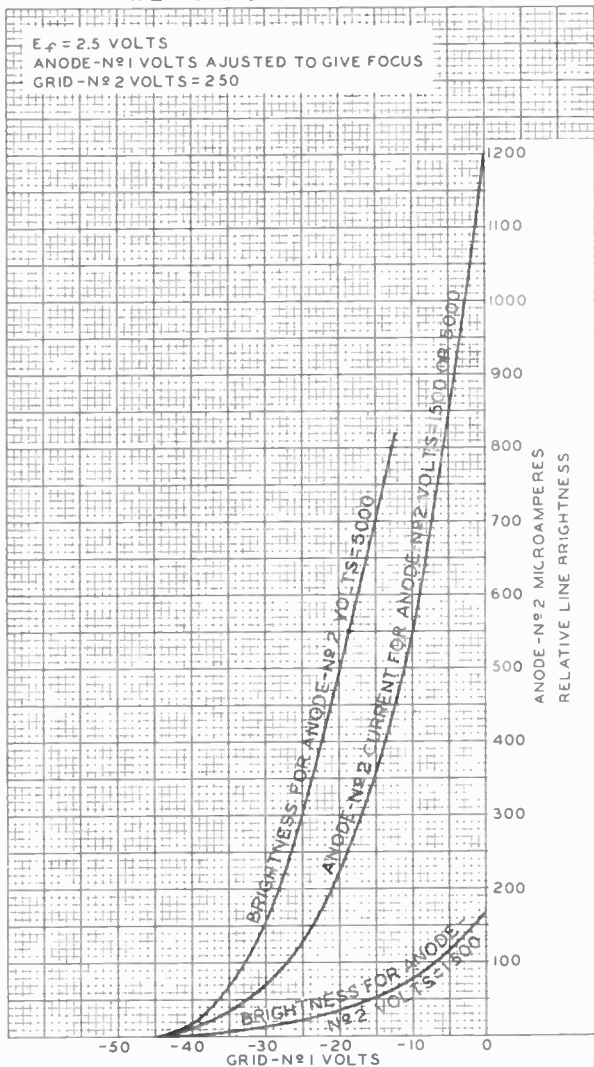
CE-4718R3

914-A



914-A

AVERAGE CHARACTERISTICS



JULY 19, 1946

TUBE DEPARTMENT

92CM-6785RI

RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

World Radio History

Projection Kinescope

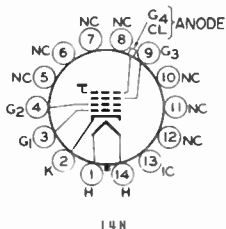
FORCED-AIR COOLED
ELECTROSTATIC FOCUSMAGNETIC DEFLECTION
20 FT. x 15 FT. PROJECTED PICTURES*For Black-and-White Projection Systems in
Theater and Closed-Circuit Television Applications**The 4486 is the same as the 7NP4 except that it is supplied with
a fitted high-voltage anode cable. (See Accompanying
Dimension Outline).*

MECHANICAL

See drawing for type 7NP4 dimensions and details for mechanical.

TERMINAL DIAGRAM (Bottom View)

- Pin 1 - Heater
- Pin 2 - Cathode
- Pin 3 - Grid No. 1
- Pin 4 - Grid No. 2
- Pin 5 - No Connection
- Pin 6 - No Connection
- Pin 7 - No Connection
- Pin 8 - No Connection
- Pin 9 - Grid No. 3
- Pin 10 - No Connection
- Pin 11 - No Connection
- Pin 12 - No Connection
- Pin 13 - Internal connection—
Do Not Use
- Pin 14 - Heater
(Cable - Probe - Grid No. 1,
Collector)

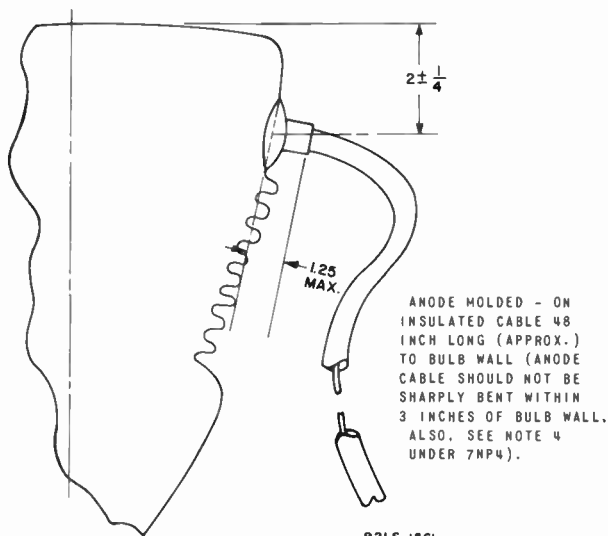


Note: Socket contacts for Pins No. 5, 6, 7, 8, 10, 11, 12, and 13 should be removed so that maximum insulation is provided for Pin No. 9.



DIMENSIONAL OUTLINE

(Other dimensions are the same as those shown for Type 7NP4)



92LS-1561

DIMENSIONS IN INCHES

Oscillograph-Type Cathode-Ray Tubes

Post-deflection Accelerator

Electrostatic Deflection

Electrostatic Focus

For General Oscillographic Applications in which Low-Speed or Medium-Speed Recurrent-Wave Phenomena are to be Observed

ELECTRICAL

Heater Current at 6.3 V	0.6	A
Direct Interelectrode Capacitances (Approx.)		
Grid-No.1 to all other electrodes	6	pF
Cathode to all other electrodes	7.5	pF
DJ1 to DJ2	3	pF
DJ3 to DJ4	2	pF
DJ1 to all other electrodes	9	pF
DJ2 to all other electrodes	9	pF
DJ3 to all other electrodes	7	pF
DJ4 to all other electrodes	7	pF
Focusing Method	Electrostatic	
Deflection Method	Electrostatic	

OPTICAL

Phosphor	P31
Fluorescence and phosphorescence	Green
Persistence	Medium-Short
Faceplate	Clear Glass
Shape	Curved, Circular
Minimum Useful Screen Diameter	
4490	6 in
4491	7 in

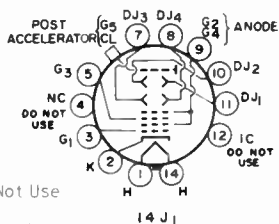
MECHANICAL

Operating Position	Any
Weight (Approx.)	3 lb
Base	Medium-Shell Diheptal 12-Pin (JEDEC No. B12-37)
	4490 4491
Overall Length	14.62 + 0.25-0.50 16.50 + 0.38 in
Greatest Diameter	7.12 8.50 in
Bulb	J56H1A J67A1A

TERMINAL DIAGRAM (Bottom View)

- Pin 1 - Heater
- Pin 2 - Cathode
- Pin 3 - Grid No. 1
- Pin 4 - No Connection - Do Not Use
- Pin 5 - Grid No. 3
- Pin 7 - Deflecting Electrode DJ3
- Pin 8 - Deflecting Electrode DJ4
- Pin 9 - Anode (Grids No. 2 & No. 4)
- Pin 10 - Deflecting Electrode DJ2
- Pin 11 - Deflecting Electrode DJ1
- Pin 12 - Internal Connection - Do Not Use
- Pin 14 - Heater

Cap - Post-Accelerator (Grid No. 5 & Collector)



4490, 4491

ABSOLUTE-MAXIMUM AND MINIMUM RATINGS

Post-Deflection Accelerator Voltage.	8000 max	V
Anode Voltage.	4000 max	V
Grid-No.3 (Focusing-Electrode) Voltage	2000 max	V
Grid-No.1 Voltage		
Negative bias value.	200 max	V
Positive bias value.	0 max	V
Positive peak value.	2 max	V
Heater Voltage	{ 6.9 max	V
	{ 5.7 min	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode.	125 max	V
Heater positive with respect to cathode.	125 max	V

TYPICAL OPERATING VALUES

Unless otherwise specified all values are positive with respect to cathode

Post-Deflection Accelerator Voltage.	6000	V
Anode Voltage.	3000	V
Grid-No.3 (Focusing-Electrode) Voltage	750 to 1200	V
Grid-No.1 Voltage.	-58 to -93	V

For visual cutoff of focused spot

Deflection Factors

	4490	4491	
DJ1 and DJ2.	133 to 153	107 to 129	V (dc)/in
DJ3 and DJ4.	99 to 115	85 to 101	V (dc)/in

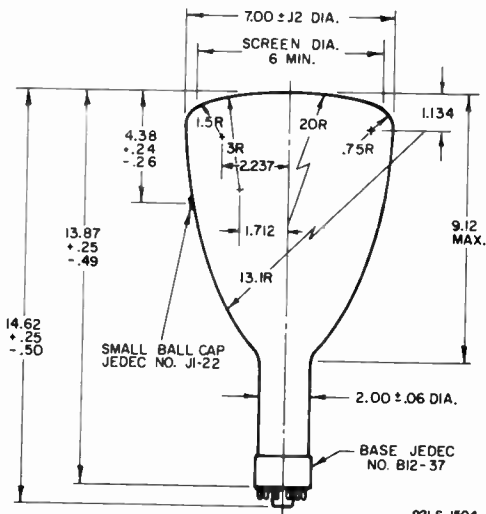
MAXIMUM CIRCUIT VALUES

Grid-No.1-Circuit Resistance	1.5 max	MΩ
Resistance in any Deflection Electrode Circuit ^a	5 max	MΩ

^a It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

X-RADIATION WARNING: Shielding of these cathode-ray tubes for x-radiation may be needed to protect against possible danger of personal injury from prolonged exposure at close range.

DIMENSIONAL OUTLINE (4490)



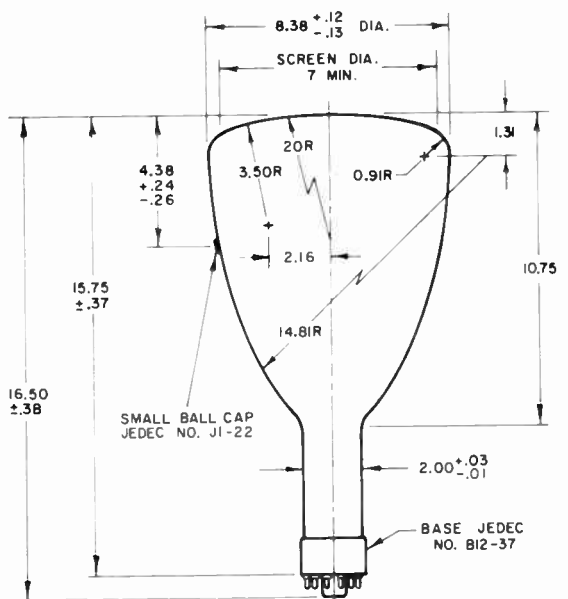
DIMENSIONS IN INCHES

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

The plane through the tube axis and pin 5 may vary from the trace produced by DJ1 and DJ2 by an angular tolerance (measured about the tube axis) of $\pm 10^{\circ}$. Angle between DJ1 - DJ2 trace and DJ3 - DJ4 trace is $90^{\circ} \pm 3^{\circ}$.

DJ1 and DJ2 are nearer the screen; DJ3 and DJ4 are nearer the base. With DJ1 positive with respect to DJ2, the spot will be deflected toward pin 5; likewise, with DJ3 positive with respect to DJ4, the spot will be deflected toward pin 2.

DIMENSIONAL OUTLINE (4491)



92LS-1505

DIMENSIONS IN INCHES

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

The plane through the tube axis and pin 5 may vary from the trace produced by DJ1 and DJ2 by an angular tolerance (measured about the tube axis) of $\pm 10^{\circ}$. Angle between DJ1 - DJ2 trace and DJ3 - DJ4 trace is $90^{\circ} \pm 3^{\circ}$.

DJ1 and DJ2 are nearer the screen; DJ3 and DJ4 are nearer the base. With DJ1 positive with respect to DJ2, the spot will be deflected toward pin 5; likewise, with DJ3 positive with respect to DJ4, the spot will be deflected toward pin 2.

Oscillograph-Type Cathode-Ray Tube

ELECTROSTATIC DEFLECTION 5-in DIAMETER ELECTROSTATIC FOCUS

*For General Oscillographic Applications in which
Recurrent-Wave Phenomena are to be Observed*

ELECTRICAL

Heater Current at 6.3 V	0.6	A
Direct Interelectrode Capacitances (Approx.)		
Grid-No.1 to all other electrodes	10	pF
Cathode to all other electrodes	5.5	pF
DJ1 to DJ2	2.5	pF
DJ1 to DJ4	3.0	pF
DJ1 to all other electrodes	10.5	pF
DJ2 to all other electrodes	8.5	pF
DJ3 to all other electrodes	8.5	pF
DJ4 to all other electrodes	9.5	pF
Focusing Method	Electrostatic	
Deflection Method	Electrostatic	

OPTICAL

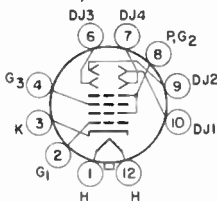
Phosphor	P1
Fluorescence and phosphorescence	Yellowish-Green
Persistence	Medium
Faceplate	Clear Glass
.	Flat, Circular
Minimum Useful Screen Diameter	4.56 in

MECHANICAL

Operating Position	Any
Weight	2 lb
Overall Length	12.000 ± 0.125 in
Greatest Diameter	5.25 ± 0.06 in
Bulb	J42 Dev.66
Base	Special, Small-Shell Duodecal, 10-pin

TERMINAL DIAGRAM (Bottom View)

Pin 1—Heater
Pin 2—Grid-No.1
Pin 3—Cathode
Pin 4—Grid-No.3
Pin 5—Deflecting Electrode-DJ3
Pin 6—Deflecting Electrode-DJ4
Pin 7—Grid-No.2
Pin 8—Deflecting Electrode-DJ2
Pin 9—Deflecting Electrode-DJ1
Pin 10—Heater



ABSOLUTE-MAXIMUM AND MINIMUM RATINGS

Anode Voltage	2800 max	V
Grid-No.3 (Focusing-Electrode) Voltage	1100 max	V
Grid-No.1 Voltage		
Negative bias value	200 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V



Heater Voltage.	{ 6.9 max	V
	{ 5.7 min	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	125 max	V
Heater positive with respect to cathode	125 max	V

TYPICAL OPERATING VALUES

Unless otherwise specified all values are positive with respect to cathode

Anode Voltage	2200	V
Grid-No.3 (Focusing-Electrode) Voltage.	750 to 1000	V
Grid-No.1 Voltage	-60 to -140	V

For visual cutoff or focusing spot

Deflection Factors

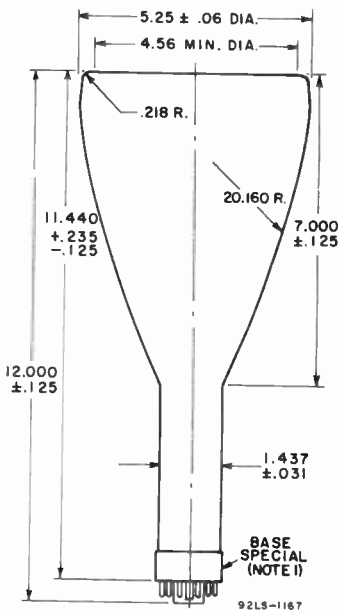
DJ1 and DJ2	84 to 106	V (dc)/in
DJ3 and DJ4	67 to 83	V (dc)/in

MAXIMUM CIRCUIT VALUES

Grid-No.1-Circuit Resistance.	1.5 max	MΩ
Resistance in any Deflection Electrode Circuit ^a	5 max	MΩ

^a It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

DIMENSIONAL OUTLINE



The plane through the tube axis and pin 4 may vary from the trace produced by DJ1 and DJ2 by an angular tolerance (measured about the tube axis) of 10°. Angle between DJ1 - DJ2 trace and DJ3 - DJ4 trace is 90° ± 3°.

DJ1 and DJ2 are nearer the screen; DJ3 and DJ4 are nearer the base. With DJ1 positive with respect to DJ2, the spot will be deflected toward pin 4; likewise, with DJ3 positive with respect to DJ4, the spot will be deflected toward Pin 1.

Note 1: Base is identical to short small-shell duodecal JEDEC No. B12-207 except pin No. 5 and pin No. 11 are omitted.

DIMENSIONS IN INCHES

Cathode-Ray Tube

7"-DIAMETER CRT WITH MAGNETIC
FOCUSING AND DEFLECTION

- Ground Optically-Flat Faceplate
- Ultra-High Resolution
- Extra-Fine Grain Phosphor
- For Photographic Reproduction
- Useful Screen Diameter – 6–1/4"

General Data

Electrical:

Heater Voltage, DC	6.3 V
Heater Current at 6.3 V	0.6 A
Focusing Method	Magnetic
Deflection Method	Magnetic
Deflection Angle (approx.)	42°
Direct Interelectrode Capacitances (approx.):	
Cathode to all other electrodes	10.0 pF
Grid No.1 to all other electrodes	10.0 pF

Optical:

Faceplate, flat	Clear, Browning-Resistant Glass
Transmission Factor	90%
Reflection Factor ^a	<0.5%
Index of Refraction	1.52
Minimum Useful Screen Diameter	6.25 in
Phosphor, Aluminized	Sulfide Type
Luminescence	Purplish Blue
C.I.E. coordinates (x,y)	0.150, 0.059
Persistence	Short

Mechanical:

Tube Dimensions:

Maximum Overall Length	22–1/8 in
Maximum Bulb Diameter	7–1/16 in
Neck Diameter	1–7/16 in

4506

Base	Small-Shell, Duodecal, 7-Pin
Anode Lead (flying) ^b	24 in
Operating Attitude	Any
Weight (approx.)	4.8 lb

Ratings, Absolute-Maximum Values:

Anode Voltage, DC	25,000	V
Grid-No.2 Voltage, DC	1,500	V
Grid-No.1 Voltage:		
Negative bias DC	200	V
Positive bias DC	0	V
Heater-to-Cathode Voltage:		
Cathode positive	60	V
Cathode negative	180	V

Typical Operation:

Anode Voltage, DC	20,000	V
Grid-No.2 Voltage, DC	1,000	V
Grid-No.1 Cut-Off Voltage, DC	-55 to -95	V

Performance Data:

Maximum Line Width ^d	0.0009	in
Maximum Persistence ^e	5.0	μ sec

Circuit Requirements

Maximum Grid-No.1 Circuit Resistance	1.0 M Ω
Heater Voltage Regulation	See Note f

- a The external surface of the faceplate is treated with a multiple-layer, optical coating to suppress reflections of light in the 400 to 800 nm range.
- b The anode is terminated with the assembly, AMP B37740 which mates with the AMP Connector 830050-1 or equivalent.
- d Line width is defined as the width at the half-amplitude point of the light energy distribution of the line. The line width is measured with a slit analyzer at a cathode current of 1.0 μ A.
- e Persistence is defined as the time following cessation of excitation for the light output to decay to 10% of the value observed during excitation. The persistence is measured using a stationary, focused spot. Cathode current during excitation is 1.0 μ A.
- f Heater voltage must be regulated to within 1.0% to assure optimum tube performance.

SAFETY PRECAUTIONS

X-Radiation Warning

Although X-radiation is generated primarily at the face of the tube when it is operated, the X-rays are emitted in all directions.

These rays can constitute a health hazard unless the tube is adequately shielded. Make sure that the shielding provides the required protection against personal injury.

On the neck of the tube itself the following warning appears and should be strictly adhered to:

X-RAY WARNING

This tube in operation produces X-Rays which can constitute a health hazard unless the tube is adequately shielded for radiation.

High Voltage

The high voltages at which tube type is operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Precautions include the enclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is required.

In the use of the tube it should always be remembered that high voltages may appear at normally low-potential points in the circuit because of capacitor breakdown or incorrect circuit connections, and that the tube surface maintains a static charge for some time after the power has been turned off. Therefore, before any part of the circuit or the tube is touched, the power-supply switch should be

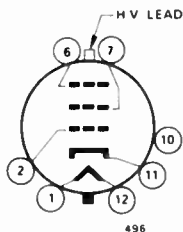
turned off, both terminals of high-voltage capacitors should be grounded, and the terminals of the high-voltage power supply should be grounded.

After these steps have been taken and before touching the tube, discharge the anode terminals, the surface of the faceplate, and the coated surface of the cone by use of a suitable wand which is connected to ground. It is to be noted that the entire surface of the cone and of the faceplate will not be discharged by touching the wand to a single point on either surface, because the surfaces have high resistance. Therefore, to discharge each surface, it will be necessary to sweep over the entire surface with the wand.

Tube Handling

Wear "Safety" Goggles with side shields, when handling tube, to prevent possible injury from flying glass in case of tube breakage. Do not strike or scratch tube. Never subject it to more than moderate pressure when installing in or removing from equipment. Always Handle Tube with Extreme Care. Ground anode contact before touching after power is off.

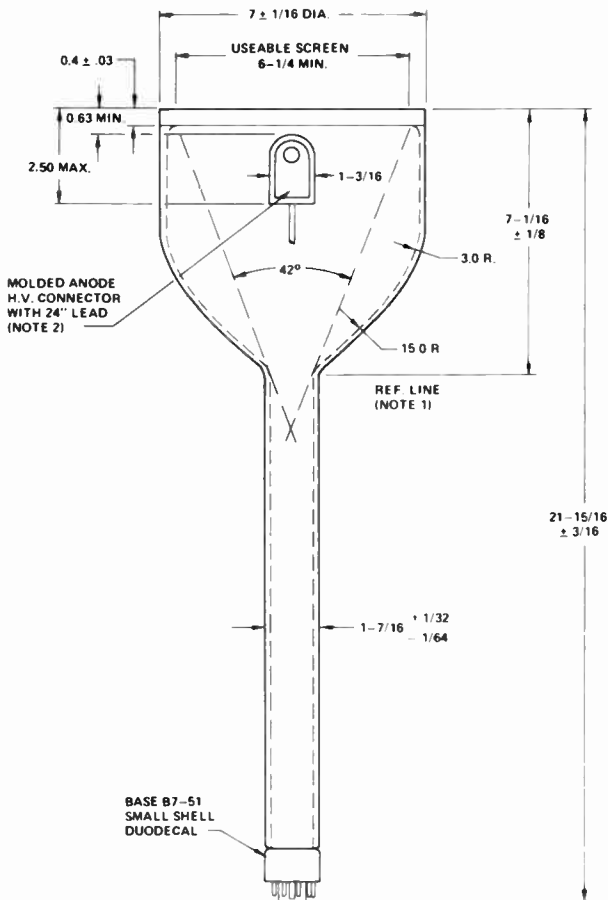
TERMINAL DIAGRAM



- Pin 1— Heater
- Pin 2— Grid No.1
- Pin 7— Grid No.2
- Pin 11— Cathode
- Pin 12— Heater
- H.V. Lead — Accelerator

4506

DIMENSIONAL OUTLINE



92LM 3800

Note 1— Ref. line determined by position of 1.5 inch dia. ring at rest.

Note 2— The anode is terminated with the assembly AMP B37740 which mates with the AMP Connector 830050-1 or equiv.



Oscillograph-Type Cathode-Ray Tube

**5-Inch Diameter
Electrostatic Deflection**

**Post-Deflection Accelerator
Electrostatic Focus**

For General Oscillographic Applications in which Extremely Low-Speed or Medium-Speed Recurrent- or Non-Recurrent-Wave Phenomena are to be Observed

ELECTRICAL

Heater Current at 6.3 V	0.6	A
Direct Interelectrode Capacitances (Approx.)		
Grid No.1 to all other electrodes	10	pF
Cathode to all other electrodes	5.5	pF
DJ1 to DJ2.	2.5	pF
DJ3 to DJ4.	3.0	pF
DJ1 to all other electrodes	10.5	pF
DJ2 to all other electrodes	8.5	pF
DJ3 to all other electrodes	8.5	pF
DJ4 to all other electrodes	9.0	pF
Focusing Method		Electrostatic
Deflection Method		Electrostatic

OPTICAL

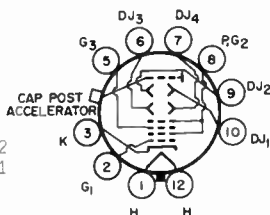
Phosphor. . . . .	.P7
Fluorescence.	Purplish-Blue
Phosphorescence	Yellowish-Green
Persistence	Long
Faceplate	Clear Glass
Shape	Flat, Circular
Minimum Useful Screen Diameter.	4.56 in

MECHANICAL

Operating Position.	Any
Weight (Approx.).	2 lb
Overall Length.	12.00 ± 0.13 in
Greatest Diameter	5.31 in
Bulb.	J42 Dev.67
Base.	Special, Small-Shell Duodecal, 10-Pin

TERMINAL DIAGRAM (Bottom View)

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 3 - Cathode
- Pin 5 - Grid No.3
- Pin 6 - Deflecting Electrode DJ3
- Pin 7 - Deflecting Electrode DJ4
- Pin 8 - Anode, Grid No.2
- Pin 9 - Deflecting Electrode DJ2
- Pin 10 - Deflecting Electrode DJ1
- Pin 12 - Heater
- Cap - Post-Accelerator
(Grid No.5 & collector)



ABSOLUTE-MAXIMUM AND MINIMUM RATINGS

Post-Deflection Accelerator Voltage	6000 max	V
Anode Voltage	3000 max	V
Grid-No.3 (Focusing-Electrode) Voltage.	1200 max	V
Grid-No.1 Voltage		
Negative bias value	200 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V
Heater Voltage.	{ 6.9 max 5.7 min	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode . . .	125 max	V
Heater positive with respect to cathode . . .	125 max	V

TYPICAL OPERATING VALUES

Unless otherwise specified all values are positive with respect to cathode

Post-Deflection Accelerator Voltage	3000	V
Anode Voltage	1500	V
Grid-No.3 (Focusing-Electrode) Voltage.	475 to 725	V
Grid-No.1 Voltage	-40 to -94	V

For visual cutoff of focused spot

Deflection Factors

DJ1 and DJ2	69 to 91	V (dc)/in
DJ3 and DJ4	57 to 73	V (dc)/in

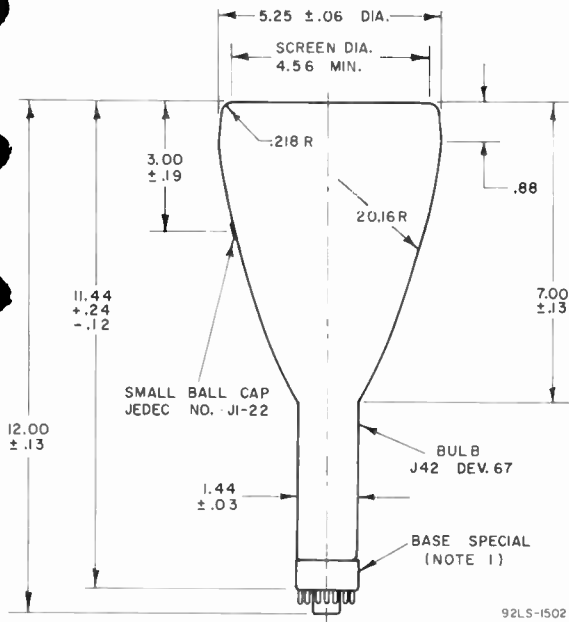
MAXIMUM CIRCUIT VALUES

Grid-No.1-Circuit Resistance.	1.5 max	MΩ
Resistance in any Deflection Electrode Circuit ^a	5 max	MΩ

^a It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

X-RADIATION WARNING: Shielding of these cathode-ray tubes for x-radiation may be needed to protect against possible danger of personal injury from prolonged exposure at close range.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

The plane through the tube axis and pin 1 may vary from the trace produced by DJ3 and DJ4 by an angular tolerance (measured about the tube axis) of 10° . Angle between DJ1 - DJ2 trace and DJ3 - DJ4 trace is $90^{\circ} \pm 3^{\circ}$.

DJ1 and DJ2 are nearer the screen; DJ3 and DJ4 are nearer the base. With DJ1 positive with respect to DJ2, the spot will be deflected toward pin 5; likewise, with DJ3 positive with respect to DJ4, the spot will be deflected toward pin 1.

Note 1: Base is identical to short small-shell duodecal JEDEC No. B12-207 except pin No. 4 and pin No. 11 are omitted.



5" Radar Display CRT

- Electrostatic focus
- Magnetic deflection
- Less than ten inches overall length
- Offset neck facilitates positioning of display origin at screen edge
- For display of airborne weather radar data in airplane cockpits

Data

Electrical:

Heater for Unipotential Cathode:

Voltage ^a (AC or DC)	6.3	V
Current at 6.3 V	0.3	A

Focusing Method	Electrostatic
Deflection Method	Magnetic

Direct Interelectrode Capacitances:

Grid No.1 to all other electrodes	10	max.	pF
Cathode to all other electrodes	6	max.	pF

Optical:

Faceplate:

Material	Clear Glass
Shape	Spherical
Minimum useful diameter	4.5 in

Phosphor:

Type	Aluminized, P7
Fluorescence	White
Phosphorescence	Yellowish Green
Persistence	Long (100 ms to 1 sec.)

Mechanical:

Tube Dimensions:

Maximum overall length	9-13/16	in
Maximum bulb diameter	5	in
Neck diameter	7/8	in

Base (9 Pin) JEDEC No.E9-37

Anode Connector Button J1-22

Operating Attitude Any

Weight 2 lb

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Maximum Ratings, Absolute Maximum Values^b

Anode Voltage	12000	max.	V
Grid No.4 Voltage	450	max.	V
Grid No.2 Voltage	450	max.	V
Grid No 1 Voltage:			
Negative bias value	100	max.	V
Positive bias value	0	max.	V
Positive peak value	2	max.	V
Peak Heater Cathode Voltage	125	max.	V

Typical Operating Values

All values are specified with respect to cathode.

Anode Voltage	8500	V
Grid No.4 Voltage ^c	40 to 250	V
Grid No.2 Voltage	250	V
Grid No.1 Voltage ^d	-25 to -50	V
Anode Current	100	μ A
Grid No.3 Current	10	μ A
Grid No.2 Current	1.0	μ A
Grid No.1 Drive Voltage	25	V
Resolution ^e	0.014	in

^a For optimum life the heater voltage should be regulated at 6.3 volts.

^b A description of the Absolute-Maximum Rating is given in the General Section, titled Rating Systems for Electron Tubes.

^c Adjust for best focus

^d Adjust for visual cutoff of undeflected spot.

^e At center of tube face. Shrinking raster measurement.

X-Ray Warning

Shielding of this cathode-ray tube for X-ray radiation may be needed to protect against possible danger of personal injury from prolonged exposure at close range.

High Voltage

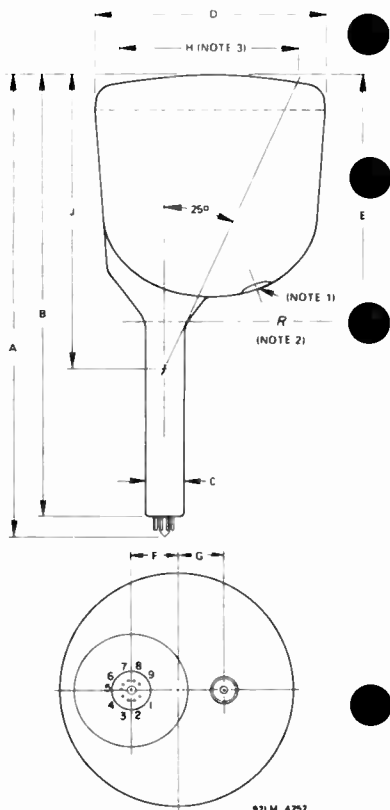
The high voltages at which tube type is operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Precautions include the enclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is required.

In the use of the - tube it should always be remembered that high voltages may appear at normally low-potential points in the circuit because of capacitor breakdown or incorrect circuit connections, and that the tube surface maintains a static charge for some time after the power has been turned off. Therefore, before any part of the circuit or the tube is touched, the power-supply switch should be turned off, both terminals of high-voltage capacitors should be grounded, and the terminals of the high-voltage power supply should be grounded.

