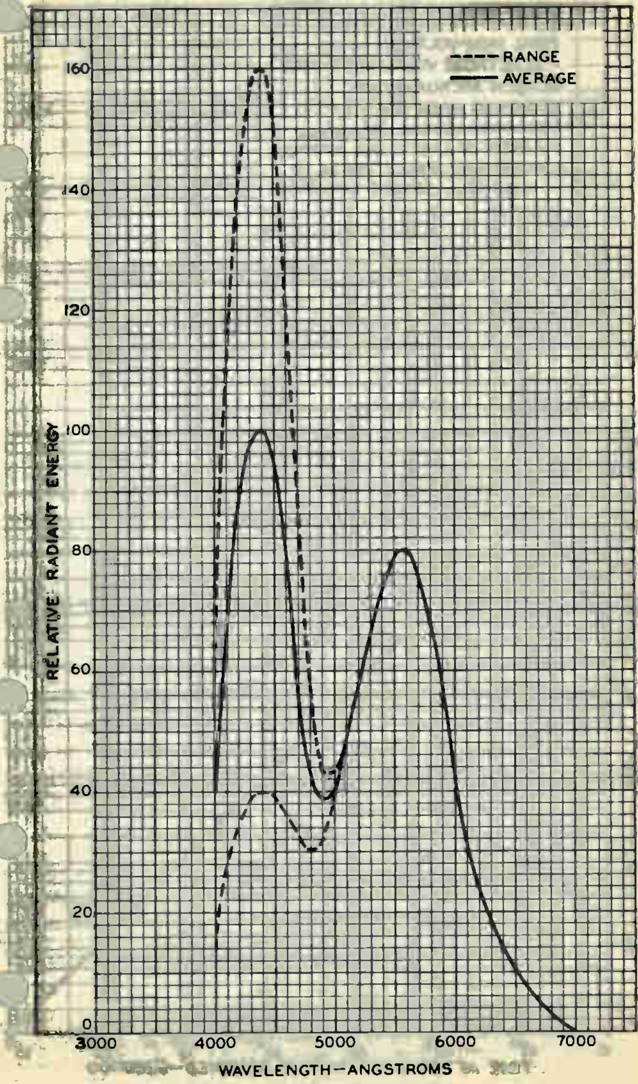
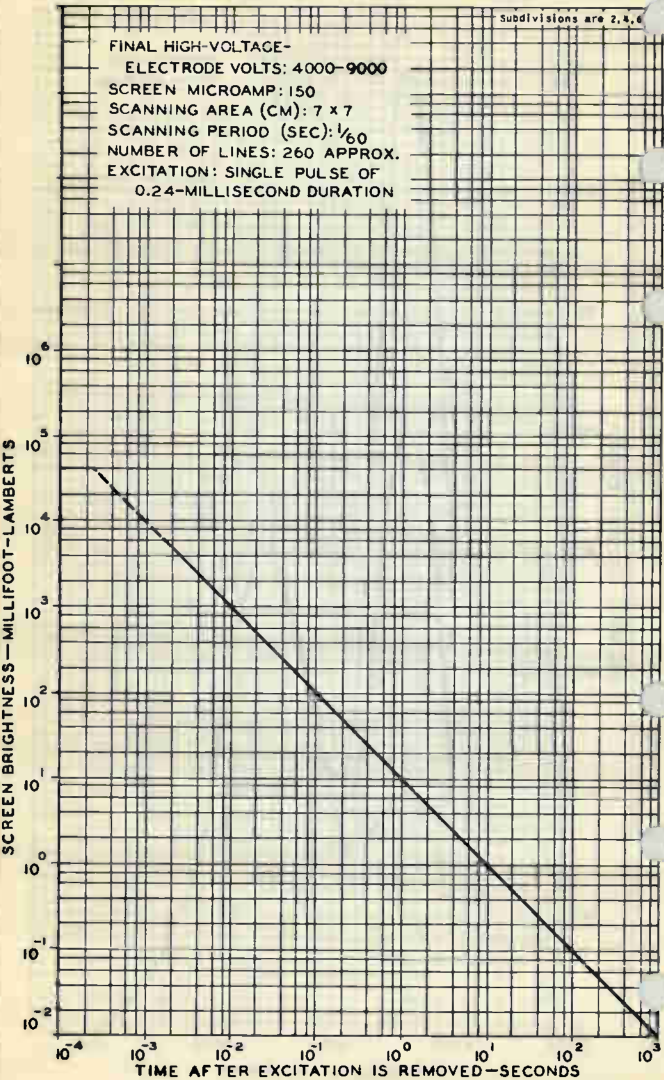
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P7



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7336

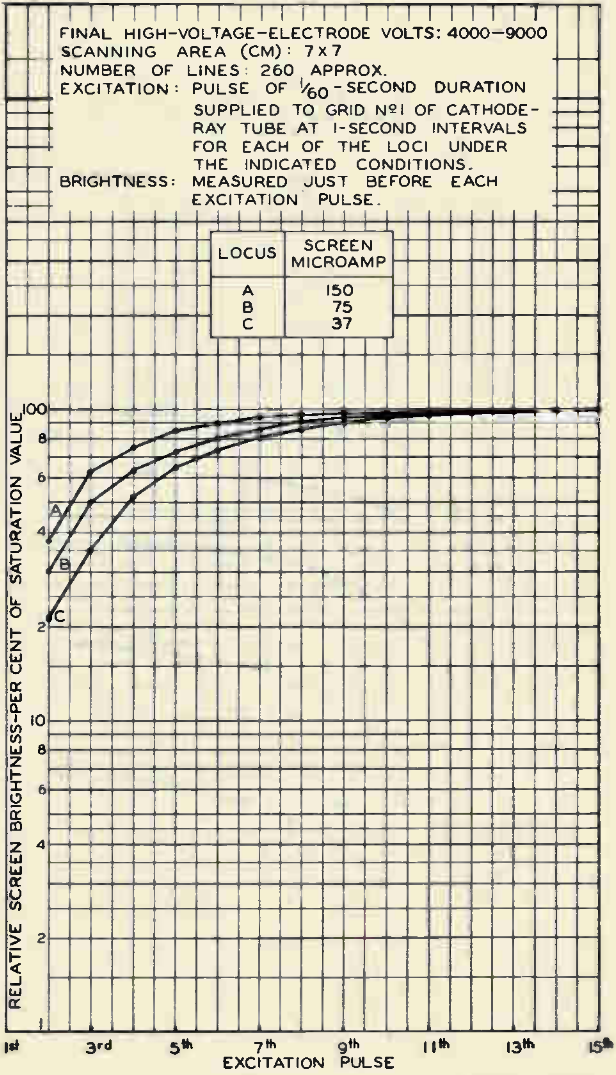
PERSISTENCE CHARACTERISTIC OF PHOSPHOR P7



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7015R4

BUILDUP CHARACTERISTICS OF PHOSPHOR P7



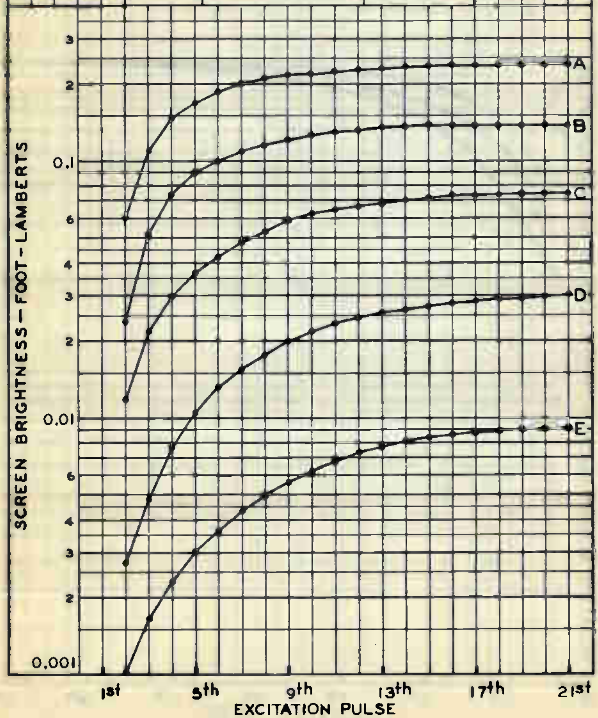
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM - 7019R3

BUILDUP CHARACTERISTICS OF PHOSPHOR P7

SCANNING AREA (CM): 7 x 7
NUMBER OF LINES: 260 APPROX.
EXCITATION: PULSE OF 1/60-SECOND DURATION SUPPLIED TO GRID Nº1 OF CATHODE-RAY TUBE AT 1-SECOND INTERVALS FOR EACH OF THE LOCI UNDER THE INDICATED CONDITIONS.
BRIGHTNESS: MEASURED JUST BEFORE EACH EXCITATION PULSE.

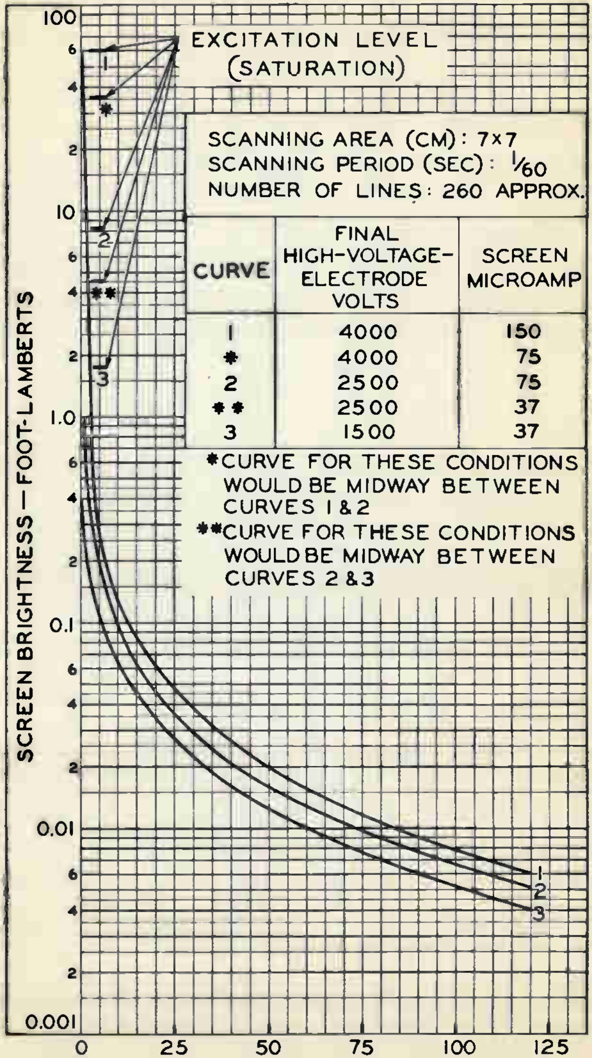
LOCUS	FINAL HIGH-VOLTAGE-ELECTRODE VOLTS	SCREEN MICROAMP
A	4000	150
B	4000	75
C	2500	75
D	2500	37
E	1500	37



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

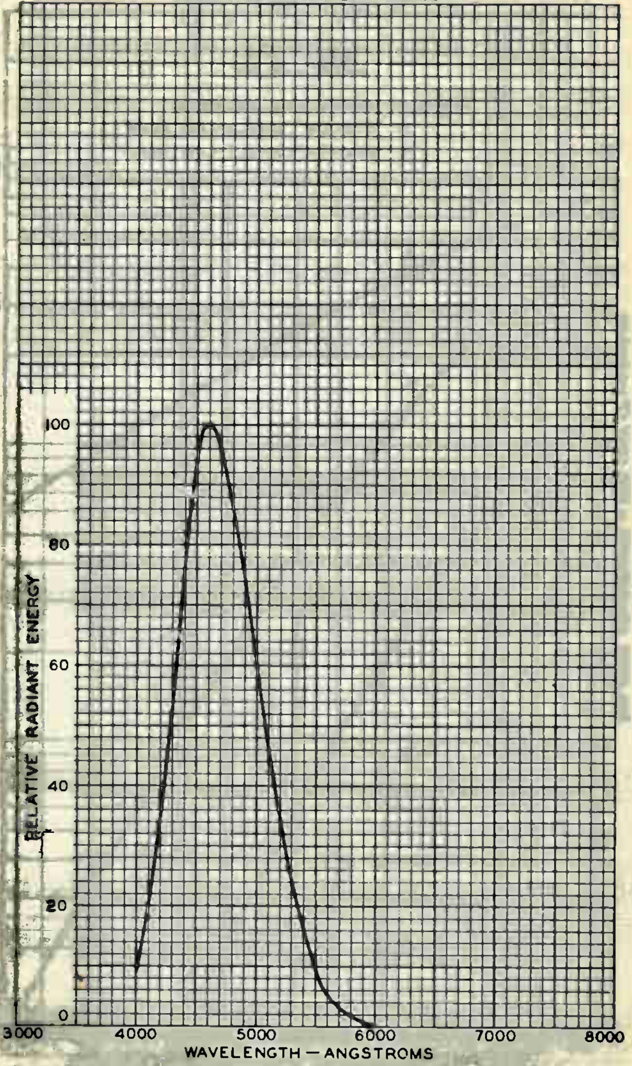
RCA

PERSISTENCE CHARACTERISTICS OF PHOSPHOR P7



CURVE	FINAL HIGH-VOLTAGE-ELECTRODE VOLTS	SCREEN MICROAMP
1	4000	150
*	4000	75
2	2500	75
**	2500	37
3	1500	37

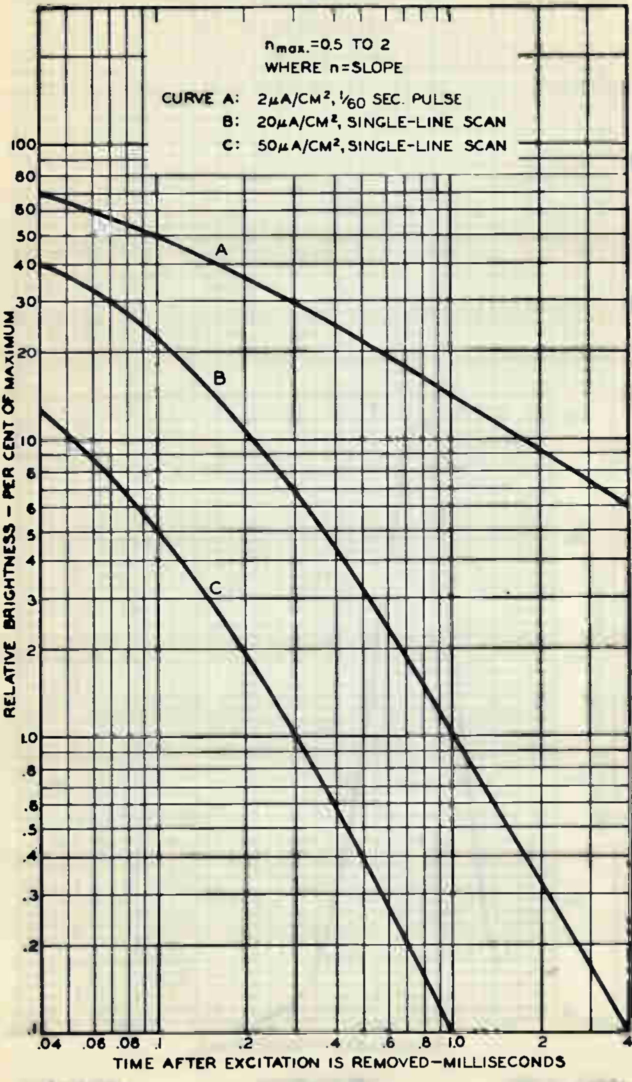
SPECTRAL-ENERGY EMISSION CHARACTERISTIC
OF PHOSPHOR № 11



APRIL 9, 1946 TUBE DEPARTMENT 92CM-6749

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

PERSISTENCE CHARACTERISTICS OF PHOSPHOR No. 11



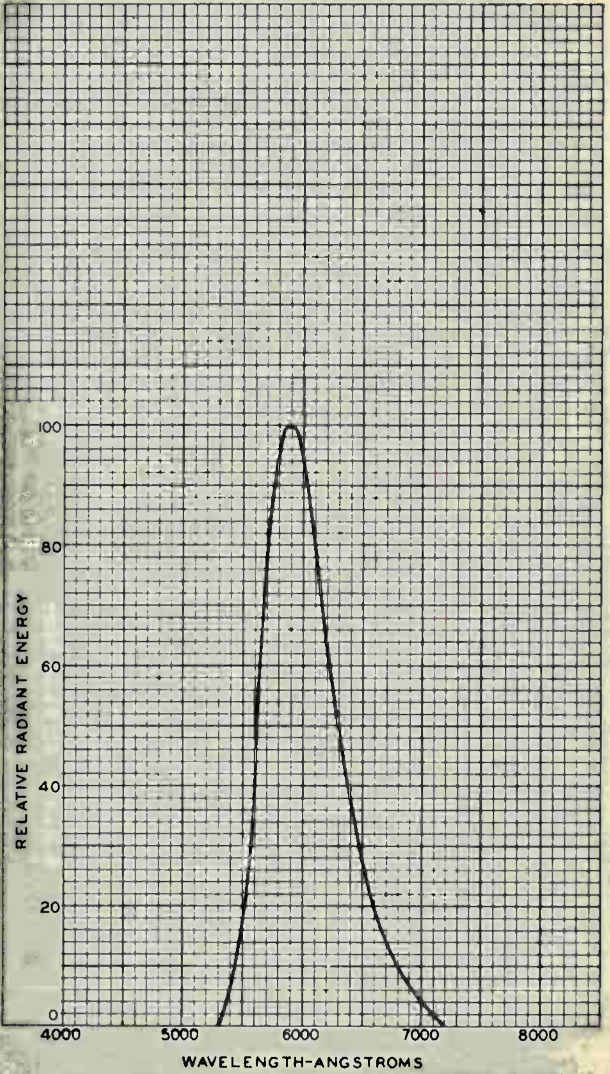
JULY 7, 1950

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8806R2

SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P12

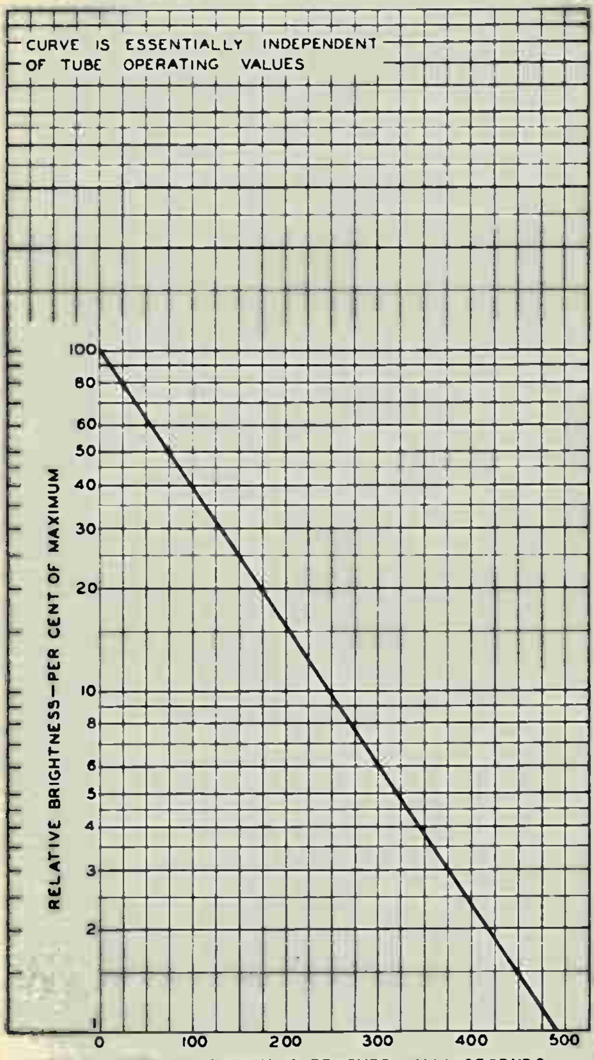


JULY 18, 1949

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7317

PERSISTENCE CHARACTERISTIC OF PHOSPHOR P12

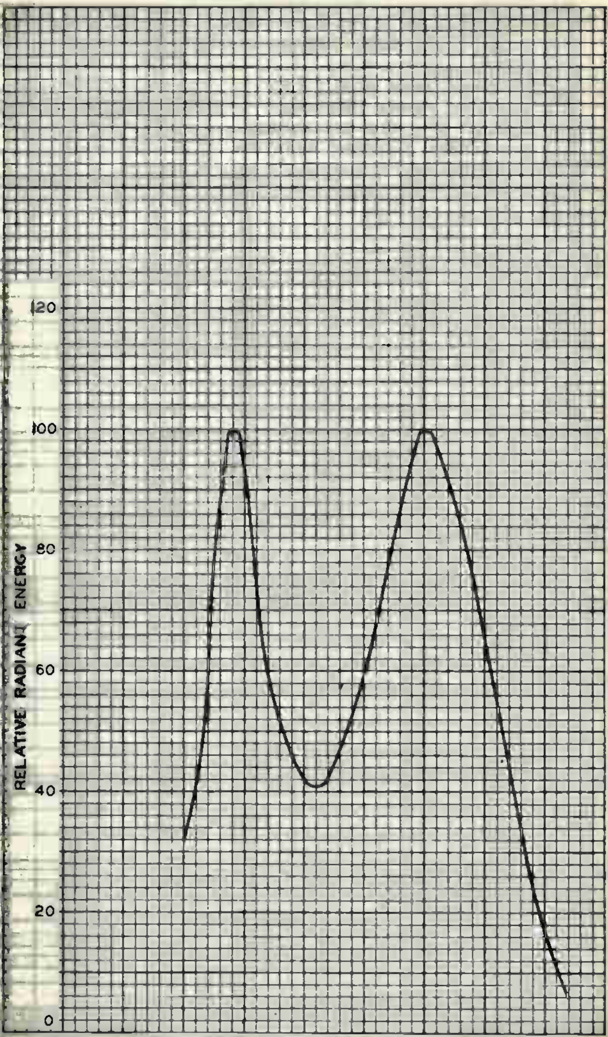


FEB. 1, 1951 TUBE DEPARTMENT 92CM-7318R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P14



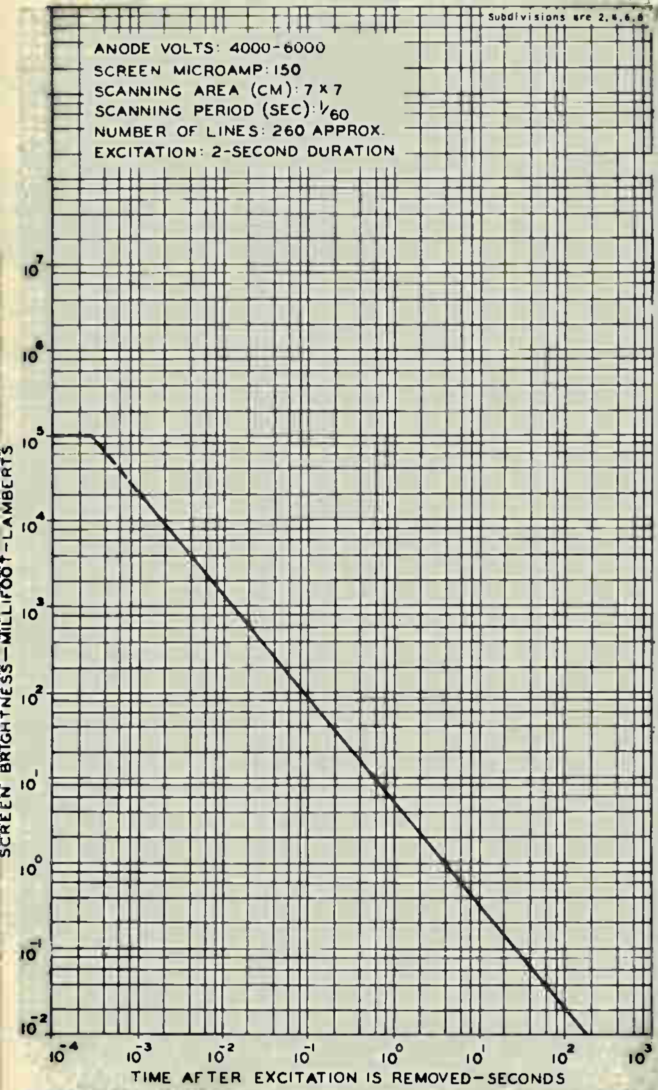
AUG. 1, 1951

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7675

PERSISTENCE CHARACTERISTIC OF PHOSPHOR P14

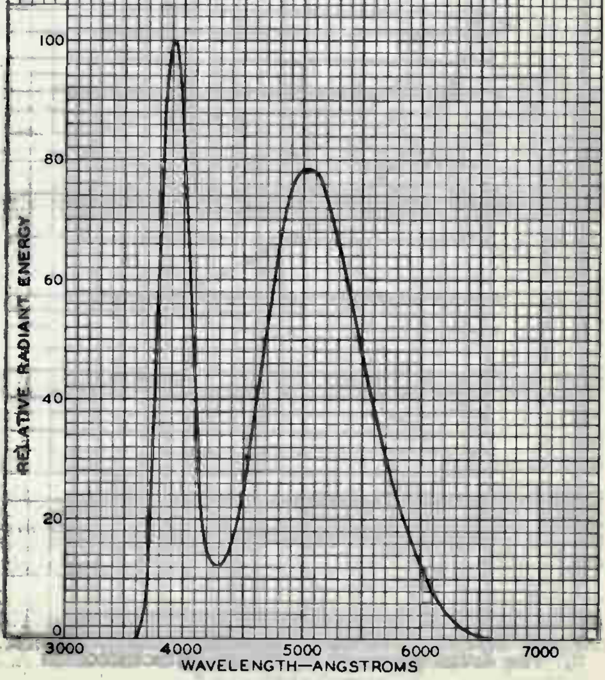


JAN. 26, 1951 TUBE DEPARTMENT 92CM-7328R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P15