After these steps have been taken and before touching the tube, discharge the anode terminals, the surface of the faceplate, and the coated surface of the cone by use of a suitable wand which is connected to ground. It is to be noted that the entire surface of the cone and of the faceplate will not be discharged by touching the wand to a single point on either surface, because the surfaces have high resistance. Therefore, to discharge each surface, it will be necessary to sweep over the entire surface with the wand.

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Dimensional Outline



- Note 1: Anode button J1-22.
 Note 2: Reference line; ring gauge (1.000" \pm .003" .000" diameter x 1.500" long) will stop at this reference line.
 Note 3: Quality circle.

- Pin No.1 - G1
 Pin No.2 - H
 Pin No.3 - H
 Pin No.4 - G1
 Pin No.5 - NC
 Pin No.6 - G4
 Pin No.7 - G2
 Pin No.8 - G1
 Pin No.9 - K
 Button - Anode, G3

Tabulated Dimensions

A	9.812 Max.
B	9.060 \pm .060
C	0.870 \pm .030
D	4.950 \pm .062
E	5.218 \pm .125
F	1.000 Ref.
G	1.000 Ref.
H	4.500 Min.
J	6.250 Ref.

Display-Storage Tube

Single Writing Gun High Luminance
 Single Viewing Gun High Resolution
 High Display Uniformity TV Capability

ELECTRICAL

	Writing Section	Viewing Section	Units
Heater: For Unipotential Cathode			
Voltage (AC or DC)	6.3 ± 10%	6.3 ± 10%	V
Current at 6.3 V	0.6	0.6	A
Warmup Time ^a		60	s
Direct Interelectrode Capacitances:			
Grid No.1 to all other electrodes	7.0		pF
Cathode to all other electrodes	5.0		pF
Backplate to all other electrodes		150	pF
Focusing Method	Electrostatic		
Deflection Method	Magnetic		
Phosphor	P20 (Aluminized)		

MECHANICAL

Minimum Useful Viewing Diameter	4.0	in
Maximum Overall Length (Excluding Ring) ^b	11.59	in
Maximum Seated Length (Excluding Ring) ^b	11.25	in
Maximum Diameter (Silastic Padding Ring) ^b	5.396 ± 0.015	in
Bases:		
Writing gun	JEDEC No.E8-49	
Viewing gun	JEDEC No.E7-1	
Bulb terminals (two)	JEDEC No.J1-21	
Screen connector	AMP Type LGH ^c No.832692 or equiv.	
Operating Position		Any
Weight (Approx.)	20	lb

MAXIMUM RATINGS

Absolute-Maximum Ratings — All voltages are shown with respect to the cathode of the viewing gun unless otherwise specified.

	Min.	Max.	Units
Screen Voltage			
Peak	0	10,000	V
DC	0	9,000	V
Backplate Voltage			
Peak	0	15	V
DC	-30	10	V
Viewing Section Voltages			
Collector (Grid No.5)	180	300	V
Collimator (Grid No.4)	40	150	V
Grid No.3 ^e	10	150	V
Grid No.2		150	V
Grid No.1	-100	0	V
Heater	-125	125	V
Writing Section			
Grid No.4 ^e	10	150	V
Grid No.3 ^f	0	1200	V
Grid No.2 ^e	10	150	V
Grid No.1 ^f	-200	Note g	V
Cathode	-2750	145	V
Heater ^f	-125	125	V
Screen Resistor ^h	1.0		MΩ
Collector Resistor ^h	5,000		Ω

RECOMMENDED OPERATING VALUES

All voltages are shown with respect to the cathode of the viewing gun.

Screen Voltage	8500	V
Backplate Voltage	0	V
Viewing Section Voltages		
Collector (Grid No.5)	200	V
Collimator ^j (Grid No.4)	60 to 110	V
Grid No.3 ^j	10 to 60	V
Grid No.2 ^j	110	V
Grid No.1 ^j	-40 to 0	V

RECOMMENDED OPERATING VALUES (Cont'd)

Writing Section Voltages

Grid No.3 ^k	-2075 to 1575	V
Grid No.1		Notes g,m
Cathode	-2500	V
Screen Resistor	1.0	M Ω
Collector Resistor	10,000	Ω

PERFORMANCE DATA AND CHARACTERISTICS

	Min.	Typical	Max.	Units
Useful Viewing Diameter	4.0			in
Luminance (Brightness) ^p	700	1300		fL
Viewing Duration ^f	10			s
Undelected Spot Position			Note s	
Screen Current ^p		300	750	μ A
Viewing Gun Collector Current ^t ..		1.0	2.4	mA
Viewing Gun Cathode Current ^u ..		2.5	4.0	mA
Writing Gun Cathode Current ^v ..		2.5	5.0	mA
Resolution ^w	400			lines
Erase Time ^x	1.5	2.5	3.5	ms

- a Viewing-gun Heater Warm-up Time must be completed before any other voltages are applied.
- b The silastic-padding ring is permanently attached to the bulb and is used to facilitate shock mounting.
- c Mates with AMP No.833589 or equiv. from AMP Inc., 155 Park Street, Elizabethtown, PA 17022.
- e Grids No.4 and No.2 of Writing Gun and grid No.3 of Viewing Gun are connected within the tube.
- f Voltages are shown with respect to cathode of Writing Gun.
- g The writing-gun grid No.1 should never be more positive than necessary to write the display to saturated brightness for a given scanning and drive condition. In no case should the writing-gun No.1 voltage have a value greater than zero with respect to the writing-gun cathode.
- h Unbypassed, current-limiting resistor.
- j Adjust for brightest, most uniform, full-size pattern.
- k Adjust for the smallest, most circular spot.

- m The maximum bias-voltage value for writing-beam cutoff is -130 volts with respect to writing-gun cathode.
- p Luminance (Brightness) and screen current are measured after the entire display is written to saturated brightness, the writing gun has been turned off, and with no erasing pulse applied.
- r The time required for any 1.5-inch diameter area of the useful 4-inch diameter viewing area to spontaneously rise (with no writing or erasing) from zero brightness (viewing-beam cutoff) to 10% of saturated brightness.
- s The undeflected spot position must fall within a circle having a 5/16-inch radius (maximum), 1-3/4-inches from the geometric center of the tube face, on the radius passing through the center of the neck of the writing gun.
- t With writing gun turned off, with no erasing pulse applied, and display erased to cutoff.
- u Measured with viewing-gun grid No.1 at zero volts and with all other electrodes at voltages shown under Recommended Operating Values.
- v Measured with writing-gun grid No.1 at zero volts while writing an overscanned TV-type raster.
- w Adjust erase pulser to 60 pps, 0.5 milliseconds width, and sufficient amplitude to just erase any written information. Using a standard television raster, without blanking or video, adjust raster to 3.0 inch horizontal by 2-1/4 inch vertical. Adjust writing-gun grid No.1 bias to reduce the raster to just under write threshold. Adjust the video amplitude so that all half-tones, of a television pattern such as that provided by an RCA 2F21 Monoscope, are clearly discernable. Move the raster and adjust the erase-pulse amplitude to eliminate undersirable picture retention. Minor re-adjustment of the write-gun grid No.1 bias, the erase pulse amplitude and the video drive may be necessary to obtain the best subjective picture.
- x Measured from saturated brightness to cutoff with an erase pulse 0.5 volt more positive than that necessary for complete erasure.

ENVIRONMENTAL TESTS

The 4547 is designed to withstand the following environmental tests:

Test 1. Vibration in each of the three orthogonal axes as shown in Figure 1, to a double amplitude of 0.03 inch, varied at a uniform rate from 10 to 55 Hz and back to 10 Hz over a five minute interval for each axis.

Test 2. Temperature storage for 24 hours each at 100°C and at -65°C .

Test 3. Temperature and altitude in three phases as follows:

Phase 1. Storage for one hour at a temperature of -40°C followed by tube operation for five minutes under the conditions shown under Recommended Operating Values.

Phase 2. Temperature is increased from -40°C at a rate of 2°C per minute until a temperature of $+86^{\circ}\text{C}$ is reached. Following one hour storage at $+86^{\circ}\text{C}$, the tube is operated for five minutes under the conditions shown under Recommended Operating Values.

Phase 3. Barometric pressure is next reduced until a pressure equivalent to an altitude of 20,000 feet is attained. The tube is then operated for five minutes under the conditions shown under Recommended Operating Values. Upon completion of the third phase of this test, pressure is increased and temperature decreased, at a rate of 2°C per minute, until ambient pressure-temperature conditions are reached.

ORTHOGONAL AXES OF 4547 USED FOR ENVIRONMENTAL TESTING

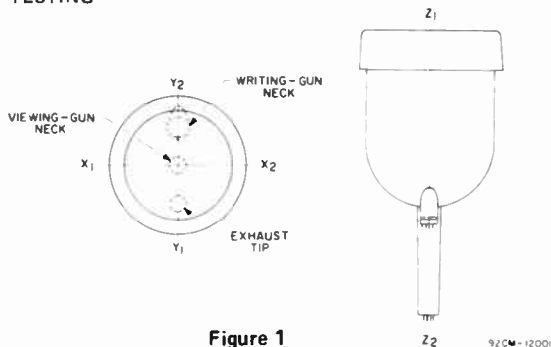


Figure 1

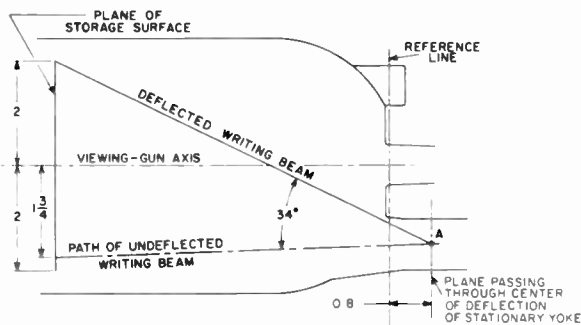
OPERATING CONSIDERATIONS

Deflection. The undeflected, focused writing beam lands nearly normal (perpendicular) to the storage-grid surface at a distance of 1-3/4 inches from its center and in the direction of the writing gun neck.

The writing beam may be deflected by two stationary pairs of coils. One pair is used for horizontal deflection, and the other pair for vertical deflection. When these coils are used, centering the undeflected writing beam can be accomplished by passing direct current of the required value through each pair of deflecting coils.

To avoid neck shadow, when the stationary coils are used, it is essential that the center of deflection should be located not more than 0.8 inch from the reference line as shown below. The writing beam must be deflected from its undeflected position, through a typical angle of 34° to sweep fully the storage surface.

LOCATION OF CENTER OF DEFLECTION



92LS-3654

CAUTION

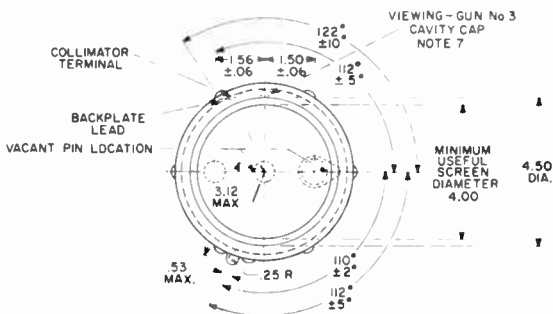
To prevent possible damage to the tube, allow the viewing-gun beam current to reach normal operating value before turning on the writing-gun beam current, and keep the viewing beam on till the writing beam is turned off.

PRECAUTIONS

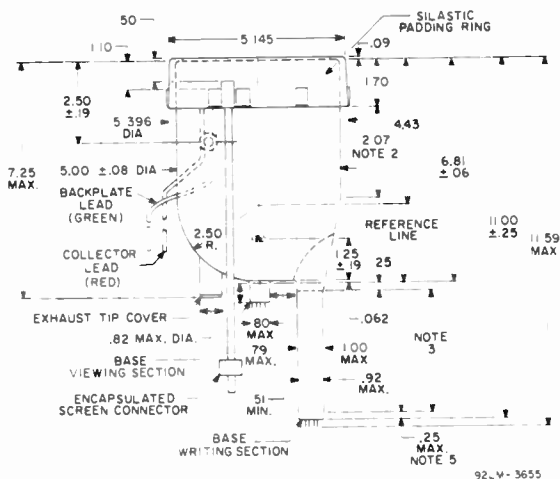
The following operating precautions must be followed to protect the 4547 from inadvertent damage —

1. Do not exceed maximum ratings.
2. Be sure to include the screen resistor.
3. Be sure to include the collector resistor.
4. Do not apply excessive writing-beam current density.
5. Protect against scanning failure.
6. Protect against loss of bias.
7. Apply voltages to tube in correct order.
8. Never write unless viewing beam is on.
9. Stay within recommended viewing-grid voltage ranges.

DIMENSIONAL OUTLINE (TOP VIEW)



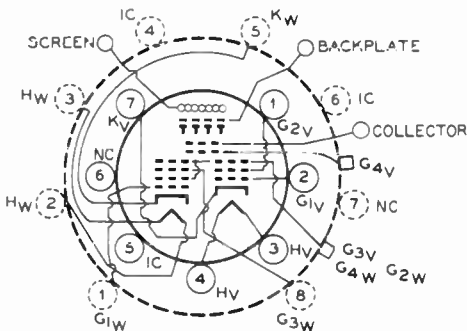
DIMENSIONAL OUTLINE (FRONT VIEW)



DIMENSIONAL OUTLINE NOTES

- Note 1: The silastic-padding ring is permanently attached to the bulb and fits with a light push into a gauge having an inside diameter of $5.396'' \pm 0.015''$.
- Note 2: Within this length, bulb diameter is $5.00'' \pm 0.08''$.
- Note 3: Within this length, neck diameter is 0.920'' maximum.
- Note 4: Aircraft-Marine Products, Inc., type LGH Part No.832692, or equivalent. This part mates with Aircraft-Marine Products, Inc., Part No. AMP 833589, Ceramic Terminal, or Equivalent.
- Note 5: Within this length, neck diameter is 0.950'' maximum.
- Note 6: Do not use these cavity caps for connection. The caps are connected internally and may be at a potential which could constitute a shock hazard. It is recommended that these caps be covered with electrical insulation.
- Note 7: Grids No.4 and No.2 of Writing Gun and grid No.3 of the Viewing Gun are connected within the tube.

BASING DIAGRAM – BOTTOM VIEW



SOLID-LINE CIRCLES DEPICT
MINIATURE 7-PIN BASE
BROKEN-LINE CIRCLES DEPICT
NEODITETRAR 8-PIN BASE

Small-Button Miniature 7-Pin Base

461

VIEWING SECTION

Pin 1: Grid No.2

Pin 2: Grid No.1

Pin 3: Heater

Pin 4: Heater

Pin 5: Internal Connection –Do Not Use

Pin 6: No Connection

Pin 7: Cathode

Flexible Lead (Large): Screen 8.38" \pm 0.20" long

Flexible Lead (Green): Backplate 10.00" \pm 0.50" long

Flexible Lead (Red): Collector 10.0 \pm 0.5" long

Recessed Cavity Caps: JEDEC No.J1-21

Collimator (Grid No.4)

Small-Button Neoditetrar 8-Pin Base

WRITING SECTION

Pin 1: Grid No.1

Pin 2: Heater

Pin 3: Heater

Pin 4: Internal Connection – Do Not Use

Pin 5: Cathode

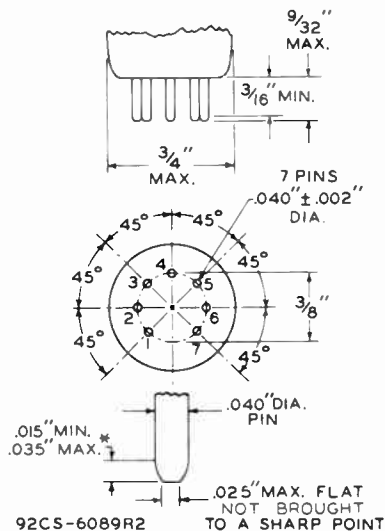
Pin 6: Internal Connection – Do Not Use

Pin 7: No Connection

Pin 8: Grid No.3

Note: Grids No.4 & No.2 are connected internally to Grid No.3 of viewing gun.

SMALL BUTTON MINIATURE 7-PIN BASE



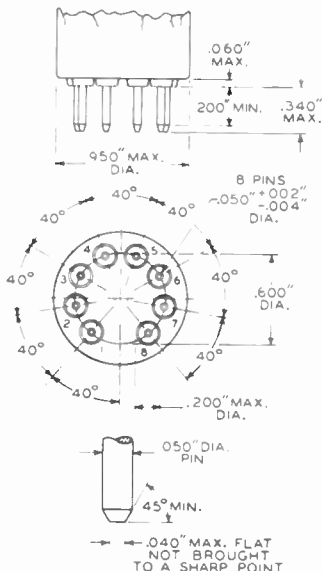
*This dimension around the periphery of any individual pin may vary within the limits shown.

Base-pin positions are held to tolerances such that entire length of pins will, without undue force, pass into and disengage from flat-plate gauge (part of gauge JEDEC No. GE7-1) having thickness of $1/4$ " and eight holes with diameters of $0.0520" \pm 0.0005"$ so located on a $0.3750" \pm 0.0005"$ diameter circle that the distance along the chord between any two adjacent hole centers is $0.1434" \pm 0.0005"$.

The design of the socket should be such that circuit wiring can not impress lateral strains through the socket contacts on the base pins. The point of bearing of the contacts on the base pins should not be closer than $1/8$ " from the bottom of the seated tube.

SMALL BUTTON NEODITETRAR 8-PIN BASE

Base-pin positions are held to tolerances such that entire length of pins will, without undue force, pass into and disengage from flat-plate gauge having thickness of $1/4"$ and nine holes with diameter of $0.0700" \pm 0.0005"$ so located on a $0.6000" \pm 0.0005"$ diameter circle that the distance along the chord between any two adjacent hole centers is $0.2052" \pm 0.0005"$.



92CS-9603

X-RADIATION WARNING: Shielding of this cathode-ray tube for x-radiation may be needed to protect against possible danger of personal injury from prolonged exposure at close range.

For further information or application assistance on this device, contact your RCA Field Representative or write, Display Tube Marketing, RCA, Lancaster, PA. 17604



Display Cathode-Ray Tube

12"-Rectangular 70°-Magnetic Deflection
Display Cathode-Ray Tube Having Integral
Protective Window and P4 Phosphor Screen

ELECTRICAL

Heater Current at 6.3 volts	0.6 A
Focus Method	Electrostatic
Deflection Method	Magnetic
Direct Interelectrode Capacitances (Typical):	
Grid No.1 to all other electrodes	6 pF
Cathode to all other electrodes	5 pF
External conductive coating to anode	{ 1300 max. pF 700 min. pF

OPTICAL

Faceplate, Spherical Filterglass

Light transmission at center (Approx.) 37%

Phosphor P4-Sulfide Type, Aluminized
Tube Dimensions:

Overall length 16.60 max. in

Neck length 7.56 ± 0.25 in

Greatest width 10.94 ± 0.12 in

Greatest height 8.56 ± 0.12 in

Bulb See Dimensional Outline

Anode Cap Recessed Small Cavity Cap
(JEDEC No.J1-21)

Base Small-Shell Duodecal,
Arrangement 1,
6-Pin (JEDEC No.B6-63)

Operating Position Any

Weight (Approx.) 9-1/2 lb

MAXIMUM AND MINIMUM RATINGS, Absolute-Maximum Values

Unless otherwise specified, values are positive with respect to cathode.

Anode Voltage 16,000 max. V

Grid-No.3 (Focusing-Electrode) Voltage 2700 max. V

Grid-No.2 Voltage 400 max. V

Grid-No.1 Voltage:

Negative bias value 80 max. V

Positive bias value 0 max. V

Positive peak value	2 max. V
Peak Heater-Cathode Voltage:	
Heater negative with respect to cathode.	180 max. V
Heater positive with respect to cathode.	180 max. V
Heater Voltage (ac or dc):	
Under operating conditions ^b	{ 6.9 max. V 5.7 min. V

RECOMMENDED OPERATING VALUES

Unless otherwise specified, values are positive with respect to cathode. Raster size 6 inches by 8 inches. Standard TV Scan.

Anode Voltage	12000 V
Anode Current	100 μ A
Grid-No.3 (Focusing-Electrode)	
Voltage for an Anode Current of 100 microamperes	1400 to 1800 V
Grid-No.2 Voltage	340 V
Grid-No.1 Voltage for Visual Extinction of Focused Raster	
	-68 to -38 V
	See accompanying <i>Cutoff Design Chart</i>

TYPICAL PERFORMANCE DATA

At recommended operating values, unless otherwise specified.

Anode Current	70 to 30% of cathode current
Grid-No.3 Current	30 to 70% of cathode current
Typical Trace Luminance ^c	See accompanying <i>Typical Trace Luminance Characteristic</i>
Typical Center Line Width ^d	0.010 in
Spot Position	See footnote e

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max. M Ω
--	---------------------

^b For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts.

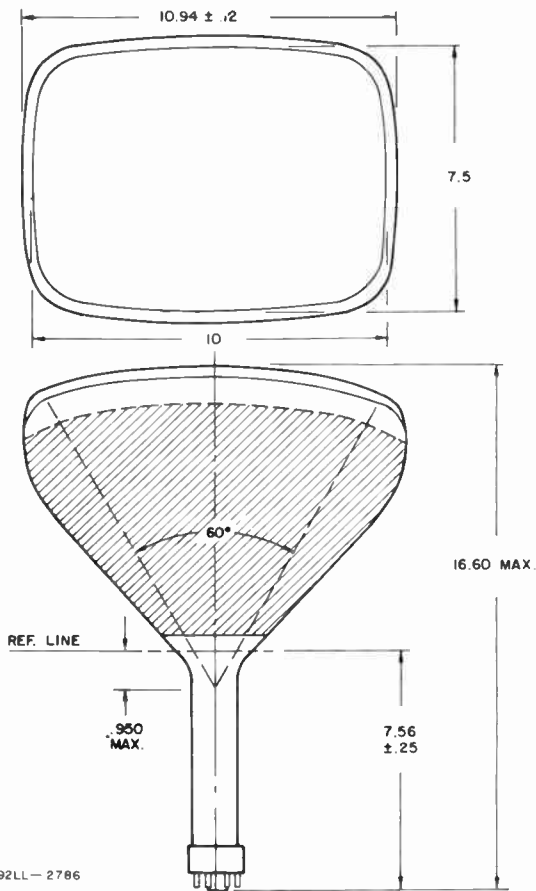
^c Average luminance (brightness) at the center of a single trace scanned at a given sweep speed and refreshed at a given rate.

^d Measured by shrinking raster technique at an anode current of 100 microamperes.

^e The center of the undeflected, unfocused spot will fall within a circle having a 0.8 inch diameter concentric with the center of the tube face.

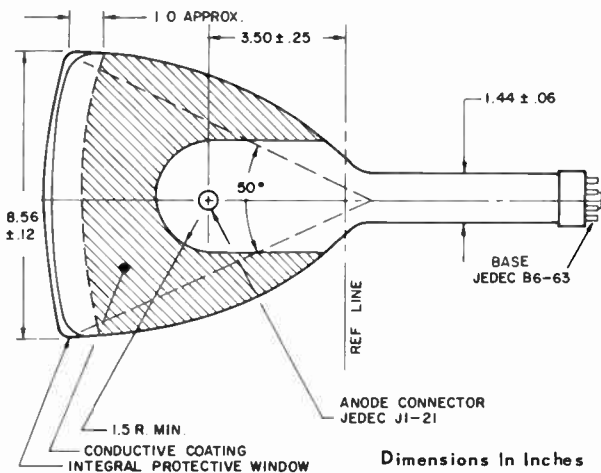
X-RADIATION WARNING

Because the 4557 is designed to be operated at anode voltages as high as 16,000 volts, shielding of the 4557 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

DIMENSIONAL OUTLINE Dimensions In Inches

See accompanying *Inch Dimension Equivalents in Millimeters.*

DIMENSIONAL OUTLINE (Top Right Side View)



Inch Dimension Equivalents in Millimeters

Inch	mm	Inch	mm	Inch	mm
.06	1.5	1.44	36.5	8.56	217.4
.12	3	1.5	38.1	10	254
.25	6.3	3.50	88.9	10.94	277.8
.950	24.1	7.5	190.5	16.60	421.6
1.0	25.4	7.56	192		

TERMINAL DIAGRAM (Bottom View)

Pin 1: Heater

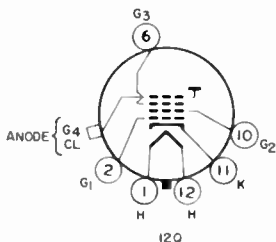
Pin 2: Grid No.1

Pin 6: Grid No.3

Pin 10: Grid No.2

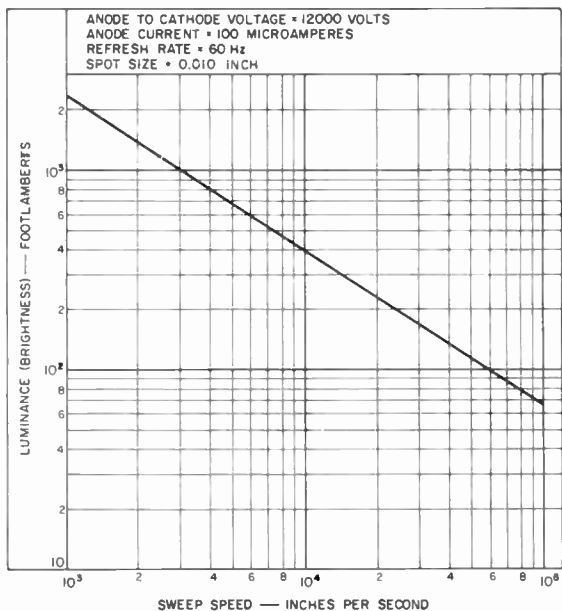
Pin 11: Cathode

Pin 12: Heater

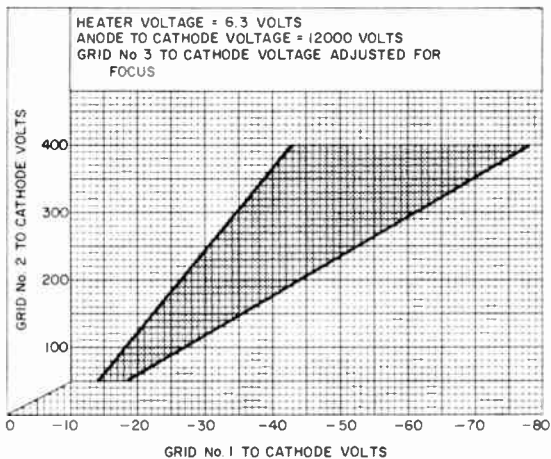
Cap: Anode (Grid No.4
and Collector)

TYPICAL TRACE LUMINANCE CHARACTERISTIC

(Average brightness at center of single trace scanned at the refreshed at the indicated rate)



CUTOFF DESIGN CHART



92LS-2787

Monoscopes^a

**Custom-Built 2"-Diameter, Electrostatic-Focus,
Electrostatic-Deflection Monoscope Tubes For
Use As Alpha-Numeric Character Generators**

ELECTRICAL

Heater Current at 6.3 volts	0.6 A
Focusing Method	Electrostatic
Deflection Method	Electrostatic
Direct Interelectrode Capacitances (Approx.):	

Grid No.1 to all other electrodes	7 pF
Cathode to all other electrodes	5 pF
Output Signal Electrode to all other electrodes	8 pF
DJ1 to all other electrodes	10 pF
DJ2 to all other electrodes	10 pF
DJ3 to all other electrodes	7 pF
DJ4 to all other electrodes	7 pF
DJ1 to DJ2	3 pF
DJ3 to DJ4	3 pF

Deflection Direction:

A positive voltage on DJ1 deflects the beam toward top of stencil.

A positive voltage on DJ3 deflects the beam toward the left side of the stencil.

MECHANICAL

Tube Dimensions:

Maximum Overall Length	11.5 in
Maximum Diameter Including Bulb Terminals	2.285 in
Bulb (Glass)	T16
Base	Medium-Shell, Diheptal 12-Pin JEDEC No.B12-37
Socket	Cinch ^b Part No.3M14, or equivalent
Bulb Terminals (Two)	Small Ball JEDEC J1-25
Bulb Terminal Contacts	Cinch ^b Part No.3A1, or equivalent

Stencil Electrode:

Useful area	1.1 x 1.1 in
Typical Pattern	See accompanying pattern.
Operating Position	Any
Weight (Approx.)	13 oz

MAXIMUM AND MINIMUM RATINGS,**Absolute-Maximum Values**

Unless otherwise stated, values are positive with respect to cathode.

Output Signal Electrode Voltage	2500 max. V
Stencil-Electrode Voltage	2500 max. V
Deflecting Electrode Voltage:	
DJ1 and DJ2	2500 max. V
DJ3 and DJ4	2500 max. V
Grid-No.4 & Grid-No.2 Voltage	2500 max. V
Grid-No.3 Voltage	1000 max. V
Grid-No.1 Voltage:	
Negative Bias Value	200 max. V
Positive Bias Value	0 max. V
Positive Peak Value	2 max. V
Peak Heater-Cathode Voltage:	
Heater Negative with respect to Cathode	200 max. V
Heater Positive with respect to Cathode	200 max. V
Heater Voltage (ac or dc):	
Under Operating Conditions ^c	{ 6.9 max. V 5.7 min. V

RECOMMENDED OPERATING VALUES^d

Unless otherwise specified, values are positive with respect to output signal electrode.

Output Signal Electrode Voltage	Ground ^e
Stencil-Electrode Voltage	-15 V
Average Deflecting Electrode Voltage:	
Vertical (DJ1 and DJ2)	+35 V
Horizontal (DJ3 and DJ4)	+35 V
Grid-No.4 & Grid-No.2 Voltage ^f (Astigmatism)	0 to +70 V

Grid-No.3 (Focusing Electrode) Voltage	-1600 to -1500 V
Grid-No.1 Voltage ^g	-1865 to -1800 V
Cathode Voltage	-1800 V
Heater Voltage ^h	6.3 V

TYPICAL PERFORMANCE CHARACTERISTICS AT RECOMMENDED OPERATING VALUES

	Min.	Typical	Max.	
Output Signal Current ⁱ	—	5	—	μA
Trace Angle:				
Vertical	—	2	5	degrees
Horizontal	—	2	5	degrees
Between Vertical and Horizontal Traces	89	90	91	degrees
Deflection Factors: ^k				
Vertical (DJ1 and DJ2)	46	—	60	V/in
Horizontal (DJ3 and DJ4)	46	—	60	V/in
Undelected Spot Position ^m	—	—	0.15	in

^a A specific tube designation in the 4560 series will be assigned to each type employing a different stencil pattern.

^b Made by Cinch Manufacturing Company, 1501 Morse Avenue, Elk Grove Village, IL 60007.

^c For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts.

^d The tube must be shielded to prevent stray magnetic fields from affecting performance. At no time should the undeflected beam be allowed to rest on the usable 1.1" x 1.1" area of the stencil electrode pattern.

^e The output signal electrode is grounded through a 1000-ohm load resistor.

^f Adjust for minimum astigmatism.

^g Adjust as required.

^h One side of heater terminal (Pin No.1) is connected to -1800 V dc.

- i For cathode current not exceeding 110 microamperes.
- k Useful area of stencil electrode is 1.1" x 1.1".
- m The undeflected spot position must fall within a circle having a 0.15 inch diameter (maximum) centered on the stencil electrode pattern.

TYPICAL STENCIL ELECTRODE PATTERN



OPERATING CONSIDERATIONS

Tubes in the 4560 series are intended for use as character generators in conjunction with display cathode-ray tubes in computer data terminal display equipment. In such equipment, the electron beam in the monoscope is first deflected to a desired character location on the stencil and at the same time the display cathode-ray tube electron beam is deflected to a desired position in the display. The monoscope electron beam is then rapidly scanned over the selected character in the stencil

and the display cathode-ray tube electron beam is synchronously deflected on the phosphor screen.

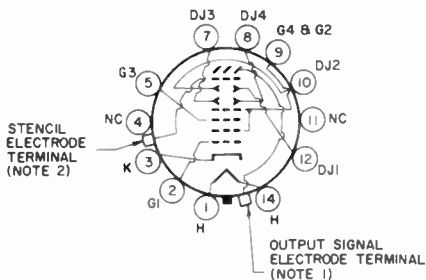
In the monoscope, electrons which pass through the stencil are collected on the output signal electrode and generate a video signal across the output load resistor. This signal is amplified and then applied to the grid of the display cathode-ray tube.

The effect of this operation is that the character stenciled into the monoscope is displayed on the phosphor screen of the display cathode-ray tube. Other characters may be chosen by positioning the monoscope electron beam at different locations on the stencil. A character may be located anywhere in the cathode-ray tube display by appropriate positioning of its electron beam.

NOTE

Stencil patterns supplied to RCA for incorporation in the 4560 family of monoscopes should be at least 10 times larger than the useful 1.1" x 1.1" area of the stencil electrode. The alpha-numeric characters of the pattern should be white on a dark background. Such patterns or requests for information on RCA fabricated stencil patterns should be directed to Storage Tube Marketing, RCA, Lancaster, PA 17604, or to the nearest Sales Office.

TERMINAL DIAGRAM (Bottom View)



Pin No.1: Heater

Pin No.2: Grid No.1

Pin No.3: Cathode

Pin No.4: No connection

Pin No.5: Grid No.3

Pin No.7: Deflecting Electrode DJ3

Pin No.8: Deflecting Electrode DJ4

Pin No.9: Grid No.4 and Grid No.2

Pin No.10: Deflecting Electrode DJ2

Pin No.11: No connection

Pin No.12: Deflection Electrode DJ1

Pin No.14: Heater

Terminals —

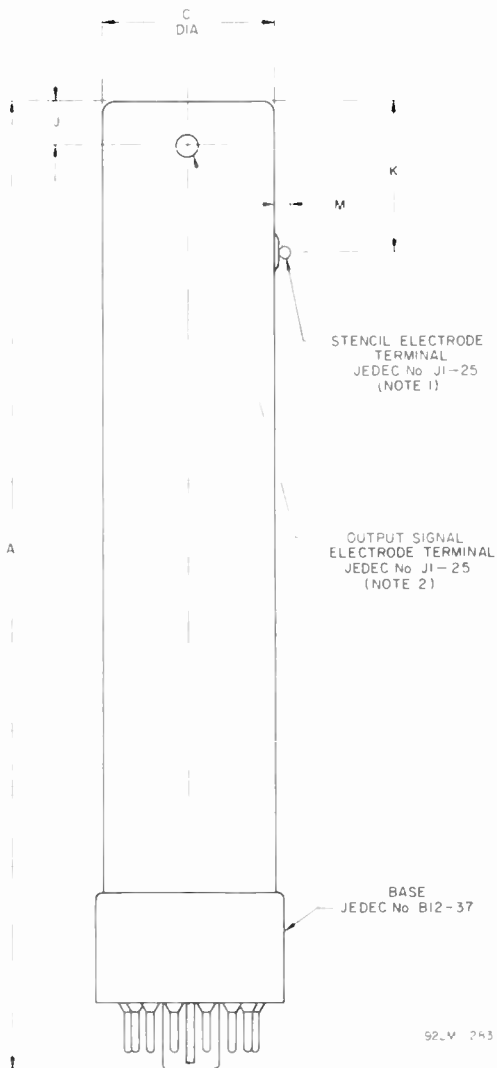
Nearest Base: Stencil Electrode

Furthest from Base: Output Signal Electrode

Note 1: The plane passing through the tube axis and the key of the base does not deviate more than $\pm 10^0$ from the plane passing through the tube axis and the output signal electrode terminal cap.

Note 2: The plane passing through the tube axis and Pin No.4 of the base does not deviate more than $\pm 10^0$ from the plane passing through the tube axis and the stencil electrode cap.

DIMENSIONAL OUTLINE



NOTES FOR DIMENSIONAL OUTLINE

Note 1: Angular orientation of the stencil electrode terminal with respect to pin No.4 of base is $\pm 10^{\circ}$.

Note 2: Angular orientation of the output signal electrode terminal with respect to key of base is $\pm 10^{\circ}$.

OUTLINE DIMENSIONS

Dimensions	Inches	mm
A	$11.312 \pm .188$	287.32 ± 4.77
C	$2.050 \pm .050$ Dia.	52.07 ± 1.27 Dia
J	$.500 \pm .062$	12.70 ± 1.57
K	$1.750 \pm .125$	44.45 ± 3.17
M	.185 max.	4.69 max.

4583, 4584, 4585

Projection Kinescopes

7"-Diameter Electrostatic-Focus, Magnetic-Deflection Types

- Matched Trio of Tubes for Color Projection Systems
- Designed for Use with Schmidt Reflective Optical Systems
- Matched Phosphors
- High Picture Brightness
- Wide Range of Synthesized Colors
- Balanced Drive Characteristics

General Data

Electrical:

Heater Current at 6.6 Volts	0.62 A
Focusing Method	Electrostatic
Deflection Method ^a	Magnetic
Deflection Angle (Approx.)	35°
Direct Interelectrode Capacitances (Approx.):	
Grid No.1 to all other electrodes	12 pF
Cathode to all other electrodes	6 pF

Optical:

Faceplate, Spherical	Clear, Browning Resistant Glass
Radius of curvature (inner radius)	15.315 in
Minimum Optical-Quality-Rectangle	5x3-3/4 in
Refractive Index of Faceplate	1.469

Phosphors, Alumined:

4583	Sulfide (Blue) Type
C.I.E. coordinates (x,y)	0.155, 0.048
Luminescence	Blue
Persistence	Medium
4584	Silicate (Green) Type
C.I.E. coordinates (x,y)	0.218, 0.728
Luminescence	Green
Persistence	Medium
4585	Rare-Earth (Red) Type
C.I.E. coordinates (x,y)	0.660, 0.340
Luminescence	Red
Persistence	Medium

4583, 4584, 4585

Mechanical:

Tube Dimensions:

Overall length	19-1/2 ± 5/8 in
Greatest diameter of bulb (excluding side cap or cable)	7 ± 3/16 in
Base	Small-Shell Diheptal 14-Pin, JEDEC No. B14-45
Anode Lead	Molded-on, Insulated Cable, 48 in. long
Operating Position	Any
Weight (Approx.)	5 lbs

Maximum and Minimum Ratings, Absolute-Maximum Values^b

Average Anode Power:^c

With forced-air cooling of faceplate	160 max.	W
Air Flow to Face ^d	40	cfm
Anode-to-Cathode Voltage	80 max.	kV
Grid-No.3-to-Cathode Voltage	20 max.	kV
Grid-No.2-to-Cathode Voltage	1.05 max.	kV
Grid-No.1-to-Cathode Voltage:		
Negative bias value	250 max.	V
Positive bias value	0 max.	V
Peak positive value	2 max.	V

Anode Current, Long-Term

Average (for 5" x 3-3/4" TV raster)	2 max.	mA
-------------------------------------	--------	----

Peak Heater-Cathode Voltage:

Heater negative with respect to cathode	150 max.	V
Heater positive with respect to cathode	150 max.	V
Heater Voltage (AC or DC) ^e	6.93 max.	V
	6.27 min.	V

Recommended Operating Values^f

Raster Size	5" x 3-3/4"
Anode Voltage	75 kV
Anode Current, Long-Term Average	1000 μA
Grid-No.3 Voltage for Focus at an Anode Current of 1000 μA	15 to 17 kV
Grid-No.2 and Grid-No.1 Voltages for Visual Extinction of Focused Raster	See Figure 1
Heater Voltage	6.6 V

4583, 4584, 4585

Typical Performance Data

	Blue	Green	Red	
Luminous Output of each Tube at an Anode Current of 1000 μ A for each tube	88	1400	520	lumens
Luminance of Each Tube at an Anode Current of 1000 μ A for Each Tube	680	10800	4000	fL
Luminance of Three Tubes Combined at an Anode Current of 1000 μ A on Limiting Tube and with Anode Current of Other Two Tubes Adjusted to Produce White of 9300° K + 27 M.P.C.D.			8500	total fL
Percentage of Total Luminance Supplied by Each Tube	8	70	22	%
Percentage of Total Anode Current Supplied by Each Tube (Approx.)	50	27	23	%
Center Resolution ⁹			600	TV Lines
Grid-No.3 Current (Total) ^h			± 15	μ A
Grid-No.2 Current			± 15	μ A

Circuit Requirements

High Voltage Circuits

In order to minimize the possibility of damage to the tubes and adjacent circuits caused by a momentary internal arc, it is recommended that the high-voltage power supply and the grid-No.3 power supply be of the limited-energy type. An external spark gap must be provided at the grid-No.3 terminal. The following resistor and voltage values are mandatory.

Anode-Circuit Resistance (unbypassed)	0.5	min.	$M\Omega$
Grid-No.3 Circuit Resistance (unbypassed)	0.1		$M\Omega$
Grid-No.3 Spark-Gap Firing Voltage	20		kV

Low-Voltage Circuits

Grid-No.2 Circuit Resistance (bypassed)	10		$k\Omega$
Grid-No.1 Circuit Resistance (unbypassed)	1		$k\Omega$
Effective Grid-No.1-to-Cathode Circuit Resistance	1.5	max.	$M\Omega$

- ^a Sharp corners on the yoke assembly in the vicinity of the tube neck should be avoided. Insulation between the yoke winding and/or the core and the tube neck should be capable of withstanding at least 10 kV and preferably 15 kV.

4583, 4584, 4585

- b A description of the Absolute Maximum Rating is given in the General Section, titled Rating Systems for Electron Tubes.
- c The product of anode-to-cathode voltage and anode current (long term average) should never exceed 160 watts.
- d The specified air flow should be delivered perpendicularly from a nozzle having a diameter of about 2 inches onto the face of the tube while it is in operation. In a typical system with air filter, the total system static pressure is approximately 0.25 inch of water. The cooling air must not contain water, dust, or other foreign matter. The air-cooling system should be electrically interconnected with the anode power supply to prevent operation of the tube without cooling.

Cooling of the tube by a tangential flow of air across its face is not recommended because the temperature gradient produced across the face may result in immediate or delayed cracking of the face.

- e For maximum cathode life, it is recommended that the heater supply be regulated at 6.6 volts.
- f These tubes may be operated at reduced anode voltage and/or anode current. At reduced anode voltage, center resolution will decrease. At reduced anode voltage and/or anode current, luminance will decrease. The grid No.3 voltage for focus will be reduced in proportion to the reduction in anode voltage. Other performance characteristics may also be affected.
- g Determined for a 3 3/4 inch high TV resolution test pattern with tube operating at a screen current of 1000 microamperes.
- h Grid-No.3 current is normally low, as indicated in the data, when the tube is operated under recommended conditions. Lower grid-No.3 voltages (as required for focus if anode voltage is reduced) and/or higher grid-No.2 voltages can lead to a grid-No.3 current level approaching that measured in the anode circuit. Note that the fraction of available current intercepted by the grid-No.3 electrode is not constant, but increases with increasing anode current.

The Conductive Coating

The conductive coating on the exterior of the tube neck must be grounded. Connection to the coating may be made by using a flexible metal band fastened firmly around the neck at the base end of the coating. The metal band should be fastened only tight enough to insure good contact. If

the band is clamped very tight, resultant glass strains may eventually cause the neck to break. This coating must not be scratched and must never be washed with liquids likely to soften or dissolve lacquers.

The external coating on the neck serves to prevent corona between the neck and the yoke. Corona would damage the yoke insulation and cause breakdown in the glass of the neck. It is important that the yoke insulation be adequate for operation of the yoke against the external grounded coating. The resistance of the external conductive coating is sufficiently high so that damping of the yoke deflecting energy is negligible. Because of this high resistance, a contact area of at least 1/4 square inch should be used in making connection to the external coating.

Safety Precautions

X-Radiation Warning

Although X-radiation is generated primarily at the face of the tube when it is operated, the X-rays are emitted in all directions.

These rays can constitute a health hazard unless the tube is adequately shielded. Make sure that the shielding provides the required protection against personal injury.

On the neck of the tube itself the following warning appears and should be strictly adhered to:

X-Ray Warning

This tube in operation produces X-rays which can constitute a health hazard unless the tube is adequately shielded for radiation.

High Voltage

The high voltages at which these tubes are operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Precautions include the enclosing of

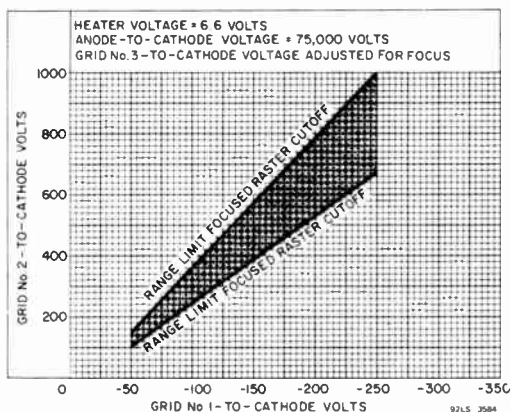
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high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is required.

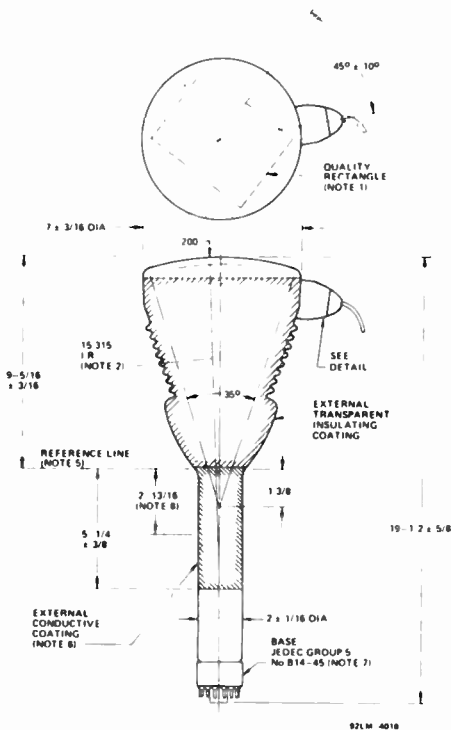
In the use of these tubes it should always be remembered that high voltages may appear at normally low-potential points in the circuit because of capacitor breakdown or incorrect circuit connections, and that the tube surface maintains a static charge for some time after the power has been turned off. Therefore, before any part of the circuit or the tube is touched, the power-supply switch should be turned off, both terminals of high-voltage capacitors should be grounded, and the terminals of the high-voltage power supply should be grounded.

After these steps have been taken and before touching the tube, discharge the anode terminal, the surface of the faceplate, and the coated surface of the cone by use of a suitable wand which is connected to ground. It is to be noted that the entire surface of the cone and of the faceplate will not be discharged by touching the wand to a single point on either surface, because the surfaces have high resistance. Therefore, to discharge each surface, it will be necessary to sweep over the entire surface with the wand.

Cutoff Design Chart



Dimensional Outline



Note 1: When viewed from the face of the tube, the minor axis of the 5" x 3-3/4" quality rectangle is located $45^\circ \pm 10^\circ$ in a counter-clockwise direction from a plane through the anode terminal and the tube axis.

Note 2: Inside surface of faceplate within the quality rectangle may vary ± 0.006 " from the spherical surface having a 15.315" radius.

Note 4: The plane through Base Pin No.9 and the tube axis may vary from the plane through the anode terminal and the tube axis by an angular tolerance (measured about the tube axis) of $\pm 10^\circ$. The anode terminal is on same side as Pin No.9.

4583, 4584, 4585

Note 5: Reference line is determined by position where gauge 2 100" ± 0.001" I D and 3" long will rest on bulb cone

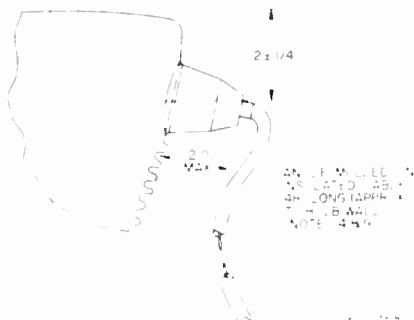
Note 6: External conductive coating must be grounded

Note 7: Socket for this base should not be rigidly mounted, it should have flexible leads and be allowed to move freely
Socket contacts for Pins 5, 6, 7, 8, 10, 11, 12, and 13 should be removed in order to provide maximum insulation for Pin No 9

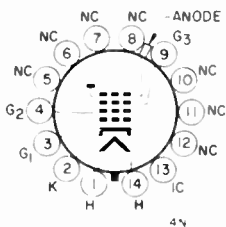
Note 8: Effective deflecting field must be within this space

Note 9: Anode cable should not be sharply bent within 5" of bulb wall

Dimensional Outline Detail



Socket Connections (Bottom View)



- Pin 1 Heater
- Pin 2 Cathode
- Pin 3 Grid No 1
- Pin 4 Grid No 2
- Pin 5 No Connection
- Pin 6 No Connection
- Pin 7 No Connection
- Pin 8 No Connection
- Pin 9 Grid No 3
- Pin 10 No Connection
- Pin 11 No Connection
- Pin 12 No Connection
- Pin 13 Internal Connection
Do Not use
- Pin 14 Heater
- Cable Anode

Note: Socket contacts for Pins No. 5, 6, 7, 8, 10, 11, 12, and 13 should be removed so that maximum insulation is provided for Pin No. 9.

Graphochon Tube

Scan-Conversion Storage-Tube Assembly

Very High Resolution Capability

Ruggedized Structure Designed to
Meet MIL-E-5400 Specification

Integral Shielding and Deflection Coils

Small Size – 15" Max. Length 3.65" Diameter

0.6-Watt Heaters for Writing and Reading Guns

ELECTRICAL

Heater Current at 6.3 Volts, Each Gun	0.1 A
Focusing Method, Each Gun	Electrostatic
Deflection Method, Each Gun	Magnetic
Deflection Coils	See footnote a
Total Deflection Angle, Each Gun (Approx.)	50 degrees
Deflection Coil Alignment ^b	0.5 degrees
Undelected Spot Position, Each Gun ^c	5% of target diameter
Direct Interelectrode Capacitances:	

	Typ.	Max.	
Output-signal-electrode to all other electrodes ^d	17	20	pF
Reading-gun grid No.1 to all other electrodes	—	15	pF
Reading-gun cathode to all other electrodes	—	9	pF
Writing-gun grid No.1 to all other electrodes	—	15	pF
Writing-gun cathode to all other electrodes	—	9	pF

MECHANICAL

Tube Dimensions	See Dimensional Outline
Connections	See footnote e
Operating Position	Any
Maximum Weight	5.25 lbs

MAXIMUM AND MINIMUM RATINGS, *Absolute-Maximum Values*

Voltages are referred to ground unless otherwise specified.

	Min.	Max.	
Writing Gun:			
Heater voltage ^g (AC or DC)	5.7	6.9	V
Cathode voltage	-9000	-	V
Heater-cathode voltage	-125	10	V
Grid-No.1 (control grid) voltage ^h	-300	0	V
Grid-No.2 voltage ^h	-	750	V
Grid-No.3 (beam focus) voltage ^{h,j}	-	1500	V
Grid-No.4 (anode) voltage	Ground		

Reading Gun:			
Heater voltage ^k (AC or DC)	5.7	6.9	V
Cathode voltage	-1500	-	V
Heater-cathode voltage	-125	10	V
Grid-No.1 (control grid) voltage ^m	-300	0	V
Grid-No.2 voltage ^m	-	750	V
Grid-No.4 (beam focus) voltage ^{i,m}	-	750	V
Grids No.3 & No.5 (anode) voltage	-30	30	V
External conductive coating	Ground		

Target Section:			
Output signal electrode voltage	-10	10	V
Shading electrode voltage	-30	30	V
Backplate voltage	-20	50	V

TYPICAL OPERATING CONDITIONS

Voltages are referred to ground unless otherwise specified.

Writing Gun:			
Heater voltage ^g (AC or DC)		6.3	V
Cathode voltage		-8000	V
Grid-No.1 (control grid) voltage for beam cutoff ^h	-120 to -70		V
Grid-No.2 voltage ^h		300	V
Grid-No.3 (beam focus) voltage ^{h,j}	600 to 1400		V
Grid-No.4 (anode) voltage	Ground		

Reading Gun:			
Heater voltage ^k (AC or DC)		6.3	V
Cathode voltage		-1200	V

TYPICAL OUTPUT CONDITIONS

Reading Gun:

Grid-No.1 (control grid) voltage for beam cutoff ^m	-120 to -70	V
Grid-No.2 voltage ^m	300	V
Grid-No.4 (beam focus) voltage ^{l,m}	200 to 440	V
Grids No.3 & No.5 (anode) voltage ⁿ	-20 to 0	V
External conductive coating	Ground	

Target Section:

Output-signal-electrode voltage	0	V
Shading electrode voltage ⁿ	0 to 20	V
Backplate voltage ⁿ	-15 to 0	V

PERFORMANCE CHARACTERISTICS

The Performance Characteristics shown below are obtained in one mode of tube operation which is representative of many applications. Trade-offs in these characteristics may be made to achieve optimum tube performance in other operating modes.

	Min.	Max.
Output Signal Current ^p	0.5	— μ A
Storage Time ^q		See footnote r
Signal-to-Shading Ratio ^s	5:1	—
Signal-to-Background-Shading Ratio ^t	8:1	—
Center Resolution, At 50% amplitude response	1600	— TV lines/ target diameter
Edge Resolution, At 50% amplitude response		See footnote v
Writing Speed	200	— μ s/ target diameter
Shades of Gray ^w	7	—
Blemishes ^x		See footnote y

ENVIRONMENTAL CONDITIONS

The 4598 will provide the performance specified under Performance Characteristics when the tube is exposed to the following environmental conditions:

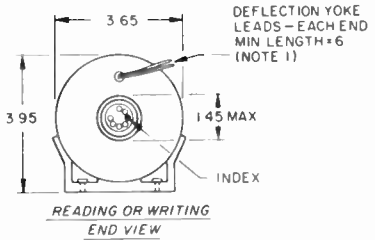
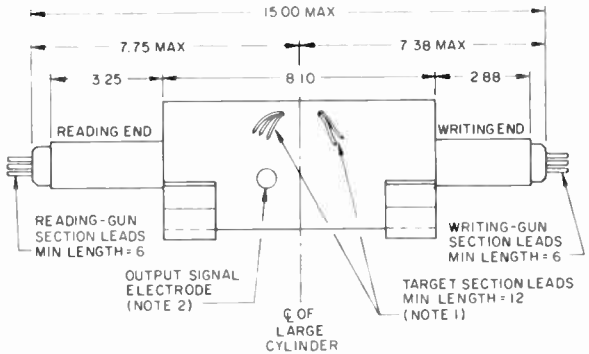
	Requirement
Temperature-Altitude ^z	MIL-E-5400L, Par. 3.2.24.3, Table I Class 1A
Humidity	MIL-E-5400L, Par. 3.2.24.4
Shock	MIL-E-5400L, Par. 3.2.24.6
Vibration	See accompanying <i>Vibration Levels</i>

- a The deflection coils are electrically similar to type Y65 manufactured by Syntronic Instruments Inc., Addison, Illinois. A variety of inductances are available, which are suitable for either push-pull or single-ended circuit configurations.
- b The orthogonality of the horizontal and vertical axes of each deflection coil is within 1/2 degree of 90 degrees. The horizontal axis of the writing deflection coil is parallel within 1/2 degree to the horizontal axis of the reading deflection coil.
- c The undeflected spots of both guns fall within a circle having a diameter that is 5 per cent of the target diameter, and is centered on the target.
- d The value shown is the capacitance of the assembly supplied with a solderable terminal as the output signal electrode connection; if a coaxial connector or cable is supplied, their capacitance must be added to this value.
- e Connection to the output signal electrode can be provided by means of a solderable terminal, coaxial connector, or coaxial cable. Connections to the deflection coils and low voltage electrodes are by flexible leads. Connections to the high voltage electrodes are made by silicone rubber leads; connectors such as type B40706 lead assemblies manufactured by AMP Inc., Capiton Division, Elizabethtown, PA, can also be supplied.
- g One side to be externally connected to writing-gun cathode.
- h With respect to writing-gun cathode.
- j Adjust for best focus.
- k One side to be externally connected to reading-gun cathode.
- m With respect to reading-gun cathode.
- n Adjust for optimum signal and storage performance.
- p This value is the saturated output signal current.
- q Storage time is proportional to the area scanned by the reading-gun raster. The limits are given for a raster of aspect ratio 1:1, and inscribed within the target area.
- r The specified performance characteristics are obtained over a range of storage times from 1.0 second maximum to 3.0 seconds minimum. The specified performance characteristics except shades of gray are obtained over a range of storage times from 0.5 second maximum to 4.0 seconds minimum. Storage time is measured to 10 per cent of signal amplitude.

- s This limit applies to the central 75 per cent of the target. The measurement is taken along that single line of the output video signal which has the lowest signal-to-shading ratio.
- t This limit applies to the central 75 per cent of the target. The measurement is taken along that single line of the output video signal which has the lowest signal-to-background-shading ratio.
- u Resolution is measured using a raster written perpendicular to the horizontal scanning lines of the reading-gun raster, and with the writing-gun drive voltage adjusted to give a peak output signal 85 per cent of saturated signal amplitude.
- v A minimum resolution of 1200 TV lines per target diameter is obtained over 75 per cent of the target diameter. A minimum resolution of 1400 TV lines per target diameter is obtained over 75 per cent of the target diameter using dynamic focusing of the reading gun.
- w A step voltage waveform with seven equally spaced levels is used as input.
- x Blemishes are measured within a circular area centered on the target and with a diameter of 90 per cent of the target diameter. Blemish size is specified as a percentage of the target diameter; blemish amplitude, as a percentage of saturated signal amplitude. Blemishes with an amplitude of less than 10 per cent are not counted. Dark blemishes with a size of less than 1/8 per cent are not counted.
- y The maximum size of any light blemish is 1/2 per cent. The amplitude and number of light blemishes are limited as shown in the following table:

Amplitude	Maximum Number
10% to 50%	10
20% to 50%	3
Greater than 50%	0

- The maximum size of any dark blemish is 1/2 per cent. The maximum number of dark blemishes is five.
- z The backplate voltage of the tube may be changed in a predetermined manner to compensate for the variation in storage time as a function of temperature.



121 M 3*9t

Dimensions in Inches

DIMENSIONAL OUTLINE (cont'd)

Note 1 — All leads are labeled.

Note 2 — Connection to the output signal electrode can be provided by means of a solderable terminal, coaxial connector, or coaxial cable.

TARGET-SECTION LEADS

Lead 1: Writing-Gun Grid No.4

Lead 2: Backplate

Lead 3: Shading Electrode

Lead 4: Reading Gun Grids No. 3 & 5

Lead 5: Reading-Gun External Conductive Coating

WRITING-GUN SECTION LEADS

Lead 1: Heater

Lead 2: Grid No.1

Lead 3: Grid No.3

Lead 4: Grid No.2

Lead 5: Cathode

Lead 6: Heater

READING-GUN SECTION LEADS

Lead 1: Heater

Lead 2: Grid No.1

Lead 3: Grid No.4

Lead 4: Grid No.2

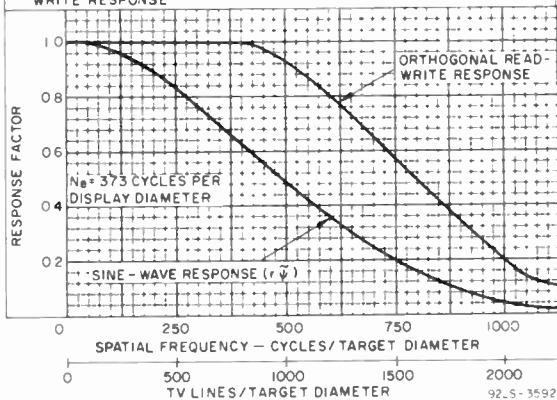
Lead 5: Cathode

Lead 6: Heater

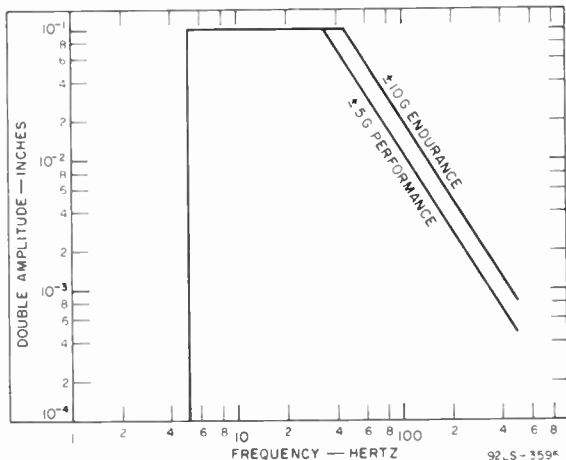
FREQUENCY RESPONSE CHARACTERISTICS

ORTHOGONAL READ-WRITE RESPONSE IS MEASURED BY SHRINKING A RASTER OF SCANNING LINES WRITTEN PERPENDICULARLY TO THE READ RASTER

SINE-WAVE RESPONSE IS DERIVED FROM THE ORTHOGONAL READ-WRITE RESPONSE



VIBRATION LEVELS



Projection Kinescope

5"-Diameter Electrostatic-Focus, Magnetic-Deflection Type

- For Monochrome Television Projectors
- Designed for Use with Schmidt Reflective Optics
- High Picture Luminance – 3000 fL at 300 μ A
- High Resolution – 600 TV Lines at 300 μ A
- Forced-Air Cooled
- Rare Earth (White) Phosphor
- Fine Screen Texture
- Color Temperature – 7800° K + 70 MPCD

General Data

Electrical:

Heater Current at 6.3 Volts	0.6 A
Focusing Method	Electrostatic
Deflection Method ^a	Magnetic
Deflection Angle (Approx.)	50°
Direct Interelectrode Capacitances (Approx.):	
Grid No.1 to all other electrodes	8 pF
Cathode to all other electrodes	5 pF

Optical:

Faceplate, Spherical	Clear, Browning-Resistant Glass
Radius of curvature (inner radius)	7.10 \pm 0.20 in
Minimum Useful Screen Diameter	4.50 in
Minimum Optical-Quality-Circle Diameter	4.25 in
Refractive Index of Faceplate	1.519
Phosphor, Aluminized	P45 Rare Earth
C.I.E. coordinates (x,y)	0.290, 0.361
Luminescence	White
Color temperature	7800° K + 70 M.P.C.D.
Persistence	Medium

Mechanical:

Tube Dimensions:

Overall length	12.19 + 0.37 – 0.38 in
Greatest diameter of bulb (Excluding cable)	5.00 \pm 0.12 in
Base	Small-Shell Duodecal 7-Pin, JEDEC No. B7-51

Anode Lead	Molded-on, Insulated Cable, 48 in long
Bulb	J40H1
Operating Position	Any
Weight (Approx.)	1-1/2 lbs

Maximum and Minimum Ratings, Absolute-Maximum Values^b

Average Anode Power:

Without forced-air cooling of faceplate	9	max.	W
With forced-air cooling of faceplate	12	max.	W

Air Flow to Face^c when Average Anode

Power Exceeds 9 Watts	40		cfm
Anode-to-Cathode Voltage	42	max.	kV
Grid-No.3-to-Cathode Voltage	9	max.	kV
Grid-No.2-to-Cathode Voltage	400	max.	V

Grid-No.1-to-Cathode Voltage:

Negative bias value	150	max.	V
Positive bias value	0	max.	V
Peak positive value	2	max.	V

Anode Current, Long-Term Average (for 4" x 3" TV raster)

300 max. μ A

Peak Heater-Cathode Voltage:

Heater negative with respect to cathode ...	175	max.	V
Heater positive with respect to cathode ...	10	max.	V

Heater Voltage (ac or dc) ^d	6.9	max.	V
	5.7	min.	V

Recommended Operating Values^e

Raster Size	4" x 3"
Anode Voltage	40 kV
Anode Current, Long-Term Average	300 μ A
Grid No.3 Voltage for Focus at an Anode Current of 300 μ A	7.4 to 9 kV
Grid-No.2 and Grid-No.1 Voltages for Visual Extinction of Focused Spot	See Figure 1
Heater Voltage	6.3 V

Typical Performance Data

At Recommended Operating Values:

Center Resolution ^f	600 TV Lines
Luminance at 300 μ A	3000 fL
	10300 nits

Luminous Flux	250	lumens
Grid-No.3 Current (Total) ^a	±10	μA
Grid-No.2 Current	±15	μA

Circuit Requirements

High-Voltage Circuits:

In order to minimize the possibility of damage to the tubes and adjacent circuits caused by a momentary internal arc, it is recommended that the high-voltage power supply and the grid-No.3 power supply be of the limited-energy type. An external spark gap must be provided at the grid-No.3 terminal. The following resistor and voltage values are mandatory.