COMPONENT	COLOR	I.C.I. COORDINATES	
		X	Y
VISIBLE	GREEN	0.246	0.439
ULTRAVIOLET	—	—	—

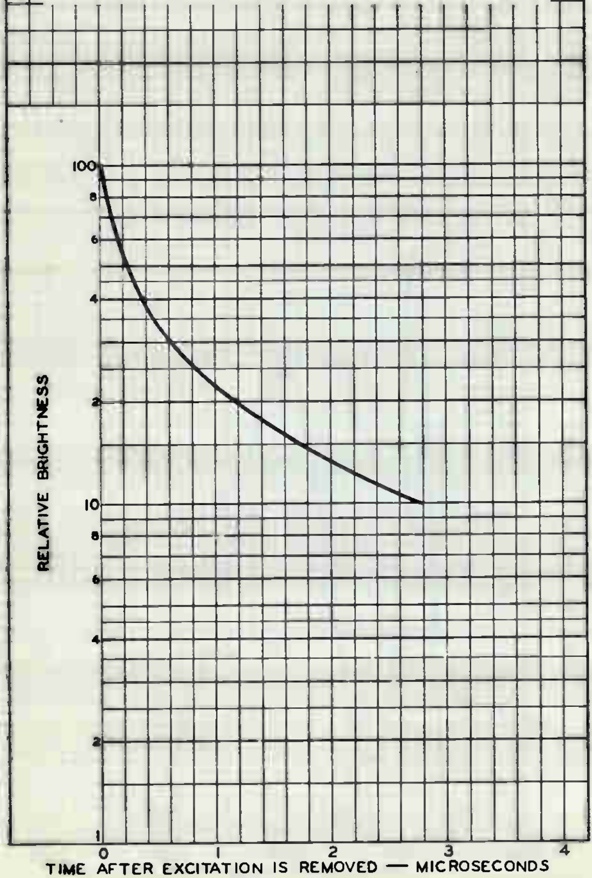


RCA

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

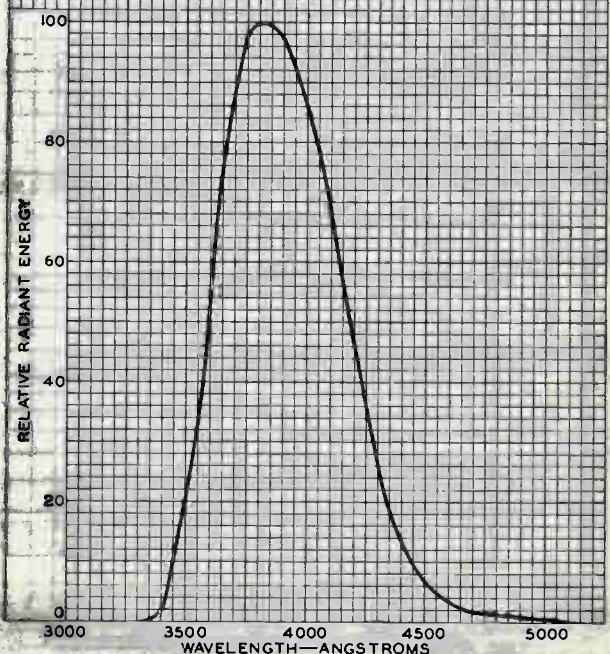
92CM-8540R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P16

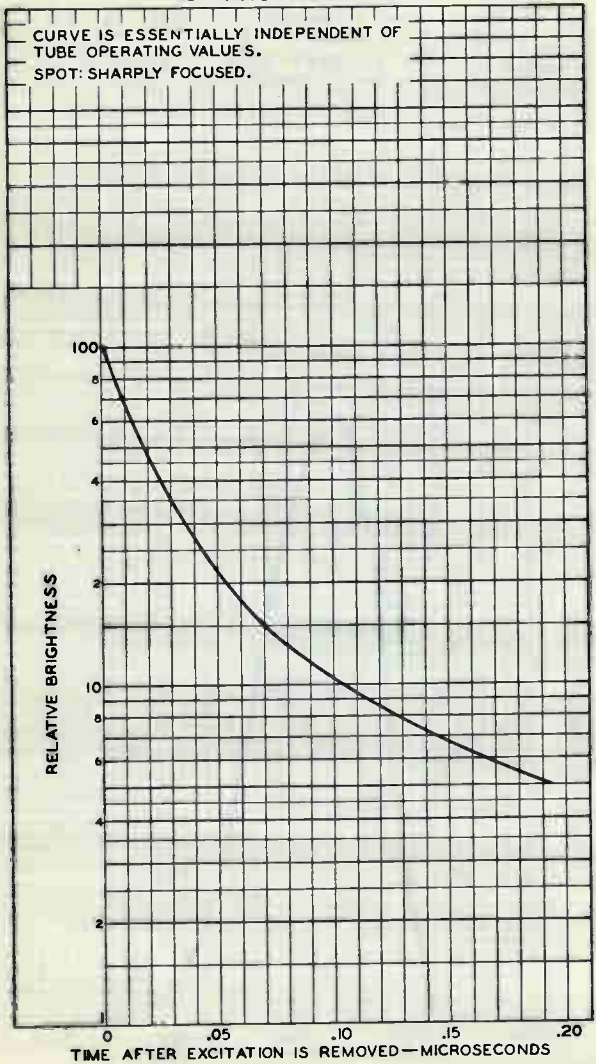
COMPONENT	COLOR	I.C.I. COORDINATES X	I.C.I. COORDINATES Y
VISIBLE	VIOLET	0.175	0.003
NEAR ULTRAVIOLET	——	——	——



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

92CM-7563R1

PERSISTENCE CHARACTERISTIC OF PHOSPHOR P16

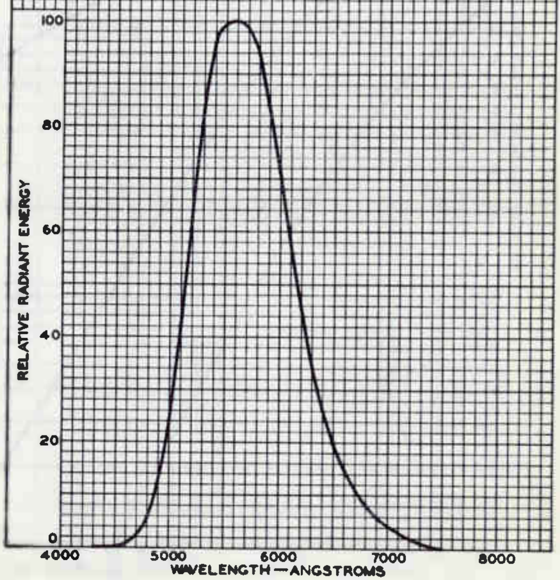


ELECTRON TUBE DIVISION 92CM–7564R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

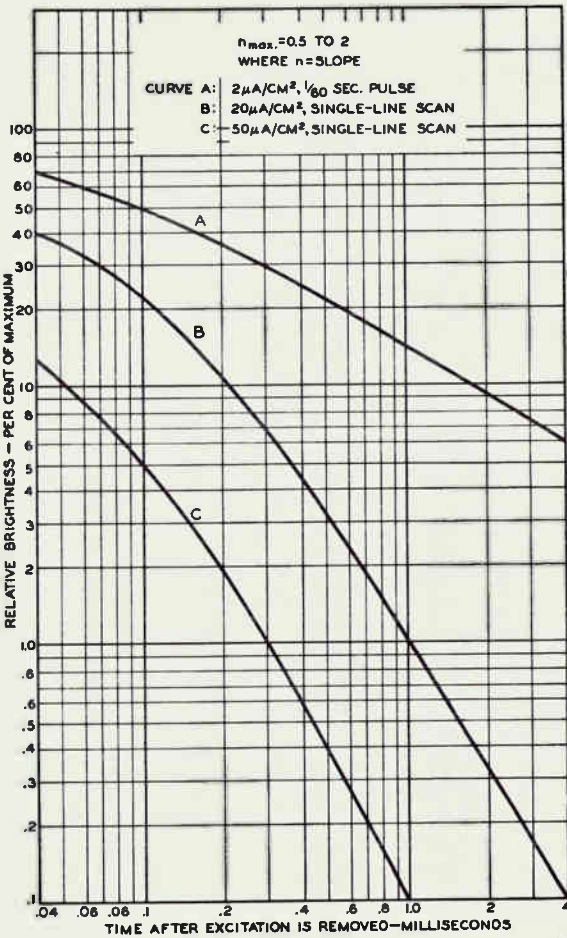
Spectral-Energy Emission Characteristic

COLOR	C.I.E. COORDINATES	
	X	Y
YELLOW-GREEN	0.426	0.546



92CM-7647R2

Persistence Characteristic



92CM-6806R2

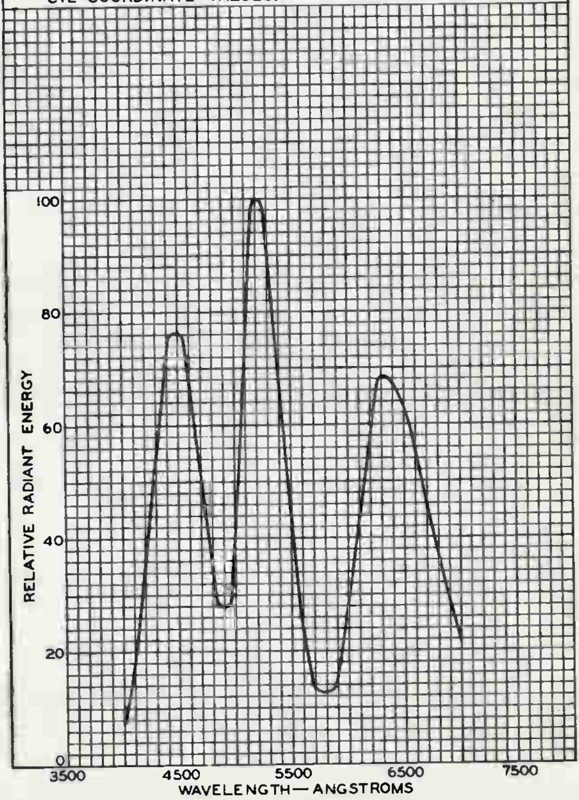
RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

SPECTRAL-ENERGY EMISSION CHARACTERISTIC

SIMULTANEOUS EXCITATION OF BLUE PHOSPHOR, GREEN PHOSPHOR, AND RED PHOSPHOR TO PRODUCE 8500° K + 27 M.P.C.D. WHITF (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

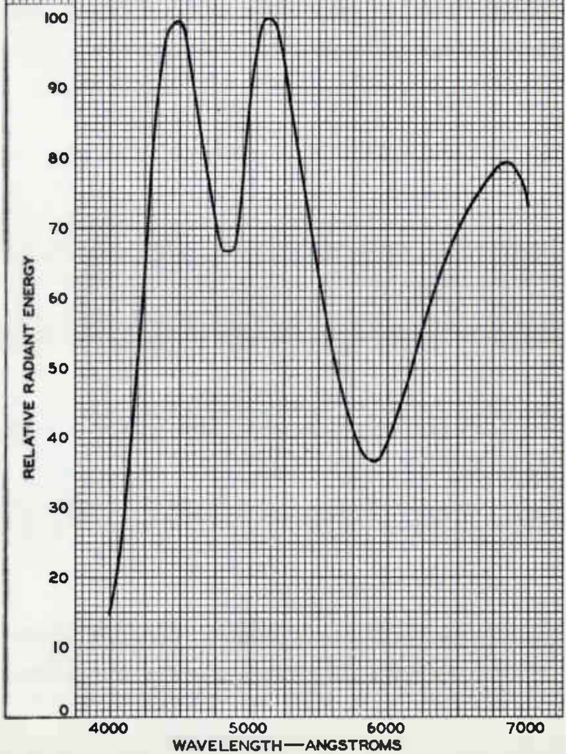
PERSISTENCE CHARACTERISTIC

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.

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

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 per cent of the initial value in:

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

Group Phosphor P22

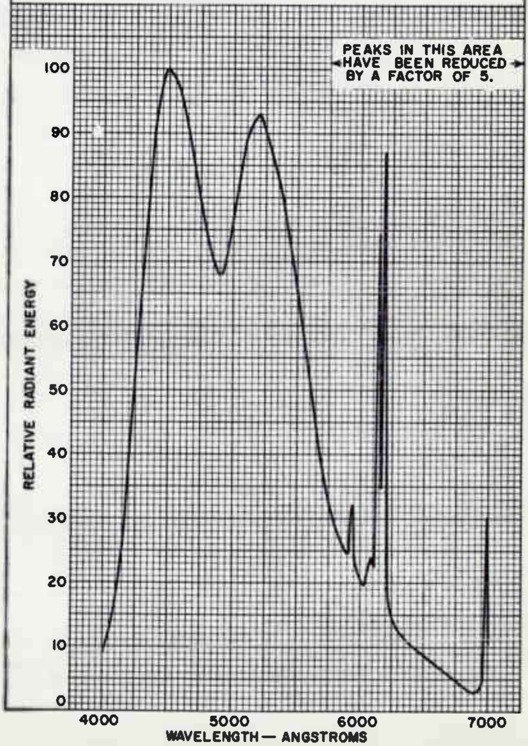
Rare-Earth (Red), Sulfide (Blue & Green) Type[a]

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 REO PHOSPHOR, BLUE PHOSPHOR, AND GREEN PHOSPHOR TO PROOUCE 9300° K + 27 M.P.C.O. WHITE (X = 0.281, Y = 0.311).

COMPONENT COLOR	C.I.E. COOROINATES	
	X	Y
REO	0.676	0.324
BLUE	0.155	0.061
GREEN	0.290	0.590



92CM-13088R1

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

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

Group Phosphor P22

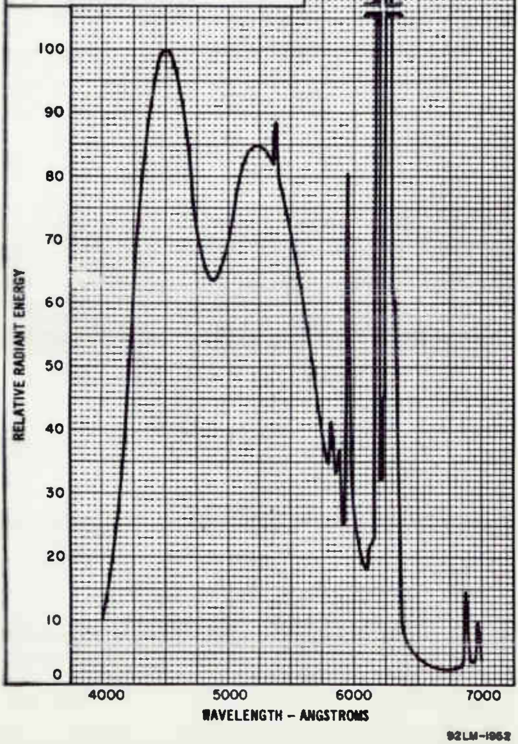
New Rare-Earth (Red), Sulfide (Blue & Green) Type[a]

Spectral-Energy Emission Characteristic

[a] The relative intensities of the narrow-emission bands of the red phosphor are dependent on the 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	0.660	0.340
BLUE	0.152	0.063
GREEN	0.300	0.600



Group Phosphor P22

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

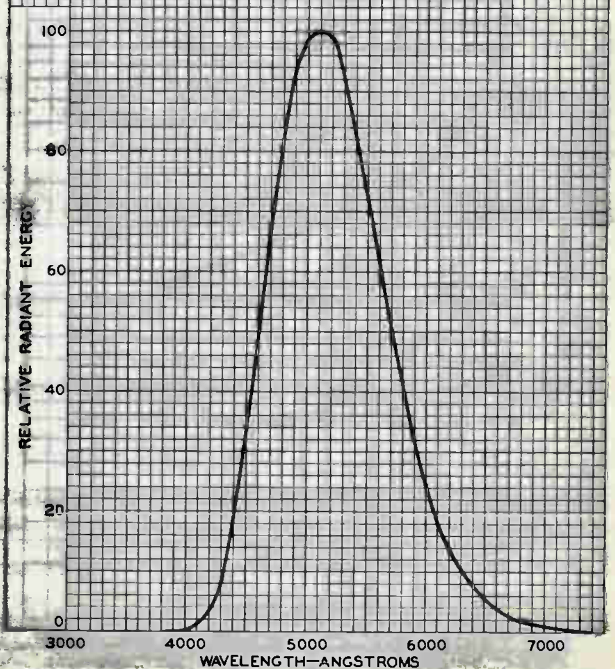
PERSISTENCE CHARACTERISTIC

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

SPECTRAL-ENERGY EMISSION CHARACTERISTIC
OF PHOSPHOR P24

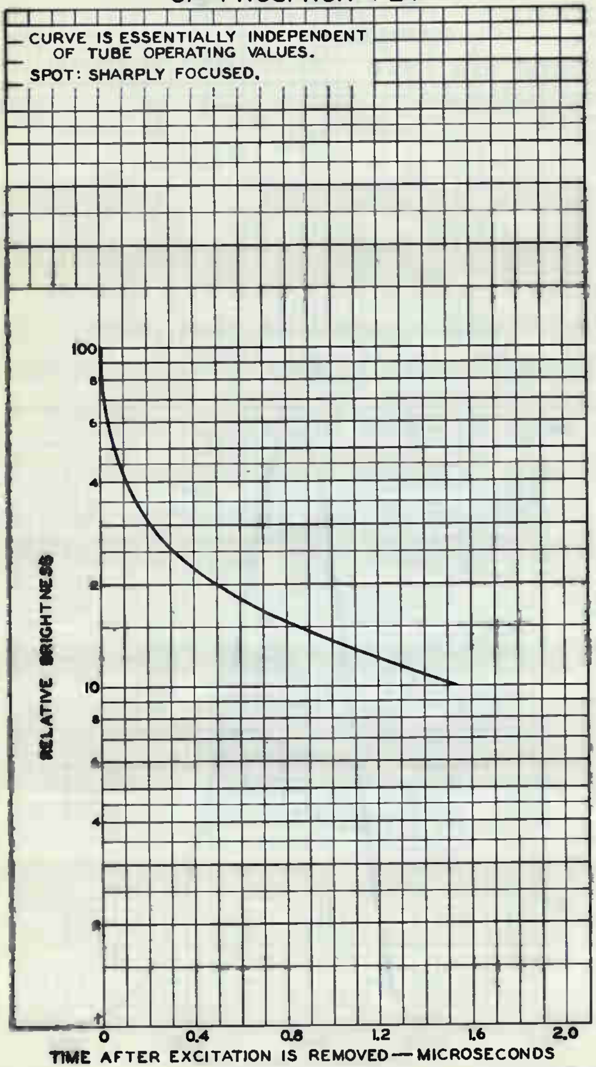
COLOR	I.C.I. COORDINATES	
	X	Y
GREEN	0.245	0.441



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

92CM-8204R1

PERSISTENCE CHARACTERISTIC OF PHOSPHOR P24



ELECTRON TUBE DIVISION 92CM-8205R2

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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.

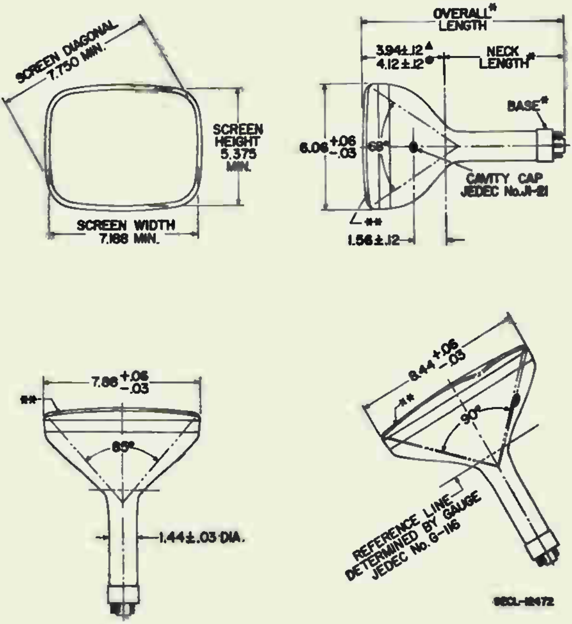
Contact Area for Grounding

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.

FOR PICTURE TUBES UTILIZING BULB J67-1/2 A

(For bulbs with and without integral protective window)



DIMENSIONS IN INCHES

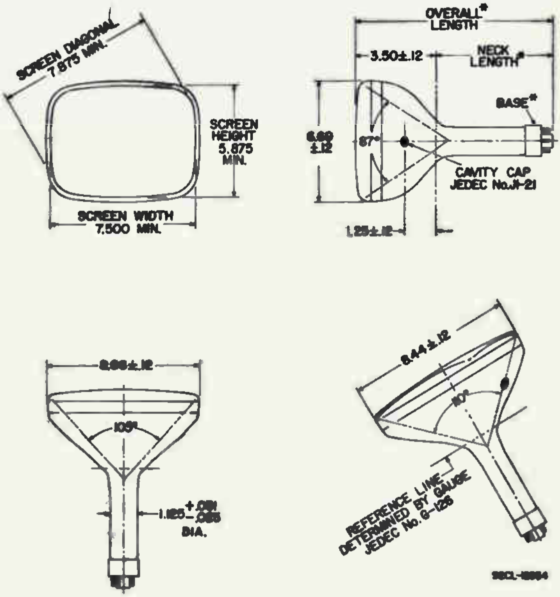
* See data for specific tube type.

** Integral protective window is indicated.

▲ For bulb without protective window.

● For bulb with protective window.

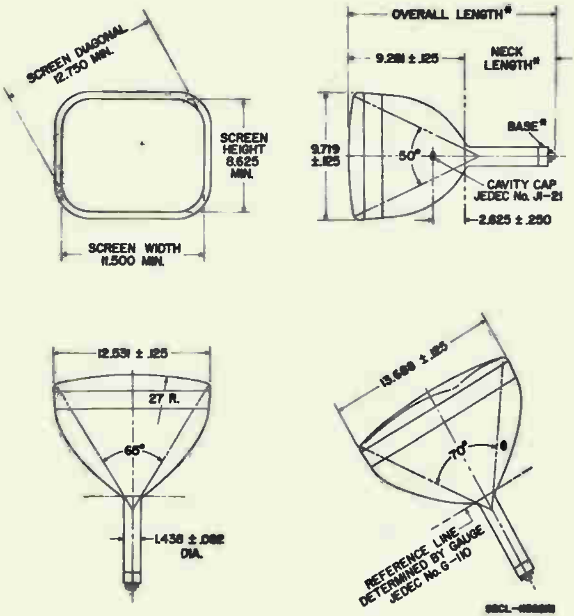
FOR PICTURE TUBES UTILIZING BULB J67-1/2 B



DIMENSIONS IN INCHES

* See data for specific tube type.

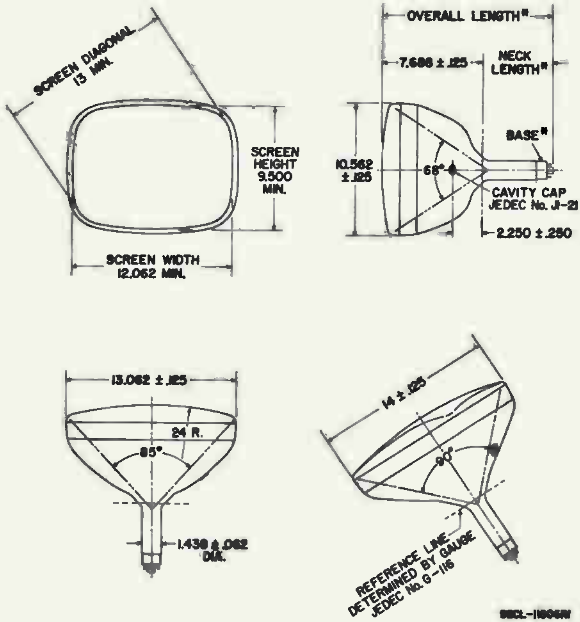
FOR PICTURE TUBES UTILIZING BULB J109-1/2 A/C



DIMENSIONS IN INCHES

* See data for specific tube type.