Anode-Circuit Resistance (unbypassed)	0.5	min.	MΩ
Grid-No.3 Circuit Resistance (unbypassed)	0.1		MΩ
Grid-No.3 Spark-Gap Firing Voltage	12		kV

Low-Voltage Circuits:

Grid-No.2 Circuit Resistance (bypassed)	10		kΩ
Grid-No.1 Circuit Resistance (unbypassed)	1		kΩ
Effective Grid-No.1-to-Cathode Circuit Resistance	1.5	max.	MΩ

- a Sharp corners on the yoke assembly in the vicinity of the tube neck should be avoided. Insulation between the yoke winding and/or the core and the tube neck should be capable of withstanding at least 10 kV and preferably 15 kV.
- b A description of the Absolute Maximum Ratings is given in the General Section, titled Rating System for Electron Tubes.
- c The specified air flow should be delivered perpendicularly from a nozzle having a diameter of about 2 inches onto the face of the tube while it is in operation. In a typical system with air filter, the total system static pressure is approximately 0.25 inch of water. The cooling air must not contain water, dust, or other foreign matter. The air-cooling system should be electrically interconnected with the anode power supply to prevent operation of the tube without cooling.
Cooling of the tube by a tangential flow of air across its face is not recommended because the temperature gradient produced across the face may result in immediate or delayed cracking of the face.
- d For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts.
- e This tube may be operated at reduced anode voltage and/or anode current. At reduced anode voltage, center resolution will decrease. At reduced anode voltage and/or anode current, lumi-

nance will decrease. The grid-No.3 voltage for focus will be reduced in proportion to the reduction in anode voltage. Other performance characteristics may also be affected.

- f Determined for a 3-inch high TV resolution test pattern with tube operating at a screen current of 300 microamperes.
- g Grid-No.3 current is normally low, as indicated in the data, when the tube is operated under recommended conditions. Lower grid-No.3 voltage (as required for focus if anode voltage is reduced) and/or higher grid-No.2 voltages can lead to a grid-No.3 current level approaching that measured in the anode circuit. Note that the fraction of available current intercepted by the grid-No.3 electrode is not constant, but increases with increasing anode current.

Safety Precautions

X-Radiation Warning

Although X-radiation is generated primarily at the face of the tube when it is operated, the X-rays are emitted in all directions.

These rays can constitute a health hazard unless the tube is adequately shielded. Make sure that the shielding provides the required protection against personal injury.

On the neck of the tube itself the following warning appears and should be strictly adhered to:

X-RAY WARNING

This tube in operation produces X-Rays which can constitute a health hazard unless the tube is adequately shielded for radiation.

In normal operation, this tube produces more x-radiation than the Tube Type 5AZP4 which it may replace. Make sure that shielding is adequate.

High Voltage

The high voltages at which this type is operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Precautions include the enclosing of high-potential terminals and the use of interlocking switches to

break the primary circuit of the power supply when access to the equipment is required.

In the use of this tube it should always be remembered that high voltages may appear at normally low-potential points in the circuit because of capacitor breakdown or incorrect circuit connections, and that the tube surface maintains a static charge for some time after the power has been turned off. Therefore, before any part of the circuit or the tube is touched, the power-supply switch should be turned off, both terminals of high-voltage capacitors should be grounded, and the terminals of the high-voltage power supply should be grounded.

After these steps have been taken and before touching the tube, discharge the anode terminal, the surface of the faceplate, and the coated surface of the cone by use of a suitable wand which is connected to ground. It is to be noted that the entire surface of the cone and of the faceplate will not be discharged by touching the wand to a single point on either surface, because the surfaces have high resistance. Therefore, to discharge each surface, it will be necessary to sweep over the entire surface with the wand.

Tube Handling

Wear "Safety" Goggles with side shields, when handling tube to prevent possible injury from flying glass in case of tube breakage. Do not strike or scratch tube. Never subject it to more than moderate pressure when installing in or removing from equipment. Always Handle Tube with Extreme Care. Ground anode contact before touching after power is off.

Operating Considerations

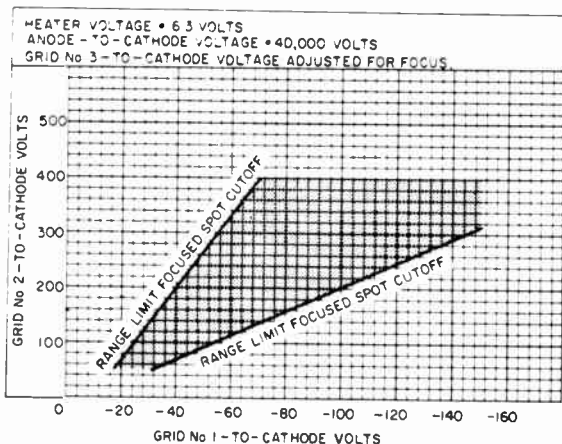
Humidity Considerations. When humidity is high, a continuous film of moisture may form on untreated glass. If a high-voltage gradient is present, this film may permit sparking to take place over the glass surface. In order to minimize the formation of a continuous moisture film, the glass cone is treated with a transparent moisture-repellent insulating coating. This coating must not be scratched, and must be

kept clean and free from contamination such as fingerprints. The coating may be washed with a solution of a mild soapless detergent and water. After the surface is washed, it should be rinsed with clean water and be dried immediately. Any damage to the coating or any contamination on the surface may result in sparking over the cone of the bulb.

Dust Considerations. The high voltage applied to the tube increases the rate at which dust is precipitated on the surface of the tube. The rate of precipitation is further accelerated in the presence of corona. Such dust not only decreases the insulation of the bulb coating but also reduces the amount of radiation transmitted through the bulb face. The dust usually consists of fibrous materials and may contain soluble salts. The fibers absorb and retain moisture; the soluble salts provide electrical leakage paths that increase in conductivity as the humidity increases. Because a film of dust can nullify the protection provided by the insulating coating on the bulb, the tube should be protected as much as possible from dust and should be cleaned, when necessary, as described under **Humidity Considerations**.

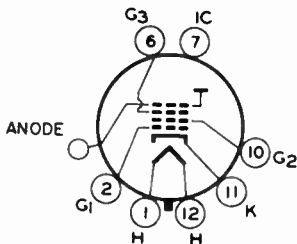
Corona Considerations. A high-voltage system may be subject to corona, especially when the humidity is high, unless suitable precautions are taken. Corona, which is an electrical discharge appearing on the surface of a conductor when the voltage gradient exceeds the breakdown value of air, causes deterioration of organic insulating materials, induces arc-over at points and sharp edges, and forms ozone, a gas which is deleterious to many insulating materials. Sharp points or other irregularities on any part of the high-voltage system may increase the possibility of corona and should be avoided. Instead, rounded contours and surfaces should be used.

Cutoff Design Chart



92LS-2953

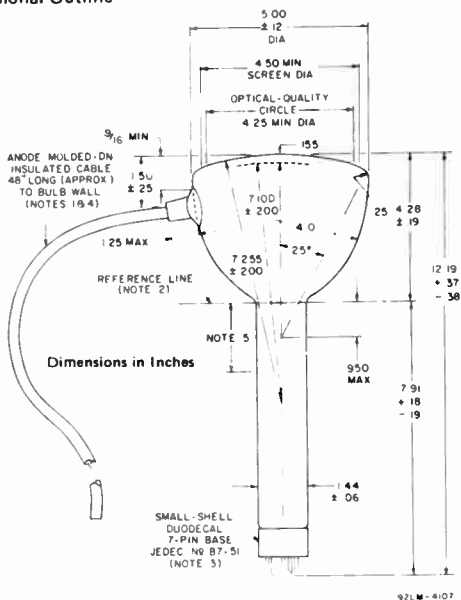
Basing Diagram, Bottom View



- Pin 1: Heater
 Pin 2: Grid No.1
 Pin 6: Grid No.3
 Pin 7: Internal Connection - Do not use
 Pin 10: Grid No.2
 Pin 11: Cathode
 Pin 12: Heater
 Flexible Cable: Anode

Note: Socket contacts for vacant pin positions No.3, 4, 5, 8, and 9 should be removed so that maximum insulation is provided for pins No.6 and 7.

Dimensional Outline



- Note 1** – The plane through the tube axis and vacant pin position No.3 may vary from the plane through the tube axis and anode-cable connection at bulb wall by angular tolerance (measured about the tube axis) of $\pm 20^\circ$. Anode-cable connection is on same side as vacant pin position No.3.
- Note 2** – Reference line is determined by position where gauge 1.500" +0.003" -0.000" I.D. and 2" long will rest on bulb cone.
- Note 3** – Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Socket contacts corresponding to vacant pin positions No.3, 4, 5, 8 and 9 should be removed in order to provide maximum insulation for pins No.6 and 7.
- Note 4** – Anode cable should not be sharply bent within 3" of bulb wall.
- Note 5** – To avoid excessive interaction between the deflecting and focusing fields, the windings of the deflecting yoke should not extend more than 2 inches from the reference line toward the base.



5826

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IMAGE ORTHICON

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 20 μmf

Photocathode, Semi-Transparent:

Response See Curve

Useful Size of Rectangular Image

(4 x 3 aspect ratio). 1.6" max. diagonal

Orientation of Rectangular Image— Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of face plate and pin No.7 of the shoulder base.

Focusing Method. Magnetic

Deflection Method. Magnetic

Overall Length 15-3/16" ± 1/4" ←

Greatest Diameter of Bulb. 3" ± 1/16"

Minimum Deflecting-Coil Inside Diameter. 2-1/8"

Deflecting-Coil Length 5"

Focusing-Coil Length 10"

Alignment-Coil Length. 15/16"

Photocathode Distance Inside End of Focusing Coil. 1/2"

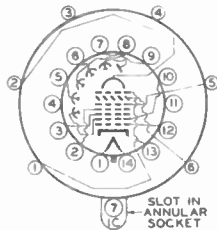
Operating Position: Any except with diheptal base up and tube axis at angle of less than 20° from vertical

End Base Small-Shell Diheptal 14-Pin (JETEC No.B14-45)

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

BOTTOM VIEW

DIRECTION OF LIGHT: PERPENDICULAR TO LARGE END OF TUBE



Shoulder Base Keyed Jumbo Annular 7-Pin

- 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

← indicates a charge.

5826



5826

IMAGE ORTHICON

Maximum Ratings, Absolute Values:

PHOTOCATHODE VOLTAGE	-550 max.	volts
PHOTOCATHODE ILLUMINATION	50 max.	ft-c
OPERATING TEMPERATURE OF ANY PART OF BULB.	65 max.	°C
→ OPERATING TEMPERATURE 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	50 max.	volts
Negative value	50 max.	volts
GRID-NO.5 VOLTAGE.	150 max.	volts
GRID-NO.4 VOLTAGE.	300 max.	volts
GRID-NO.3 VOLTAGE.	400 max.	volts
GRID-NO.2 & DYNODE-NO.1 VOLTAGE.	350 max.	volts
GRID-NO.1 VOLTAGE:		
Negative bias value.	125 max.	volts
Positive bias value.	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	10 max.	volts
ANODE-SUPPLY VOLTAGE [⊕]	1500 max.	volts
VOLTAGE PER MULTIPLIER STAGE	350 max.	volts

Typical Operation:

Photocathode Voltage (Image Focus) . . .	-300 to -500	volts
Grid-No.6 Voltage (Accelerator)—		
75% of photocathode voltage	-225 to -375	volts
Target Voltage [•]	0	volts
Grid-No.5 Voltage (Decelerator) ^{••}	0 to 100	volts
Grid-No.4 Voltage (Beam Focus)	160 to 240	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.	50	μa
→ Target Temperature Range	35 to 60	°C

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

[•] Adjustable from -3 to +5 volts with blanking voltage off.

^{••} Taps at 0, 30, 60, and 90 volts are recommended. Set at voltage giving most uniform resolution and signal output over entire picture area.

^{**} Adjust to give the most uniformly shaded picture near maximum signal.

→ Indicates a change

FEB. 1, 1952

DATA 1

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History



5826

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IMAGE ORTHICON

Highlight illumination on Photocathode for Maximum Signal Output: With 2870°K Tungsten illumination, White Fluorescent illumination, or Daylight.	0.04	ft-c
Ratio of Peak-to-Peak Highlight Video- Signal Cur. to RMS Noise Current (Approx.)	70	
Minimum Peak-to-Peak Blanking Voltage. . . .	10	volts
Field Strength at Center of Focusing Coil. . .	75	gausses
Focusing-Coil Current (Approx. for coil listed below) [□]	75	ma
Deflecting-Coil Current (Approx. for assembly listed below):		
Horizontal (Peak to Peak).	625	ma
Vertical (Peak to Peak).	290	ma
Alignment-Coil Current (Approx. for coil listed below)	0 to 30	ma

Components:

Deflecting-Coil Assembly (Includes Keyed Jumbo Annular 7-Pin Socket).	RCA Type No. 201D75
Focusing-Coil Assembly	RCA Type No. 202D75
Alignment-Coil Assembly.	RCA Type No. 204D75
Hor. Deflection Output Transformer	RCA Type No. 204T1
Ver. Deflection Output Transformer	RCA Type No. 204T2

[□] Direction of current should be such that a north-seeking pole is attracted to the image end of focusing coil.

OPERATING NOTES

After the 5826 has been inserted in its sockets and the voltages applied, allow it to warm up for 1/2 to 1 hour with the camera lens iris closed. Then, proceed with normal operating adjustments.

When the equipment design or operating conditions are such that the maximum temperature rating or maximum temperature difference 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 and its extension. For this purpose, a small blower is satisfactory, but it should run at low speed to prevent vibration of the 5826 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 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.

5826

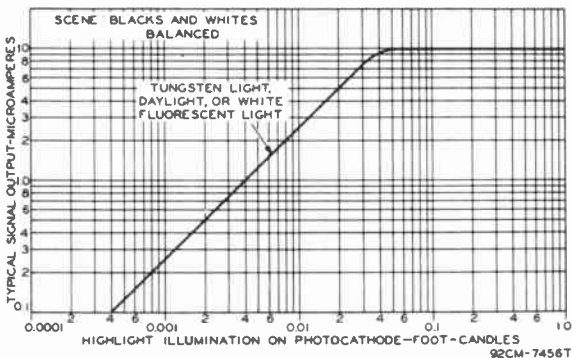


5826

IMAGE ORTHICON

Resolution of better than 500 lines at the center of the picture can be produced by the 5826 when the highlight illumination from an RMA Standard Test Chart is above the knee of the typical signal-output curve for this type. To utilize such resolution capability 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. The maximum resolution obtainable is limited by the mesh-screen portion of the target.

TYPICAL SIGNAL OUTPUT



SPECTRAL SENSITIVITY CHARACTERISTIC

and

OUTLINE DIMENSIONS

are the same as those shown for Type 5820

MAY 1, 1950

TUBE DEPARTMENT

TENTATIVE DATA 2

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History



6499

RADECHON

CHARGE STORAGE TUBE

SINGLE-BEAM, BARRIER-GRID TYPE

NON-EQUILIBRIUM WRITING CAPACITANCE-DISCHARGE READING

6499

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.	9	μf
Deflecting electrode DJ ₁ to all other electrodes	13	μf
Deflecting electrode DJ ₂ to all other electrodes	13	μf
Deflecting electrode DJ ₃ to all other electrodes	11.5	μf
Deflecting electrode DJ ₄ to all other electrodes	11.5	μf
DJ ₁ to DJ ₂	3	μf
DJ ₃ to DJ ₄	3	μf
Grid No.5 to backing-electrode	800	μf
Grid No.5 and backing-electrode to collector	4	μf
Collector to all other electrodes & external cylindrical shield.		See Curve

Focusing Method. Electrostatic

Deflection Method. Electrostatic

Overall Length 11-27/32" \pm 3/8"

Greatest Diameter of Tube. 3.30" \pm 0.05"

Minimum Useful Storage-Surface Diameter. 2-1/4"

Mounting Position. Any except those positions where the diheptal base is up and the tube axis is at an angle of less than 60° from the vertical.

Weight (Approx.) 1 lb

Base:

On large end of tube Small-Button Twentyninar 8-Pin (JETEC No.E8-19)

VIEW OF TWENTYNINAR-BASE END OF TUBE

Pin 2	} Multiple Connections to Backing-Electrode. Only One Need be Used
Pin 6	
Pin 10	
Pin 14	
Pin 18	

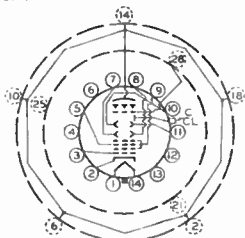
Pin 21 - No Connection

Pin 25 - No Connection

Pin 28 - Grid No.5

PINS 2,6,10,14,18: ON 1-7/8" DIA. PIN CIRCLE

PINS 21,25,28: ON 7/8" DIA. PIN CIRCLE



SOLID-LINE CIRCLES DEPICT DIHEPTAL BASE; BROKEN-LINE CIRCLES DEPICT TWENTYNINAR BASE



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RADECHON

On small end of tube. Small-Shell Diheptal 14-Pin
(JETEC No. B14-45)

VIEW OF DIHEPTAL-BASE END OF TUBE

Pin 1 - Heater	Pin 10 - Deflecting Electrode DJ_2
Pin 2 - Cathode	Pin 11 - Deflecting Electrode DJ_1
Pin 3 - Grid No. 1	Pin 12 - No Connection
Pin 4 - Internal Connection-Do Not Use	Pin 13 - Same as Pin 4
Pin 5 - Grid No. 3	Pin 14 - Heater
Pin 6 - No Connection	C, CL - External Conductive Coating, Collector, Internal Shield, Flange between Neck and Large Part of Tube
Pin 7 - Deflecting Electrode DJ_4	
Pin 8 - Deflecting Electrode DJ_3	
Pin 9 - Ultor (Grids No. 2 & No. 4)	

All voltages are with respect to cathode unless otherwise specified

Maximum Ratings, Absolute Values:

BACKING-ELECTRODE-TO-GRID-No. 5

(BARRIER-GRID) VOLTAGE:

Backing-electrode positive with respect to grid No. 5	100 max. volts
Backing-electrode negative with respect to grid No. 5	100 max. volts

COLLECTOR-TO-GRID-No. 5 VOLTAGE:

Positive value	100 max. volts
Negative value	0 max. volts

ULTOR* VOLTAGE 1500 max. volts

GRID-No. 3 VOLTAGE 500 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 HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode	125 max. volts
Heater positive with respect to cathode	10 max. volts

Equipment Design Ranges:

*For any ultor voltage (E_{C4}) between 1000 and 1500 volts**

Backing-Electrode-to-Grid-No. 5 Voltage. See Note 1

* 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 6499, the ultor function is performed by grid No. 4. Since grid No. 4 and grid No. 2 are connected together within the 6499, they are collectively referred to simply as "ultor" for presenting data.

*: See next page.



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Collector-to-Grid-No.5 Voltage	0 to 50	volts
Grid-No.3 Voltage for Focus with grid- No.1 volts = 0	14% to 26% of E_{c4}	volts
Grid-No.1 Voltage for collector-current cutoff	-2.5% to -4.7% of E_{c4}	volts
Collector Current for grid-No.1 volts = 0	20 to 50	μ amp
Max. Cathode Current for grid-No.1 volts = 0	See Curve	
Deflection Factors:		
DJ ₁ and DJ ₂	85 to 105 v dc/in./kv of E_{c4}	
DJ ₃ and DJ ₄	78 to 96 v dc/in./kv of E_{c4}	
Spot Position	See Note 2	
Signal-Uniformity Ratio	See Note 3	

Examples of Use Design Ranges:

For ultor voltage of	1000	volts
Grid-No.3 Voltage for Focus with grid- No.1 volts = 0	140 to 260	volts
Grid-No.1 Voltage for collector-current cutoff	-25 to -47	volts
Deflection Factors:		
DJ ₁ and DJ ₂	85 to 105	v dc/in.
DJ ₃ and DJ ₄	78 to 96	v dc/in.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting- Electrode Circuit*	1.0 max.	megohm

* In general, the recommended minimum ultor voltage should not be less than 1000 volts. Signal output and resolution decrease with decreasing ultor voltage. Secondary emission characteristics of the dielectric layer limit the maximum ultor voltage to 1500 volts.

* It is recommended that all deflecting-electrode-circuit resistances be approximately equal.

Note 1: The backing-electrode, grid No.5, and ultor are usually operated at the same dc potential. During the writing cycle, the backing-electrode may be pulsed to ± 60 volts with respect to grid No.5.

Note 2: The undeflected focused spot will fall within a circle having a diameter equal to 10% of the minimum storage-surface diameter and having its center coincident with the center of the storage surface.

Spot position is calculated as follows: With heater voltage of 6.3 volts, ultor voltage of 1000 volts, grid-No.5 voltage of 1000 volts, collector voltage of 1050 volts, grid-No.3 voltage adjusted to give focus, grid-No.1 voltage adjusted for 15 microamperes peak collector current, each deflecting electrode connected through a 1-megohm resistor to ultor, and the tube shielded from all extraneous fields, the voltages

Note 3: See next page.



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RADECHON

required to displace the beam from its undeflected position to the edge of the storage surface in the direction of each deflecting electrode are recorded as a for DJ_1 , b for DJ_2 , c for DJ_3 , and d for DJ_4 .

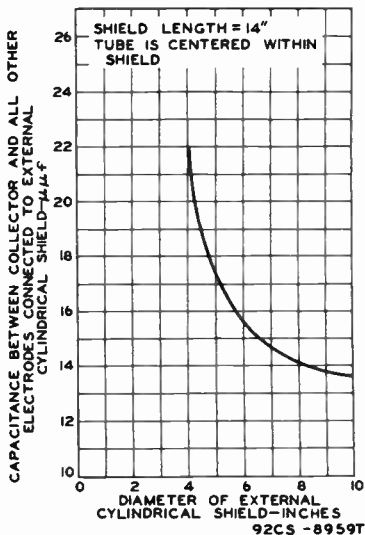
Spot Position in % of Storage-Surface Diameter

$$= 1/2 \sqrt{\left(\frac{b-a}{b+a}\right)^2 + \left(\frac{d-c}{d+c}\right)^2} \times 100$$

Note 3: With voltages as specified in Note 2, and with a signal written into storage by applying a series of well-formed symmetrical square waves to grid No. 1 such that a series of 25 equally spaced stored elements are written across a single line scan, the ratio of the maximum to minimum signal amplitude observed as the single line scan is moved across the storage surface will not exceed 1.35.

OPERATING CONSIDERATIONS

Shielding. The use of a magnetic shield of high-permeability material surrounding the tube is recommended. This shield prevents the effect of stray fields in causing unwanted deflection of the electron beam.

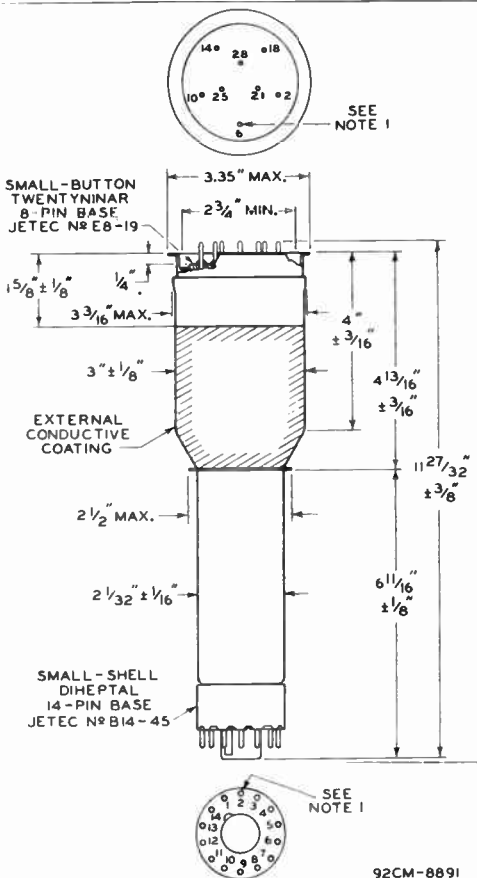
INDICATED CAPACITANCE
VS. SHIELD DIAMETER



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NOTE 1: THE ANGLE BETWEEN PLANE THROUGH PIN 6 OF TWENTYNINAR BASE AND TUBE AXIS, AND PLANE THROUGH PIN 2 OF DIHEPTAL BASE AND TUBE AXIS WILL NOT EXCEED 10°. THE INDICATED PINS ARE BOTH ON THE SAME SIDE OF THE TUBE.

NOTE 2: DEFLECTING ELECTRODES DJ₁ & DJ₂ ARE NEARER THE TARGET. DEFLECTING ELECTRODES DJ₃ & DJ₄ ARE NEARER THE DIHEPTAL BASE.

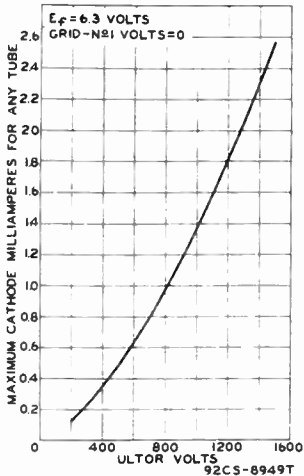
NOTE 3: ANGLE BETWEEN DJ₁ & DJ₂ DEFLECTION PATH AND DJ₃ & DJ₄ DEFLECTION PATH IS 90° ± 30°.



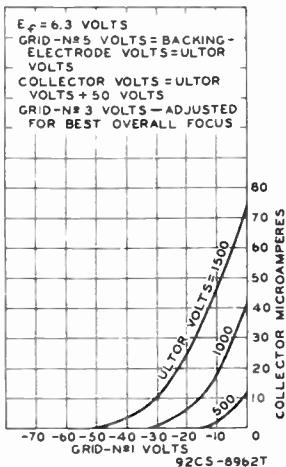
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MAXIMUM CATHODE CURRENT



AVERAGE TRANSFER CHARACTERISTICS

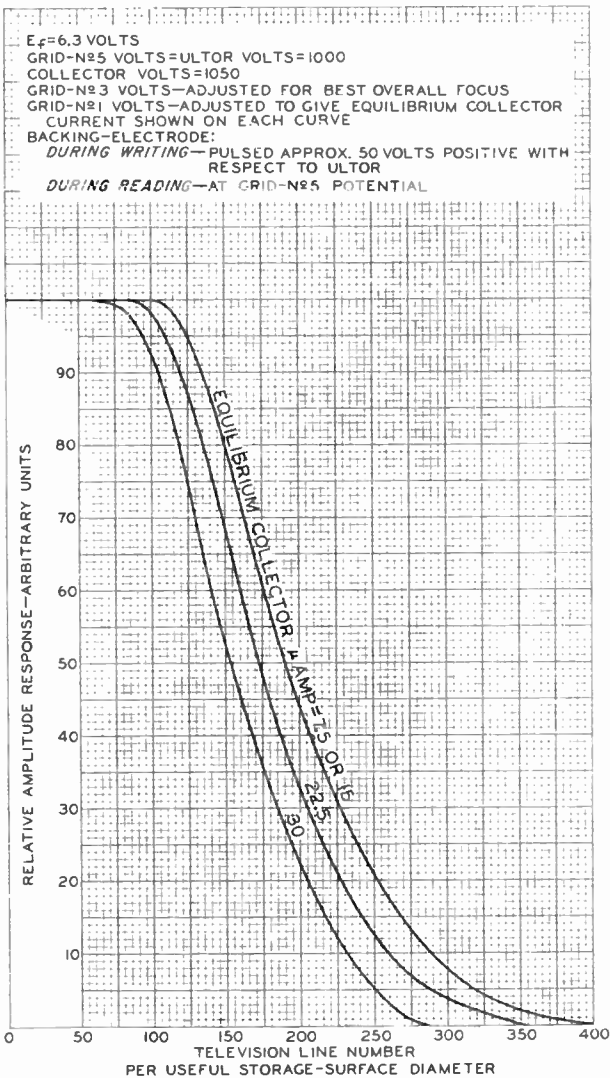




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RESOLUTION CHARACTERISTICS



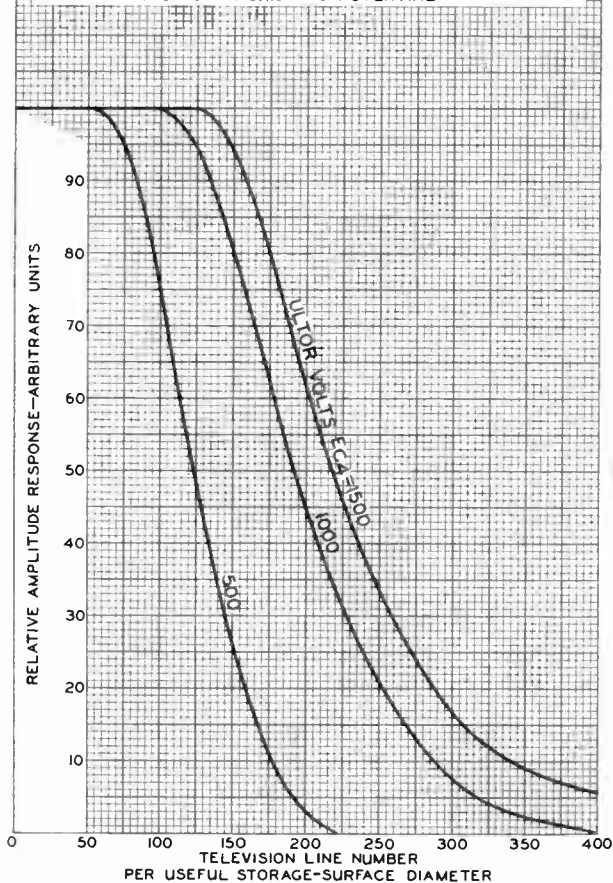
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RESOLUTION CHARACTERISTICS

$E_f = 6.3$ VOLTS
 GRID-N^o 5 VOLTS = ULTOR VOLTS
 COLLECTOR VOLTS = ULTOR VOLTS + 50 VOLTS
 GRID-N^o 3 VOLTS — ADJUSTED FOR BEST OVERALL FOCUS
 GRID-N^o 1 VOLTS — ADJUSTED TO GIVE EQUILIBRIUM COLLECTOR
 CURRENT OF 7.5 MICROAMPERES
 BACKING-ELECTRODE:
 DURING WRITING — PULSED APPROX. 50 VOLTS POSITIVE WITH
 RESPECT TO ULTOR
 DURING READING — AT GRID-N^o 5 POTENTIAL



TUBE DIVISION

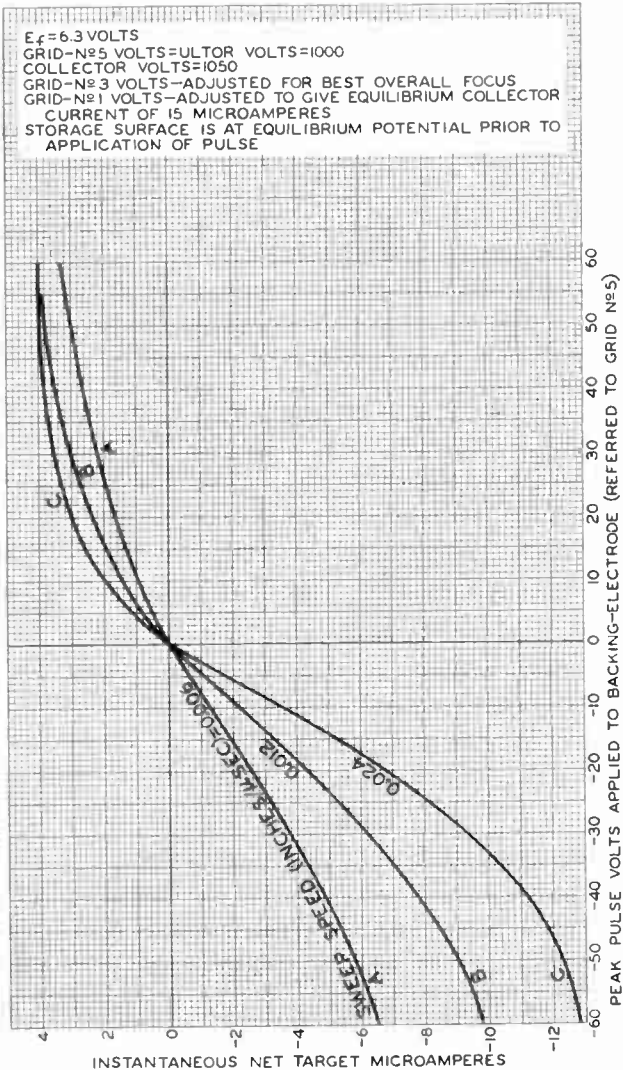
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TYPICAL TARGET CHARACTERISTICS



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APPROXIMATE DISCHARGE-FACTOR CHARACTERISTIC

$E_f = 6.3$ VOLTS

GRID-Nº5 VOLTS = ULTOR VOLTS = 1000

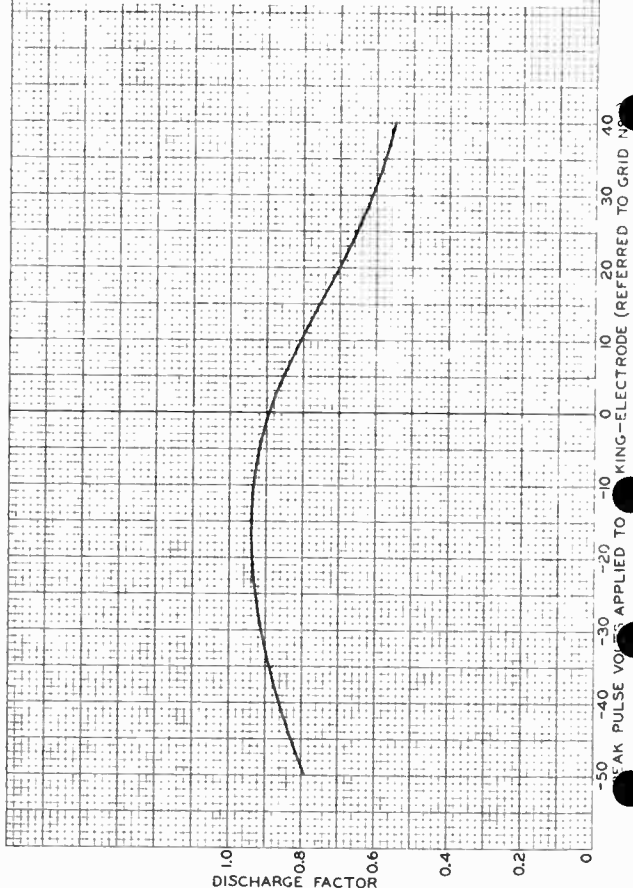
COLLECTOR VOLTS = 1050

GRID-Nº3 VOLTS — ADJUSTED FOR BEST OVERALL FOCUS

GRID-Nº1 VOLTS — ADJUSTED TO GIVE EQUILIBRIUM COLLECTOR
CURRENT OF 15 MICROAMPERES

STORAGE SURFACE IS AT EQUILIBRIUM POTENTIAL PRIOR TO
APPLICATION OF PULSE

SWEEP SPEED = 0.012 INCH/µSEC



TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8960



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DISPLAY STORAGE TUBE

	Writing Section	Viewing Section**		
<i>Equivalent Values</i>				
GRID-No. 4 VOLTAGE	2900 max.*	150 max.**	300 max.	volts
GRID-No. 3 VOLTAGE	1000 max.*	-	300 max.	volts
GRID-No. 2 VOLTAGE	2750 max.*	-	150 max.	volts
CATHODE VOLTAGE	-	-2900 max.**	-	volts
GRID-No. 1 VOLTAGE:				
Negative bias value	200 max.*		100 max.	volts
Positive bias value	0 max.*		0 max.	volts
Positive peak value	2 max.*		0 max.	volts
PEAK VOLTAGE BETWEEN GRID No. 4 AND ANY DEFLECTING ELECTRODE.				
	500 max.		-	volts
PEAK HEATER-CATHODE VOLTAGE:				
Heater negative with respect to cathode.	125 max.*		125 max.	volts
Heater positive with respect to cathode.	125 max.*		125 max.	volts

VIEWING SECTION**

Operating Values and Typical Performance Characteristics:

Screen Voltage	5000	10000	10000	volts
DC Backing-Electrode				
Voltage	5	5	5	volts
Grid-No. 4 Voltage	150	210	150	volts
Grid-No. 3 Voltage [#]	25 to 125	50 to 150	25 to 125	volts
Grid-No. 2 Voltage [†]	50 to 75	70 to 105	50 to 75	volts
Grid-No. 1 Voltage [#]	0 to -50	0 to -75	0 to -50	volts
Maximum Screen Current.	350	600	350	μamp
Maximum Peak Backing-				
Electrode Current	1.5	2	1.5	ma
Maximum Grid-No. 4 Current	2	3	2	ma
Maximum Grid-No. 3 Current	1.5	2	1.5	ma
Maximum Cathode Current	3	4	3	ma
Writing Speed ^{††}	300000	300000	300000	in./sec
Number of Half-Tone Steps [□]	5	5	5	
Viewing Duration	40	20	40	sec
Maximum Erasing-Uniformity				
Factor [△]	0.5	0.5	0.5	
Resolution [#]	50	50	50	lines/in.
Brightness [▲]	275	2750	1500	fl

** Voltages are shown with respect to cathode of Viewing Gun.

Adjusted for brightest, most uniform pattern.

† Grid No. 2 of the viewing Gun is connected internally to grid No. 4 of the Writing Gun.

□ For conditions with combined adjustment of grid-No. 1 voltage, grid-No. 2 voltage, and grid-No. 3 voltage to give brightest, most uniform pattern.

. , † , □ , ▲ , △ , ● : See next page.

← Indicates a change.

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DISPLAY STORAGE TUBE

WRITING SECTION*

Range Values for Equipment Design:*

With any grid-No.2 voltage (E_{c2}) between 500 and 2750 volts

Grid-No.4 voltage (E_{c4})	95% to 105% of E_{c2}	volts
Grid-No.3 Voltage for Focus	14% to 28% of E_{c2}	volts
Maximum Grid-No.1 Voltage for Cutoff of Undelected Focused Spot.	-4.6% of E_{c2}	volts
Maximum Grid-No.3 Current	-15 to +10	μ amp
Maximum Cathode Current	See Curve	
Deflection Factors:		
DJ ₁ and DJ ₂	28 to 38 v dc/in./kv of E_{c4}	
DJ ₃ and DJ ₄	28 to 38 v dc/in./kv of E_{c4}	
Focused Beam Position	##	

Examples of Use of Design Ranges:*

With grid-No.2 voltage of	1500	2500	volts
Grid-No.4 Voltage (E_{c4})	1425 to 1575	2375 to 2625	volts
Grid-No.3 voltage for Focus	210 to 420	350 to 700	volts
Maximum Grid-No.1 voltage for Cutoff of Undelected Focused Spot.	-69	-115	volts
Deflection Factors when $E_{c4} = E_{c2}$:			
DJ ₁ and DJ ₂	42 to 57	70 to 95	v dc/in.
DJ ₃ and DJ ₄	42 to 57	70 to 95	v dc/in.

Equivalent Values for Examples of Writing-Gun Voltages Referred to Cathode of Viewing Gun:

Cathode Voltage	-1450 to -1395	-2450 to -2395	volts
Grid-No.2 Voltage	-25 to +180	-75 to +230	volts
Grid-No.3 voltage for Focus	-1240 to -975	-2100 to -1695	volts
Grid-No.4 Voltage	50 to 105	50 to 105	volts

VIEWING SECTION and WRITING SECTION

Circuit Values:

Grid-No.1-Circuit Resistance (Either gun)	1.0 max.	megohm
Resistance in Any Deflecting-Electrode Circuit [†]	0.1 max.	megohm
Backing-Electrode-Circuit Resistance.	0.005 max.	megohm
Series Current-Limiting Resistance in Screen Circuit.	1.0 min.	megohm

* Voltages are shown with respect to cathode of writing Gun.

†† Measured under conditions of writing from just zero brightness (viewing-beam cutoff) to maximum brightness with grid No.1 of writing Gun at -10 volts with respect to cathode of writing Gun, and grids No.2 and No.4 of writing Gun at +2500 volts with respect to cathode of writing Gun.

□ Observed with an RCA-2F21 Monoscope display.

▲, □, ⊕, ⊖, ●, **, ■: See next page.

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ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

World Radio History

TENTATIVE DATA 2



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DISPLAY STORAGE TUBE

- ▲ Expressed in terms of the time required for the brightness of the un-written background to rise from just zero brightness (viewing-beam cutoff) to 10% of the maximum brightness.
- Defined as $(t_2 - t_1)/t_2$, where
 - t_1 = time measured from start of erasing to instant at which any screen area is reduced to zero brightness.
 - t_2 = time measured from start of erasing to instant at which entire screen area is reduced to zero brightness.
- ⊞ Measured by shrinking-raster method at a display brightness of 50% of saturated brightness and with grids No.2 and No.4 of Writing Gun at +2500 volts with respect to cathode of writing Gun.
- Measured with entire storage grid written to produce maximum brightness and with screen at indicated voltage.
- The cathode of the writing Gun is operated at about -2500 volts with respect to the cathode of the viewing Gun which is usually operated at ground potential.
- ## The center of the undeflected focused beam will fall within a circle having a 10-mm radius concentric with the center of the face under the following conditions: grids No.2 and No.4 of writing Gun at +2500 volts with respect to cathode of writing Gun, grid No.3 of writing Gun at voltage to give focus, grid No.1 of writing Gun at voltage which will permit storage of a charge just sufficient to give a barely perceptible spot on screen, viewing Section operating under normal conditions, and tube shielded against extraneous fields.
- It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

OPERATING CONSIDERATIONS

Magnetic shielding must be provided to prevent external fields from interfering with the required accurate control of the low-velocity viewing beam. A cylindrical shield of properly annealed high-permeability material about 1/16-inch thick is usually satisfactory. The screen cable should be placed outside the shield.

The *metal flange* at the face end of the tube requires the use of a spring-contact ring bearing against the edge of the flange.

To prevent possible damage to the tube, allow the viewing-gun beam current to reach normal operating value before turning on the writing-gun beam current, and keep the viewing beam on until the writing beam is turned off.

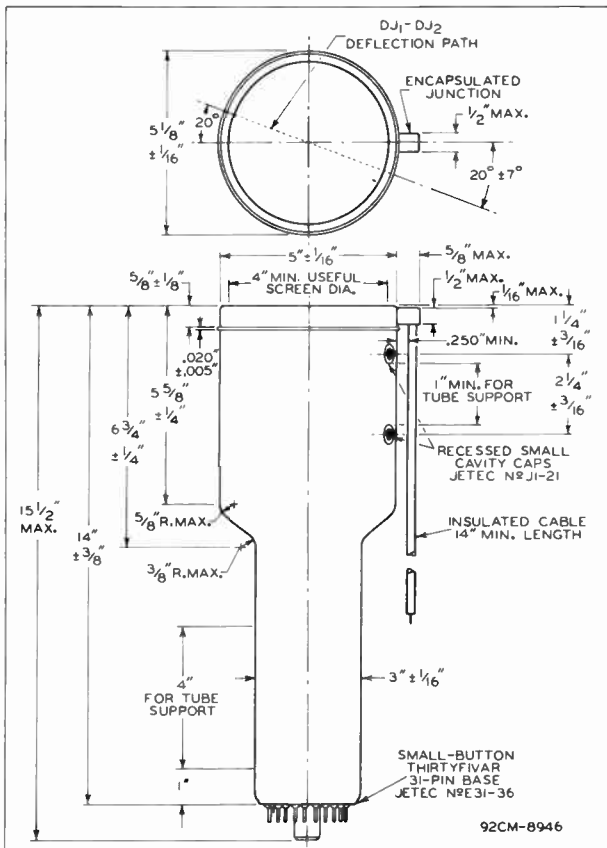
← Indicates a change.

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DISPLAY STORAGE TUBE



CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 30° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT CENTER OF FACEPLATE.

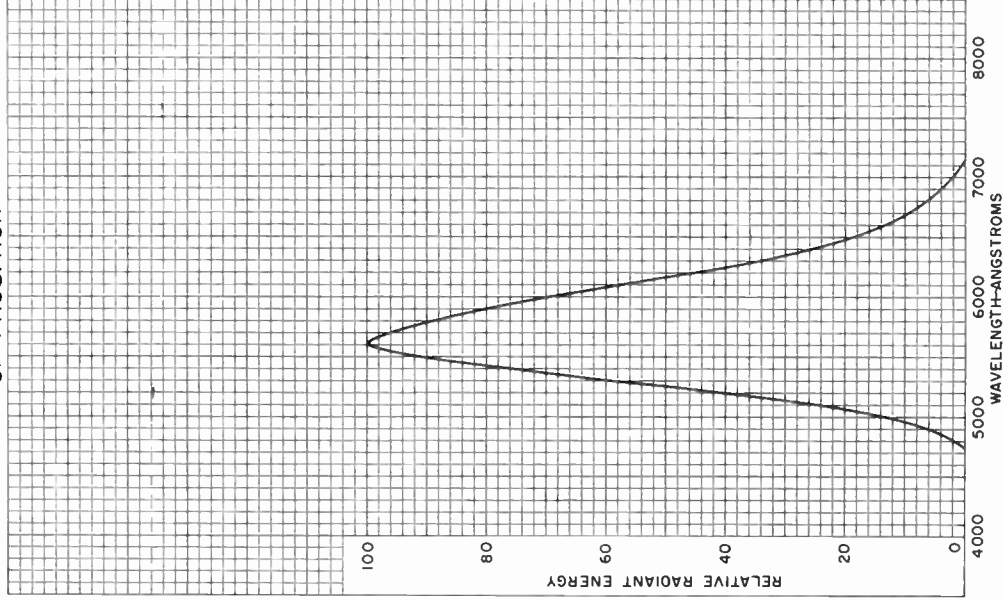
THE PLANE THROUGH TUBE AXIS AND EACH OF THE FOLLOWING ITEMS MAY VARY FROM THE DEFLECTION PATH PRODUCED BY DJ₁ AND DJ₂ BY THE FOLLOWING ANGULAR TOLERANCES (MEASURED ABOUT THE TUBE AXIS): PIN 27, ± 10°; EACH CAVITY CAP (ON SAME SIDE AS PIN 27), + 17°; ENCAPSULATED JUNCTION, + 10°. ANGLE BETWEEN DJ₁ - DJ₂ DEFLECTION PATH AND DJ₃ - DJ₄ DEFLECTION PATH IS 90° ± 30°.

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SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR





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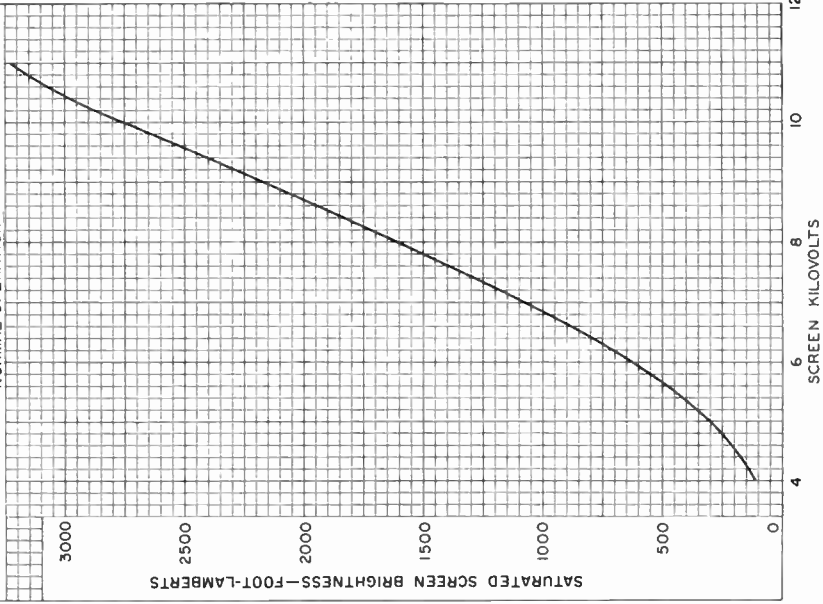
AVERAGE CHARACTERISTIC

VIEWING SECTION

$E_f = 6.3$ VOLTS
 BACKING-ELECTRODE VOLTS* = 5
 GRID-N₂ 4 VOLTS* = 210
 GRID-N₂ 2 VOLTS* = 85
 GRID-N₂ 3 VOLTS* } ADJUSTED FOR BRIGHTEST,
 GRID-N₂ 1 VOLTS* } MOST UNIFORM DISPLAY.
 *REFERRED TO CATHODE OF VIEWING GUN.

WRITING SECTION

NORMAL OPERATION



Display-Storage Tube

5-Inch Diameter

High Display Uniformity

Improved Collimation System Design

Typical Luminance of 1300 Footlamberts

For use in radar and other information-handling systems requiring bright non-flickering displays of stored information, including half-tones, for relatively long periods.

The 7183A is Directly Interchangeable with Type 7183.

GENERAL

	Writing Section	Viewing Section	
Heater, for Unipotential Cathode:			
Voltage (AC or DC)	6.3 ± 10%	6.3 ± 10%	V
Current at 6.3 volts	0.6	0.6	A
Cathode Heating Time (Minimum) before other electrode voltages are applied			
	—	60	s
Direct Interelectrode Capacitances:			
Grid No.1 to all other electrodes	7	—	pF
Cathode to all other electrodes	5	—	pF
Backplate to all other electrodes	—	100	pF
Focusing Method	Electrostatic	—	
Deflection Method	Magnetic	—	
Phosphor	—	P20, Aluminized	
Minimum Useful Viewing Diameter			4"
Maximum Overall Length			11.62"
Maximum Seated Length			11.25"
Maximum Diameter (Excluding Screen Connector Assembly)			5.06"
Bases:			
Writing Gun	Small-Button Neoditetrar	8-Pin	(JEDEC No.E8-49)
Viewing Gun	Small-Button Miniature	7-Pin	(JEDEC No.E7-1)
Bulb Terminals (Five)	Recessed Small Cavity		(JEDEC No.J1-21)

7183A

Screen Connector Assembly Aircraft-Marine
 Products, Inc.,^o Type LGH,
 Part No.832692^b, or equivalent

Operating Position Any

Weight (Approx.) 1-3/4 lb

ABSOLUTE MAXIMUM AND MINIMUM RATINGS

*All voltages are shown with respect to the cathode
 of the viewing gun unless otherwise specified*

	Minimum	Maximum	
Screen Voltage:			
Peak	0	10,000	V
DC	0	9,000	V
Backplate Voltage:			
Peak	0	30	V
DC	-30	10	V
Collector (Viewing-Grid- No.5) Voltage	180	300	V
Collimator (Viewing-Grid- No.4) Voltage	50	150	V
Viewing-Grid-No.3 Voltage, Writing-Grid-No.4 and Writing-Grid-No.2 Voltage ^d . . .	10	150	V
Viewing-Grid-No.2 Voltage . . .	100	150	V
Viewing-Grid-No.1 Voltage . . .	0	-100	V
Viewing-Gun Heater-to- Cathode Voltage	-125	125	V
Writing-Grid-No.3 Voltage ^e . . .	0	1200	V
Writing-Grid-No.1 Voltage ^e . . .	-200	(f)	V
Writing-Gun Cathode Voltage . .	-2750	145	V
Writing-Gun Heater-to- Cathode Voltage	-125	125	V
Series Current-Limiting Resistor (Unbypassed) in Screen Circuit	1	—	MΩ
Series Current-Limiting Resistor (Unbypassed) in Collector (Viewing-Grid- No.5) Circuit	0.005	—	MΩ

RECOMMENDED OPERATING VALUES

*All voltages are shown with respect to the cathode
 of the viewing gun unless otherwise specified*

Screen Voltage	8500	V
Backplate Voltage ^g	0	V
Collector Voltage	250	V
Collimator Voltage ^h	40 to 115	V

Viewing-Grid-No.3 Voltage ^{d,h}	10 to 40	V
Viewing-Grid-No.2 Voltage	100	V
Viewing-Grid-No.1 Voltage ^h	-40 to 0	V
Writing-Grid-No.3 Voltage ^l	-1925 to -1675	V
Writing-Grid-No.1 Voltage	(f,k)	V
Writing-Gun Cathode Voltage	-2500	V

Circuit Values:

Grid-No.1 circuit resistance (Either gun)	1 max.	MΩ
Backplate-circuit resistance	0.005 max.	MΩ
Series current-limiting resistor (Unbypassed) in screen circuit	1	MΩ
Series current-limiting resistor (Unbypassed) in collector (Viewing-grid-No.5) circuit	0.01	MΩ

PERFORMANCE DATA AND CHARACTERISTICS

	Min.	Typ.	Max.	
Useful Viewing Diameter	4.0	—	—	in
Luminance (Brightness) ^m	—	1300	—	fL
Viewing Duration ⁿ	10	—	—	s
Erase Time ^p	—	35	200	ms
Erasing Uniformity Factor: For 4"-diameter area ^q	—	—	0.35	
Resolution ^r	50	—	—	lines/ in
Undelected Spot Position	—	—	(s)	
Screen Current ^m	—	300	750	μA
Viewing-Gun Grid-No.5 Current ^t	—	1.0	2.4	mA
Maximum Viewing-Gun Cathode Current ^u	—	2.5	4	mA
Maximum Writing-Gun Cathode Current ^v	—	2.5	5.0	mA

^a Aircraft-Marine Products, Inc., Capiton Division, 155 Park St., Elizabethtown, Pa.

^b This part mates with Aircraft-Marine Products, Inc., Part No. AMP833589, ceramic terminal, or equivalent.

^d Grids No.4 and No.2 of Writing Gun and grid No.3 of Viewing Gun are connected within the tube.

^e Voltages are shown with respect to cathode of Writing Gun.

^f The writing-gun grid No.1 should never be more positive than necessary to write the display to saturated brightness

for a given scanning and drive condition. In no case should the writing-gun grid-No.1 voltage have a value greater than zero with respect to the writing-gun cathode.

- g Dynamic erasure and bright-ring elimination circuitry are recommended. Dynamic erasure is accomplished by a series of rectangular pulses. The backplate should be maintained at zero volts between erase pulses. Bright-ring elimination is accomplished by connecting an 0.1 μF , 200 VDC capacitor between the backplate electrode and the collimator electrode.
- h Adjusted for brightest, most uniform, full-size pattern.
- i Adjusted for the smallest, most circular spot.
- k The maximum bias-voltage value for writing-beam cutoff is -130 volts with respect to writing-gun cathode.
- m Luminance (Brightness) and screen current are measured after the entire display is written to saturated brightness, the writing gun has been turned off, and with no erasing pulse applied.
- n The time required for any 1.5-inch diameter area of the useful 4-inch diameter viewing area to spontaneously rise (with no writing or erasing) from zero brightness (viewing-beam cutoff) to 10% of saturated brightness.
- p With the display at saturated brightness, a series of rectangular pulses 5 milliseconds in width and at a repetition frequency of 2 pps is applied to the backplate. The number of pulses required to just erase completely the center of the display is noted. This number is multiplied by 5 milliseconds to obtain the erase time. The amplitude of the erase pulses is adjusted to obtain the minimum erase time.
- q Determined as follows: With no erasing pulse, overscan the storage surface with writing beam to obtain maximum pattern brightness. Then cut off writing beam and adjust erasing pulse to obtain complete erasure in approximately 10 seconds. Measure time (t_1) from start of erasing to the instant at which any area within the 4" diameter is reduced to background-brightness level, and time (t_2) from start of erasing to the instant at which the entire area within the 4" diameter area is reduced to background-brightness level. The erasing-uniformity factor is defined as $(t_2 - t_1) / t_2$.
- r Measured by shrinking-raster method at a display brightness of 50% of saturated brightness and with grids No.2 and No.4 of Writing Gun at about +2500 volts with respect to cathode of Writing Gun.

- ^s The undeflected spot position must fall within a circle having a 5/16-inch radius (maximum), 1-3/4-inches from the geometric center of the tube face, on the radius passing through the center of the neck of the writing gun.
- ^t With writing gun turned off, with no erasing pulse applied, and display erased to cutoff.
- ^u Measured with viewing-gun grid No.1 at zero volts and with all other electrodes at voltages shown under *Recommended Operating Values*.
- ^v Measured with writing-gun grid No.1 at zero volts while writing an overscanned TV-type raster.

ENVIRONMENTAL TESTS

The 7183A is designed to withstand the following environmental tests:

Vibration parallel to each of the three orthogonal axes shown in *Fig.1*, and as specified in the schedule below:

Axis of Vibration	Double Amplitude inches	Frequency in Hz	Cycle Duration minutes
X	0.08	30	30
Y	0.08	30	30
Z	0.08	30	30

High and Low Temperature Storage for at least 24 hours at a temperature of +100° C and for at least 24 hours at a temperature of -65° C.

Temperature and Low Pressure (Altitude) in three concurrent phases as specified below:

Phase 1. Storage for one hour at a temperature of -40° C followed by tube operation for five minutes under the conditions shown under *Recommended Operating Values*.

Phase 2. Temperature is increased from -40°C at a rate of 2°C per minute until a temperature of $+86^{\circ}\text{C}$ is reached. Following one hour storage at $+86^{\circ}\text{C}$, the tube is operated for five minutes under the conditions shown under *Recommended Operating Values*.

Phase 3. Barometric pressure is next reduced until a pressure equivalent to an altitude of 20,000 feet is attained. The tube is then operated for five minutes under the conditions shown under *Recommended Operating Values*. Upon completion of the third phase of this test, pressure is increased and temperature decreased, at a rate of 2°C per minute, until ambient pressure-temperature conditions are reached.

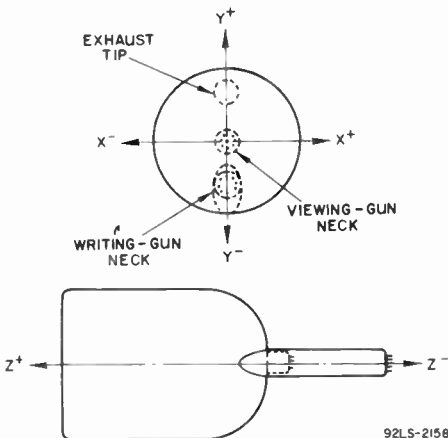
PRECAUTIONS

The following operating precautions must be followed to protect the 7183A from inadvertent damage —

1. Do not exceed maximum ratings.
2. Be sure to include the screen resistor.
3. Be sure to include the collector resistor.
4. Do not apply excessive writing-beam current density.
5. Protect against scanning failure.
6. Protect against loss of bias.
7. Apply voltages to tube in correct order.
8. Never write unless viewing beam is on.
9. Stay within recommended viewing-grid voltage ranges.

SCHEMATIC DIAGRAM

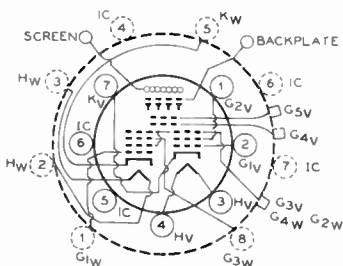
Showing Orthogonal Axes of 7183A
Used during Environmental Tests



92LS-2158

Fig. 1

TERMINAL DIAGRAM (Bottom View)



SOLID-LINE CIRCLES DEPICT
MINIATURE 7-PIN BASE
BROKEN-LINE CIRCLES DEPICT
NEODITETRAR 8-PIN BASE

VIEWING SECTION

Small-Button Miniature 7-Pin Base

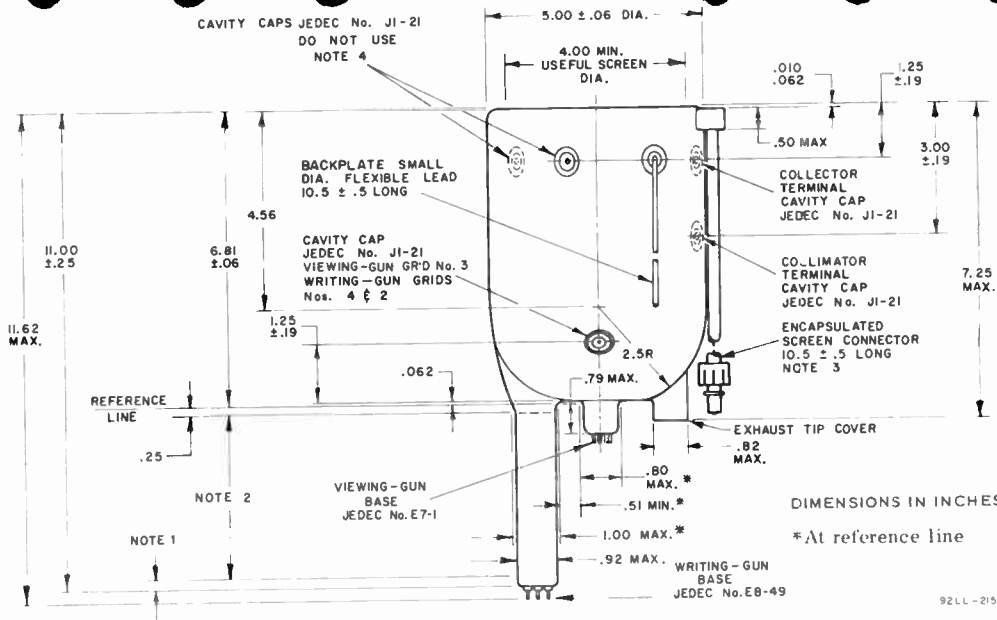
Pin 1: Grid No.2	Recessed Cavity Caps:
Pin 2: Grid No.1	Collector (Grid No.5) –
Pin 3: Heater	Located 1.25" from tube
Pin 4: Heater	face; 15° from center
Pin 5: Internal Connection –	line through writing and
Do Not Use	viewing gun necks away
Pin 6: Internal Connection –	from screen connector.
Do Not Use	Collimator (Grid No.4) –
Pin 7: Cathode	located 3" from tube
Flexible Lead (Large):	face; 15° from center
Screen	line through writing and
Flexible Lead (Small):	viewing gun necks away
Backplate	from screen connector.
	Located near viewing gun–
	Grid No.3 and Grids No.4
	& No.2 of writing gun.