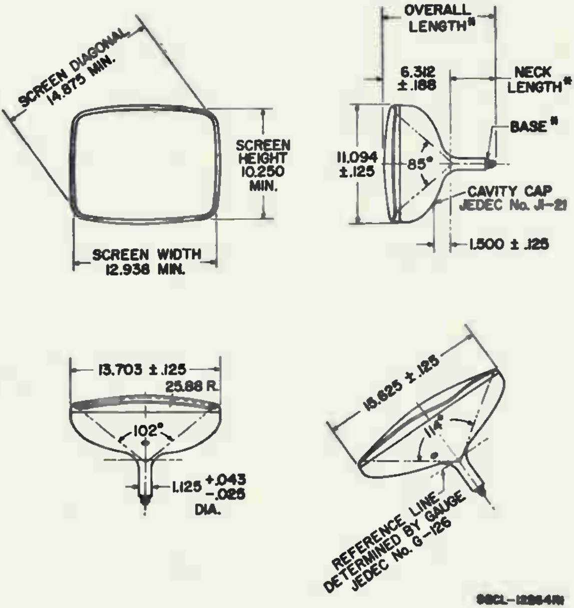
FOR PICTURE TUBES UTILIZING BULB J112 A/B



DIMENSIONS IN INCHES

* See data for specific tube type.

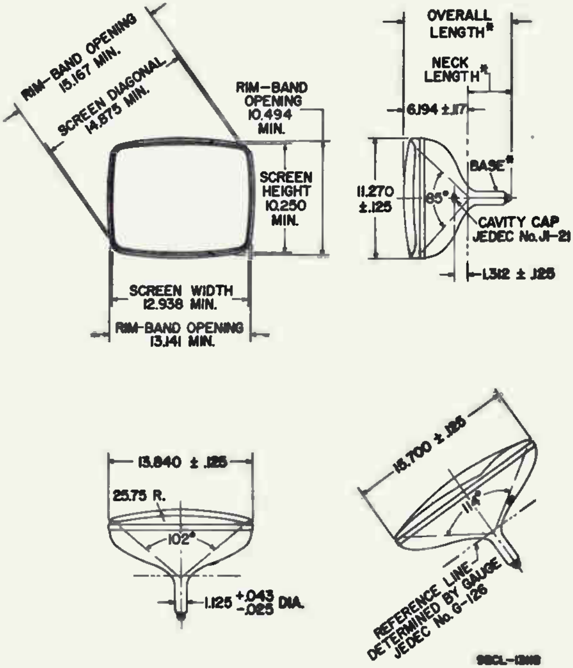
FOR PICTURE TUBES UTILIZING BULB J125 A AND PROTECTIVE WINDOW (FP125 A)



DIMENSIONS IN INCHES

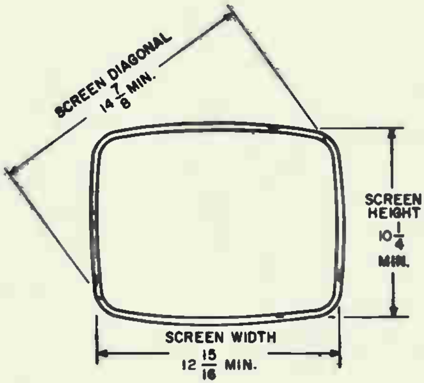
* See data for specific tube type.

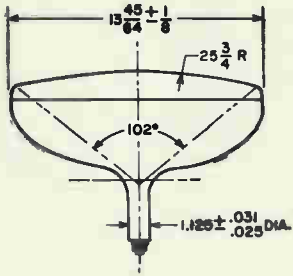
FOR PICTURE TUBE UTILIZING BULB J125 B



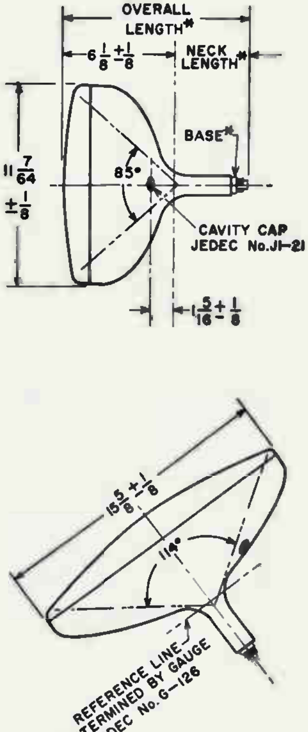
DIMENSIONS IN INCHES

* See data for specific tube type.


SCREEN DIAGONAL
14 7/8 MIN.
SCREEN HEIGHT
10 1/4
MIN.
SCREEN WIDTH
12 15/16 MIN.


13 45/64 ± 1/8
25 3/4 R
102°
1.125 ± .031 .025 DIA.

BULB J125 C2



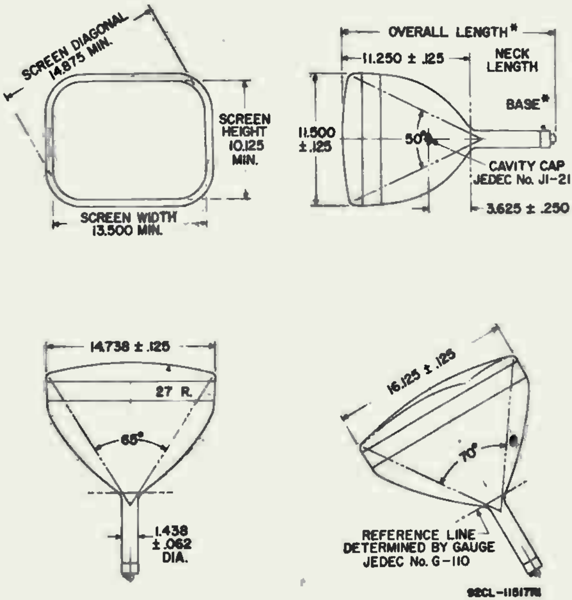
92CL-12037

DIMENSIONS IN INCHES

* See data for specific tube type.

Dimensional Outline Bulb J129 A/B

FOR PICTURE TUBES UTILIZING BULB J129 A/B

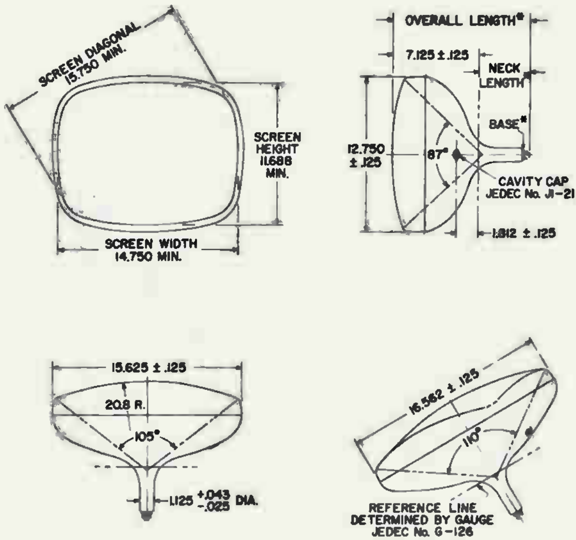


DIMENSIONS IN INCHES

* See data for specific tube type.

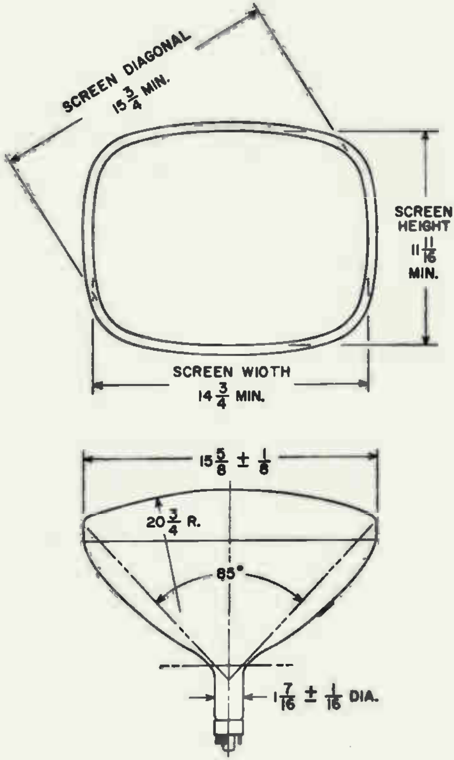
Dimensional Outline Bulb J132-1/2 A/B

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

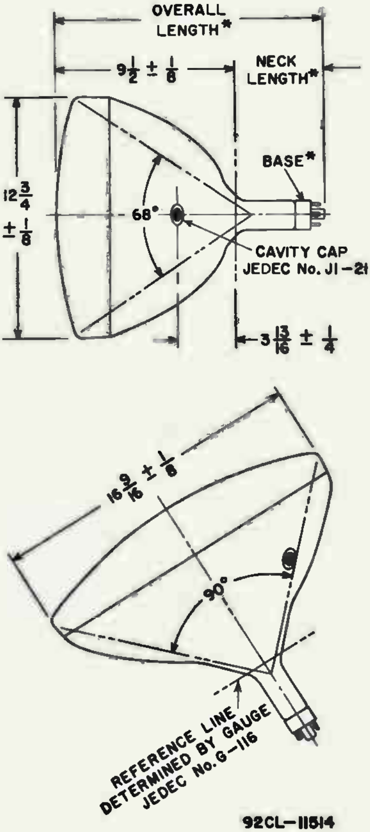


DIMENSIONS IN INCHES

* See data for specific tube type.


SCREEN DIAGONAL
15 3/4 MIN.
SCREEN HEIGHT
11 11/16
MIN.
SCREEN WIDTH
14 3/4 MIN.
15 5/8 ± 1/8
20 3/4 R.
85°
1 7/16 ± 1/16 DIA.

BULB J132-1/2 C/D

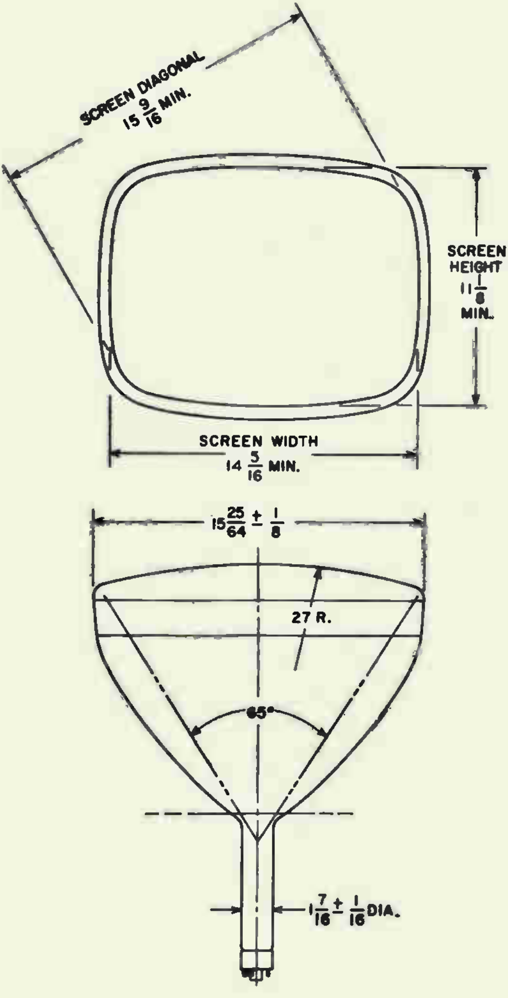


ALL DIMENSIONS IN INCHES

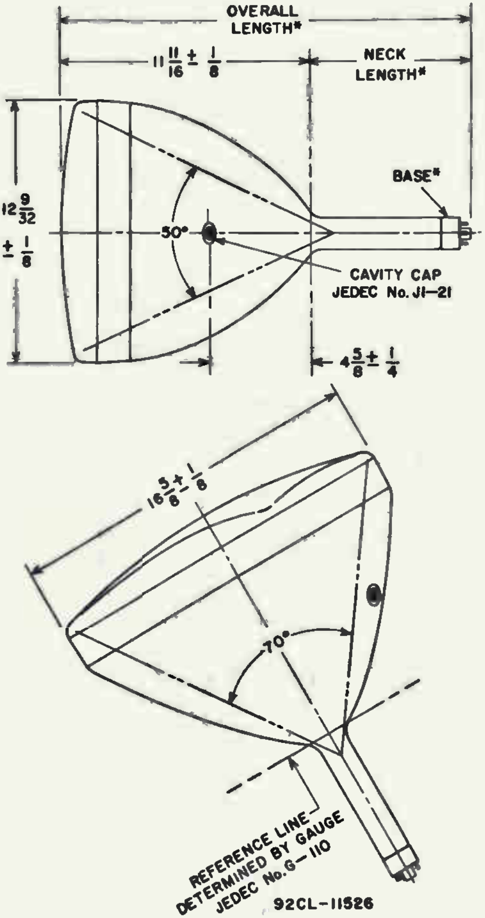
* See data for specific tube type.

Dimensional Outline

FOR PICTURE TUBES UTILIZING



BULB J133 B/D

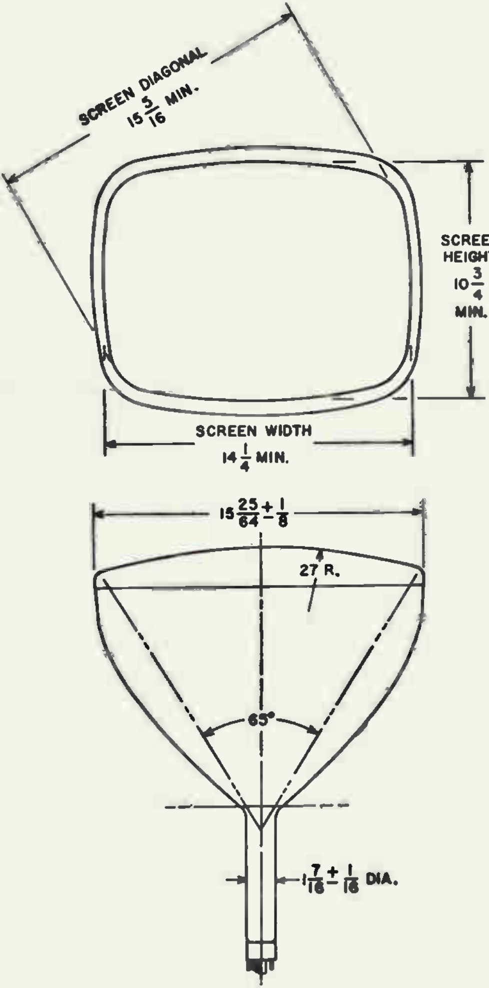


ALL DIMENSIONS IN INCHES

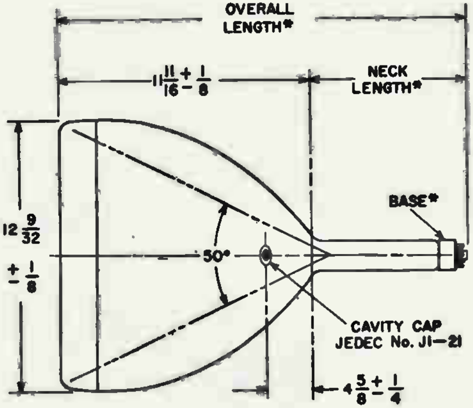
* See data for specific tube type.

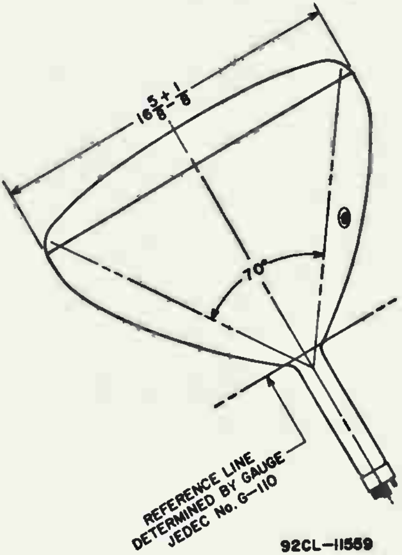
Dimensional Outline

FOR PICTURE TUBES UTILIZING



BULB J133 C/E



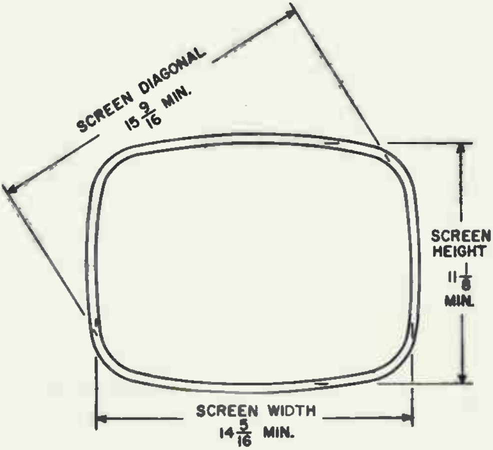


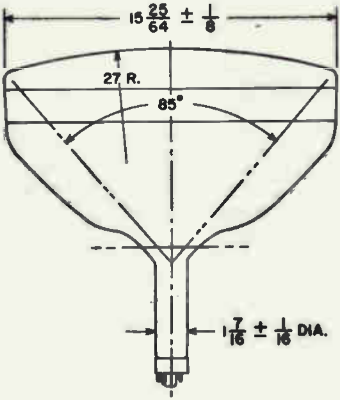
ALL DIMENSIONS IN INCHES

* See data for specific tube type.

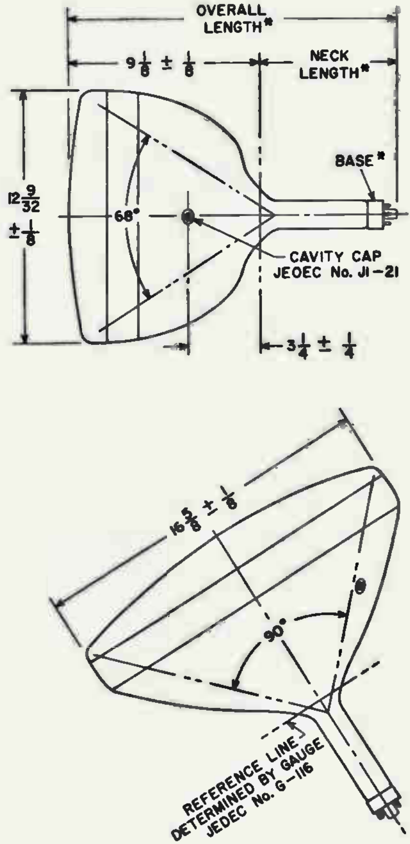
Dimensional Outline

FOR PICTURE TUBES UTILIZING





BULB J133 F/G

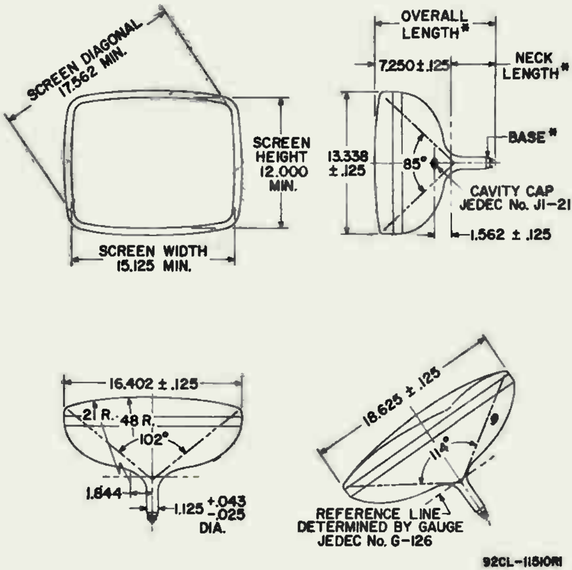


92CL-11557

DIMENSIONS IN INCHES

* See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J149 A

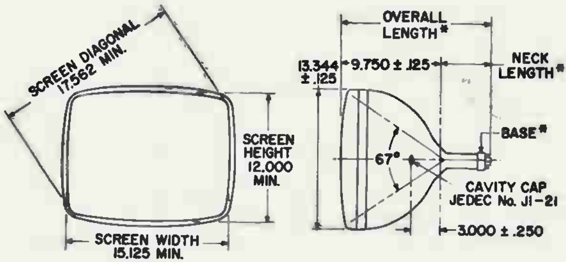


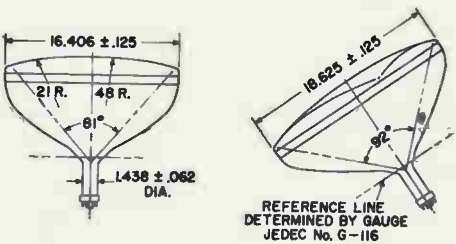
DIMENSIONS IN INCHES

* See data for specific tube type.

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

FOR PICTURE TUBES UTILIZING BULB J149 B

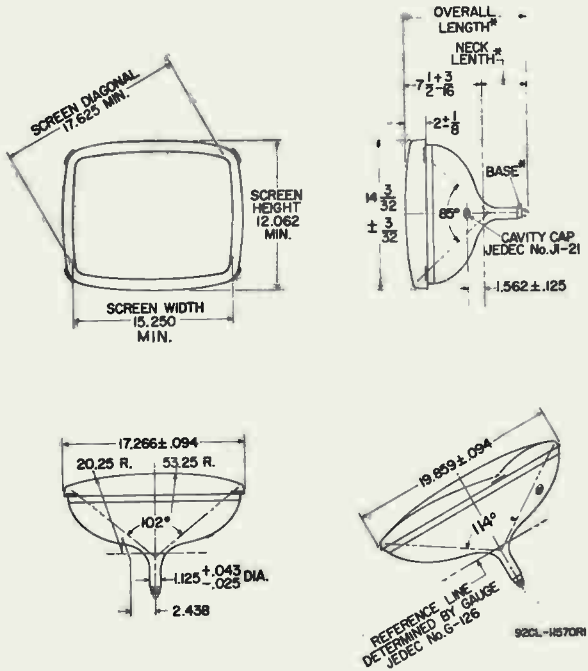




DIMENSIONS IN INCHES

* See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J149 C AND PROTECTIVE PANEL

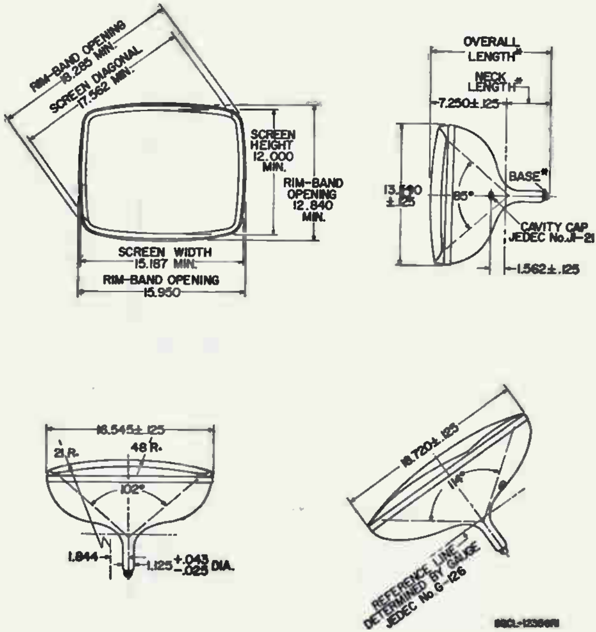


DIMENSIONS IN INCHES

* See data for specific tube type.

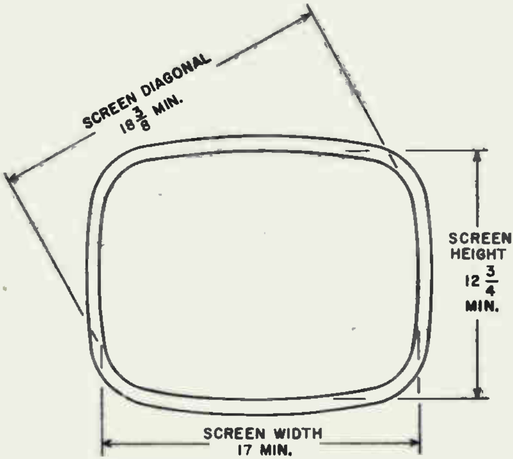
RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

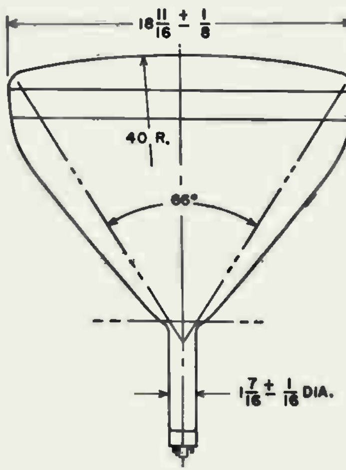
FOR PICTURE TUBES UTILIZING BULB J149 F



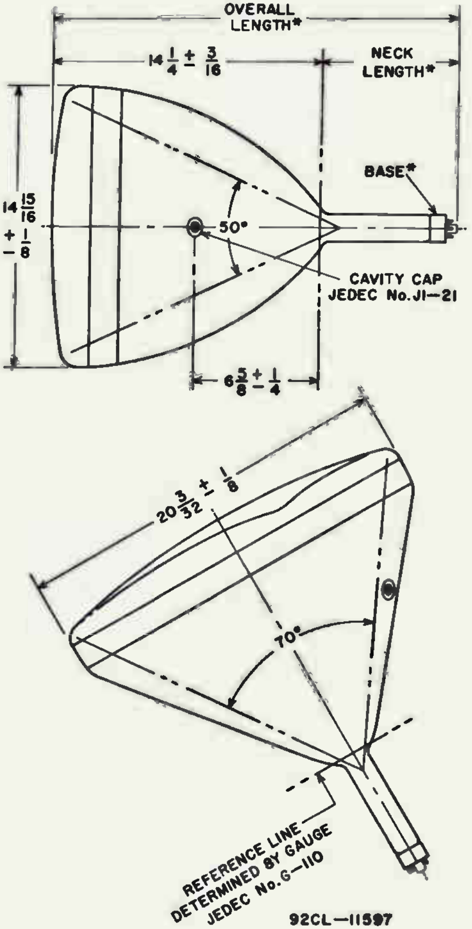
DIMENSIONS IN INCHES

*See data for specific tube type.