WRITING SECTION

Small-Button Neoditetrar 8-Pin Base

Pin 1: Grid No.1	Pin 6: Internal Connection –
Pin 2: Heater	Do Not Use
Pin 3: Heater	Pin 7: Internal Connection –
Pin 4: Internal Connection –	Do Not Use
Do Not Use	Pin 8: Grid No.3
Pin 5: Cathode	

Note : Grids No.4 & No.2 are connected
internally to Grid No.3 of viewing gun



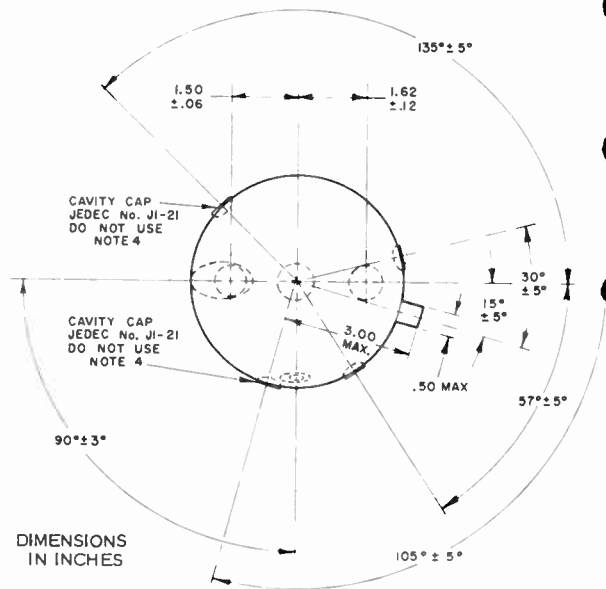
DIMENSIONAL OUTLINE (Front View)

7183A

92LL-2153

7183A

DIMENSIONAL OUTLINE (Top View)



NOTES FOR DIMENSIONAL OUTLINE

Note 1: Within this distance, neck diameter is .920" max.

Note 2: Within this distance, neck diameter is .950" max.

Note 3: Aircraft-Marine Products, Inc., type LGH Part No. 832692, or equivalent. This part mates with Aircraft-Marine Products, Inc., Part No. AMP833589, ceramic terminal, or equivalent.

Note 4: Do not use these cavity caps for connection. The caps are connected internally and may be at a potential which could constitute a shock hazard. It is recommended that these caps be covered with electrical insulation.

Display-Storage Tube

"RUGGEDIZED" TYPE
TWO WRITING GUNS
ONE VIEWING GUN

5-INCH DIAMETER
4-INCH-DIAMETER DISPLAY
INTEGRAL MAGNETIC SHIELD

For Use in Military and Commercial Information-Handling Displays Where Rough Tube Usage May be Encountered. The 7268A is Unilaterally Interchangeable with Type 7268.

ELECTRICAL

Heater, for Unipotential Cathode

All guns			
Voltage (AC or DC)	6.3 ± 10%	V	
Current at 6.3 V	0.6	A	
Cathode Heating Time	30	s	
Minimum, before other electrode voltages are applied			

Writing Section - Each Gun

Focusing Method	Electrostatic
Deflection Method	Electrostatic
Deflecting-Electrode Arrangement	See <i>Dimensional Outline</i>
Direct Interelectrode Capacitances	
Grid No.1 to all other electrodes	15 max pF
Cathode to all other electrodes	8 max pF
Deflecting electrode DJ1 to deflecting electrode DJ2	3 max pF
Deflecting electrode DJ3 to deflecting electrode DJ4	2 max pF
DJ1 to all other electrodes	10 max pF
DJ2 to all other electrodes	10 max pF
DJ3 to all other electrodes	10 max pF
DJ4 to all other electrodes	10 max pF

Viewing Section

Direct Interelectrode Capacitances	
Grid No.1 to all other electrodes	18 max pF
Cathode to all other electrodes	10 max pF
Backplate to all other electrodes	110 max pF

OPTICAL

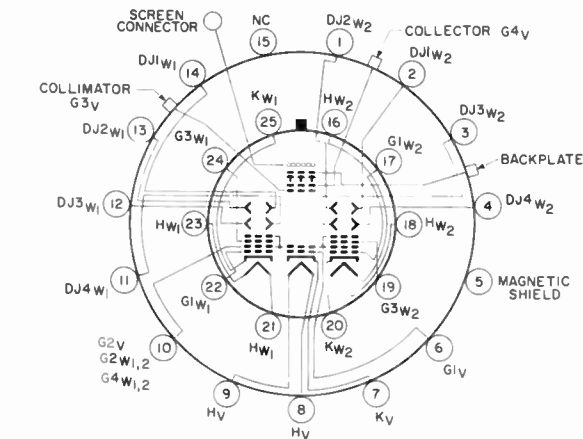
Phosphor P20, Aluminized

MECHANICAL

Operating Position	Any
Minimum Useful Viewing Diameter	4 in
Maximum Overall Length	16 in
Maximum Diameter	5.28 in
Excluding screen lead	
Screen-Connector Assembly	See <i>Dimensional Outline</i>
Weight	5-1/4 lb
Bulb Terminals	Recessed Small-Ball (JEDEC No. J1-22)
Caps (Three)	
Base	JEDEC No. B25-216



TERMINAL DIAGRAM (Bottom View)



- Pin 1—Deflecting Electrode
D₂ of Writing Gun No. 1
- Pin 2—Deflecting Electrode
D₁ of Writing Gun No. 2
- Pin 3—Deflecting Electrode D₃
of Writing Gun No. 2
- Pin 4—Deflecting Electrode D₄ of
Writing Gun No. 2
- Pin 5—Integral Magnetic Shield
- Pin 6—Grid No. 1 of Viewing Gun
- Pin 7—Cathode of Viewing Gun
- Pin 8—Heater of Viewing Gun
- Pin 9—Heater of Viewing Gun
- Pin 10—Grid No. 2 of Viewing Gun,
Grid No. 1 and Grid No. 4 of
Writing Gun No. 1 and No. 2
- Pin 11—Deflecting Electrode DJ₄
of Writing Gun No. 1
- Pin 12—Deflecting Electrode DJ₃
of Writing Gun No. 1
- Pin 13—Deflecting Electrode DJ₂
of Writing Gun No. 1
- Pin 14—Deflecting Electrode DJ₁
of Writing Gun No. 1

- Pin 15—NC—No internal
connection
- Pin 16—Heater of Writing Gun No. 1
- Pin 17—Grid No. 2 of Writing Gun
No. 1
- Pin 18—Heater of Writing Gun No. 2
- Pin 19—Grid No. 3 of Writing Gun
No. 2
- Pin 20—Cathode of Writing Gun No. 2
- Pin 21—Heater of Writing Gun No. 2
- Pin 22—Grid No. 1 of Writing Gun
No. 2
- Pin 23—Heater of Writing Gun No. 2
- Pin 24—Grid No. 3 of Writing Gun
No. 2
- Pin 25—Cathode of Writing Gun No. 1
(Flashed Lead-in) (Encapsulated
Refer to Small Ball Cap—
Over Pin No. 3 Collimator
Viewing Grid No. 3)
Over Pin No. 13 Collector
(Viewing Grid No. 4)
Over Pin No. 14 Backplate

MAXIMUM AND MINIMUM RATINGS, ABSOLUTE-MAXIMUM VALUES

All voltages are shown with respect to the cathode of the viewing gun unless otherwise specified.

	Min	Max	
Screen Voltage			
Per	-	11500	V
DC	0	11000	V
DC Backplate Voltage	0	35	V
Collector Voltage ^a	0	300	V
Viewing-grid-No.1			
Collimator Voltage ^b	0	300	V
Viewing-grid-No.2			
Viewing-Grid-No.2, Writing-Grid-No.4, and Writing-Grid-No.2 voltage ^{c,d}	0	200	V
Viewing-Grid-No.1 Voltage ^a	-150	0	V
Viewing-Gun Heater-to-Cathode Voltage.	-125	125	V
Magnetic Shield Voltage.	-200	200	V
Writing-Grid-No.4, Writing-Grid-No.2 To Any Deflecting Electrode Voltage.	-500	500	V
Each gun ^b			
Writing-Grid-No.3 Voltage.	0	2000	V
Each gun ^c			
Writing-Grid-No.1 Voltage.	-200	(d)	V
Each gun ^c			
Writing-Gun Cathode Voltage.	-2800	0	V
Each gun			
Writing-Gun Heater-To-Cathode Voltage.	-125	125	V
Each gun			
Series Current-Limiting Resistor			
Unbypassed, in screen circuit.	1	-	MΩ
Unbypassed, in viewing-grid-no.4 circuit	0.005	-	MΩ

RECOMMENDED OPERATING VALUES

All voltages are shown with respect to the cathode of the viewing gun unless otherwise specified.

Screen Voltage	10000	V
Backplate Voltage ^e	2	V
Collector Voltage.	265	V
Viewing-grid-no.1		
Collimator Voltage ^f	50 to 125	V
Viewing-grid-no.2		
Viewing-Grid-No.2 Voltage ^a	100	V
Viewing-Grid-No.1 Voltage ^f	-50 to 0	V
Writing-Grid-No.3 Voltage.	-2325 to -1975	V
Each gun ^g		
Writing-Grid-No.1 Voltage		
Each gun	(d,h)	V
Writing-Gun Cathode Voltage.	-2400	V
Magnetic Shield Voltage.	0	V
Average Deflecting Plate Voltage ^j	100	V
Circuit Values		
Grid-No.1 circuit resistance, either gun.	1 max	MΩ



Circuit Values (cont'd)

Impedance in any deflecting electrode circuit ^k	0.01	max	M Ω
Backplate-circuit resistance	0.005	max	M Ω
Series current-limiting resistor:			
Unbypassed, in screen circuit	1		M Ω
Grid res. in collector viewing-grid No. 4 circuit	0.01		M Ω

CHARACTERISTICS

	Min	Typ	Max	
Useful Viewing Diameter	4	-	-	in
Brightness (Luminance) ^m	-	2500	-	fL
Viewing Duration ⁿ	15	-	-	s
Erase Time ^k	-	28	-	ms
Resolution ^q	70	-	-	lines/in
Undelected Spot Position	-	-	(r)	mm
Deflection Factors				
D ₁ & W ₂	82	-	100	V/in
D ₃ & W ₄	82	-	100	V/in

^a These voltages should never be adjusted to values which will permit the display of a sharply-defined circular area of brightness having a diameter of less than 3.5 inches. See *Operating Procedure* for the proper set-up to follow.

^b Grids No. 1 and No. 2 of writing gun and the grid No. 2 of viewing gun are connected within the tube.

^c Voltages are shown with respect to cathode of writing gun.

^d The writing-gun grid No. 1 should never be more positive than necessary to write the display to saturated brightness for a given scanning and drive condition. In no case should the writing-gun grid-No. 1 voltage have a value greater than zero with respect to the writing-gun cathode.

^e The backplate should be maintained at 2 volts between erasing pulses when dynamic erasure is employed.

^f Adjusted for brightest, most uniform, full-size pattern.

^g Adjusted for the smallest, most circular spot.

^h The bias-voltage value for writing-beam cutoff is between -60 and -100 volts with respect to writing-gun cathode.

^j With respect to the viewings-gun cathode for each pair of deflecting electrodes.

^k Recommended value for minimum distortion because of viewing-beam collection by the deflecting plates. Where strict display accuracy and display uniformity are not required, the impedance value for any deflecting-electrode circuit may be as high as 0.1 megohm maximum. For optimum performance, it is recommended that the deflecting-electrode-circuit impedances be approximately equal.

^m Brightness (Luminance) is measured after the entire display is written to saturated brightness, the writing gun has been turned off and with no erasing pulse applied.

ⁿ The time required for any 0.5-inch diameter area of the 4-inch-diameter viewing area to rise spontaneously (with no writing or erasing) from zero brightness (viewing-beam visual cutoff) to 10% of saturated brightness.

^p With the display at saturated brightness, a series of rectangular pulses 5 millisecons in width and at a repetition frequency of 2 p.s. is applied to the backplate. The number of pulses required to just erase completely the center of the display is noted. This number is multiplied by 5 millisecons to obtain the erase time. The amplitude of the erase pulses is adjusted to obtain the minimum erase time.

^q Measured by the "shrinking" raster method under conditions of continuous writing and erasing with erase pulses of 60 μ sec width and a repetition frequency of 300 p.s. The amplitude of the erase pulses is adjusted to provide 3.5-second erasure and grid No. 1 is adjusted to provide 1000 foot-lamberts brightness of the just "shrunk" raster.

^r The undelected spot position must fall within a square having a 15 millimeter side (maximum) centered on the tube face and parallel to a trace produced by one set of deflecting plates.



Performance Data:

Writing Ability and *Writing Uniformity* characteristics are measured singly for both guns. A 3.5 x 3.5 inch raster is centered on the tube face. Vertical scanning is accomplished by an interrupted linear sawtooth waveform having a scan time of 625 microseconds and a prf of 500 p/s. Horizontal scanning is provided by a triangular waveform having a scan rate of 3.5 inches per second.

Writing Ability. The writing-gun grid No. 1 of the gun under test is driven above cutoff during the vertical scan time by white noise, of approximately 5 megacycles bandwidth, having a zero-to-peak amplitude of approximately 35 volts. The display brightness under these conditions shall be at least 20% of saturated brightness.

Writing Uniformity. This characteristic is determined under the same conditions as specified above except that the rms amplitude of the white noise is adjusted to produce brightness of 40% of saturated brightness of the dimmest area in the display. The measured brightness at the brightest area of the display shall be not more than 80% of saturated brightness.

Environmental Tests:

The 7268A is designed to withstand the following operational and non-operational environmental tests.

Operational Tests:

Sinusoidal Vibration. This test consists of tube vibration in each of three orthogonal axes. One of these axes is in the plane passing through the major axis of the tube and the center of the tube-base key. The tube is mounted so that its major axis is parallel to the plane of the earth. A total of 6 cycles of swept sinusoidal vibration, from 10 to 500 and back to 10 cycles per second, is performed. The duration of a sweep cycle is 15 minutes. The frequencies of any resonant points are noted. The sinusoidal vibration schedule is shown below.

Double Amplitude inches	Peak Acceleration g's	Sweep Frequency c/s	Sweep Cycle Duration minutes
0.27	-	10 to 20	15
-	4	20 to 46	
-	2	46 to 500	
-	2	500 to 46	
-	4	46 to 20	
0.27	-	20 to 10	

Vibration of Resonance. This test consists of tube vibration at the resonant point or points determined in *Sinusoidal Vibration* for a period of 30 minutes. If more than one



resonant point is noted for a given axis, the tube is vibrated for a total of 30 minutes at that resonant point in each axis most likely to produce tube failure. If no resonant points are determined in *Sinusoidal Vibration*, the tube is vibrated for 60 minutes at a frequency of 55 cycles per second.

Low Pressure - High Temperature. This test consists of tube storage for a period of not less than one hour at a temperature of $+100^{\circ}\text{C}$. At the termination of this storage period, the tube is operated with the values shown under *Recommended Operating Values* applied and at a pressure equivalent to an altitude of 32,000 feet. The temperature is then reduced to $+53^{\circ}\text{C}$. The tube is stored at this temperature for 1 hour and then is operated with normal voltages applied at a pressure equivalent to an altitude of 60,000 feet.

Low Temperature. This test consists of the tube being maintained at a temperature of -65°C for 48 hours. At the end of this period and while the tube is still at -65°C , the tube is operated with recommended voltages applied for 15 minutes.

Non-Operational Tests:

Temperature Cycling. This test consists of tube storage for a period of not less than 2 hours at a temperature of -65°C followed within 5 minutes by storage for a period of 2 hours at a temperature of $+100^{\circ}\text{C}$. A minimum of five consecutive cycles are performed.

High Pressure. This test consists of tube exposure to an absolute pressure of 45 pounds per square inch for a period of at least 60 seconds. This pressure shall be attained within 60 seconds.

Torque. This test consists of the application of a torque of 40 inch-pounds between the integral magnetic shield and the tube base.

Salt Spray. This test consists of tube exposure to a fine spray from a salt solution for a period of 48 hours. The ambient temperature is maintained at approximately 35°C .

OPERATING PROCEDURE

The following steps should be followed when the 7268A is first placed in operation. Refer to the precautions shown under *Operating Considerations* in the publication ICE-277 "RCA Display-Storage Tubes". Note that all electrode voltages are referred to the cathode of the viewing gun unless otherwise specified.

1. **Viewing Gun.** Apply power to the heater of the viewing gun and allow 60 seconds for the cathode to reach normal operating temperature. Next apply the following voltages to the viewing-gun electrodes: zero volts to the viewing-gun cathode, zero volts to the viewing-gun grid No. 1, $+100$ volts to the viewing-gun grid No. 2, -125 volts to the collimator, $+265$ volts to the collector, $+2$ volts to the backplate, and $+10,000$ volts to the screen. Except for the application of screen voltage, which may be increased, at the user's option,



from 0 volts to 10,000 volts slowly, all of the above voltage values should be applied to the tube simultaneously and without first passing through intermediate voltage values. Next apply dynamic erasing pulses to the backplate. Adjust the viewing-gun grid-No.1 voltage to a value midway between zero volts and that voltage at which the viewing diameter begins to decrease. Reduce the collimator voltage until the viewing diameter starts to decrease, and then increase the collimator voltage by 10 volts. The storage property of the tube can be observed by setting the amplitude of the dynamic erasing pulses at +12 volts for several seconds and by then reducing it to zero volts. As the erasing pulse amplitude is reduced the screen should go dark. The 7268A is now storing an overall "black picture" and stays in this condition until the screen begins to brighten as a result of the storage grid being gradually discharged by positive ions landing on it.

2. *Writing Gun*—Apply power to the heater of the writing gun and allow 60 seconds for the cathode to reach normal operating temperature. Then, with reference to the typical operating values shown in the tabulated data under *Recommended Operating Values*, set the grid-No.1 voltage to cutoff, and apply dc voltages to the electrodes of the writing gun. With the screen made dark by the charging method described under (1), the grid-No.1 bias is reduced until the writing beam is seen as a spot on the screen. If the beam is caused to move, either by centering adjustment or by application of deflection voltage, it should leave a bright trace. After an area has been written to full brightness, the writing-beam spot may be seen as a slightly brighter spot on the bright background. Writing-beam focus can then be optimized by adjusting the grid-No.3 voltage.

3. *Final Display Adjustments*—The dc bias and the video-signal amplitude applied to grid No.1 or cathode of the writing gun should be adjusted to set the black level and the highlight level in the display. These adjustments depend on the scanning rate used. Resolution decreases with increasing writing-gun beam current. Excessive writing-gun beam current will produce screen saturation and any further beam-current increase will not produce additional highlight brightness and may also decrease half-tone rendition. It is recommended that the writing-beam current always be adjusted to a minimum value to produce the best display without saturation of highlight brightness. The dynamic erasing-pulse amplitude and duty cycle should be adjusted in accordance with the information contained in ICE-277. The collimator voltage should be adjusted for optimum display uniformity. If the collimator voltage is too high, the center area of the display will tend to erase slowly. If the collimator voltage is too low, the edges of the display will tend to erase slowly.

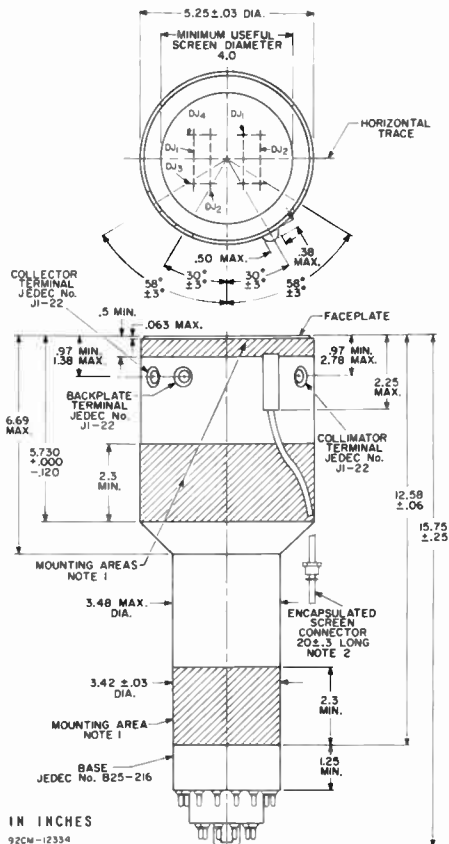
The following operating precautions must be followed to protect the 7268A from inadvertent damage—

1. Do not exceed maximum ratings.
2. Be sure to include the screen resistor.
3. Be sure to include the collector resistor.



4. Do not apply excessive writing-beam current density.
5. Protect against scanning failure.
6. Protect against loss of bias.
7. Apply voltages to tube in correct order.
8. Never write unless viewing beam is on.
9. Stay within recommended viewing-grid voltage ranges.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

92CM-12334

Note 1: The indicated areas are recommended for mounting purposes.

Note 2: Amp Part No. Amp 812 692-0; manufactured by Aircraft Marine Products, Inc., Harrisburg, Pa., or equivalent.

Display-Storage Tube

FACTORY-COLLIMATED "RUGGEDIZED" TYPE 5-INCH DIAMETER
TWO WRITING GUNS 4-INCH-DIAMETER DISPLAY
ONE VIEWING GUN INTEGRAL MAGNETIC SHIELD

For Use in Military and Commercial Information Handling Displays Where Rough Tube Usage May Be Encountered. The 7268B is Unilaterally Interchangeable with Types 7268 and 7268A.

ELECTRICAL

Heater, for Unipotential Cathode (All guns)
 Voltage (AC or DC) 6.3 ± 10% V
 Current at 6.3 0.6 A
Cathode Heating Time (Minimum) 30 s
 Before other electrode voltages are applied

Writing Section—Each Gun

Focusing Method Electrostatic
Deflection Method Electrostatic
Deflecting-Electrode Arrangement . . . See *Dimensional Outline*
Direct Interelectrode Capacitances
 Grid to .01 to all other electrodes 15 max pF
 Cathode to all other electrodes 8 max pF
 Deflecting electrode DJ1 to deflecting
 electrode DJ2 3 max pF
 Deflecting electrode DJ2 to deflecting
 electrode DJ1 2 max pF
 DJ1 to all other electrodes 10 max pF
 DJ2 to all other electrodes 10 max pF
 DJ3 to all other electrodes 10 max pF
 DJ4 to all other electrodes 10 max pF

Viewing Section

Direct Interelectrode Capacitance
 Backplate to all other electrodes 110 max pF

OPTICAL

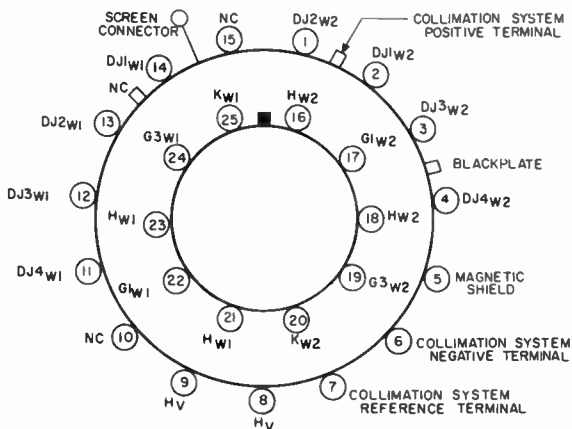
Phosphor P20, Aluminized

MECHANICAL

Operating Position Any
Minimum Useful Viewing Diameter 4 in
Maximum Overall Length 16 in
Maximum Diameter 5.28 in
 Excluding screen lead
Screen-Connector Assembly See *Dimensional Outline*
Weight 5-1/4 lb
Bulb Terminals
 Caps (Three) Recessed Small Ball (JEDEC No. J1-22)
Base JEDEC No. B25-216



TERMINAL DIAGRAM (Bottom View)



92LS-1218

- | | |
|---|---|
| Pin 1 - Deflecting Electrode
DJ2 of Writing Gun No. 2 | Pin 17 - Grid No. 1 of Writing
Gun No. 2 |
| Pin 2 - Deflecting Electrode
DJ1 of Writing Gun No. 2 | Pin 18 - Heater of Writing Gun
No. 2 |
| Pin 3 - Deflecting Electrode
DJ3 of Writing Gun No. 2 | Pin 19 - Grid No. 3 of Writing
Gun No. 2 |
| Pin 4 - Deflecting Electrode
DJ4 of Writing Gun No. 2 | Pin 20 - Cathode of Writing Gun
No. 2 |
| Pin 5 - Integral Magnetic Shield | Pin 21 - Heater of Writing Gun
No. 1 |
| Pin 6 - Collimation System
Negative Terminal | Pin 22 - Grid No. 1 of Writing
Gun No. 1 |
| Pin 7 - Collimation System
Reference Terminal | Pin 23 - Heater of Writing Gun
No. 1 |
| Pin 8 - Heater of Viewing Gun | Pin 24 - Grid No. 3 of Writing
Gun No. 1 |
| Pin 9 - Heater of Viewing Gun | Pin 25 - Cathode of Writing Gun
No. 1 |
| Pin 10 - No Internal
Connection | Flexible Lead - Screen
(Frogsul) Lead |
| Pin 11 - Deflecting Electrode
DJ4 of Writing Gun No. 1 | Persees Small Ball Caps -
Over Pin No. 3 |
| Pin 12 - Deflecting Electrode
DJ3 of Writing Gun No. 1 | NC - No Internal Connection |
| Pin 13 - Deflecting Electrode
DJ2 of Writing Gun No. 1 | Over Pin No. 13 |
| Pin 14 - Deflecting Electrode
DJ1 of Writing Gun No. 1 | Collimation System Positive
Terminal |
| Pin 15 - NC - No Internal
Connection | Over Pin No. 14 |
| Pin 16 - Heater of Writing Gun
No. 2 | Barkhousen |



MAXIMUM AND MINIMUM RATINGS, ABSOLUTE MAXIMUM VALUES

All voltages are shown with respect to the reference terminal of the collimation system unless otherwise specified. The reference terminal must be grounded.

	Min	Max	
Screen Voltage			
Perk.	-	11500	V
DC.	0	11000	V
DC Backplate Voltage.	0	35	V
Collimation System^a			
Positive-terminal voltage	0	300	V
Negative-terminal voltage	-100	-50	V
Viewing-Gun Heater.	-125	125	V
Magnetic Shield Voltage	-200	200	V
Deflecting-Electrode Voltage.	-600	600	V
Each gun			
Writing-Grid-No.3 Voltage	0	2000	V
Each gun ^b			
Writing-Grid-No.1 Voltage	-200	(c)	V
Each gun ^b			
Writing-Gun Cathode Voltage	-2800	0	V
Each gun			
Writing-Gun Heater-to-Cathode Voltage	-125	125	V
Each gun			
Series Current-Limiting Resistor			
Unbypassed, in screen circuit	1	-	MΩ
Unbypassed, in collimation system positive terminal circuit.	0.005	-	MΩ

RECOMMENDED OPERATING VALUES

All voltages are shown with respect to the reference terminal of the collimation system unless otherwise specified.

Screen Voltage.	10000	V
Backplate Voltage^d.	2	V
Collimation System^a		
Positive-terminal voltage	265	V
Negative-terminal voltage	-55	V
Reference terminal	grounded	
Writing-Grid-No.3 Voltage	-2325 to -1975	V
Each gun ^e		
Writing-Grid-No.1 Voltage	(c, f)	V
Each gun		
Writing-Gun Cathode Voltage	-2400	V
Magnetic Shield Voltage	0	V
Average Deflecting Plate Voltage^g	100	V
Circuit Values		
Grid-No.1 circuit resistance (Filter gun).	1 max	MΩ
Impedance in any deflecting electrode circuit ^h	0.01 max	MΩ
Backplate-circuit resistance.	0.005 max	MΩ
Series current-limiting resistor:		
Unbypassed, in screen circuit	1	MΩ
Unbypassed, in collimation system positive terminal circuit.	0.005	MΩ



CHARACTERISTICS

	Min	Typ	Max	
Useful Viewing Diameter	4	-	-	in
Brightness (Luminance) ^j	-	2500	-	fL
Viewing Duration ^k	15	-	-	s
Erase Time ^m	-	28	-	ms
Resolution ⁿ	70	-	-	lines/in
Undelected Spot Position	-	-	(p)	mm
Deflection Factors				
DJ1 & DJ2	82	-	100	V/in
DJ3 & DJ4	82	-	100	V/in

- a The collimation system includes a passive internal network which provides the proper voltages for all viewing gun electrodes; except screen, backplate and heater; as well as grids No.2 and 4 of the writing gun. Voltages are shown with respect to cathode of writing gun.
- b The writing-gun grid No.1 should never be more positive than necessary to saturate the display to saturated brightness for a given scanning and drive condition. In no case should the writing-gun grid No.1 voltage have a value greater than zero with respect to the writing-gun cathode.
- c The backplate should be maintained at 2 volts between erasing pulses when dynamic erasure is employed.
- d Adjusted for the smallest, most circular spot.
- e The bias-voltage value for writing-beam cutoff is between -60 and -100 volts with respect to writing-gun cathode.
- f With respect to the reference terminal of the collimation system for each pair of deflecting electrodes.
- g Recommended value for minimum distortion because of viewing-beam collection by the deflecting plates. Where strict display accuracy and display uniformity are not required, the impedance value for any deflecting-electrode circuit may be as high as 0.1 megohm maximum. For optimum performance, it is recommended that the deflecting-electrode-circuit impedances be approximately equal.
- h Brightness (Luminance) is measured after the entire display is written to saturated brightness, the writing gun has been turned off, and with no erasing pulse applied.
- i The time required for any 0.5-inch-diameter area of the 4-inch-diameter viewing area to rise spontaneously (with no writing or erasing) from zero brightness (viewing-beam visual cutoff) to 10% of saturated brightness.
- j With the display at saturated brightness, a series of rectangular pulses 5 milliseconds in width and at a repetition frequency of 2 p/s is applied to the backplate. The number of pulses required to just erase completely the center of the display is noted. This number is multiplied by 5 milliseconds to obtain the erase time. The amplitude of the erase pulses is adjusted to obtain the minimum erase time.
- k Measured by the "shrinking" raster method under conditions of continuous writing and erasing, with erase pulses of 60 microseconds width and a repetition frequency of 300 p/s. The amplitude of the erase pulses is adjusted to provide 3.5-second erasure and grid No.1 is adjusted to provide 1000 footlamberts brightness of the just "shrunk" raster.
- l The undeflected spot position must fall within a square having a 15 millimeter side (maximum) centered on the tube face and parallel to a trace produced by one set of deflecting plates.



Performance Data

Writing Ability and Writing Uniformity Characteristics are measured singly for both guns. A 3.5" x 3.5" raster is centered on the tube face. Vertical scanning is accomplished by an interrupted linear sawtooth waveform having a scan time of 625 microseconds and a prf of 500 p/s. Horizontal scanning is provided by a triangular waveform having a scan rate of 3.5 inches per second.

Writing Ability. The writing-gun grid No.1 of the gun under test is driven above cutoff during the vertical scan time by white noise, of approximately 5 megacycle bandwidth, having a zero-to-peak amplitude of approximately 35 volts. The display brightness under these conditions shall be at least 20% of saturated brightness.

Writing Uniformity. This characteristic is determined under the same conditions as specified above except that the rms amplitude of the white noise is adjusted to produce brightness of 40% of saturated brightness at the dimmest area in the display. The measured brightness at the brightest area of the display shall be not more than 60% of the saturated brightness.

Environmental Tests

The 7268B is designed to withstand the following operational and non-operational environmental tests.

Operational Tests

Sinusoidal Vibration: This test consists of tube vibration in each of three orthogonal axes. One of these axes is in the plane passing through the major axis of the tube and the center of the tube-base key. The tube is mounted so that its major axis is parallel to the plane of the earth. A total of 6 cycles of swept sinusoidal vibration, from 10 to 500 and back to 10 cycles per second, is performed. The duration of a sweep cycle is 15 minutes. The frequencies of any resonant points are noted. The sinusoidal vibration schedule is shown below.

Double Amplitude inches	Peak Acceleration g's	Sweep Frequency c/s	Sweep Cycle Duration minutes
0.27	-	10 to 20	15
-	4	20 to 46	
-	2	46 to 500	
-	2	500 to 46	
-	4	46 to 20	
0.27	-	20 to 10	



Vibration at Resonance. This test consists of tube vibration at the resonant point or points determined in *Sinusoidal Vibration* for a period of 30 minutes. If more than one resonant point is noted for a given axis, the tube is vibrated for a total of 30 minutes at that resonant point in each axis most likely to produce tube failure. If no resonant points are determined in *Sinusoidal Vibration*, the tube is vibrated for 60 minutes at a frequency of 55 cycles per second.