SCREEN DIAGONAL
18 3/8 MIN.
SCREEN HEIGHT
12 3/4
MIN.
SCREEN WIDTH
17 MIN.


18 11/16 ± 1/8
40 R.
66°
1 7/16 ± 1/16 DIA.

BULB J161 C/D

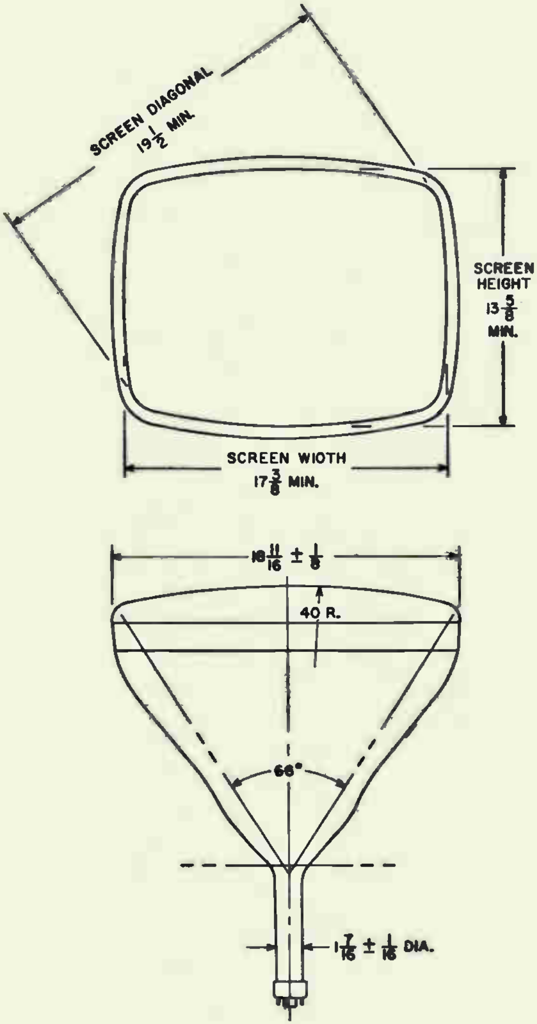


ALL DIMENSIONS IN INCHES

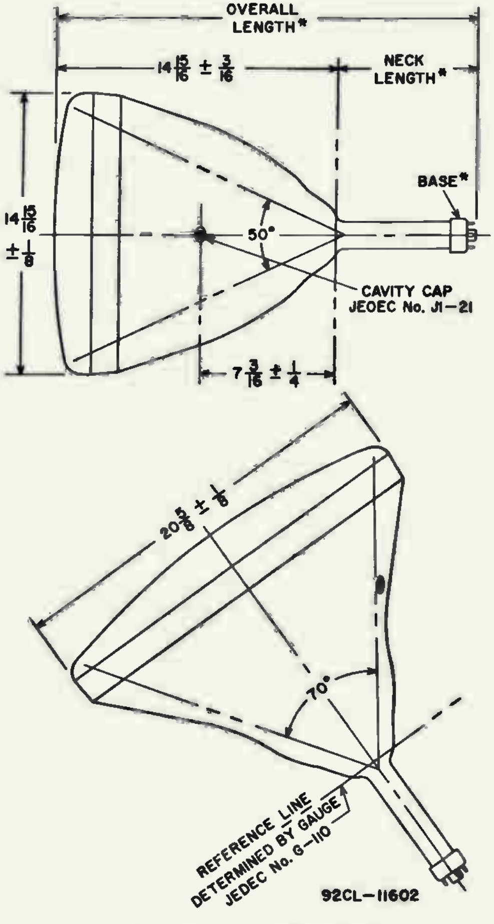
* See data for specific tube type.

Dimensional Outline

FOR PICTURE TUBES UTILIZING



BULB J165 Z

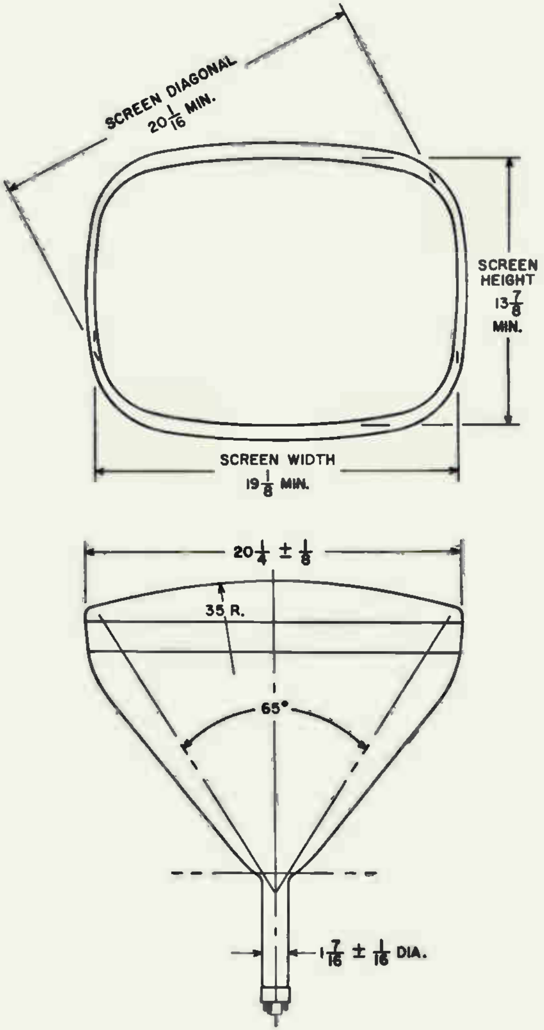


ALL DIMENSIONS IN INCHES

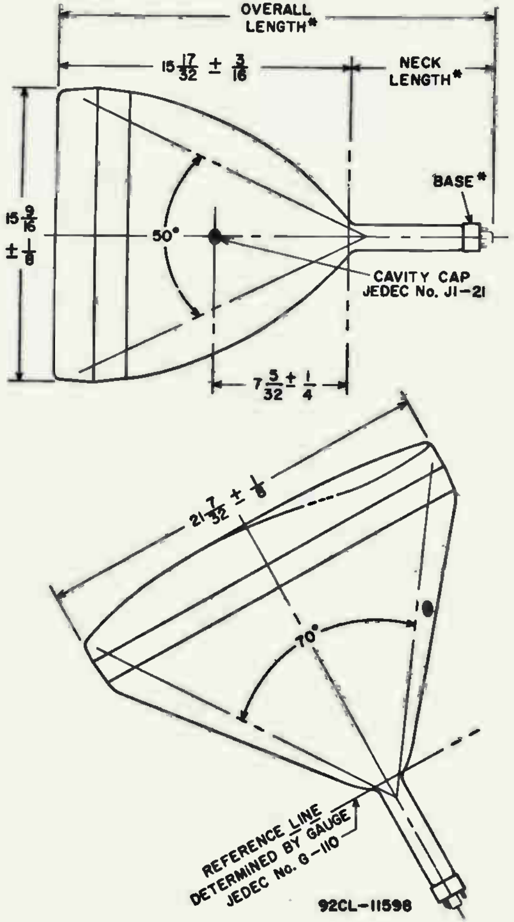
*See data for specific tube type.

Dimensional Outline

FOR PICTURE TUBES UTILIZING



BULB J170 A/C

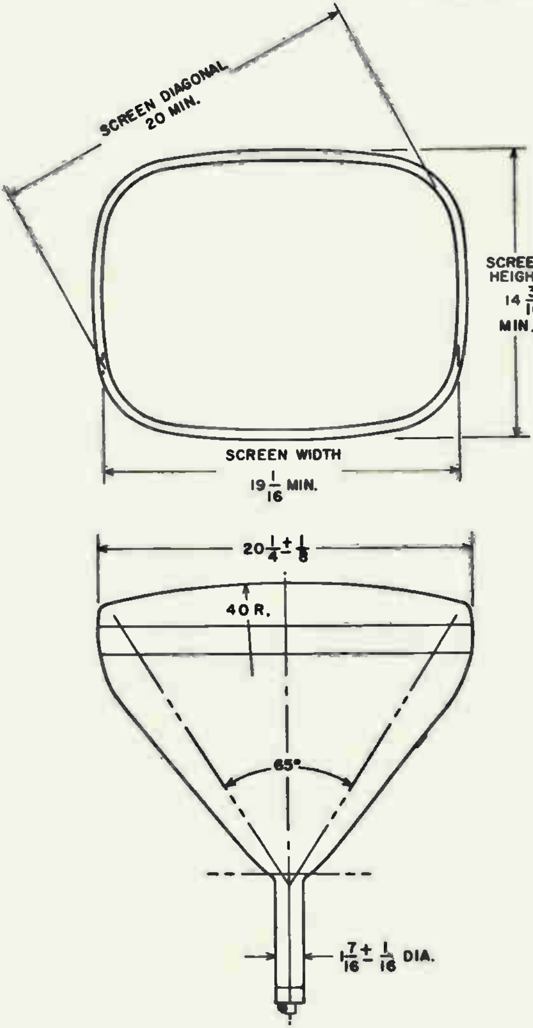


ALL DIMENSIONS IN INCHES

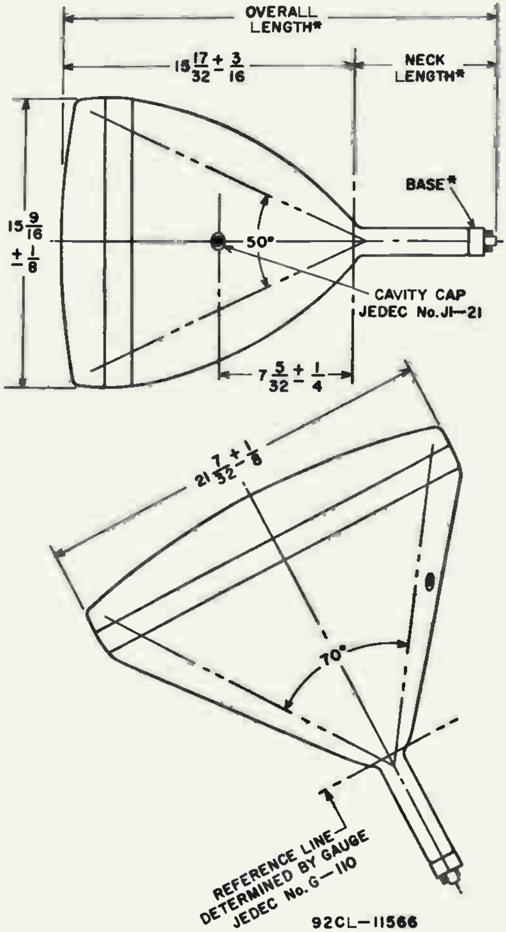
* See data for specific tube type.

Dimensional Outline

FOR PICTURE TUBES UTILIZING



BULB J170 B/D

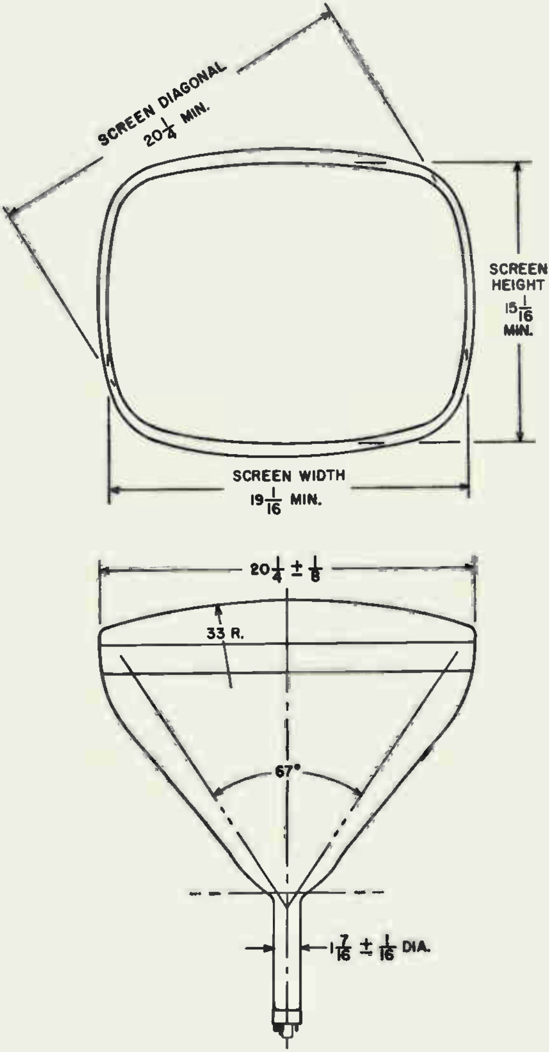


ALL DIMENSIONS IN INCHES

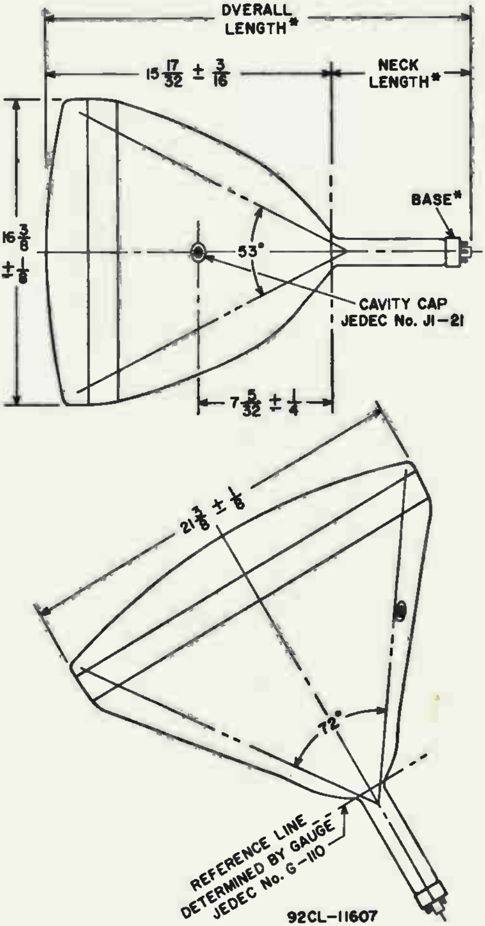
* See data for specific tube type.

Dimensional Outline

FOR PICTURE TUBES UTILIZING



BULB J171 B/F

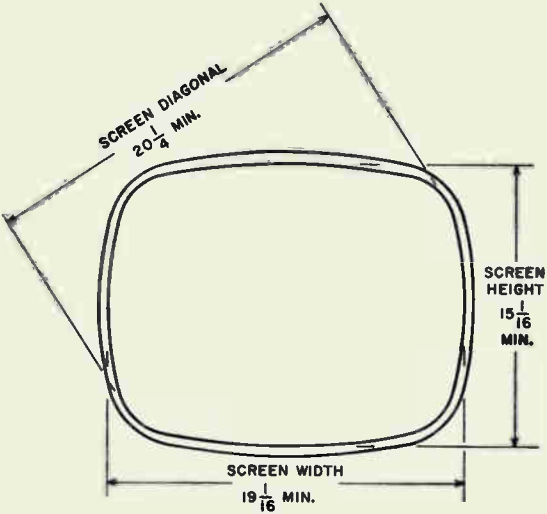


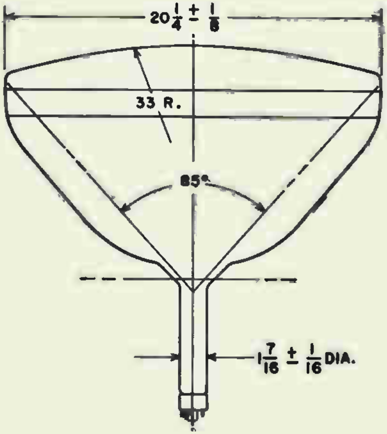
ALL DIMENSIONS IN INCHES

*See data for specific tube type.

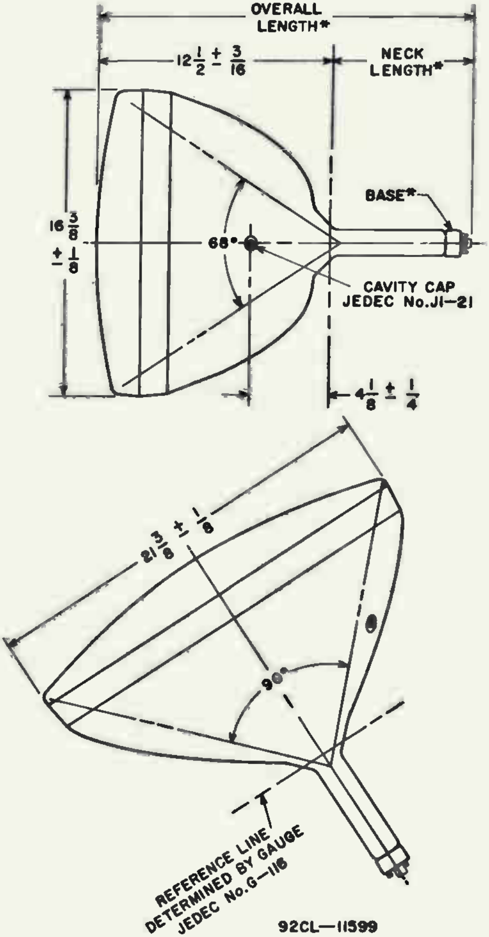
Dimensional Outline

FOR PICTURE TUBES UTILIZING





BULB J171 D/E



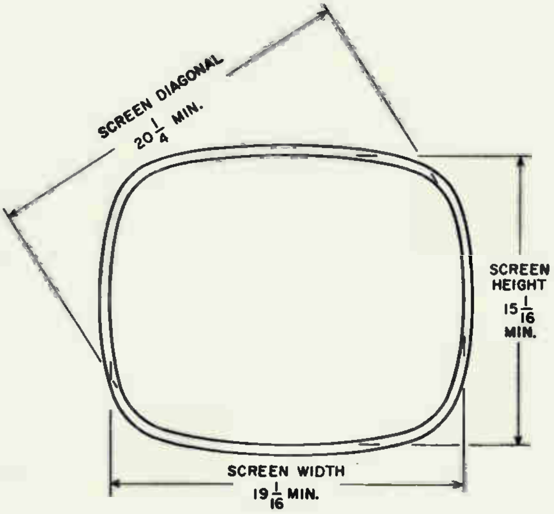
92CL—11599

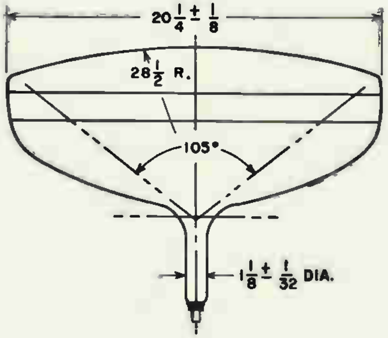
ALL DIMENSIONS IN INCHES

* See data for specific tube type.

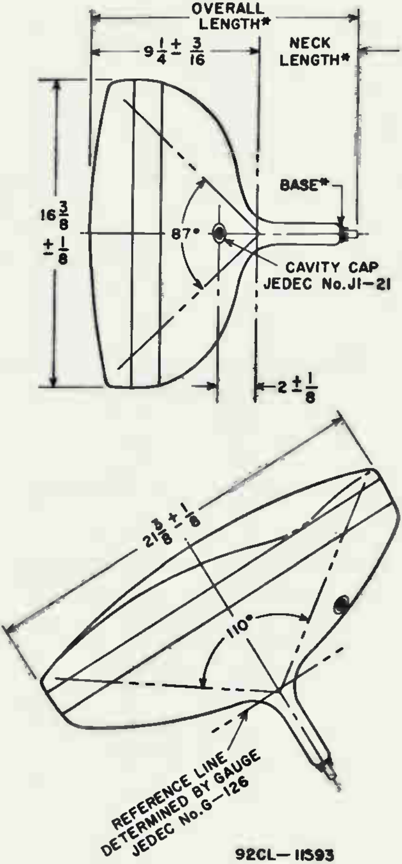
Dimensional Outline

FOR PICTURE TUBES UTILIZING





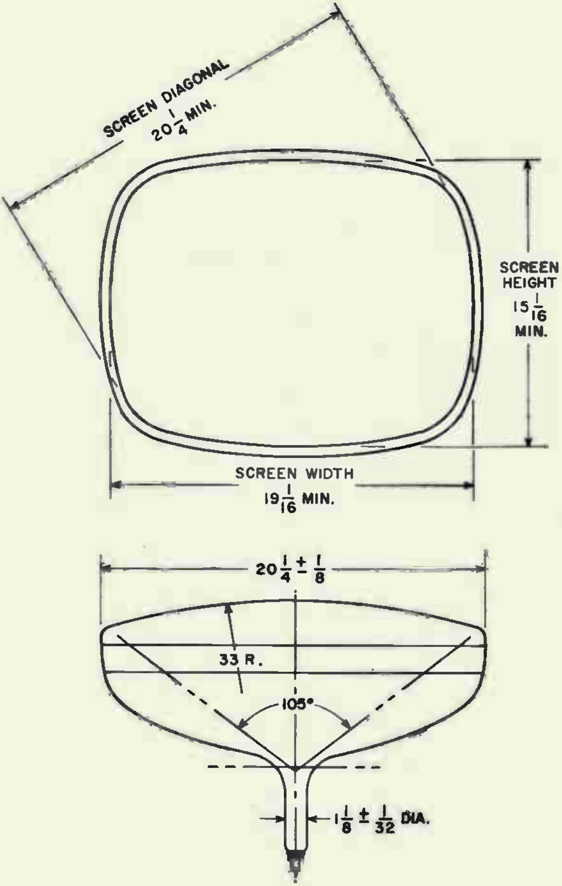
BULB J171 G/K



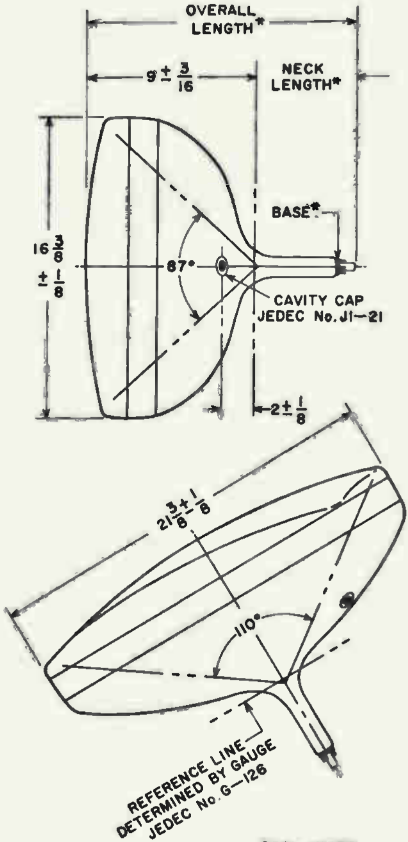
ALL DIMENSIONS IN INCHES

* See data for specific tube type.