Low Pressure-High Temperature. This test consists of tube storage for a period of not less than one hour at a temperature of $+100^{\circ}\text{C}$. At the termination of this storage period, the tube is operated with the values shown under *Recommended Operating Values* applied and at a pressure equivalent to an altitude of 32,000 feet. The temperature is then reduced to $+53^{\circ}\text{C}$. The tube is stored at this temperature for 1 hour and then is operated with normal voltages applied at a pressure equivalent to an altitude of 60,000 feet.

Low Temperature. This test consists of the tube being maintained at a temperature of -65°C for 48 hours. At the end of this period and while the tube is still at -65°C , the tube is operated with recommended voltages applied for 15 minutes.

Non-Operational Tests

Temperature Cycling. This test consists of tube storage for a period of not less than 2 hours at a temperature of -65°C followed within 5 minutes by storage for a period of 2 hours at a temperature of $+100^{\circ}\text{C}$. A minimum of five consecutive cycles are performed.

High Pressure. This test consists of tube exposure to an absolute pressure of 45 pounds per square inch for a period of at least 60 seconds. This pressure shall be attained within 60 seconds.

Torque. This test consists of the application of a torque of 40 inch-pounds between the integral magnetic shield and the tube base.

Salt Spray. This test consists of tube exposure to a fine spray from a salt solution for a period of 48 hours. The ambient temperature is maintained at approximately 35°C .

OPERATING PROCEDURE

The following steps should be followed when the 7268B is first placed in operation. Refer to the precautions shown under *Operating Considerations* in the publication ICE-277 "RCA Display-Storage Tubes". Note that all electrode voltages are referred to the reference terminal of the collimation system unless otherwise specified.

1. **Viewing Gun** — Ground the collimation system reference terminal and magnetic shield. Apply power to the heater of the



viewing gun and allow 60 seconds for the cathode to reach normal operating temperature. Next apply the following voltages, in the indicated order: +2 volts to the backplate, -55 volts to the collimation system negative terminal, and +265 volts to the collimation system positive terminal (be sure a minimum resistance of 5000 ohms is in this circuit). Then increase screen voltage slowly from 0 to 10,000 volts (be sure a minimum resistance of 1 megohm is in the screen circuit). Next apply dynamic erasing pulses to the backplate.

The storage property of the tube can be observed by setting the amplitude of the dynamic erasing pulses at +8 volts for several seconds and by then reducing it to zero volts. As the erasing pulse amplitude is reduced the screen should go dark. The 7268B is now storing an overall "black picture" and stays in this condition until the screen begins to brighten as a result of the storage grid being gradually discharged by positive ions landing on it.

2. *Writing Gun* — Apply power to the heater of the writing gun and allow 60 seconds for the cathode to reach normal operating temperature. Then, with reference to the typical operating values shown in the tabulated data under *Recommended Operating Values*, set the grid-No.1 voltage to cutoff, and apply dc voltages to the electrodes of the writing gun. With the screen made dark by the charging method described under (1), the grid-No.1 bias is reduced until the writing beam is seen as a spot on the screen. If the beam is caused to move, either by centering adjustment or by application of deflection voltage, it should leave a bright trace. After an area has been written to full brightness, the writing-beam spot may be seen as a slightly brighter spot on the bright background. Writing-beam focus can then be optimized by adjusting the grid-No.3 voltage.
3. *Final Display Adjustments* — The dc bias and the video-signal amplitude applied to grid No.1 or cathode of the writing gun should be adjusted to set the black level and and the highlight level in the display. These adjustments depend on the scanning rate used. Resolution decreases with increasing writing-gun beam current. Excessive writing-gun beam current will produce screen saturation and any further beam-current increase will not produce additional highlight brightness and may also decrease half-tone rendition. It is recommended that the writing-beam current always be adjusted to a minimum value to produce the best display without saturation of highlight brightness. The dynamic erasing-pulse amplitude and duty cycle should be adjusted in accordance with the information contained in ICE-277.

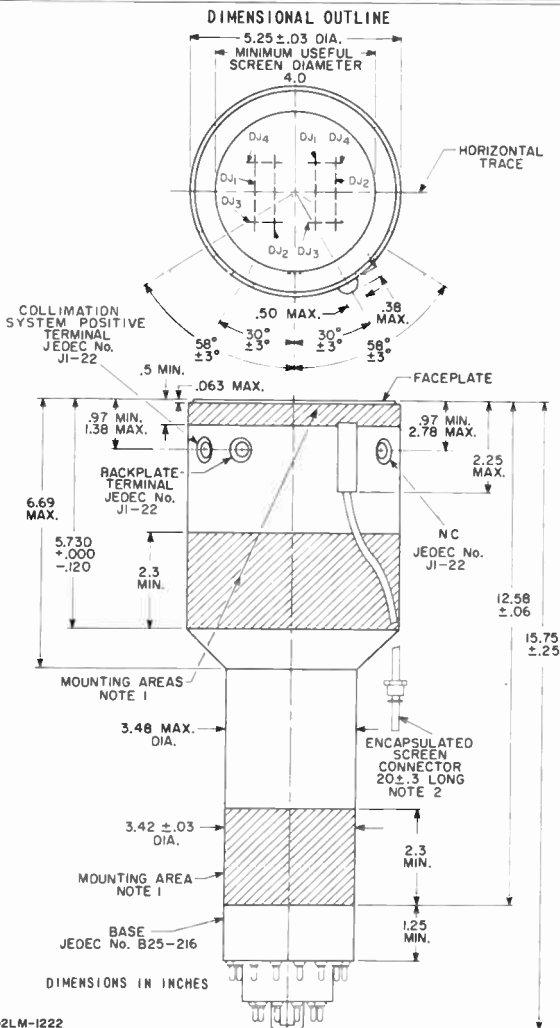
The following operating precautions must be followed to protect the 7268B from inadvertent damage —

1. Do not exceed maximum ratings.
2. Be sure to include the screen resistor.



3. Be sure to include the collimation system positive terminal resistor.
4. Do not apply excessive writing-beam current density.
5. Protect against scanning failure.
6. Protect against loss of bias.
7. Apply voltages to tube in correct order.
8. Never write unless viewing beam is on.





Note 1: The indicated areas are recommended for mounting purposes.

Note 2: Amp Part No. AMP 832 692-0; manufactured by Aircraft Marine Products, Inc., Harrisburg, Pa., or equivalent.







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DISPLAY STORAGE TUBE

DIRECT-VIEW TYPE
3.8"-DIAMETER DISPLAYWRITING GUN:
ELECTROSTATIC DEFLECTION
ELECTROSTATIC FOCUSVIEWING GUN:
NO DEFLECTION
NO FOCUS

DATA

General:

Writing Section Viewing Section

Heater, for Unipotential Cathode:			
Voltage (AC or DC)	6.3	6.3	volts
Current	0.6	0.6	amp
Minimum Cathode Heating Time before other electrode volt- ages are applied.	-	30	sec
Direct Interelectrode Capac- itances (Approx.): ^o			
Grid No.1 to all other tube electrodes	6.5	11	μHf
Cathode to all other tube electrodes	5.5	8	μHf
Backplate to all other tube electrodes	-	116	μHf
Deflecting electrode DJ ₁ to deflecting electrode DJ ₂ . . .	1.9	-	μHf
Deflecting electrode DJ ₃ to deflecting electrode DJ ₄ . . .	2	-	μHf
DJ ₁ to all other tube electrodes.	6	-	μHf
DJ ₂ to all other tube electrodes.	7	-	μHf
DJ ₃ to all other tube electrodes.	5.5	-	μHf
DJ ₄ to all other tube electrodes.	4.8	-	μHf
Focusing Method	Electrostatic	None	
Deflection Method	Electrostatic	None	
Deflecting-Electrode Arrangement.	See Dimen- sional Outline	-	
Phosphor (For Curves, see front of this Section).	-	P20, Aluminized	
Fluorescence.	-	Yellow-Green	
Phosphorescence	-	Yellow-Green	
Minimum Useful Viewing Diameter			3.8"
Maximum Overall Length.			13.64"
Seated Length		12.50" ± 0.39"	
Greatest Bulb Diameter.		5.25" ± 0.06"	
Maximum Tube Radius			2.69"
Bulb Terminals:			
Caps (Three).	Recessed Small Ball (JEDEC No. J1-22)		
Cap	Recessed Small Cavity (JEDEC No. J1-21)		
Temperature Range:			
Operating		-65° to +100° C	
Storage		-55° to +85° C	
Operating Position.			Any
Weight (Approx.).			2-3/4 lbs
Base.	Medium-Shell Dihedral 14-Pin (JEDEC Group 5, No. B14-38)		

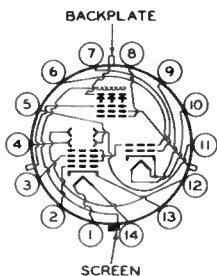


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BOTTOM VIEW

- Pin 1—Heater of Writing Gun
 Pin 2—Grid No.1 of Writing Gun
 Pin 3—Grid No.3 of Writing Gun
 Pin 4—Deflecting Electrode DJ_3 of Writing Gun
 Pin 5—Deflecting Electrode DJ_4 of Writing Gun
 Pin 6—Grid No.2 of Viewing Gun, Grid No.2 and Grid No.4 of Writing Gun
 Pin 7—Grid No.1 of Viewing Gun
 Pin 8—Grid No.3 of Viewing Gun
 Pin 9—Heater of Viewing Gun
 Pin 10—Heater and Cathode of Viewing Gun
 Pin 11—Deflecting Electrode DJ_1 of Writing Gun
 Pin 12—Deflecting Electrode DJ_2 of Writing Gun



- Pin 13—Cathode of Writing Gun
 Pin 14—Heater of Writing Gun
 Recessed Ball Cap:
Over Pin
 3—Grid No.5 of Viewing Gun
Over Pin
 12—Grid No.4 of Viewing Gun
On Side of Tube Opposite Base
 Key—Backplate
 Recessed Cavity Cap:
Over Base
 Key—Screen

Maximum and Minimum Ratings, Absolute-Maximum Values:

For altitudes up to 10,000 feet

	Writing Section		Viewing Section	
SCREEN VOLTAGE.	—		11000 max.**	volts
BACKPLATE VOLT-AGE (Peak).	—		20 max.**	volts
	<i>Equivalent Values</i>		<i>Equivalent Values</i>	
GRID—No.5 VOLT-AGE	—	—	300 max.**	volts
GRID—No.4 VOLT-AGE	2950 max.**	200 max.**	300 max.**	volts
GRID—No.3 VOLT-AGE	1200 max.*	-1550 max.**	{ 200 max.** 10 min.** }	volts
PEAK VOLTAGE BETWEEN GRID No.3 AND GRIDS No.2 & No.4.	—	2950 max.	—	volts



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DISPLAY STORAGE TUBE

	Writing Section		Viewing Section		
GRID-No.2 VOLT-AGE	2950 max.*▲	200 max.**	2950 max.*▲	200 max.**	volts
CATHODE VOLT-AGE	-	-2750 max.**	-	-	volts
GRID-No.1 VOLT-AGE:					
Negative-bias value	200 max.*		200 max.**		volts
Positive-bias value	0 max.*		0 max.**		volts
Positive-peak value	2 max.*		0 max.**		volts
PEAK VOLTAGE BETWEEN GRIDS No.2 & No.4 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

VIEWING SECTION**

Operating Values and Typical Performance Characteristics:

To prevent possible damage to the tube, allow the viewing-gun beam current to reach normal operating value before turning on the writing-gun beam current, and keep the viewing-gun beam on till the writing beam is turned off

Screen voltage	10000	10000	volts
Backplate Voltage (DC)	2	2	volts
Grid-No.5 Voltage	210	150	volts
Grid-No.4 Voltage*	50 to 150	30 to 90	volts
Grid-No.3 Voltage*	10 to 50	10 to 40	volts
Grid-No.2 Voltage▲	150	125	volts
Grid-No.1 Voltage*	0 to -80	0 to -60	volts
Maximum Screen Current	0.75	0.5	ma
Maximum Backplate Current (Peak)	2	1.5	ma
Maximum Grid-No.5 Current	3	2.5	ma
Maximum Grid-No.4 Current	3	2.5	ma
Maximum Grid-No.3 Current	5	4	ma



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DISPLAY STORAGE TUBE

Maximum Grid-No.2 Current.	3	2.5	ma
Maximum Cathode Current.	8	6.5	ma
Number of Half-Tone Steps [□]	5	5	
Viewing Duration ^{▲▲}	20	40	sec
Maximum Erasing-Uniformity Factor ^{□□}	0.45	0.4	
Resolution [*]	50	50	lines/in.
Brightness ^{◆◆}	2750	1500	fl

WRITING SECTION*

Range Values for Equipment Design:*

For any grids-No.2 & No.4 voltage ($E_{C_{2+4}}$) between
1500 and 2750 volts[▲]

Grid-No.3 Voltage for focus.	17.5% to 37.5% of $E_{C_{2+4}}$		volts
Maximum Grid-No.1 Voltage for cutoff of undeflected focused spot	-4.6% of $E_{C_{2+4}}$		volts
Maximum Grid-No.3 Current.	-15 to +10		μ a
Maximum Cathode Current.	See Curve		
Deflection Factors:			
DJ ₁ & DJ ₂	36 to 48	v dc/in./kv of $E_{C_{2+4}}$	
DJ ₃ & DJ ₄	35 to 47	v dc/in./kv of $E_{C_{2+4}}$	
Focused Beam Position.	##		
Writing Speed ^{††}	3000		in./sec

Examples of Use of Design Ranges:*

For grids-No.2 & No.4 voltage ($E_{C_{2+4}}$) [▲]	2000		volts
Grid-No.3 Voltage for focus.	350 to 750		volts
Maximum Grid-No.1 Voltage for cutoff of undeflected focused spot.	-92		volts
Deflection Factors:			
DJ ₁ & DJ ₂	72 to 96		volts
DJ ₃ & DJ ₄	70 to 94		volts

Equivalent Values of Writing-Gun Voltages Referred to Cathode of Viewing Gun:

Cathode Voltage.	-1875	-1850	volts
Grid-No.3 Voltage for focus.	-1125 to -1525	-1100 to -1500	volts
Grids-No.2 & No.4 Voltage [▲]	+125	+150	volts

VIEWING SECTION and WRITING SECTION

Circuit Values:

Grid-No.1-Circuit Resistance (Either gun).	1 max.	megohm
Resistance in Any Deflecting-Electrode Circuit [■]	0.1 max.	megohm
Series Current-Limiting Resistor (Unbypassed) in Grid-No.5 (Viewing-Section) Circuit	0.01 min.	megohm



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Backplate-Circuit Resistance.	0.005 max. megohm
Series Current-Limiting Resistance in Screen Circuit,	1 min. megohm

- without external shield.
- ▼ Minimum useful viewing area may be eccentric with respect to the tube face.
- ** voltages are shown with respect to cathode of Viewing Gun.
- * voltages are shown with respect to cathode of Writing Gun.
- ▲ Grids No.2 and No.4 of Writing Gun are connected together and to grid No.2 of Viewing Gun within the tube.
- # Adjusted for brightest, most uniform pattern.
- Observed with an RCA-2F21 Monoscope display.
- ▲▲ Expressed in terms of the time required for the brightness of the unwritten background to rise from just zero brightness (viewing-beam cutoff) to 10 per cent of saturated brightness.
- Determined as follows: With no erasing pulse, overscan the storage surface with writing beam to obtain maximum pattern brightness. Then cut off writing beam. Apply erasing pulses having an amplitude of between 8 to 10 volts and adjust duty cycle to obtain complete erasure in approximately 10 seconds. Measure time (t_1) from start of erasing to the instant at which any area within the minimum useful viewing diameter is reduced to background-brightness level, and time (t_2) from start of erasing to the instant at which the entire area within the minimum useful viewing-diameter area is reduced to background-brightness level. The erasing-uniformity factor is defined as $(t_2 - t_1)/t_2$.
- * Measured by shrinking-raster method at a display brightness of 50 per cent of saturated brightness and with grids No.2 & No.4 of Writing Gun at about +2000 volts with respect to cathode of Writing Gun.
- ▲▲ Measured with entire storage grid written to produce saturated brightness and with screen at indicated voltage.
- The cathode of the Writing Gun is operated at about -2000 volts with respect to the cathode of the Viewing Gun which is usually operated at ground potential.
- ** The center of the undeflected focused beam will fall within a circle having a 10-mm radius and having its center on the Writing-Gun axis (See Dimensional Outline) under the following conditions: grids No.2 & No.4 of Writing Gun at +2000 volts with respect to cathode of Writing Gun, grid No.3 of Writing Gun at voltage to give focus, grid No.1 of Writing Gun at voltage which will permit storage of a charge just sufficient to give a barely perceptible spot on screen, Viewing Section operating under normal conditions, and tube shielded against extraneous fields.
- † Measured under conditions of writing from just zero brightness (viewing-beam cutoff) to maximum brightness with grid No.1 of Writing Gun at -10 volts with respect to cathode of Writing Gun, and grids No.2 & No.4 of Writing Gun at +2000 volts with respect to cathode of Writing Gun.
- It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

OPERATING CONSIDERATIONS

Shielding. Magnetic shielding must be provided to prevent external fields from interfering with the required accurate control of the low-velocity viewing beam. A cylindrical shield of properly annealed high-permeability material about 1/16-inch thick is usually satisfactory.

Terminal Connections. The base pins of the 7315 fit the Diheptal 14-contact socket. The Recessed Small Ball caps and the Recessed Small Cavity cap require standard flexible-lead connectors.

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DISPLAY STORAGE TUBE

The high voltages at which the 7315 is operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Safety precautions include the enclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is desired.

In the use of high-voltage tubes, it should always be remembered that high voltages may appear at normally low-potential points in the circuit as a result of capacitor breakdown or incorrect circuit connections. Therefore, before any part of the circuit is touched, the power-supply switch should be turned off, and both terminals of any capacitors grounded.

To prevent possible damage to the tube, allow the Viewing-Gun beam current to reach normal operating value before turning on the Writing-Gun beam current, and keep the viewing beam on till the writing beam is turned off.

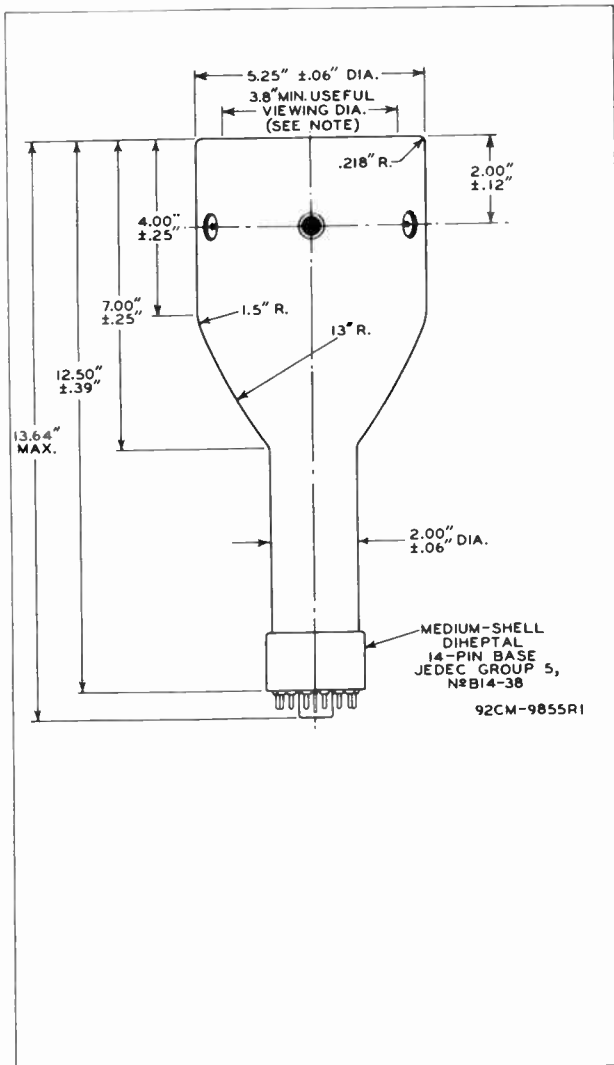
Failure of scanning while the writing beam is turned on may permanently damage the storage grid. Therefore, provision should be made to cut off automatically the writing-beam current in case of a scanning failure. The writing-beam current can be cut off by an electronic switch which applies -200 volts bias to grid No. 1 of the Writing Gun. This switch should be actuated by a portion of the scanning voltages applied to both sets of deflecting electrodes.



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DISPLAY STORAGE TUBE

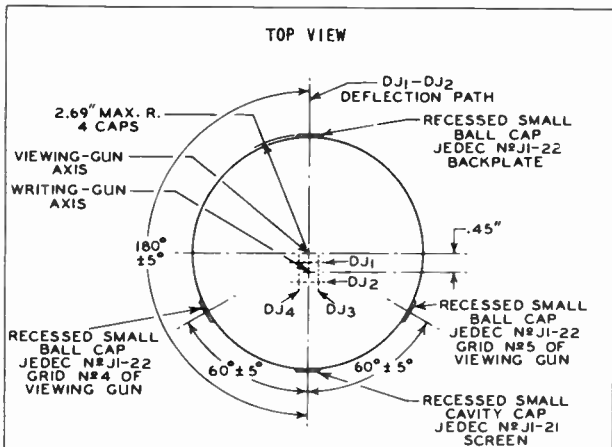


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DISPLAY STORAGE TUBE



NOTE: MINIMUM USEFUL VIEWING AREA MAY BE ECCENTRIC WITH RESPECT TO THE TUBE FACE. THE MINIMUM USEFUL VIEWING AREA WILL HAVE DIAMETER OF 3.8".

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

DEFLECTING ELECTRODES DJ₁ AND DJ₂ ARE NEARER THE SCREEN; DEFLECTING ELECTRODES DJ₃ AND DJ₄ ARE NEARER THE BASE. WITH DJ₁ POSITIVE WITH RESPECT TO DJ₂, THE SPOT WILL BE DEFLECTED TOWARD PIN 8; LIKewise, WITH DJ₃ POSITIVE WITH RESPECT TO DJ₄, THE SPOT WILL BE DEFLECTED TOWARD PIN 4.

THE ANGLE BETWEEN THE DEFLECTION PATH PRODUCED BY DJ₁ AND DJ₂ MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND THE BASE KEY BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 10°. ANGLE BETWEEN DJ₁ - DJ₂ DEFLECTION PATH AND DJ₃ - DJ₄ DEFLECTION PATH IS 90° ± 3°.

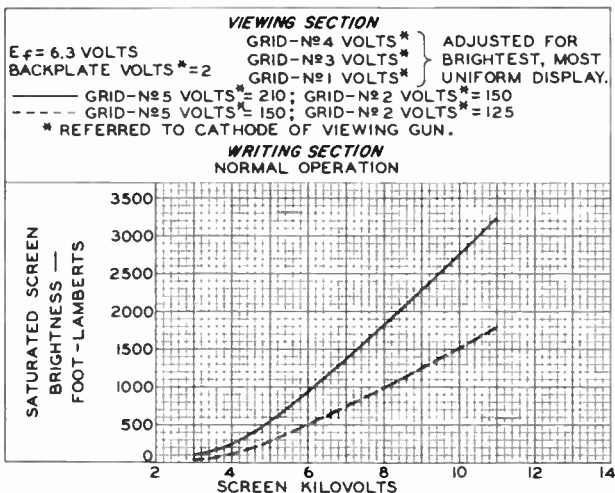
THE ANGLE BETWEEN THE DEFLECTION PATH PRODUCED BY DJ₁ AND DJ₂ MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND THE SCREEN CAP BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 10°.



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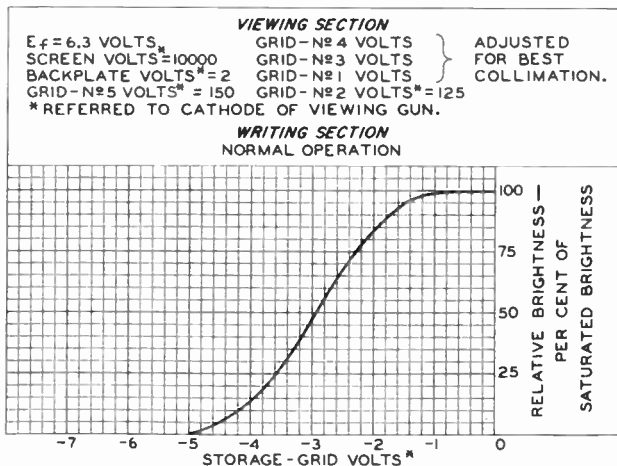
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TYPICAL CHARACTERISTICS



92CS-9858

TYPICAL STORAGE-GRID CHARACTERISTIC



ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

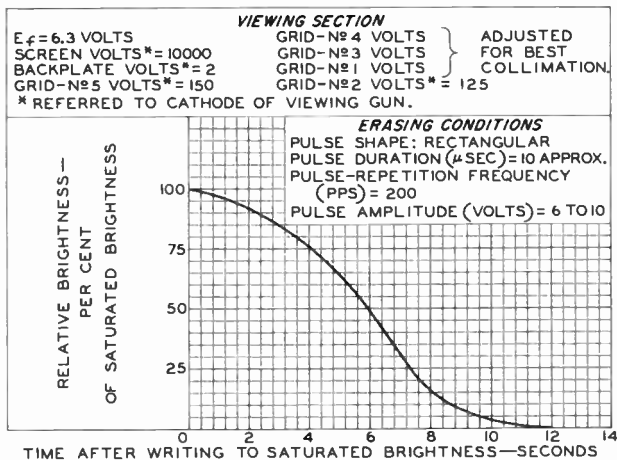
World Radio History

92CS-9861



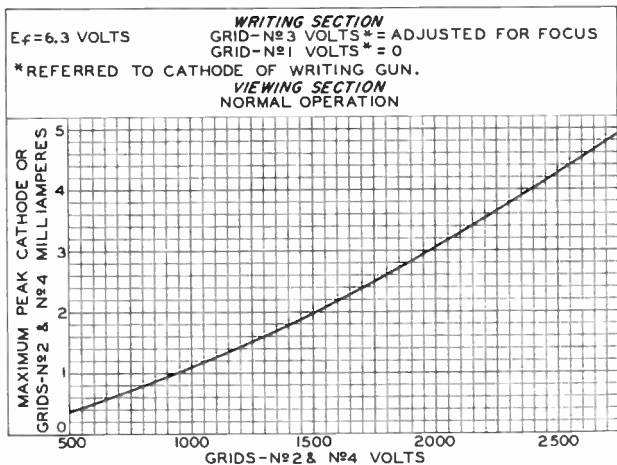
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TYPICAL ERASURE CHARACTERISTIC



92CS-9860

WRITING-GUN-CURRENT CHARACTERISTIC



NUMITRON Digital Display Devices

Segmented Incandescent Types

FEATURES:

- high brightness — fully adjustable
- low voltage operation
- high contrast — segmented digits viewed against a dark background
- compatible with IC Decoder/Drivers such as the RCA CD2500E family
- high-reliability — rugged construction
- wide-spectrum light emission permits unlimited filter selection
- DR2200 Series have a recommended DC segment operating voltage range of 1.5 to 3V
- wide viewing angle
- void of "clutter"
- solderable base pins permits direct PC board mounting
- DR2000 Series fits popular low cost 9-pin miniature socket
- DR2100 and DR2200 Series fit popular TO-5 style, 10-pin socket
- DR2100V1 and DR2200V1 Series have formed lead to facilitate direct PC-board mounting

MECHANICAL

	DR2000 Series	DR2100 DR2200 Series	DR2100V1 DR2200V1 Series
Mounting Position	Any	Any	Any
Maximum Overall Length	1.875 in.	1.660 in.	1.705 in.
Maximum Seated Length	1.625 in.	1.450 in.	1.540 in.
Maximum Diameter	0.785 in.	0.485 in.	0.485 in.
Base	9-pin min.	9-pin, 0.230 in. pin circle	9-pin, 0.380 in. pin circle

CHARACTERISTICS

ELECTRICAL

	DR2000 Series	DR2100 Series	DR2200 Series	
Recommended DC Segment Operating Voltage Range	3.5 to 5.0	3.5 to 5.0	1.5 to 3.0	V
DC Segment Voltage unless otherwise specified	4.5	4.5	2.5	/
Segment Current	24	24	14	mA
Mean Life Expectancy (at 95% confidence)	100 k	100 k	100 k	h
VISUAL				
Viewing Angle (including angle)	140	120	120	°
Segment Luminance (typ.)	7000	7000	4000	fL
Response Times:				
Ascent to Visibility (typ.)	15	15	8	ms
Descent to 50% of Luminance	<20	<20	<10	ms
Maximum Segment Deflection From a Straight Line	0.005	0.004	0.004	in
Contrast Ratio	30:1	30:1	20:1	

Mechanical Characteristics
DR2000 and DR2100 Series

TEST	CONDITIONS	DC Segment Volts
SHOCK *		
a)	100g, 1 ms, Half-Sine Wave	4.5
b)	50g, 11 ms, Half-Sine Wave	Not Applied
VIBRA-TION		
a)	Variable Frequency: 10 to 44 Hz, 0.1-inch DA	4.5
b)	Variable Frequency: 44 to 200 Hz, 10g	4.5
c)	Variable Frequency: 200 to 800 Hz, 1g	4.5
d)	Variable Frequency: 800 to 2000 Hz, 10g	4.5
e)*	Fatigue: 25 Hz, 2.5g, 96 hr	4.5

DR2200
Series

SHOCK *		
a)	200g, 1 ms, Half-Sine Wave	2.5
b)	50g, 11 ms, Half-Sine Wave	Not Applied
VIBRA-TION		
a)	Variable Frequency: 5 to 60 Hz, 0.1-inch DA	2.5
b)	Variable Frequency: 60 to 500 Hz, 20g	2.5
c)*	Fatigue: 25 Hz, 2.5g, 96 hr	2.5

* Performed in Accordance with MIL-E-1F

The NUMITRON digital display devices will meet the Specifications for operational and crash safety tests; standard environmental vibration for instrument panel location in all types of aircraft, as set by the Radio Technical Commission for Aeronautics (RTCA). Document No. DO-138 Dated June 27, 1968.

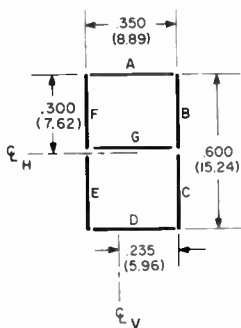
Base Pin Number And Segment Designation Chart

Display	Type	Segment Designations A-H									
		1	2	3	Base Pin Number			7	8	9	
	DR2000	NC	↑ COMMON ↓	E	D	C	G	A	B	F	
	DR2100										
	DR2200										
 with decimal	DR2010	H		↑ COMMON ↓	E	D	C	G	A	B	F
	DR2110										
	DR2115										
	DR2210										
	DR2215										
	DR2020	NC	↑ COMMON ↓		NC	NC	NC	D	B	C	A
	DR2120										
	DR2220										
	DR2030	NC		↑ COMMON ↓	NC	NC	NC	B	NC	A	NC
	DR2130										
	DR2130	NC			↑ COMMON ↓	NC	NC	NC	NC	B	NC	A
	DR2230										

NC = no connection – may be used as tie point.

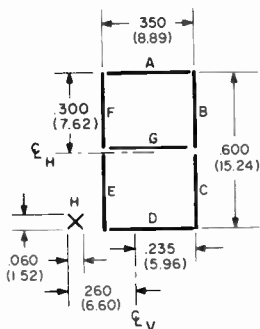
Segment Dimensions and Designations

DR2000



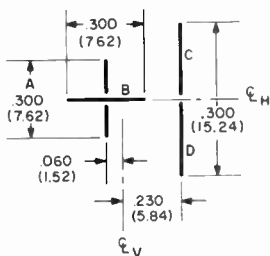
92CS-15754R1

DR2010



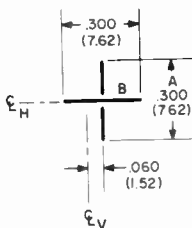
92CS-15755R1

DR2020



92CS-15756R1

DR2030



92CS-15757R1

ϵ_H = Horizontal center line of display (bulb outline dimension F) with pin No. 3 toward viewer. Segment "G" is 0.030" above ϵ_H .