FOR PICTURE TUBES UTILIZING



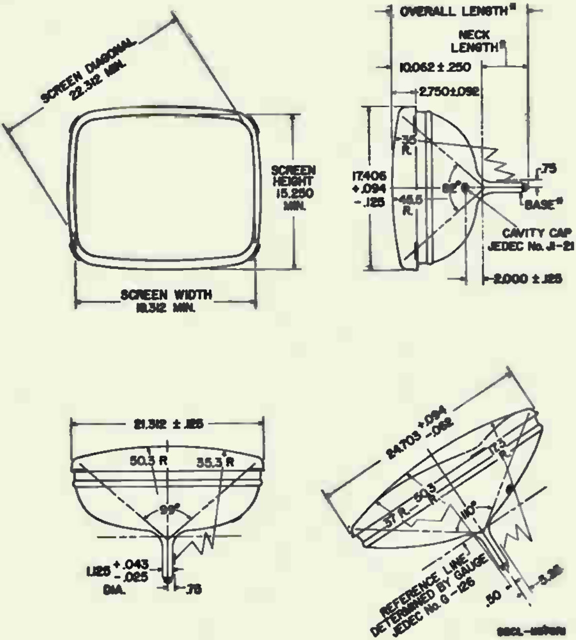
BULB J171 H/J



DIMENSIONS IN INCHES

*See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J187A
AND PROTECTIVE PANEL FP198

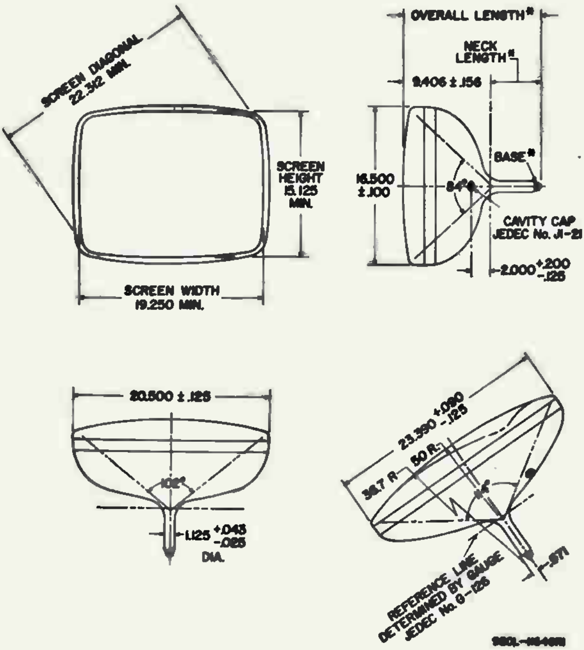


DIMENSIONS IN INCHES

* See data for specific tube type.

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

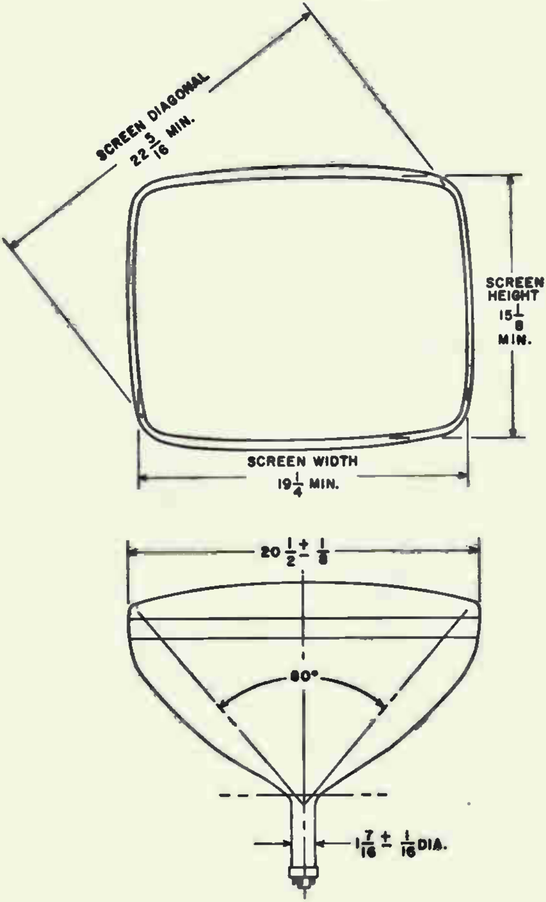
FOR PICTURE TUBES UTILIZING BULB J187 B



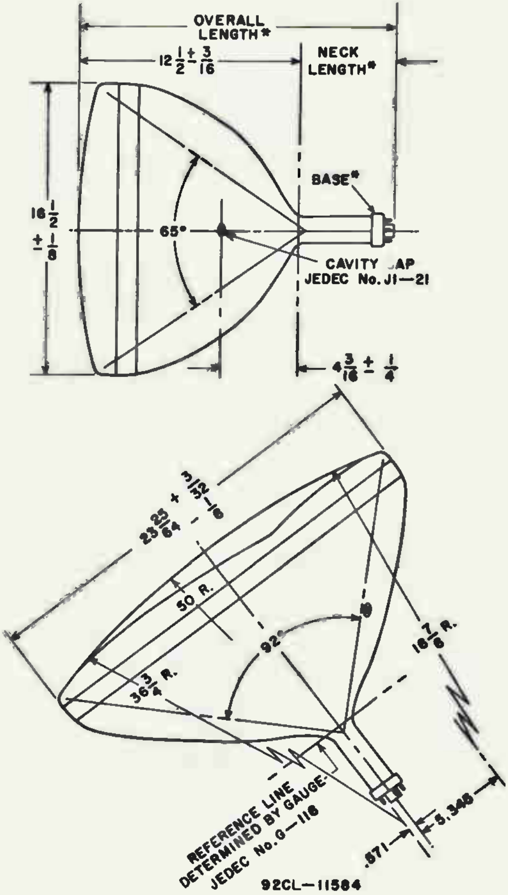
DIMENSIONS IN INCHES

* See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J187 C/F

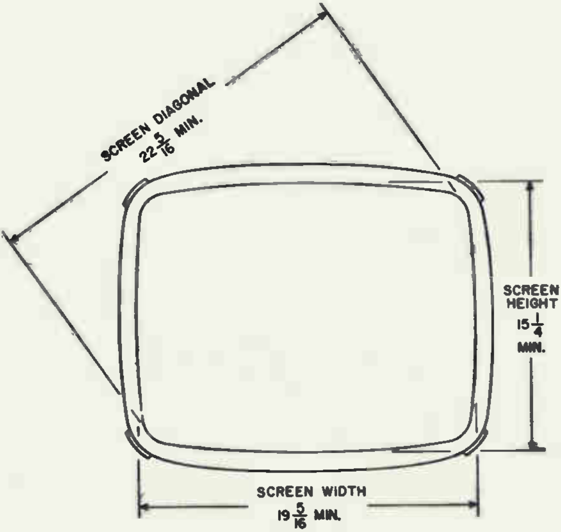


BULB J187 C/F

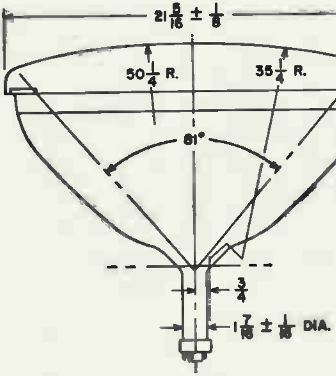


ALL DIMENSIONS IN INCHES

* See data for specific tube type.

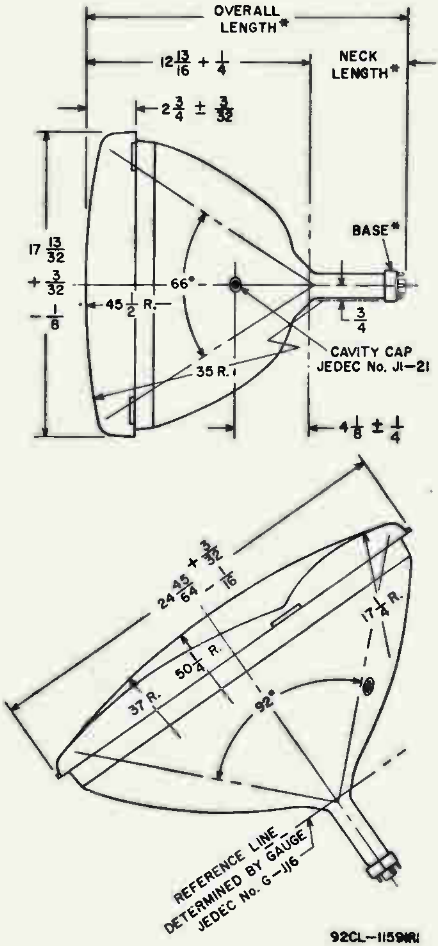


SCREEN DIAGONAL
22 5/16 MIN.
SCREEN HEIGHT
15 1/4
MIN.
SCREEN WIDTH
19 5/16 MIN.



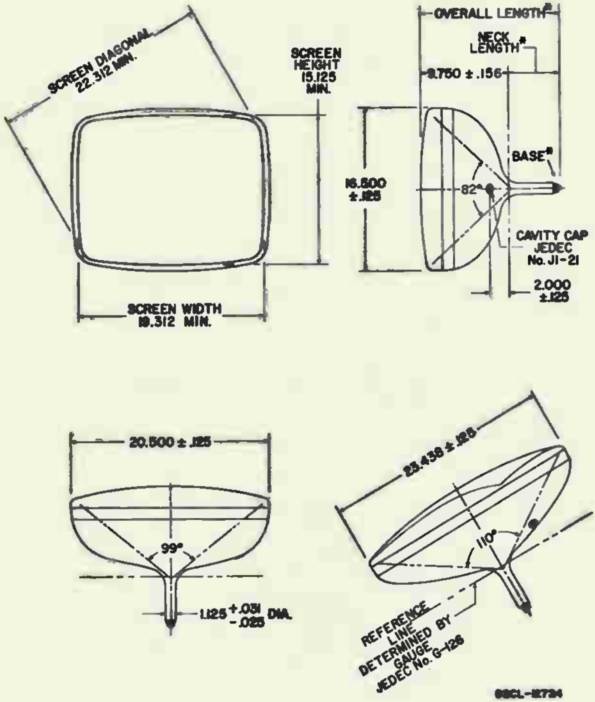
21 5/16 ± 1/8
50 1/4 R.
35 1/4 R.
81°
3/4
1 7/16 ± 1/16 DIA.

BULB J187 D/G AND PROTECTIVE PANEL



DIMENSIONS IN INCHES

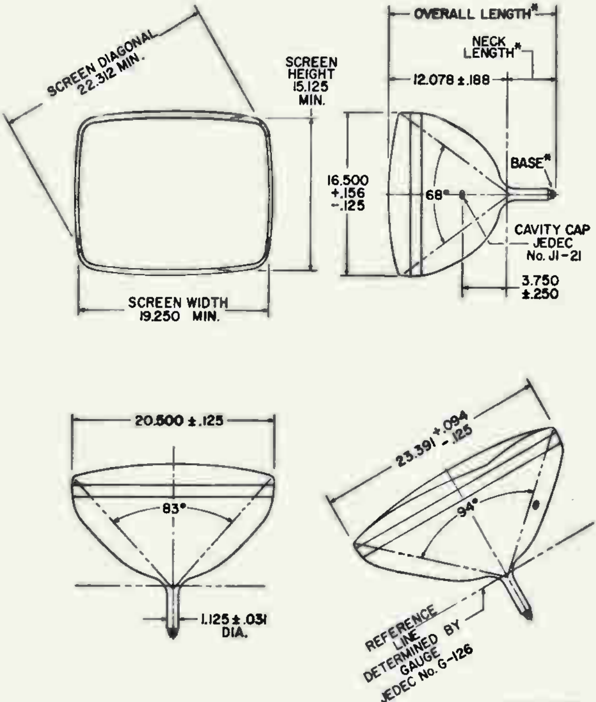
*See data for specific tube type.



DIMENSIONS IN INCHES

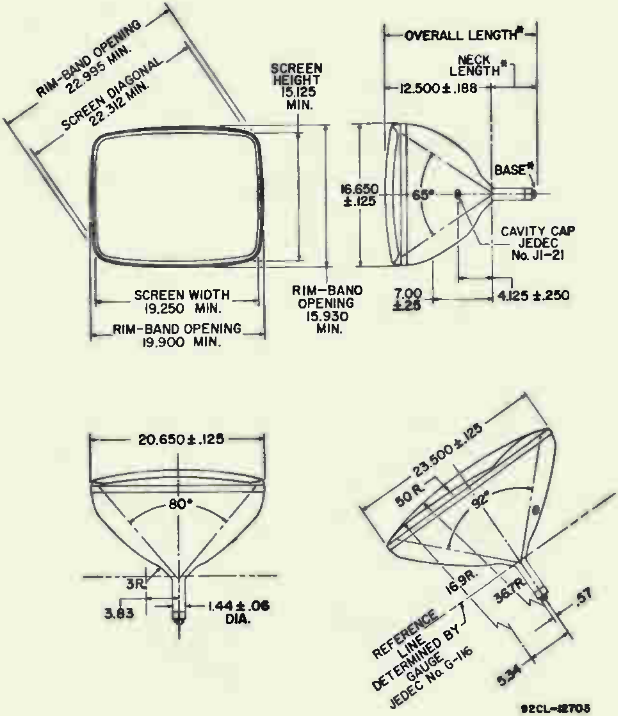
*See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J187 H1



DIMENSIONS IN INCHES

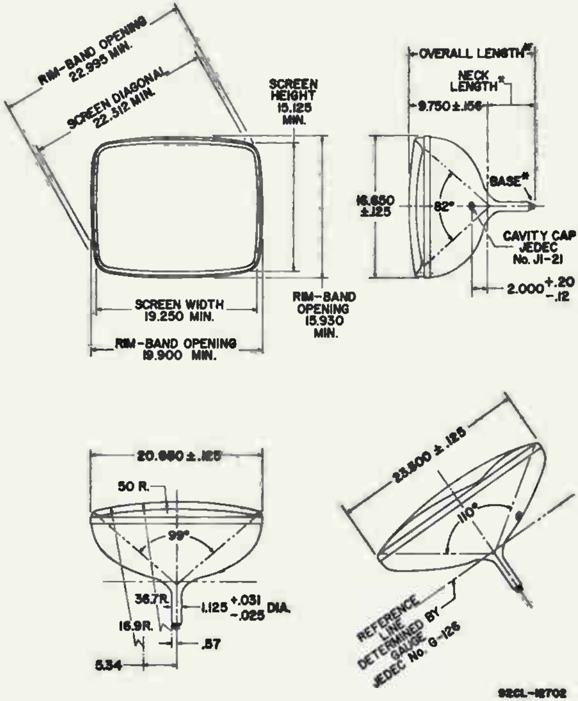
*See data for specific tube type.



DIMENSIONS IN INCHES

*See data for specific tube type.

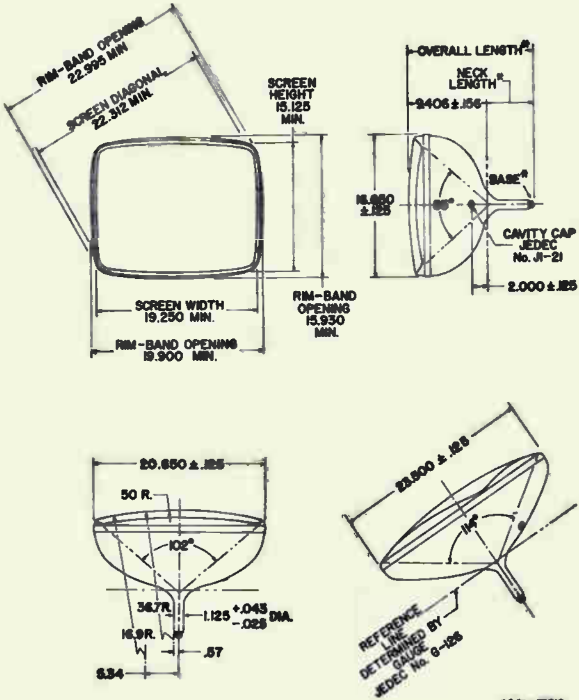
FOR PICTURE TUBES UTILIZING BULB J187 K



DIMENSIONS IN INCHES

*See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J187 L

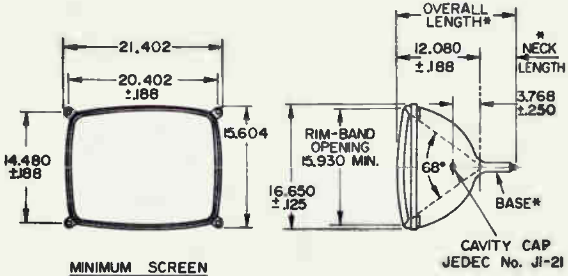


DIMENSIONS IN INCHES

*See data for specific tube type.

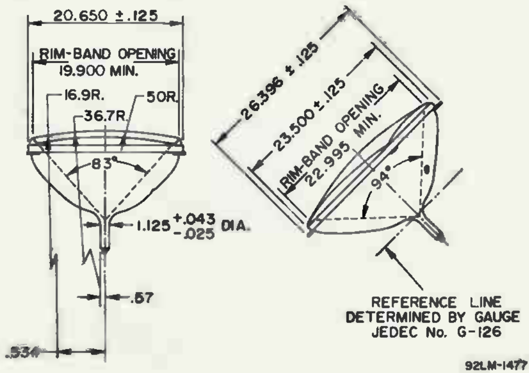
RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.

FOR PICTURE TUBES UTILIZING BULB J187 M



MINIMUM SCREEN

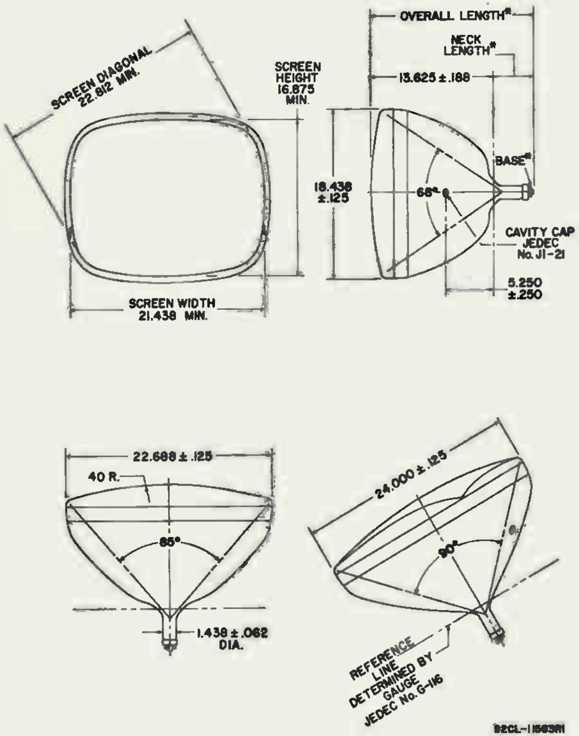
DIAGONAL	22.312
GREATEST WIDTH	19.250
GREATEST HEIGHT	15.125



DIMENSIONS IN INCHES

* See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J192 A/B

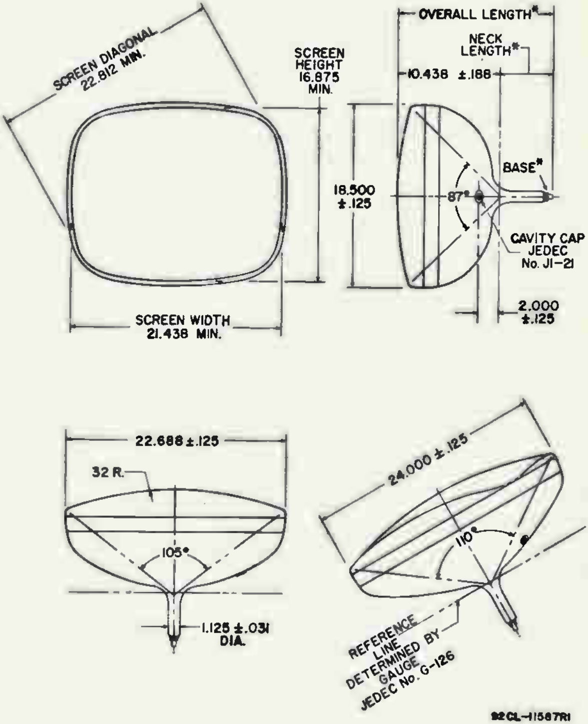


DIMENSIONS IN INCHES

* See data for specific tube type.

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

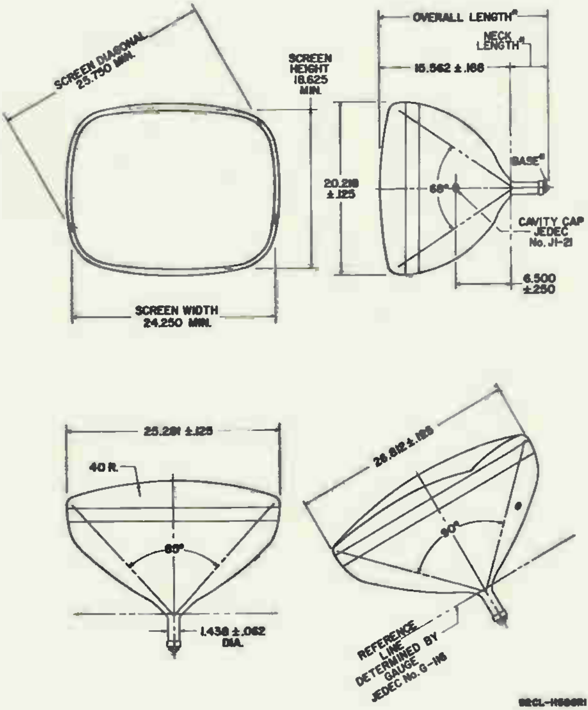
FOR PICTURE TUBES UTILIZING BULB J192 C/D



DIMENSIONS IN INCHES

*See data for specific tube type.

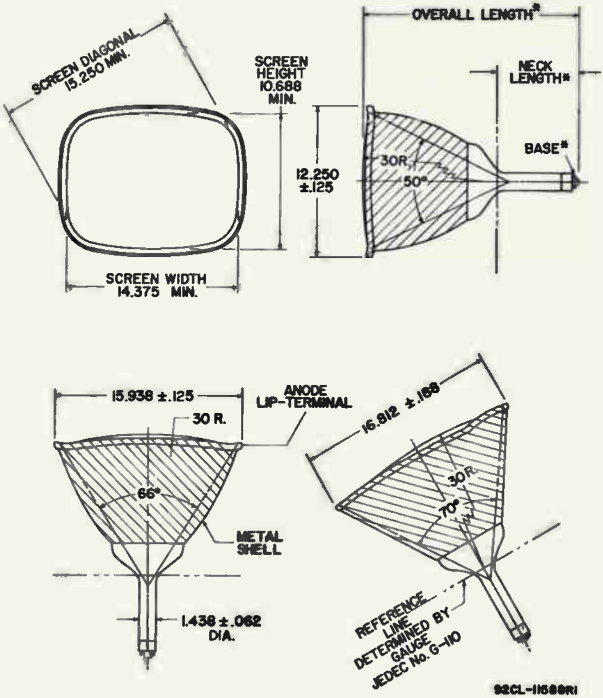
FOR PICTURE TUBES UTILIZING BULB J214-1/2 A



DIMENSIONS IN INCHES

*See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB MJ135 A

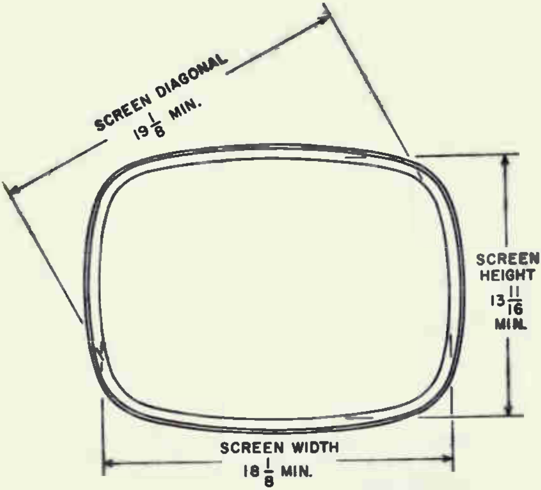


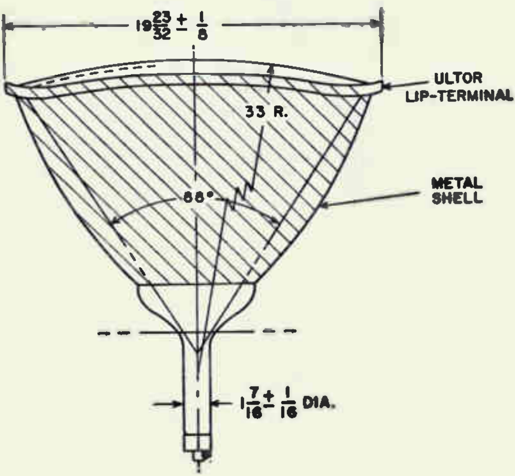
DIMENSIONS IN INCHES

*See data for specific tube type.

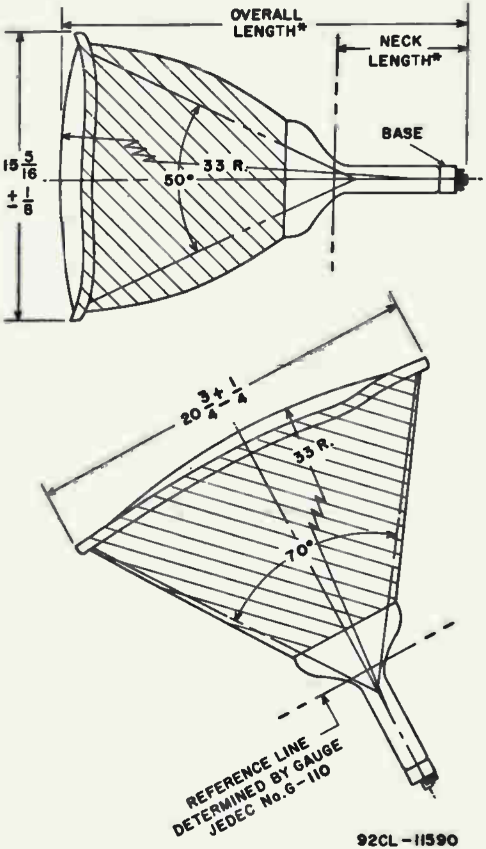
Dimensional Outline

FOR PICTURE TUBES UTILIZING BULB MJ166 A





BULB MJ166 A

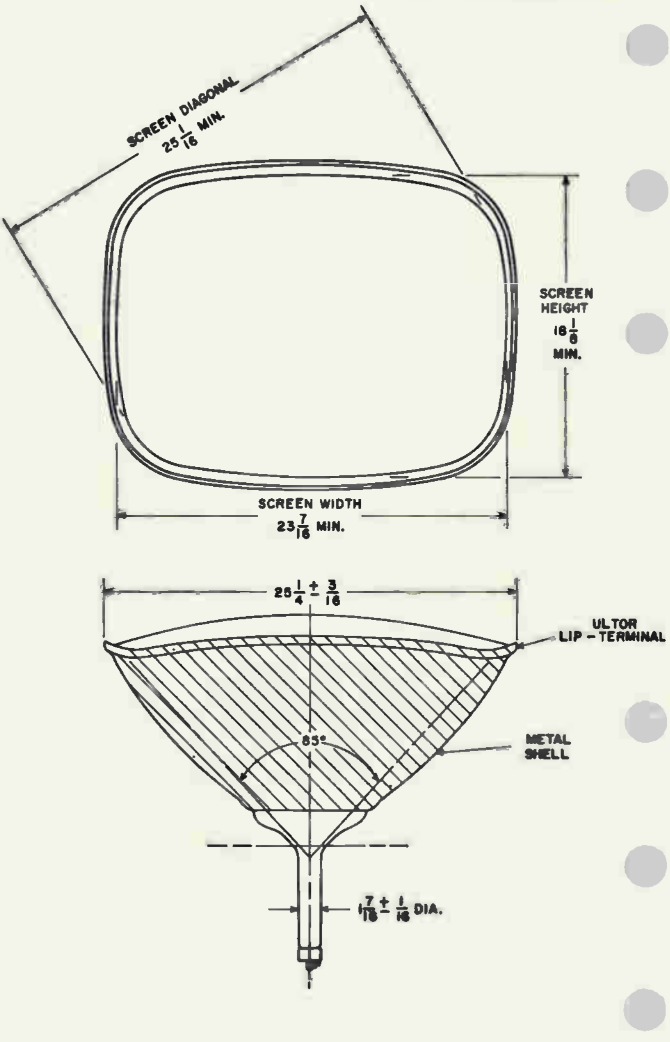


ALL DIMENSIONS IN INCHES

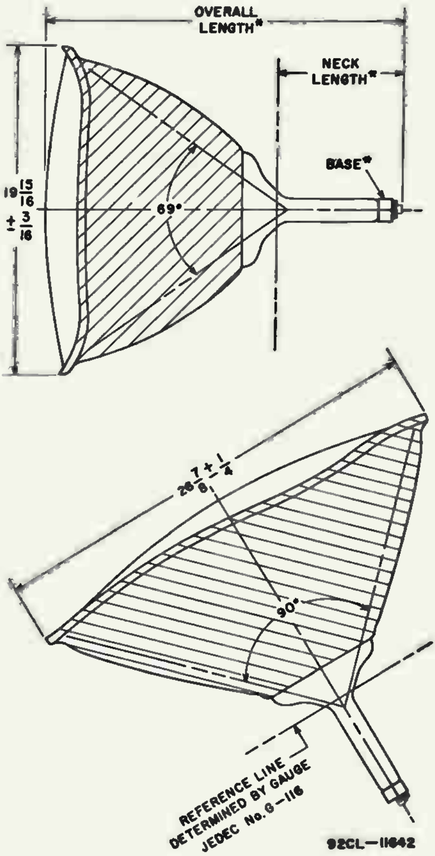
* See data for specific tube type.

Dimensional Outline

FOR PICTURE TUBES UTILIZING



BULB MJ214 A

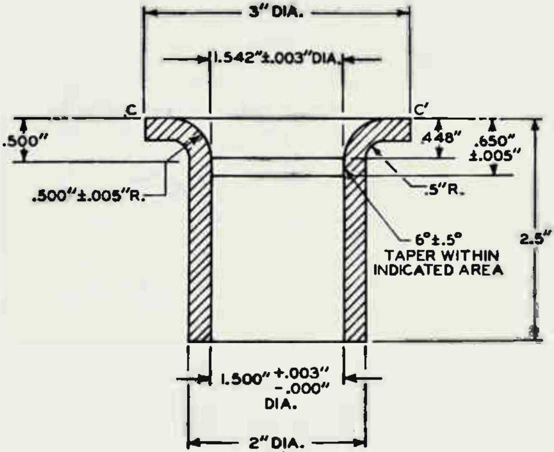


ALL DIMENSIONS IN INCHES

* See data for specific tube type.

REFERENCE-LINE GAUGE

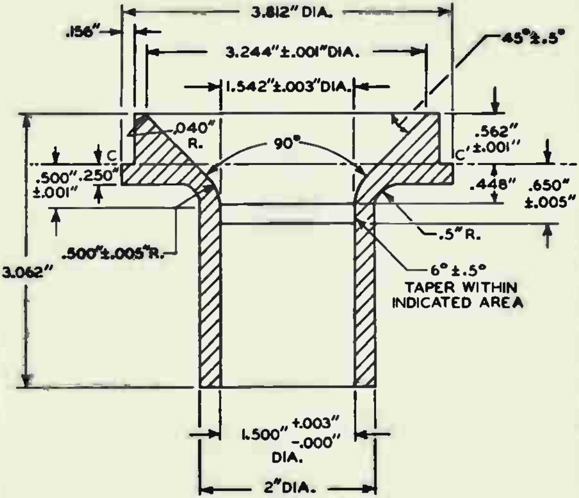
JETEC № G-110



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

92CS-7391R1

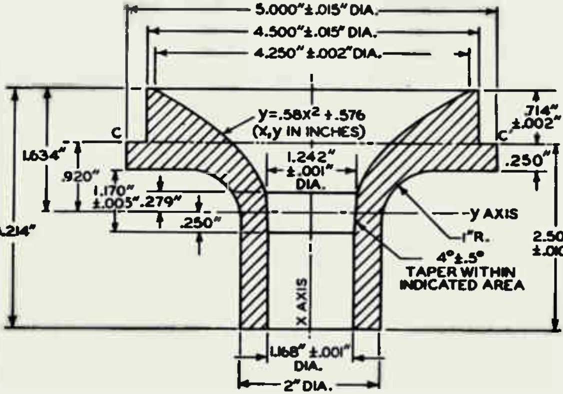
REFERENCE-LINE GAUGE
JETEC № G-116



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 Nº G-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

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

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.

IEPI

OSCILLOGRAPH TUBE

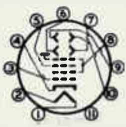
ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

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	6.5	$\mu\mu f$
Deflecting electrode DJ_1 to deflecting electrode DJ_2	1.7	$\mu\mu f$
Deflecting electrode DJ_3 to deflecting electrode DJ_4	0.6	$\mu\mu f$
DJ_1 to all other electrodes	5	$\mu\mu f$
DJ_2 to all other electrodes	5	$\mu\mu f$
DJ_3 to all other electrodes	3.8	$\mu\mu f$
DJ_4 to all other electrodes	3.8	$\mu\mu f$
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 2 – Heater
Pin 3 – Grid No.1
Pin 4 – Cathode
Pin 5 – Grid No.3
Pin 6 – Deflecting Electrode DJ_4
Pin 7 – Deflecting Electrode DJ_3



Pin 8 – Ultor (Grid No.2, Grid No.4, Collector)
Pin 9 – Deflecting Electrode DJ_2
Pin 10 – Deflecting Electrode DJ_1
Pin 11 – Internal Connection–Do Not Use

DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

1EP1

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 ±10°.

The angle between the trace produced by DJ_3 and DJ_4 and the trace produced by DJ_1 and DJ_2 is 90° ± 3°.

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_{c4}) 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 Condition.	-15 to +10	µamp
Deflection Factors:		
DJ_1 & DJ_2	210 to 310	v dc/in./kv of E_{c_4}
DJ_3 & DJ_4	240 to 350	v dc/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 1EP1 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.

TUBE DIVISION
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1EP1

OSCILLOGRAPH TUBE

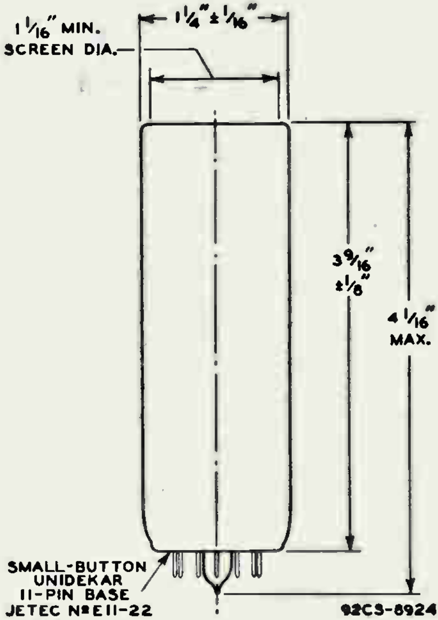
For ultor voltage of	*500*	*1000*	*volts*
Grid-No. 1 Voltage for Visual Extinction of Undeflected Focused Spot	-7 to -21	-14 to -42	volts
Deflection Factors:			
DJ_1 & DJ_2.	105 to 155	210 to 310	volts dc/in.
DJ_3 & DJ_4.	120 to 175	240 to 350	volts dc/in.

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

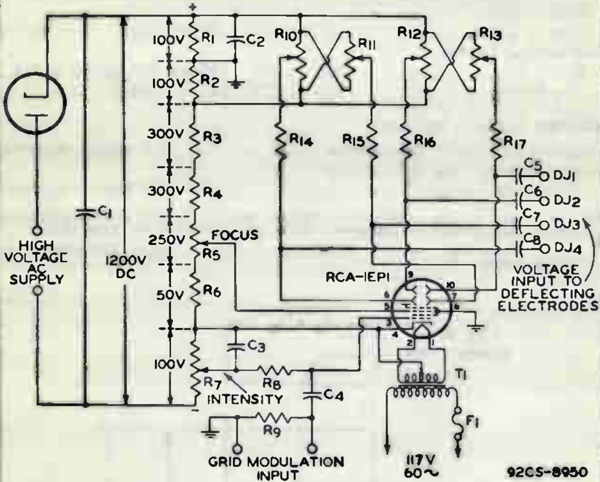
■ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.



1EP1

OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



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

TUBE DIVISION
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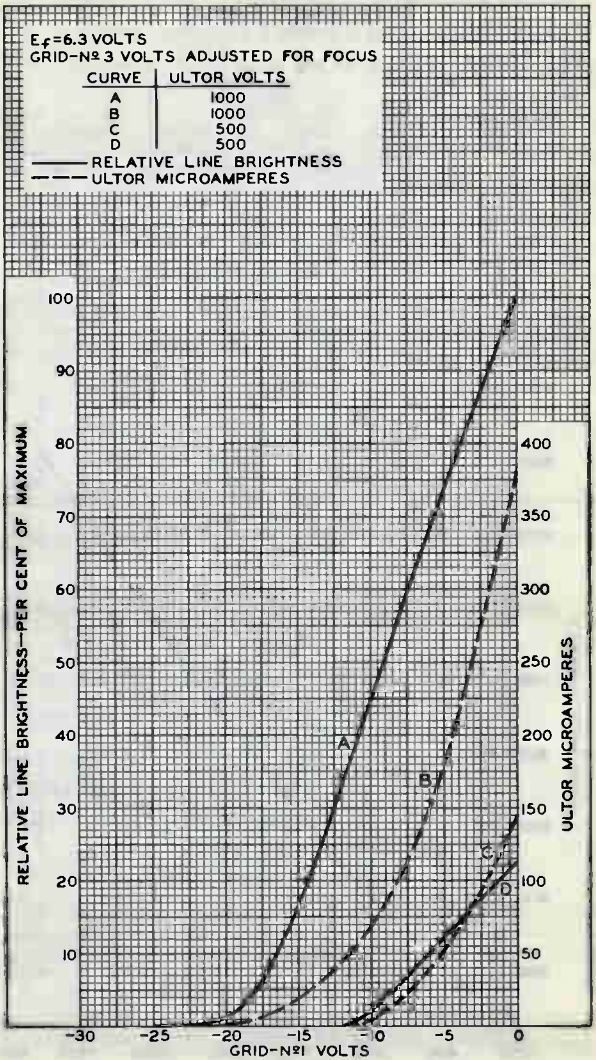
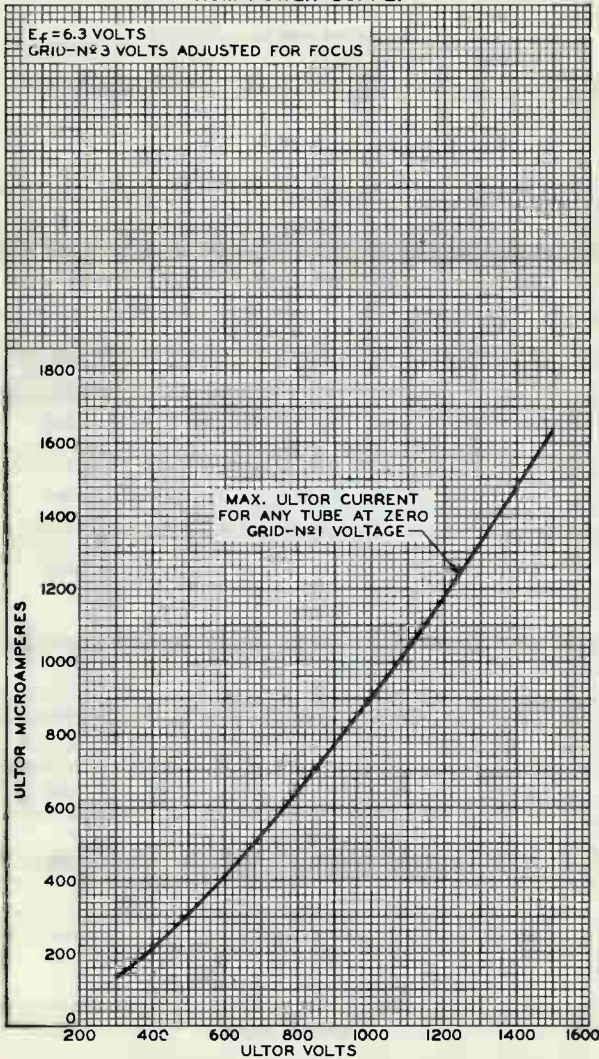
1EP1

AVERAGE CHARACTERISTICS



92CM-8938

MAXIMUM ULTOR-CURRENT REQUIREMENTS FROM POWER SUPPLY



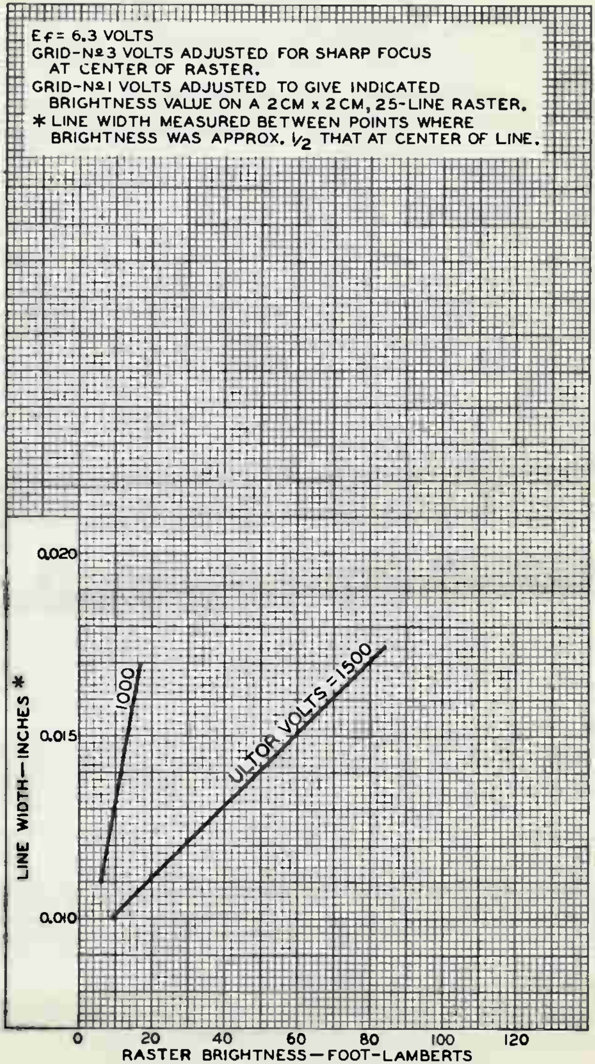
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8939

RCA

1EP1

AVERAGE CHARACTERISTICS



RCA

1EP2

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

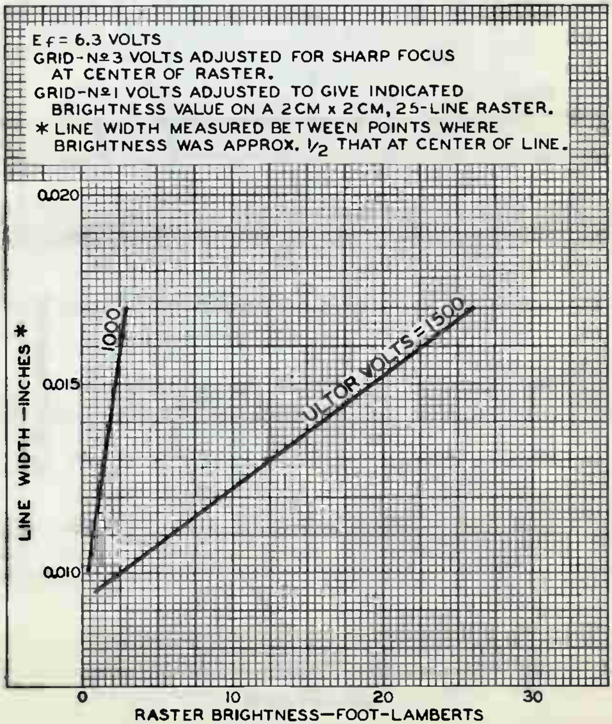
The 1EP2 is the same as the 1EP1 except for the following items:

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.

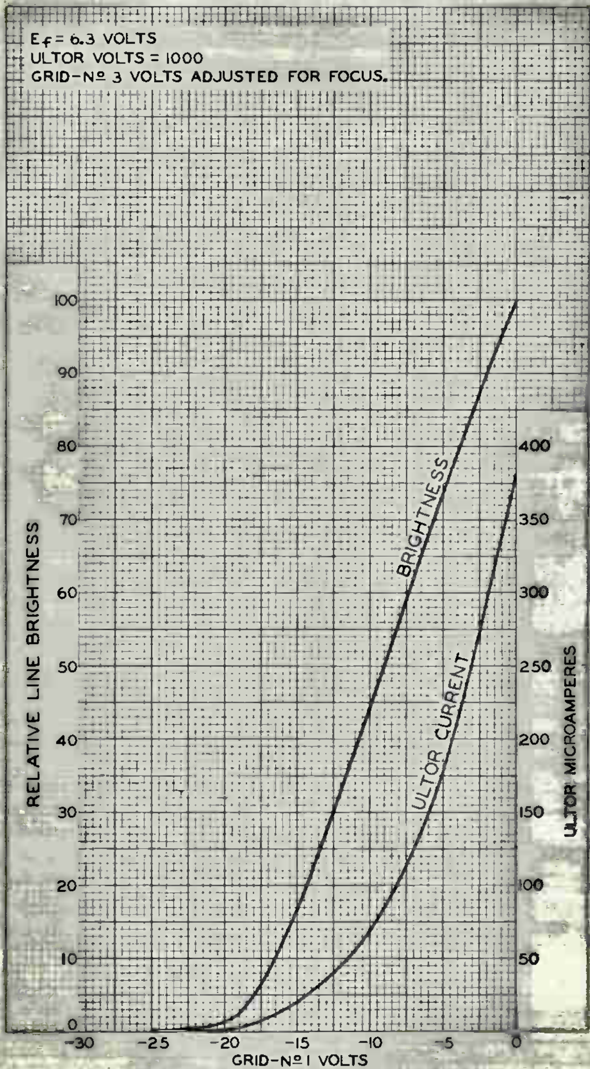
AVERAGE CHARACTERISTICS



IEP2

IEP2

AVERAGE CHARACTERISTICS



TUBE DIVISION 92CM-9298

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

1EP11

1EP11

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS — ELECTROSTATIC DEFLECTION

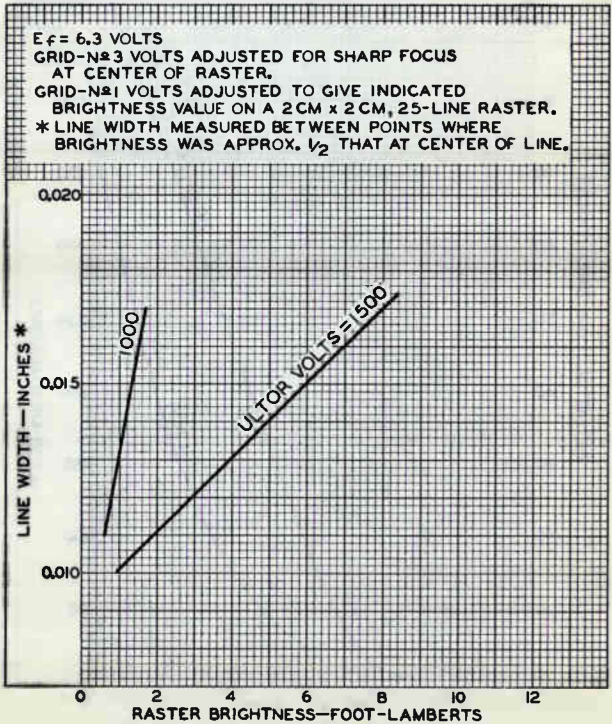
The 1EP11 is the same as the 1EP1 except for the following items:

General:

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

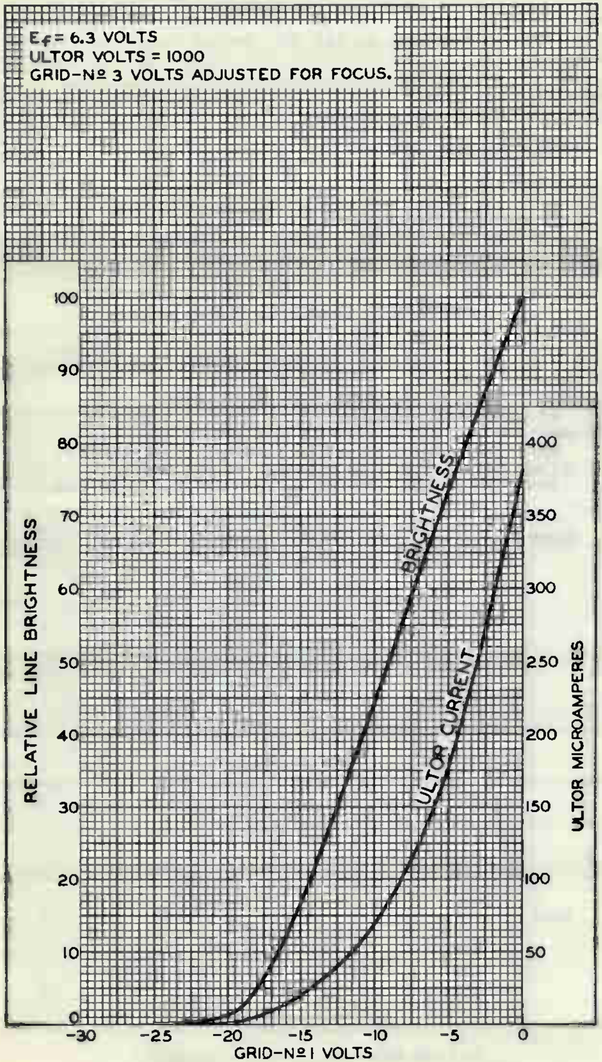
In general, operation of the 1EP11 at an ultor voltage less than 750 volts is not recommended.