ϵ_V = Vertical center line of device.

DR2100 and DR2200 series; vertical center line of display coincides with vertical center line of device.

Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated.

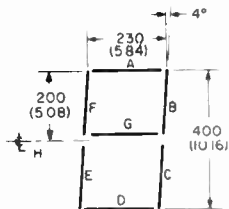
Segment Dimensions And Designations – Cont'd

DR2100

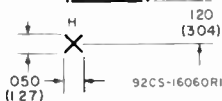
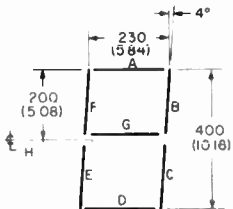
DR2110

DR2200

DR2210



92CS 16059RI



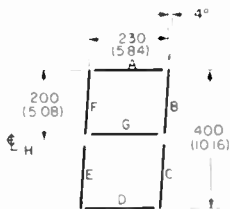
92CS-16060RI

DR2115

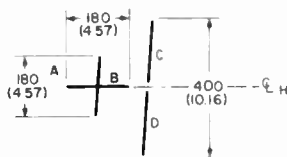
DR2130

DR2215

DR2230



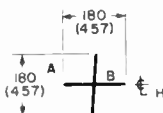
92CS-18023RI



92CS-16061RI

DR2120

DR2220



92CS-16062RI

OPERATING CONSIDERATIONS

Integrated Circuit Decoder/Driver

The NUMITRON series devices are compatible with the RCA Integrated Circuit Decoder/Driver types CD2500E and CD2501E. The integrated circuit decoder/driver accepts four inputs in BCD (8-4-2-1 code) and decodes them into outputs representing a decimal number from 0 to 9 on a 7-segment display. For basic interconnection of decoder/driver and the NUMITRON display devices see Fig. 4.

Mounting Arrangements

The NUMITRON devices are designed for mounting in either commercially available sockets or directly on printed circuit boards. The DR2000 series devices fit into a standard 9-pin miniature electron tube socket. A commercial PC board socket which permits 0.8-inch center-to-center mounting is available. (See Hardware and Accessories.) The DR2100 and DR2200 series devices are available in two versions: straight leads and V1 versions with formed leads. The straight lead versions may be mounted on 0.5-inch centers directly on PC boards or may be used with standard TO-5 style, 10-pin sockets. The V1 versions facilitate direct PC board mounting on 0.5-inch centers. To use the light shield, DR3000⁺, the center-to-center mounting must be increased to 0.515-inch.

Figure 5 shows the base diagram and pin-circle dimensions for the various NUMITRON devices.

Character Formation

The following chart gives the base pin connections for forming the various character displays for each device. Pin No. 2 is the common connection for all segments in each device. For example, to form a numeral one using type DR2000, connect the segment voltage between pin No. 2 (common) and pin Nos. 5 and 8.

Digital Character Formation

Display	Device Pin Number				
	Pin No. 2 Common For All Types				
	DR2000 DR2100 DR2200	DR2010 DR2110 DR2115 DR2210 DR2215	DR2020 DR2120 DR2220	DR2030	DR2130 DR2230
0	3,4,5,7, 8,9	3,4,5,7, 8,9			
1	5,8	5,8	6,8		
2	3,4,6, 7,8	3,4,6, 7,8			
3	4,5,6, 7,8	4,5,6, 7,8			
4	5,6,8,9	5,6,8,9			
5	4,5,6, 7,9	4,5,6, 7,9			
6	3,4,5,6, 7,9	3,4,5,6, 7,9			
7	5,7,8	5,7,8			
8	3,4,5,6, 7,8,9	3,4,5,6, 7,8,9			
9	4,5,6,7, 8,9	4,5,6,7, 8,9			
+			7,9	6,8	7,9
-			7	6	7
decimal		1			

Power Supply Requirements

The NUMITRON Series devices do not require critical voltage regulation over the useable operating range. As is the case with any incandescent type device, dc voltage operation above the recommended value may result in reduced life expectancy. For multiplex operation, segment voltage above the normal range may be used provided that the appropriate duty factor is observed. (See NUMITRON Display Device Booklet, NUM-421).

Display

Because these NUMITRON devices have a wide-band light spectrum emission, filters can be used to produce any desired color display. (See Hardware and Accessories.) A display having a broader stroke can be obtained with an etched glass such as "Trusite"* or a diffused filter. For a larger size display, a Fresnel lens may be used.

*Trademark "Trusite" Dearborn Glass Co., Chicago, Illinois.

Hardware and Accessories

Sockets

Noval 9-pin Types

DR2000 Series

- Methode Electronics, Inc., M8610 (For 0.8-inch centers) and P460 (standard)
- Cinch Mfg. Co., 121-51-00-040 (standard)

TO-5 10-Lead Types

DR2100, DR2200 Series

- Methode Electronics, Inc., M8620
- Cinch Mfg. Co., 133-99-92-054 and 133-99-92-065
133-99-92-065 (spread-lead socket)

Filters

Polaroid Corp., Cambridge Mass. 02139

Circular Polarizer:

Standard and Diffused Surface for Broader Stroke

Panelgraphic Corp., West Caldwell, N.J. 07006

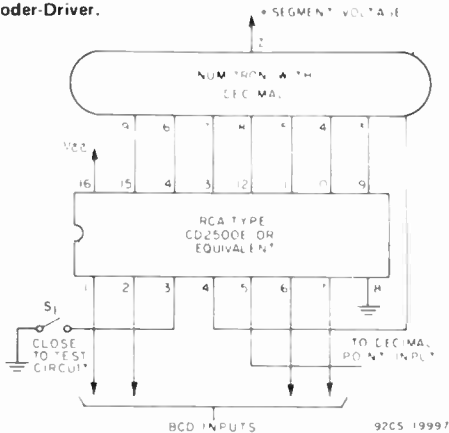
Chromafilter CF-131: Anti-Reflection Filters

Plastic Light Shield to Reduce Side Reflections

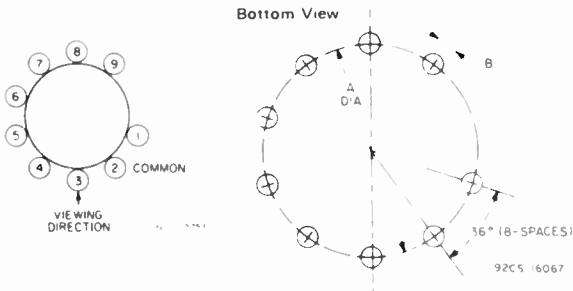
DR2100, DR2200 Series

- RCA DS3000

Basic Interconnection Circuit of NUMITRON Device and Decoder-Driver.



Base Diagram and Pin Circle Dimensions — All Series.



NUMITRON SERIES	DIMENSION (INCHES)		
	A NOMINAL	MIN.	B MAX.
DR2000	0.468	0.038	0.042
DR2100 and DR2200	0.230	0.018	0.022
DR2100V1 and DR2200V1	0.380	0.018	0.022

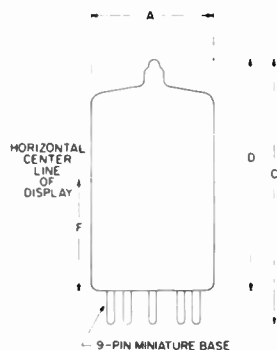
DR2000
Series

DR2100
Series

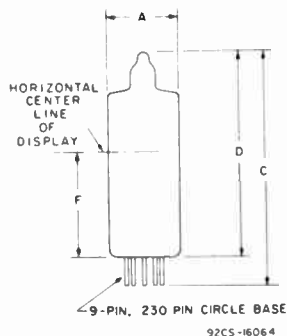
DR2200
Series

Dimensional Outlines

DR2000 Series



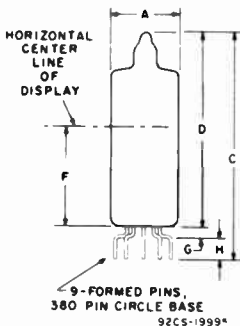
**DR2100,
DR2200 Series**



DI- MEN- SION	DR2000 Series				DR2100 and DR2200 Series			
	INCHES		MILLIMETERS		INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
A		0.800		20.32		0.485		12.32
C		1.875		47.62		1.660		42.16
D		1.625		41.27		1.450		36.83
F	0.700	0.730	17.78	18.54	0.625	0.655	15.87	16.64

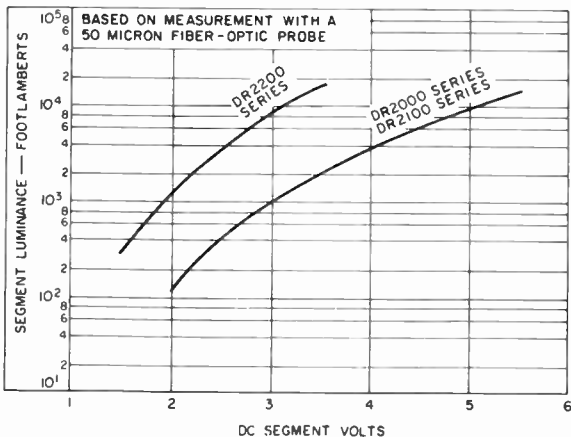
MILLIMETER DIMENSION DERIVED FROM INCH DIMENSION

Dimensional Outlines — Cont'd

DR2100V1,
DR2200V1 Series

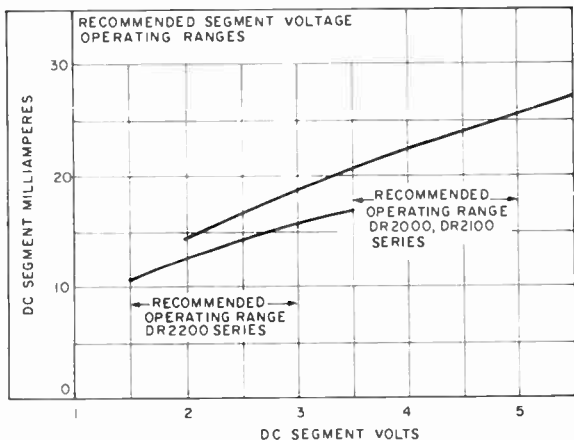
DI- MEN- SION	DR2100V1 and DR2200V1 Series			
	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A		0.485		12.32
C		1.705		43.30
D		1.450		36.83
F	0.625	0.655	15.87	16.64
G	0.060	0.090	1.52	2.28
H	0.135	0.165	3.43	4.19

Segment Luminance Characteristics



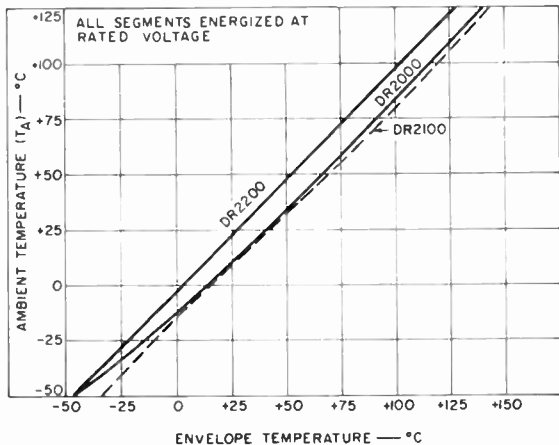
92CS-15750R1

Segment Current Characteristics



92CS-15758R1

Envelope Temperature Characteristics



92CS-16063R2



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DISPLAY STORAGE TUBE

DIRECT-VIEW TYPE
3.8"-DIAMETER DISPLAYWRITING GUN:
ELECTROSTATIC DEFLECTION
ELECTROSTATIC FOCUSVIEWING GUN:
NO DEFLECTION
NO FOCUS

DATA

General:

	Writing Section	Viewing Section	
Heater, for Unipotential Cathode:			
Voltage (AC or DC)	6.5	6.3	volts
Current	0.6	0.6	amp
Minimum Cathode Heating Time before other electrode voltages are applied.			
	-	30	sec
Direct Interelectrode Capacitances (Approx.): ^o			
Grid No. 1 to all other tube electrodes	6.5	11	μmf
Cathode to all other tube electrodes	5.5	8	μmf
Backplate to all other tube electrodes	-	116	μmf
Deflecting electrode DJ ₁ to deflecting electrode DJ ₂	1.9	-	μmf
Deflecting electrode DJ ₃ to deflecting electrode DJ ₄	2	-	μmf
DJ ₁ to all other tube electrodes.	6	-	μmf
DJ ₂ to all other tube electrodes.	7	-	μmf
DJ ₃ to all other tube electrodes.	5.5	-	μmf
DJ ₄ to all other tube electrodes.	4.8	-	μmf
Focusing Method	Electrostatic	None	
Deflection Method	Electrostatic	None	
Deflecting-Electrode Arrangement.	See Dimensional Outline		-
Phosphor (For Curves, see front of this Section).			
	-	P20, Aluminized	
Fluorescence.	-	Yellow-Green	
Phosphorescence	-	Yellow-Green	
Minimum Useful Viewing Diameter.			3.8"
Maximum Overall Length.			13.64"
Seated Length		12.50" \pm 0.39"	
Greatest Bulb Diameter.		5.25" \pm 0.06"	
Maximum Tube Radius			2.69"
Bulb Terminals:			
Caps (Three).	Recessed Small Ball (JEDEC No. J1-22)		
Cap	Recessed Small Cavity (JEDEC No. J1-21)		
Temperature Range:			
Operating	-55 ^o to +85 ^o C		
Storage	-65 ^o to +100 ^o C		
Operating Position.	Any		
Weight (Approx.).	2-3/4 lbs		
Base.	Medium-Shell Diheptal 14-Pin (JEDEC Group 5, No. B14-38)		

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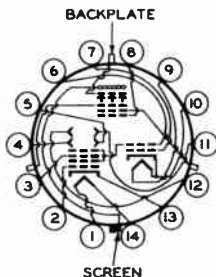


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DISPLAY STORAGE TUBE

BOTTOM VIEW

- Pin 1—Heater of Writing Gun
 Pin 2—Grid No.1 of Writing Gun
 Pin 3—Grid No.3 of Writing Gun
 Pin 4—Deflecting Electrode DJ_3 of Writing Gun
 Pin 5—Deflecting Electrode DJ_4 of Writing Gun
 Pin 6—Grid No.2 of Viewing Gun, Grid No.2 and Grid No.4 of Writing Gun
 Pin 7—Grid No.1 of Viewing Gun
 Pin 8—Grid No.3 of Viewing Gun
 Pin 9—Heater of Viewing Gun
 Pin 10—Heater and Cathode of Viewing Gun
 Pin 11—Deflecting Electrode DJ_1 of Writing Gun
 Pin 12—Deflecting Electrode DJ_2 of Writing Gun



- Pin 13—Cathode of Writing Gun
 Pin 14—Heater of Writing Gun
 Recessed Ball Cap:
 Over Pin 3—Grid No.5 of Viewing Gun
 Over Pin 12—Grid No.4 of Viewing Gun
 On Side of Tube Opposite Base
 Key—Backplate
 Recessed Cavity Cap:
 Over Base
 Key—Screen

Maximum and Minimum Ratings, Absolute-Maximum Values:

For altitudes up to 10,000 feet

	Writing Section		Viewing Section	
SCREEN VOLTAGE.	-		11000 max.**	volts
BACKPLATE VOLTAGE (Peak).	-		20 max.**	volts
	<i>Equivalent Values</i>		<i>Equivalent Values</i>	
GRID-No.5 VOLTAGE	-	-	300 max.**	volts
GRID-No.4 VOLTAGE	2950 max.**	200 max.**	300 max.**	volts
GRID-No.3 VOLTAGE	1200 max.*	-1550 max.**	{ 200 max.** 10 min.** }	volts
PEAK VOLTAGE BETWEEN GRID No.3 AND GRIDS No.2 & No.4.	-	2950 max.	-	volts



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DISPLAY STORAGE TUBE

	Writing Section		Viewing Section		
GRID-No.2 VOLT-AGE	2950 max. [▲]	200 max. ^{**}	2950 max. [▲]	200 max. ^{**}	volts
CATHODE VOLT-AGE	-	-2750 max. ^{**}	-	-	volts
GRID-No.1 VOLT-AGE:					
Negative-bias value	200 max. [*]		200 max. ^{**}		volts
Positive bias value	0 max. [*]		0 max. ^{**}		volts
Positive-peak value	2 max. [*]		0 max. ^{**}		volts
PEAK VOLTAGE BETWEEN GRIDS No.2 & No.4 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

VIEWING SECTION**

Operating Values and Typical Performance Characteristics:

To prevent possible damage to the tube, allow the viewing-gun beam current to reach normal operating value before turning on the writing-gun beam current, and keep the viewing-gun beam on till the writing beam is turned off

Screen Voltage	10000	10000	volts
Backplate Voltage (DC)	2	2	volts
Grid-No.5 Voltage	210	150	volts
Grid-No.4 Voltage*	50 to 150	30 to 90	volts
Grid-No.3 Voltage*	10 to 50	10 to 40	volts
Grid-No.2 Voltage [▲]	150	125	volts
Grid-No.1 Voltage*	0 to -80	0 to -60	volts
Maximum Screen Current	0.75	0.5	ma
Maximum Backplate Current (Peak)	2	1.5	ma
Maximum Grid-No.5 Current	3	2.5	ma
Maximum Grid-No.4 Current	3	2.5	ma
Maximum Grid-No.3 Current	5	4	ma

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DISPLAY STORAGE TUBE

Maximum Grid-No.2 Current [■]	3	2.5	ma
Maximum Cathode Current.	8	6.5	ma
Number of Half-Tone Steps [□]	5	5	
Viewing Duration ^{▲▲}	20	40	sec
Maximum Erasing-Uniformity Factor ^{□□}	0.45	0.4	
Resolution [⊕]	50	50	lines/in.
Brightness ^{⊕⊕}	2750	1500	f1

WRITING SECTION[⊕]Range Values for Equipment Design:[⊕]

For any grids-No.2 & No.4 voltage (E_{C2+4}) between
1500 and 2750 volts[▲]

Grid-No.3 Voltage for focus.	17.5% to 37.5% of E_{C2+4}		volts
Maximum Grid-No.1 Voltage for cutoff of undeflected focused spot	-4.6% of E_{C2+4}		volts
Maximum Grid-No.3 Current.	-15 to +10		μ a
Maximum Cathode Current.	See Curve		
Deflection Factors:			
DJ ₁ & DJ ₂	36 to 48	v dc/in./kv of E_{C2+4}	
DJ ₃ & DJ ₄	35 to 47	v dc/in./kv of E_{C2+4}	
Focused Beam Position.	**		
Writing Speed ^{††}	300000		in./sec

Examples of Use of Design Ranges:[⊕]

For grids-No.2 & No.4 voltage (E_{C2+4}) [▲]	2000		volts
Grid-No.3 Voltage for focus.	350 to 750		volts
Maximum Grid-No.1 Voltage for cutoff of undeflected focused spot.	-92		volts
Deflection Factors:			
DJ ₁ & DJ ₂	72 to 96		volts
DJ ₃ & DJ ₄	70 to 94		volts

Equivalent Values of Writing-Gun Voltages Referred to Cathode of Viewing Gun:

Cathode Voltage.	-1850	-1875	volts
Grid-No.3 Voltage for focus.	-1100 to -1500	-1125 to -1525	volts
Grids-No.2 & No 4 Voltage [▲]	+150	+125	volts

VIEWING SECTION and WRITING SECTION

Circuit Values:

Grid-No.1-Circuit Resistance (Either gun).	1 max.	megohm
Resistance in Any Deflecting-Electrode Circuit [■]	0.1 max.	megohm
Series Current-Limiting Resistor (Unbypassed) in Grid-No.5 (Viewing-Section) Circuit	0.01 min.	megohm



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DISPLAY STORAGE TUBE

Backplate-Circuit Resistance. 0.005 max. megohm
 Series Current-Limiting Resistance in
 Screen Circuit. 1 min. megohm

- Without external shield.
- ♥ Minimum useful viewing area may be eccentric with respect to the tube face.
- ** Voltages are shown with respect to cathode of Viewing Gun.
- * Voltages are shown with respect to cathode of Writing Gun.
- ▲ Grids No. 2 and No. 4 of Writing Gun are connected together and to grid No. 2 of Viewing Gun within the tube.
- # Adjusted for brightest, most uniform pattern.
- With writing beam cut off. Since grid No. 2 of the viewing Gun and grids No. 2 and No. 4 of the writing Gun are connected together within the tube, the maximum total current collected by these electrodes is essentially equal to the sum of the maximum grid-No. 2 current of the viewing Gun and the maximum cathode current of the writing Gun (See *Writing-Gun-Current-Characteristic Curve*).
- Observed with an RCA-2F21 Monoscope display.
- ▲▲ Expressed in terms of the time required for the brightness of the unwritten background to rise from just zero brightness (viewing-beam cutoff) to 10 per cent of saturated brightness.
- Determined as follows: With no erasing pulse, overscan the storage surface with writing beam to obtain maximum pattern brightness. Then cut off writing beam. Apply rectangular erasing pulses having an amplitude of between 8 to 10 volts and adjust duty cycle to obtain complete erasure in approximately 10 seconds. Measure time (t_1) from start of erasing to the instant at which any area within the minimum useful viewing diameter is reduced to background-brightness level, and time (t_2) from start of erasing to the instant at which the entire area within the minimum useful viewing-diameter area is reduced to background-brightness level. The erasing-uniformity factor is defined as $(t_2 - t_1)/t_2$.
- Measured by shrinking-raster method at a display brightness of 50 per cent of saturated brightness and with grids No. 2 & No. 4 of writing Gun at about +2000 volts with respect to cathode of writing Gun.
- Measured with entire storage grid written to produce saturated brightness and with screen at indicated voltage.
- The cathode of the writing Gun is operated at about -2000 volts with respect to the cathode of the viewing Gun which is usually operated at ground potential.
- # The center of the undeflected focused beam will fall within a circle having a 10-mm radius and having its center on the writing-Gun axis (See *Dimensional Outline*) under the following conditions: grids No. 2 & No. 4 of writing Gun at +2000 volts with respect to cathode of writing Gun, grid No. 3 of writing Gun at voltage to give focus, grid No. 1 of writing Gun at voltage which will permit storage of a charge just sufficient to give a barely perceptible spot on screen. Viewing Section operating under normal conditions, and tube shielded against extraneous fields.
- †† Measured under conditions of writing from just zero brightness (viewing-beam cutoff) to maximum brightness with grid No. 1 of writing Gun at -10 volts with respect to cathode of writing Gun, and grids No. 2 & No. 4 of writing Gun at +2000 volts with respect to cathode of writing Gun.
- It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

OPERATING CONSIDERATIONS

Shielding. Magnetic shielding must be provided to prevent external fields from interfering with the required accurate control of the low-velocity viewing beam. A cylindrical shield of properly annealed high-permeability material about 1/16-inch thick is usually satisfactory.

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DISPLAY STORAGE TUBE

Terminal Connections. The base pins of the 7448 fit the Diheptal 14-contact socket. The *Recessed Small Ball caps* and the *Recessed Small Cavity cap* require standard flexible-lead connectors.

The high voltages at which the 7448 is operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Safety precautions include the enclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is desired.

In the use of high-voltage tubes, it should always be remembered that high voltages may appear at normally low-potential points in the circuit as a result of capacitor breakdown or incorrect circuit connections. Therefore, before any part of the circuit is touched, the power-supply switch should be turned off, and both terminals of any capacitors grounded.

To prevent possible damage to the tube, allow the Viewing-Gun beam current to reach normal operating value before turning on the Writing-Gun beam current, and keep the viewing beam on till the writing beam is turned off.

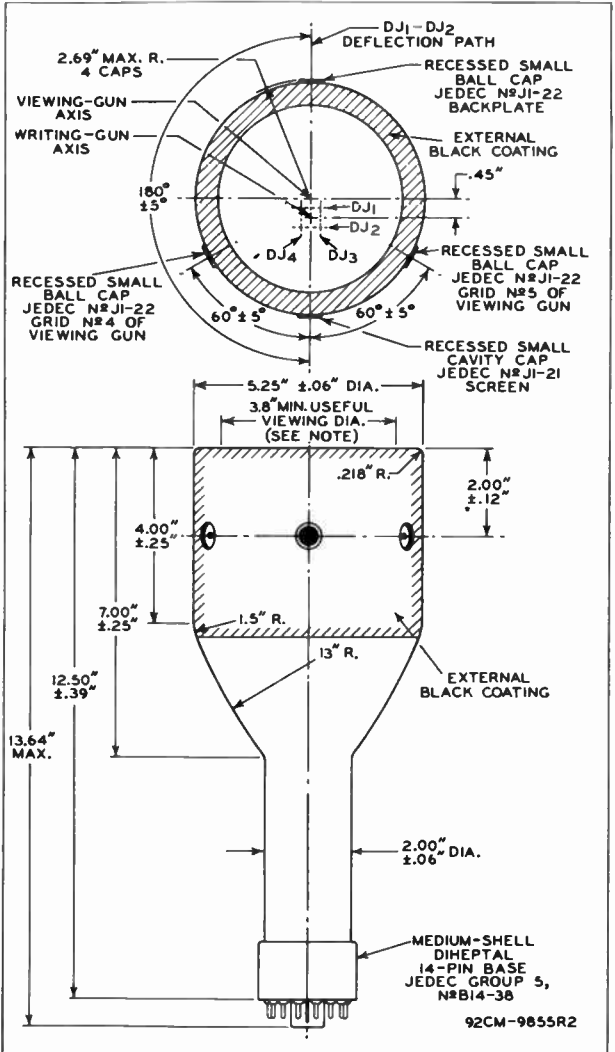
Failure of scanning while the writing beam is turned on may permanently damage the storage grid. Therefore, provision should be made to cut off automatically the writing-beam current in case of a scanning failure. The writing-beam current can be cut off by an electronic switch which applies -200 volts bias to grid No. 1 of the writing Gun. This switch should be actuated by a portion of the scanning voltages applied to both sets of deflecting electrodes.



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DISPLAY STORAGE TUBE



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DISPLAY STORAGE TUBE

NOTE: MINIMUM USEFUL VIEWING AREA MAY BE ECCENTRIC WITH RESPECT TO THE TUBE FACE. THE MINIMUM USEFUL VIEWING AREA WILL HAVE DIAMETER OF 3.8".

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

DEFLECTING ELECTRODES DJ_1 AND DJ_2 ARE NEARER THE SCREEN: DEFLECTING ELECTRODES DJ_3 AND DJ_4 ARE NEARER THE BASE. WITH DJ_1 POSITIVE WITH RESPECT TO DJ_2 , THE SPOT WILL BE DEFLECTED TOWARD PIN B; LIKewise, WITH DJ_3 POSITIVE WITH RESPECT TO DJ_4 , THE SPOT WILL BE DEFLECTED TOWARD PIN 4.

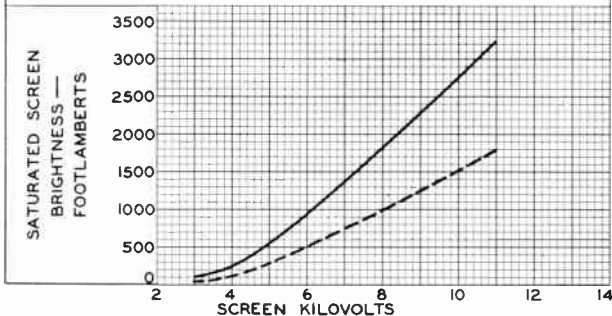
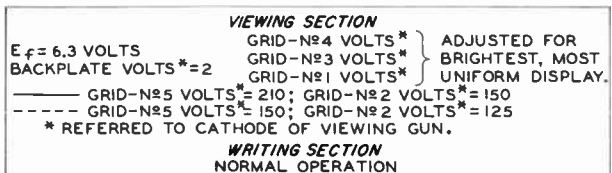
THE ANGLE BETWEEN THE DEFLECTION PATH PRODUCED BY DJ_1 AND DJ_2 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND THE BASE KEY BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 10^{\circ}$. THE ANGLE BETWEEN THE DEFLECTION PATH PRODUCED BY DJ_1 AND DJ_2 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND THE SCREEN CAP BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 10^{\circ}$. ANGLE BETWEEN $DJ_1 - DJ_2$ DEFLECTION PATH AND $DJ_3 - DJ_4$ DEFLECTION PATH IS $90^{\circ} \pm 3^{\circ}$.



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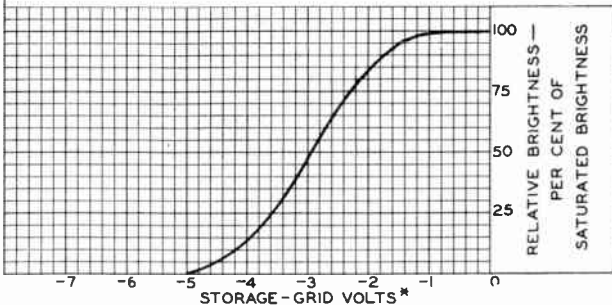
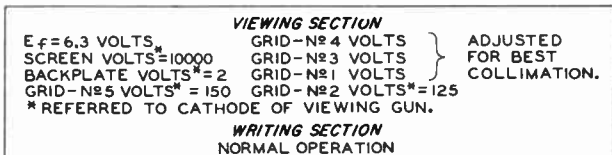
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TYPICAL CHARACTERISTICS



92CS-9858

TYPICAL STORAGE-GRID CHARACTERISTIC



92CS-9861

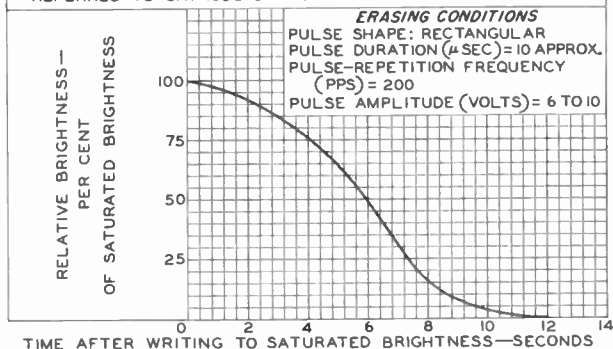
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TYPICAL ERASURE CHARACTERISTIC

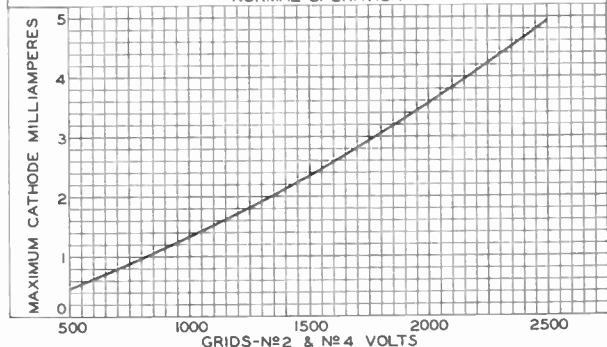
VIEWING SECTION		
$E_f = 6.3$ VOLTS	GRID-N ^o 4 VOLTS	} ADJUSTED FOR BEST COLLIMATION.
SCREEN VOLTS* = 10000	GRID-N ^o 3 VOLTS	
BACKPLATE VOLTS* = 2	GRID-N ^o 1 VOLTS	
GRID-N ^o 5 VOLTS* = 150	GRID-N ^o 2 VOLTS* = 125	
* REFERRED TO CATHODE OF VIEWING GUN.		



92CS-9860

WRITING-GUN-CURRENT CHARACTERISTIC

WRITING SECTION	
$E_f = 6.3$ VOLTS	GRID-N ^o 3 VOLTS* = ADJUSTED FOR FOCUS
	GRID-N ^o 1 VOLTS* = 0
* REFERRED TO CATHODE OF WRITING GUN.	
VIEWING SECTION	
NORMAL OPERATION	



ELECTRON TUBE DIVISION
 RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CS-9859RI