AVERAGE CHARACTERISTICS



92CM-9108

AVERAGE CHARACTERISTICS



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9298

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	μμf
Cathode to All Other Electrodes	5.5	μμf
DJ_1 to DJ_2	0.6	μμf
DJ_3 to DJ_4	1.1	μμf
DJ_1 to All Other Electrodes	8.5	μμf
DJ_3 to All Other Electrodes	9.0	μμf
DJ_1 to All Other Electrodes except DJ_2	8.0	μμf
DJ_2 to All Other Electrodes except DJ_1	4.6	μμf
DJ_3 to All Other Electrodes except DJ_4	7.5	μμf
DJ_4 to All Other Electrodes except DJ_3	6.0	μμf

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 2 - Cathode
Pin 3 - Deflecting Electrode DJ_1
Pin 4 - Anode No.1
Pin 5 - No Connection
Pin 6 - Deflecting Electrode DJ_4
Pin 7 - Anode No.2, Grid No.2

Pin 8 - Deflecting Electrode DJ_2
Pin 9 - Deflecting Electrode DJ_3
Pin 10 - Grid No.1
Pin 11 - Heater

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

The angle between the trace produced by DJ_3 and DJ_4 and its intersection with the plane through the tube axis and pin 1 does not exceed 10°.

The angle between the trace produced by DJ_3 and DJ_4 and the trace produced by DJ_1 and DJ_2 is 90° ± 4°.

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

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 Voltage 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		μamp.
Deflection Sensitivity:			
DJ_1 and DJ_2	0.220	0.110	mm/v dc
DJ_3 and DJ_4	0.260	0.130	mm/v dc
Deflection Factor:**			
DJ_1 and DJ_2	115	230	v dc/in.
DJ_3 and DJ_4	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 ± 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 DJ_1 and DJ_2. 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

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

2AP1-A

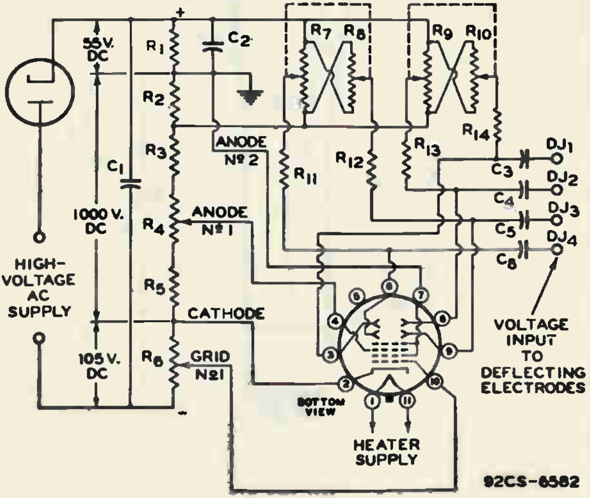
HIGH-VACUUM CATHODE-RAY TUBE

(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



92CS-6582

C1: 0.1 μf
C2: 1.0 μf
C3 C4 C5 C6: 0.05-μf 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.

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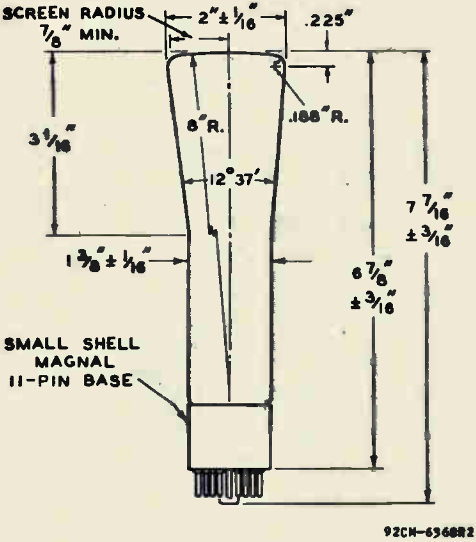
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

2AP1-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

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

2BP1

2BP1

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS — ELECTROSTATIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

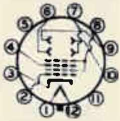
Voltage	6.3	ac or dc volts
Current	0.6	amp

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to All Other Electrodes	8	$\mu\mu$f
DJ_1 to DJ_2	2	$\mu\mu$f
DJ_3 to DJ_4	2	$\mu\mu$f
DJ_1 to All Other Electrodes	11	$\mu\mu$f
DJ_2 to All Other Electrodes	8	$\mu\mu$f
DJ_3 to All Other Electrodes	7	$\mu\mu$f
DJ_4 to All Other Electrodes	8	$\mu\mu$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" ± 3/16"
Greatest Diameter of Bulb	2" ± 1/16"
Minimum Useful Screen Diameter	1-3/4"
Mounting Position	Any
Base	Small-Shell Duodecal 12-Pin
Basing Designation for BOTTOM VIEW	12E

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Cathode
Pin 4 - Anode No.1
Pin 5 - Internal Connection— Do Not Use
Pin 6 - Deflecting Electrode DJ_3
Pin 7 - Deflecting Electrode DJ_4



Pin 8 - Anode No.2, Grid No.2
Pin 9 - Deflecting Electrode DJ_2
Pin 10 - Deflecting Electrode DJ_1
Pin 11 - Internal Connection— Do Not Use
Pin 12 - Heater

DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 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 $90^{\circ} \pm 3^{\circ}$.

← Indicates a change.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

2BP1

2BP1

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_{b_2}) 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:		
DJ1 & DJ2	115 to 155	v dc/in./kv of E_{b2}
DJ3 & DJ4	74 to 100	v dc/in./kv of E_{b2}
→ Spot Position	◻	

Examples of Use of Design Ranges:

For anode-No.2 voltage of	*1000*	*2000*	*volts*
Anode-No.1 Voltage	150 - 280	300 - 560	volts
Max. Grid-No.1 Voltage for Visual Cutoff	-67.5	-135	volts
Deflection Factors:			
DJ1 & DJ2	115 - 155	230 - 310	volts dc/in.
DJ3 & DJ4	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°	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.

° 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.

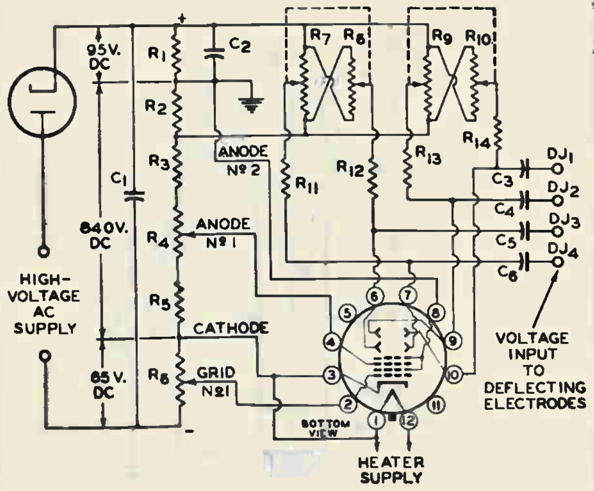
RCA

2BP1

OSCILLOGRAPH TUBE

2BP1

TYPICAL OSCILLOGRAPH CIRCUIT



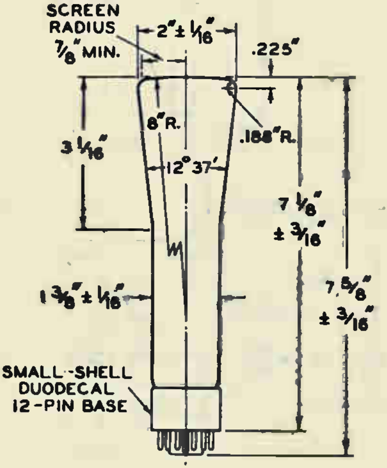
92CM-6777R1

C1: 0.2 μf
C2: 1.0 μf
C3 C4 C5 C6: 0.05-μf 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.

2BP1

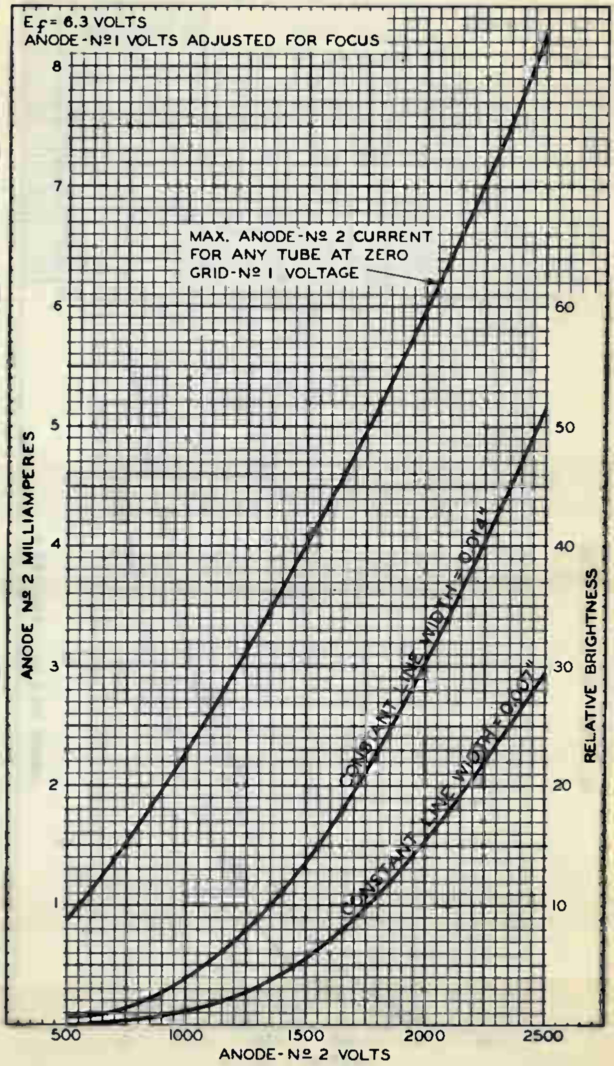
OSCILLOGRAPH TUBE



℄ 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

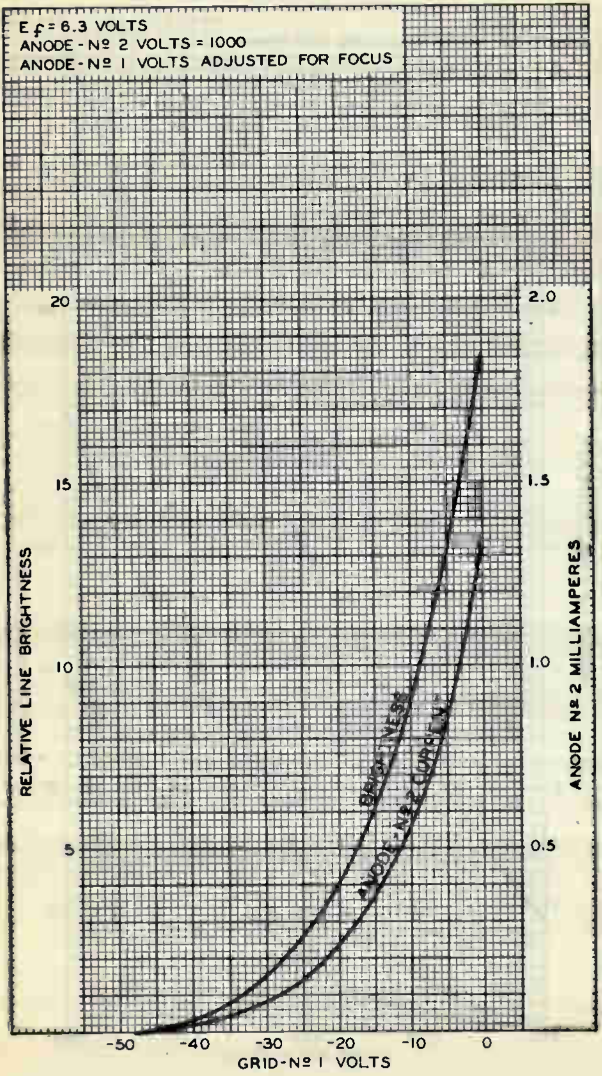
2BP1
CHARACTERISTICS



2BP1

2BP1

AVERAGE CHARACTERISTICS



2BPII

2BPII

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 moves 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

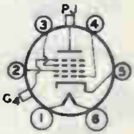
2F21
MONOSCOPE
5-INCH MAGNETIC-DEFLECTION TYPE

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	μμf
Pattern Electrode to Grid No. 4	5	μμf
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.

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

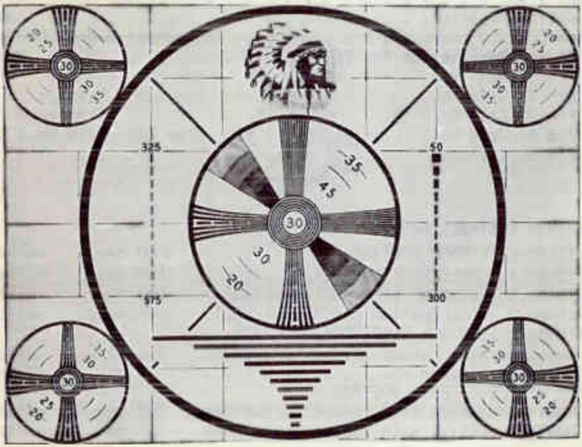
▲ Individual tubes may require between + 20% and − 20% of these values.

♦ 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.

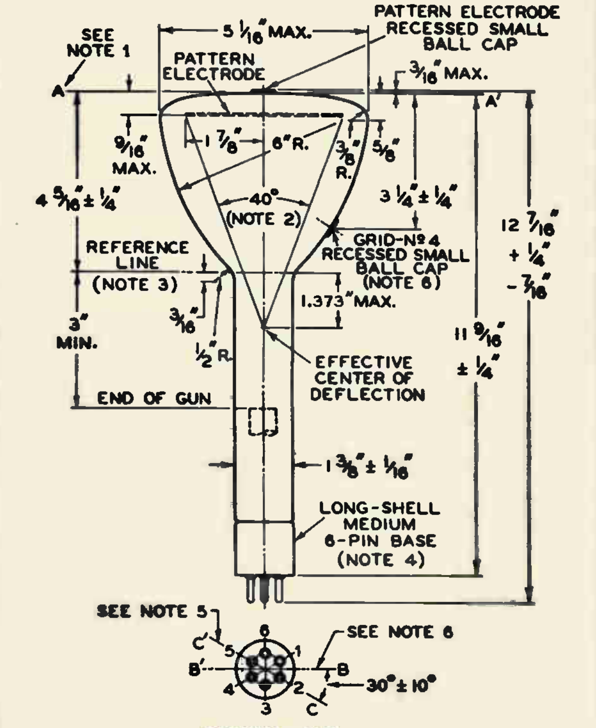
▲▲ With full scanning.

PATTERN



92CS-6666

2F21
MONOSCOPE



92CM-6653

NOTE 1: LINE AA' IS PERPENDICULAR TO THE AXIS OF THE TUBE AND INTERSECTS THE FACE CONTOUR 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" ± .003 I.D. AND 2" LONG WILL REST ON BULB CONE.

NOTE 4: ℄ 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.

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3AP1-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 3AP1-A
are the same as those for Type 908-A.

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

Oscillograph Tube

ELECTROSTATIC FOCUS — **ELECTROSTATIC DEFLECTION**

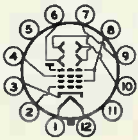
DATA

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 DJ_1 & DJ_2 . . . 2-3/4"
  By deflecting electrodes DJ_3 & DJ_4 . . . 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 DJ_3
Pin 7 - Deflecting Electrode DJ_4



Pin 8 - Ultor (Grid No.2, Grid No.4, Collector)
Pin 9 - Deflecting Electrode DJ_2
Pin 10 - Deflecting Electrode DJ_1
Pin 11 - Internal Connection— Do Not Use
Pin 12 - Heater

DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

Maximum and Minimum Ratings, ***Design-Center Values:***

ULTOR VOLTAGE	2750 max. / 500 min.	volts / 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	28 to 35	v dc/in./kv of E_{c4}

3BP1-A

HIGH-VACUUM CATHODE-RAY TUBE

Supersedes Type 3BP1

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		μμf
Cathode to All Other Electrodes	8.0		μμf
DJ_1 to DJ_2	2.0		μμf
DJ_3 to DJ_4	2.0		μμf
DJ_1 to All Other Electrodes	8.0		μμf
DJ_3 to All Other Electrodes	6.0		μμf
DJ_1 to All Other Electrodes except DJ_2	6.0		μμf
DJ_2 to All Other Electrodes except DJ_1	5.0		μμf
DJ_3 to All Other Electrodes except DJ_4	4.0		μμf
DJ_4 to All Other Electrodes except DJ_3	6.0		μμf
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			14G

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid No.1
Pin 4 - Internal Con. Do Not Use
Pin 5 - Anode No.1
Pin 7 - Deflecting Electrode DJ_3
Pin 8 - Deflecting Electrode DJ_4

Pin 9 - Anode No.2, Grid No.2
Pin 10 - Deflecting Electrode DJ_2
Pin 11 - Deflecting Electrode DJ_1
Pin 12 - No Conn.
Pin 14 - Heater

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 is deflected toward pin 5. With DJ_3 positive with respect to DJ_4 the spot is deflected toward pin 2.

The angle between the trace produced by DJ_1 and DJ_2 and its intersection with the plane through the tube axis and pin 5 does not exceed 10°.

The angle between the trace produced by DJ_3 and DJ_4 and the trace produced by DJ_1 and DJ_2 is 90° ± 3°.

Maximum Ratings, *Abolute Values*:

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

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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:			
DJ_1 and DJ_2	0.169	0.127 . .	mm/v dc
DJ_3 and DJ_4	0.229	0.172 . .	mm/v dc
Deflection Factor:**			
DJ_1 and DJ_2	150	200 . .	v dc/in.
DJ_3 and DJ_4	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 DJ_1 and DJ_2. 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.

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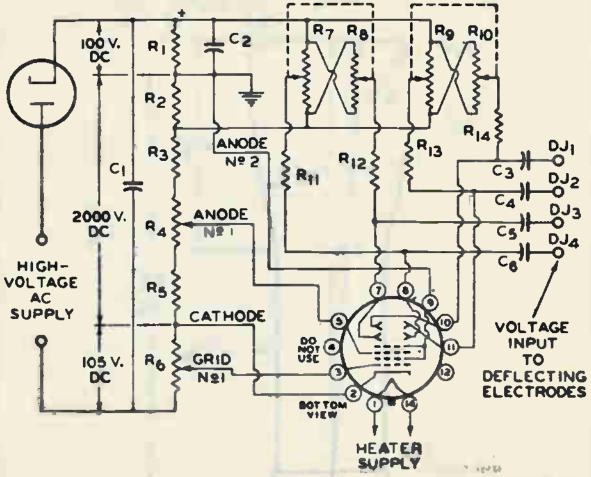
3BP1-A

HIGH-VACUUM CATHODE-RAY TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



92CS-6514

C1: 0.1 µf
C2: 1.0 µf
C3 C4 C5 C6: 0.05-µf 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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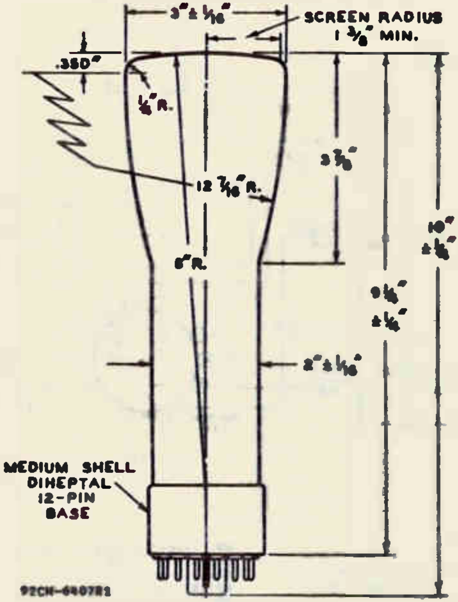
3BP1-A

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

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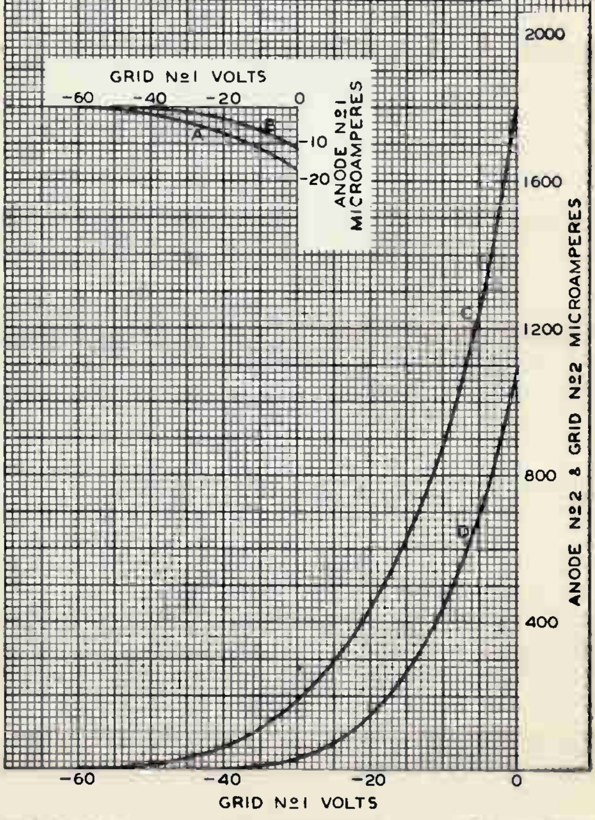
3BP1-A

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



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92CM-6412R1

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3JP1

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 μμf
- Cathode to All Other Electrodes . . . . . . 8 μμf
- DJ_1 to DJ_2 . . . . 2.5 μμf
- DJ_3 to DJ_4 . . . . 2 μμf
- DJ_1 to All Other Electrodes . . . . 8 μμf
- DJ_2 to All Other Electrodes . . . . 7 μμf
- DJ_3 to All Other Electrodes . . . . 7 μμf
- DJ_4 to All Other Electrodes . . . . 8 μμf

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" ± 1/4"

Greatest Diameter of Bulb . . . . 3" ± 1/16"

Minimum Useful Screen Diameter . . . . 2-3/4"

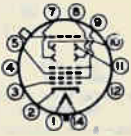
Mounting Position . . . . Any

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

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

Basing Designation for BOTTOM VIEW . . . . $14J_1$

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 DJ_3
Pin 8 - Deflecting Electrode DJ_4



Pin 9 - Anode No.2, Grid No.2
Pin 10 - Deflecting Electrode DJ_2
Pin 11 - Deflecting Electrode DJ_1
Pin 12 - No Connection
Pin 14 - Heater
Cap - Anode No.3

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 is deflected toward pin 5. With DJ_3 positive with respect to DJ_4, 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 DJ_1 and DJ_2 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 DJ_1 - DJ_2 trace and DJ_3 - DJ_4 trace is 90° ± 3°.

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3JP1

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 max.	
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 (Eb_3) between 2000 and 4000 volts and any anode-No.2 voltage (Eb_2) between 1500** and 2000 volts*

Anode-No.1 Voltage	20% to 34.5% of Eb_2 . . .	volts
Grid-No.1 Voltage†	1.5% to 4.5% of Eb_2 . . .	volts
Anode-No.1 Current for any Operating Condition . .	-50 to +10 . . .	μamp
Deflection Factors:		
	When $Eb_3 = 2 \times Eb_2$	
DJ_1 & DJ_2	85 to 115	v dc/in./kv of Eb_2
DJ_3 & DJ_4	62.5 to 85	v dc/in./kv of Eb_2
	When $Eb_3 = Eb_2$	
DJ_1 & DJ_2	68 to 92	v dc/in./kv of Eb_2
DJ_3 & DJ_4	50 to 68	v dc/in./kv of Eb_2
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 DJ_1 and DJ_2.

†: See next page.

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.

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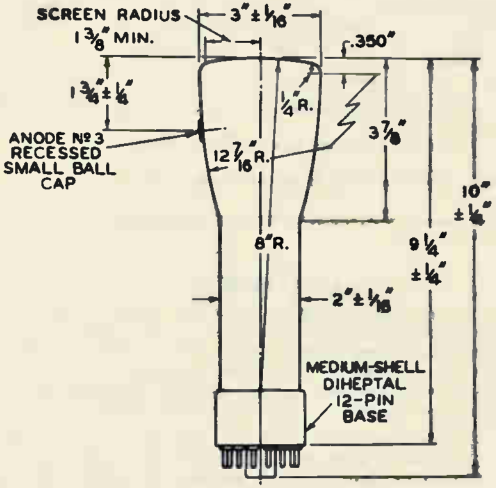
OSCILLOGRAPH TUBE



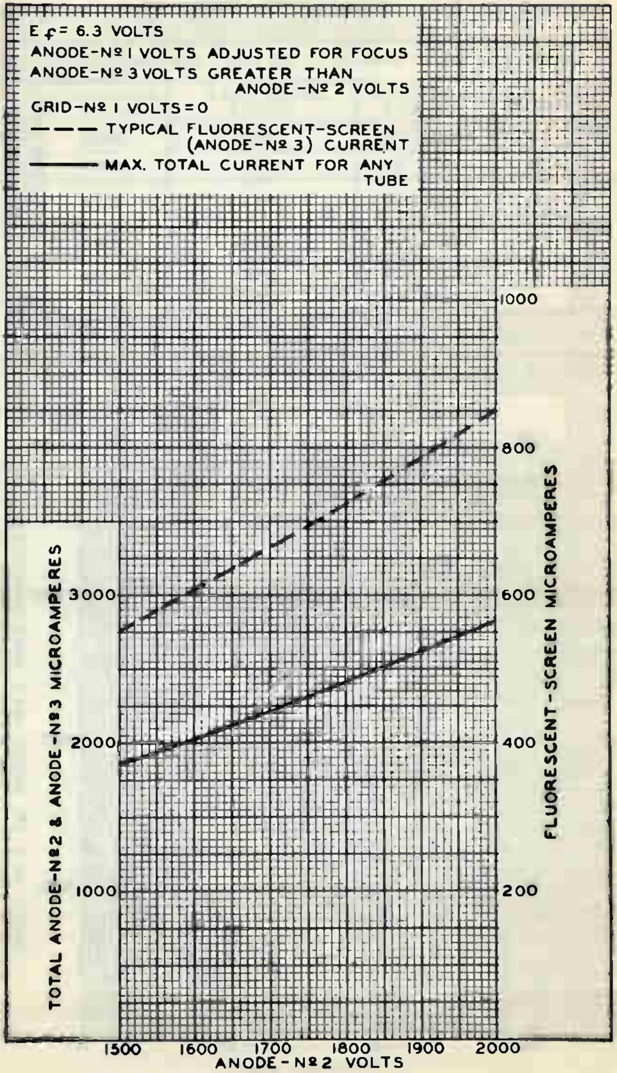
℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF BASE.

92CM-6583

RCA

3JP1

CHARACTERISTICS



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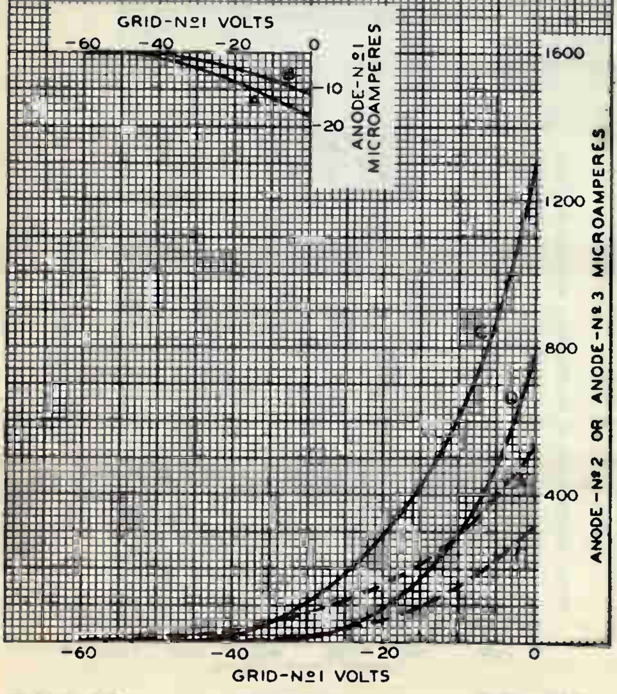
3JP1

AVERAGE CHARACTERISTICS

E_f = 6.3 VOLTS
ANODE-No.1 VOLTS ADJUSTED TO GIVE FOCUS

CURVE	ELECTRODE CURRENT	ANODE-No.2 VOLTS	ANODE-No.3 VOLTS
A	ANODE No. 1	2000	4000
B	ANODE No. 1	1500	3000
C	ANODE No. 2	2000	4000
D	ANODE No. 2	1500	3000
E	ANODE No. 3	2000	4000
F	ANODE No. 3	1500	3000



JUNE 22, 1951
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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-7870

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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.

3KP1
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	$\mu\mu f$	
Deflecting electrode DJ_1 to deflecting electrode DJ_2	2.5	$\mu\mu f$	
Deflecting electrode DJ_3 to deflecting electrode DJ_4	2.5	$\mu\mu f$	
DJ_1 to all other electrodes	11	$\mu\mu f$	
DJ_2 to all other electrodes	8	$\mu\mu f$	
DJ_3 to all other electrodes	7	$\mu\mu f$	
DJ_4 to all other electrodes	8	$\mu\mu f$	
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 Bulb		3" ± 1/16"	
Mimimum Useful Screen Diameter		2-3/4"	
Weight (Approx.)		9 oz	←
Mounting Position		Any	
Bulb		J-24	←
Base		Medium-Shell Magnal 11-Pin (JETEC No.B11-66)	←
Basing Designation for BOTTOM VIEW		11M	

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Cathode
Pin 4 - Grid No.3
Pin 5 - Deflecting Electrode DJ_3
Pin 6 - Deflecting Electrode DJ_4
Pin 7 - Ultor (Grid No.2, Grid No.4, Collector)

Pin 8 - Deflecting Electrode DJ_2
Pin 9 - Deflecting Electrode DJ_1
Pin 10 - Internal Connection—Do Not Use
Pin 11 - Heater

DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

← Indicates a change.

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RCA

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 ±10° (measured about the tube axis).

The angle between DJ_1 – DJ_2 trace and DJ_3 – DJ_4 trace is 90° ±3°.

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_{c_4}) between recommended minimum and 2500 volts*

Grid-No.3 Voltage for Focus	16% to 30% of E_{c_4}	volts
→ Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	1.9% to 4.5% of E_{c_4}	volts
Grid-No.3 Current for Any Operating Condition	-15 to +10	µamp
Deflection Factors:		
DJ_1 & DJ_2	50 to 68	v dc/in./kv of E_{c_4}
DJ_3 & DJ_4	38 to 52	v dc/in./kv of E_{c_4}
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.

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3KP1

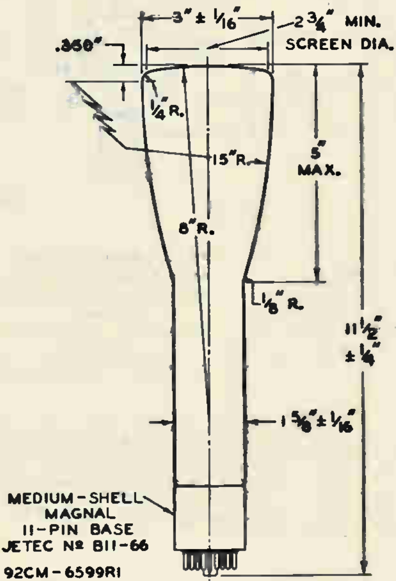
OSCILLOGRAPH TUBE

For ultor voltage of	*1000*	*2000*	*volts*
Grid-No.1 Voltage for Visual Extinction of Undeflected 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	76 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.

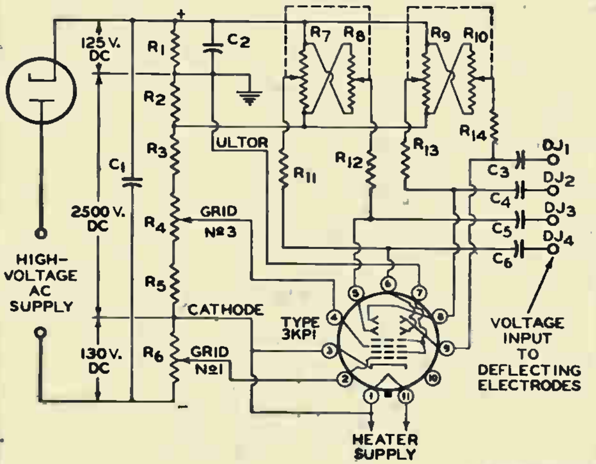
← Indicates a change.

3KP1

3KP1

OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



92CS-6690R2

C1: 0.1 µf, 3000 Volts
C2: 1.0 µf, 200 Volts
C3 C4 C5 C6: 0.05-µf 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 Watt
R9 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.

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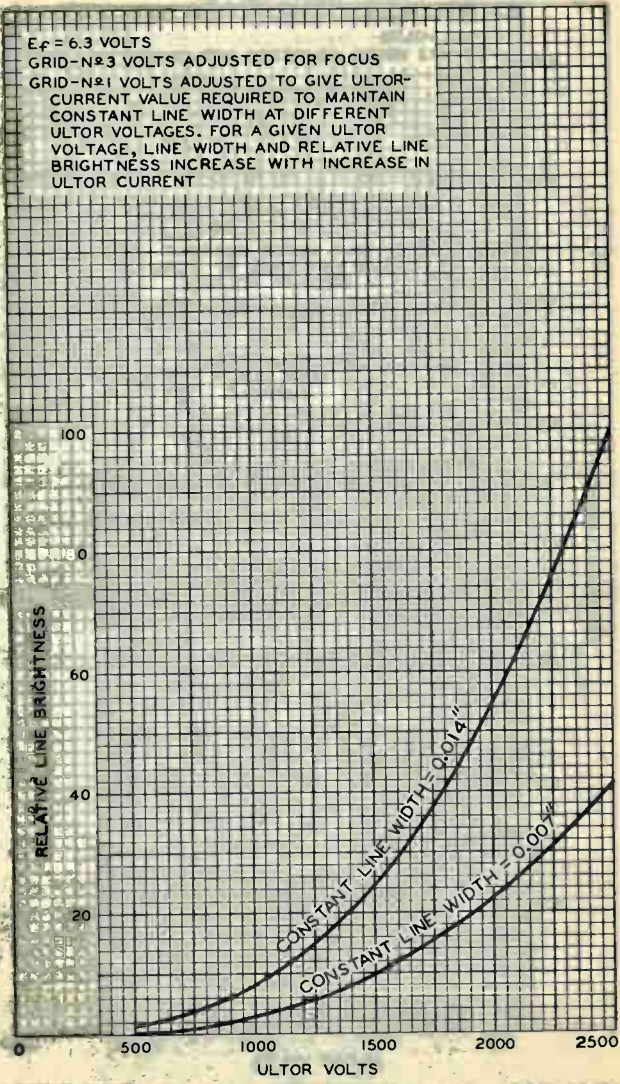
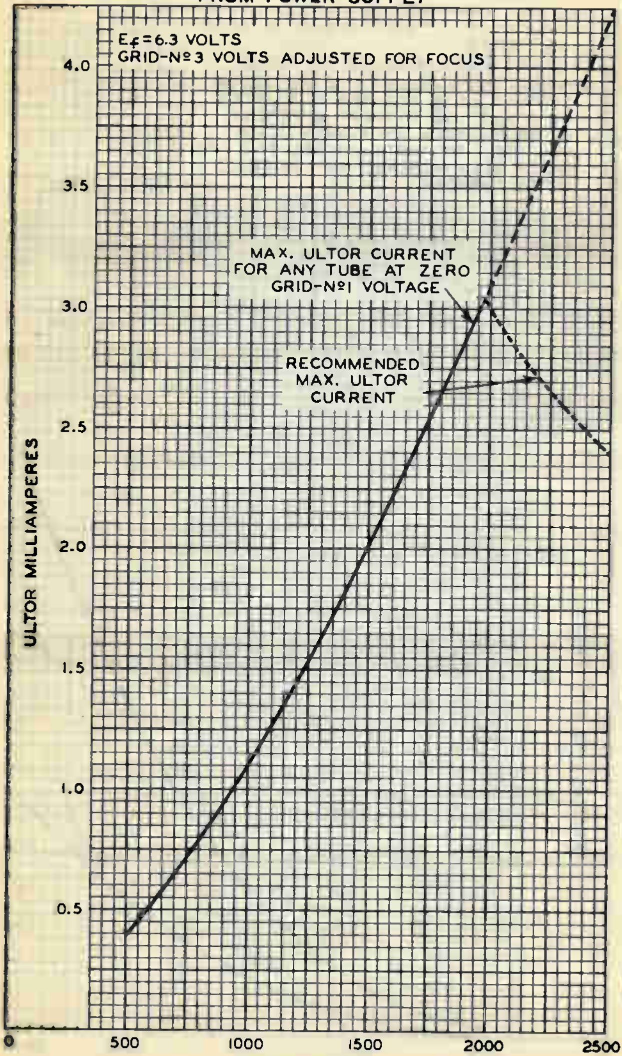
3KP1

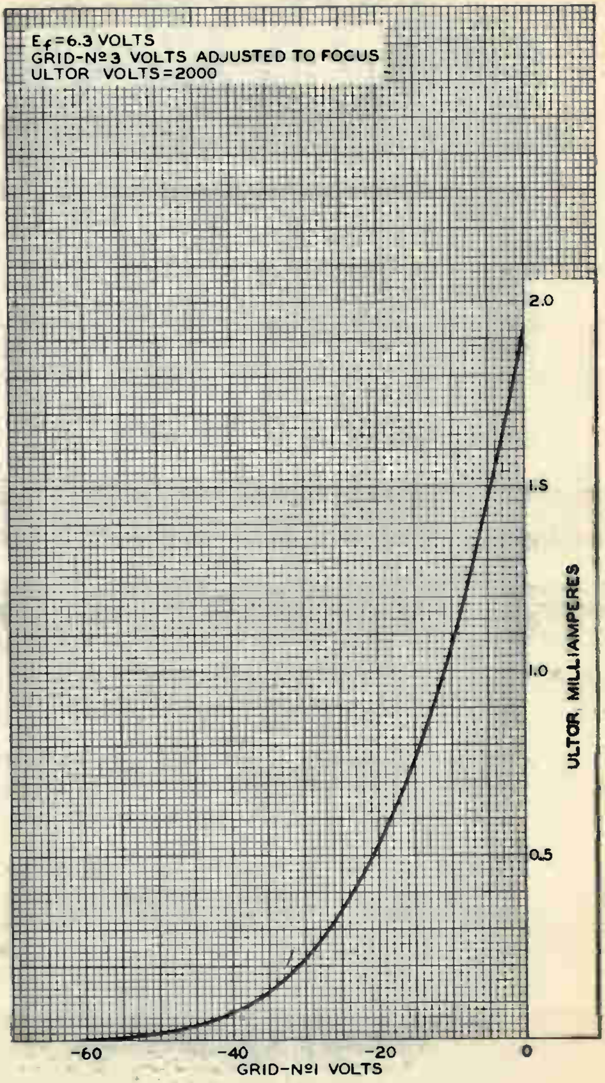
CHARACTERISTICS



MAXIMUM ULTOR-CURRENT REQUIREMENTS
FROM POWER SUPPLY



AVERAGE CHARACTERISTIC



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92CM-6658R2

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3KP4

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.

RCA

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.

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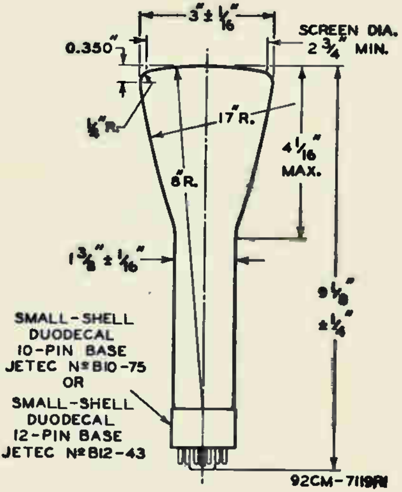
3RP1
OSCILLOGRAPH TUBE

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.

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3RP4

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

The 3RP4 is the same as the 9RP1 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.

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3RP1-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	μμf
Deflecting electrode DJ_1 to deflecting electrode DJ_2	2	μμf
Deflecting electrode DJ_3 to deflecting electrode DJ_4	2	μμf
DJ_1 to all other electrodes	11	μμf
DJ_2 to all other electrodes	8	μμf
DJ_3 to all other electrodes	7	μμf
DJ_4 to all other electrodes	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
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)
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 DJ_3
Pin 7 – Deflecting Electrode DJ_4

Pin 8 – Ultor (Grid No.2, Grid No.4, Collector)
Pin 9 – Deflecting Electrode DJ_2
Pin 10 – Deflecting Electrode DJ_1
Pin 11▲ – Internal Connection—Do Not Use
Pin 12 – Heater

DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

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

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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° 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_{c_4}) between 500 and 2500 volts*

Grid-No.3 Voltage for Focus	16.5% to 31% of E_{c4}	volts
Maximum Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	−6.75% of E_{c4}	volts
Grid-No.3 Current for Any Operating Condition	−15 to +10	μamp
Deflection Factor:		
DJ_1 & DJ_2	73 to 99	v dc/in./kv of E_{c4}
DJ_3 & DJ_4	52 to 70	v dc/in./kv of E_{c4}
Spot Position	##	

° 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.

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3RP1-A
OSCILLOGRAPH TUBE

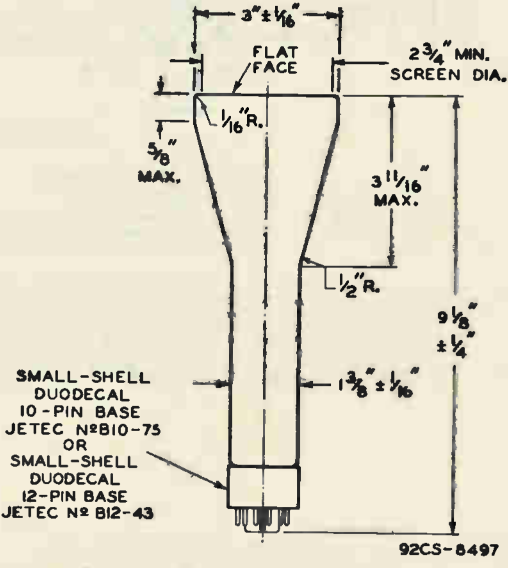
Examples of Use of Design Ranges:

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 Undeflected Focused Spot	-67.5	-135	volts
Deflection Factors:			
DJ_1 & DJ_2	73 to 99	146 to 198	volts dc/in.
DJ_3 & DJ_4	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

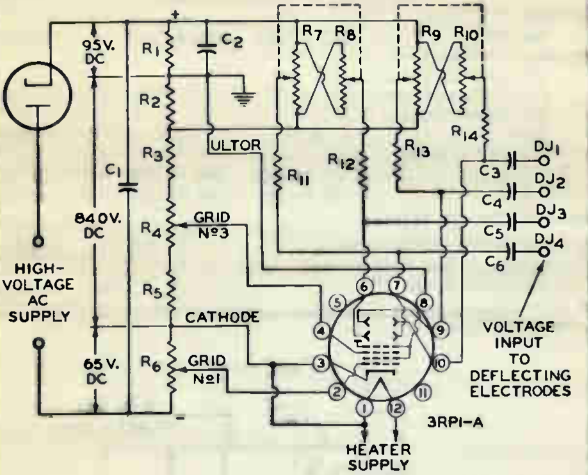
■ It is recommended that the deflecting-electrode circuit resistances be approximately equal.



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

OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



92CS-6777R1

C1: 0.2 μf
C2: 1.0 μf
C3 C4 C5 C6: 0.05-μf 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 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.

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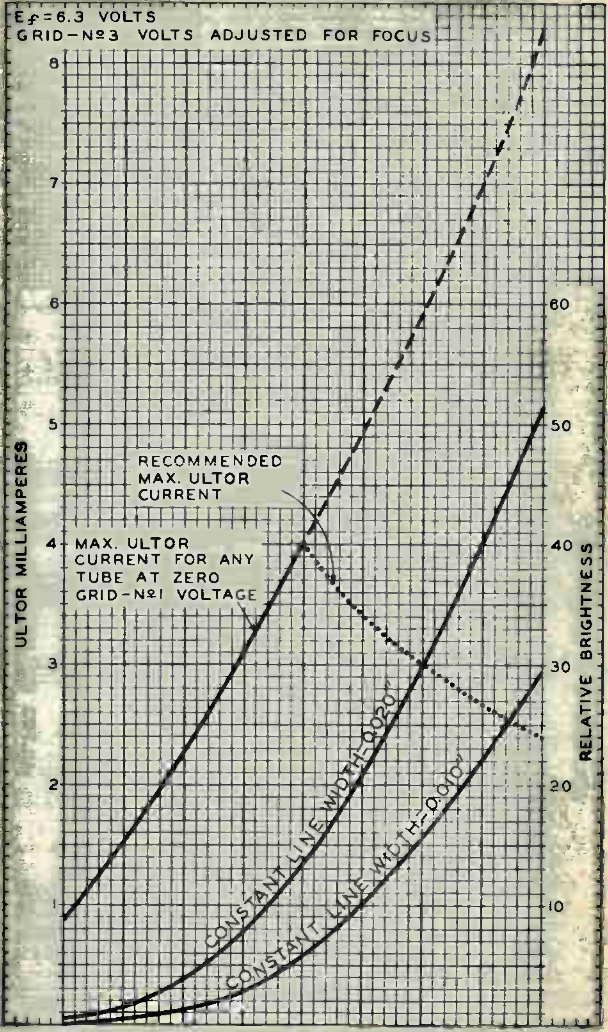
3RP1-A
CHARACTERISTICS



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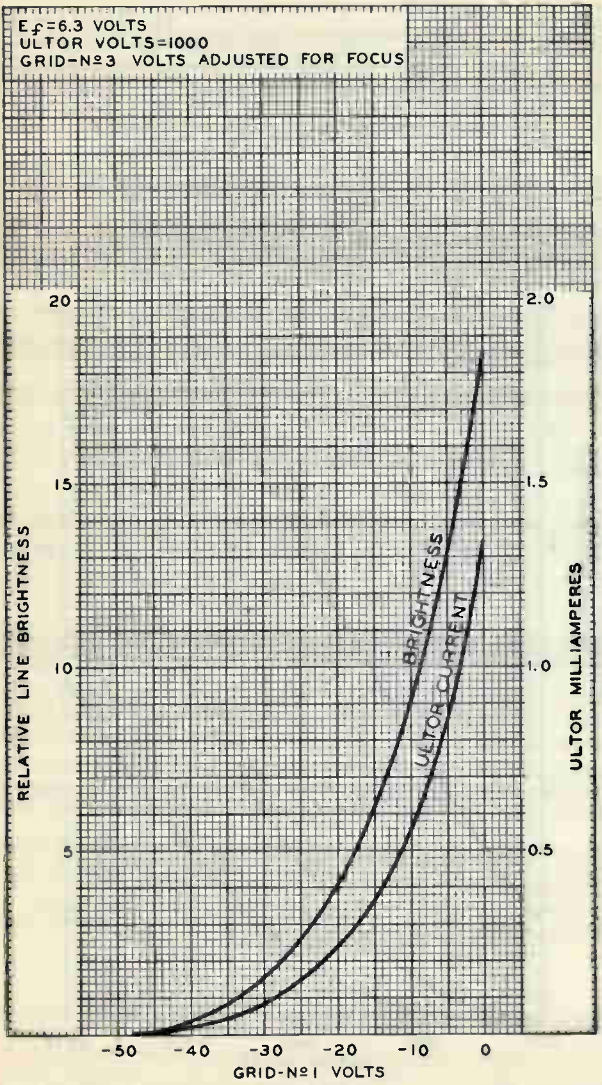
3RP1-A

AVERAGE CHARACTERISTICS



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3WP1

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS — ELECTROSTATIC DEFLECTION

3WP1

DATA

General:

Heater, for Unipotential Cathode:

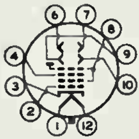
Voltage	6.3	ac or dc volts
Current	0.6 ± 10%	amp

Direct Interelectrode Capacitances:

Grid No.1 to all other electrodes	4.6 to 8.7	$\mu\mu f$
Cathode to all other electrodes	3 to 5.7	$\mu\mu f$
Deflecting electrode DJ_1 to deflecting electrode DJ_2	1.7 to 3.3	$\mu\mu f$
Deflecting electrode DJ_3 to deflecting electrode DJ_4	1 to 2	$\mu\mu f$
DJ_1 to all other electrodes	5.5 to 10.5	$\mu\mu f$
DJ_2 to all other electrodes	5.5 to 10.5	$\mu\mu f$
DJ_3 to all other electrodes	3.5 to 6.8	$\mu\mu f$
DJ_4 to all other electrodes	3.5 to 6.8	$\mu\mu f$

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 DJ_1 & DJ_2 . . . . . 2-1/2"
  By deflecting electrodes DJ_3 & DJ_4 . . . . . 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 2 – Grid No.1
Pin 3 – Cathode
Pin 4 – Grid No.3
Pin 6 – Deflecting Electrode DJ_1
Pin 7 – Deflecting Electrode DJ_2



Pin 8 – Ultor (Grid No.2, Grid No.4, Collector)
Pin 9 – Deflecting Electrode DJ_4
Pin 10 – Deflecting Electrode DJ_3
Pin 12 – Heater

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3WP1

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 Extinction of Undeflected Focused Spot	-3% to -5% of E_{c4}	volts
Grid-No.3 Current for Any Operating 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 Voltage for Focus	165 to 310	247 to 465	330 to 620	volts
Grid-No.1 Voltage for Visual Extinction of Undeflected 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 3WP1 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.

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3WP1

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▲.	0.026 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 DJ_1 and DJ_2. 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 1DJ2 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 1DJ2 direction by 1.730" in 3DJ4 direction; the other, 1.830" in 1DJ2 direction and 1.646" in 3DJ4 direction.

● The deflection factor for either DJ_1 and DJ_2 electrodes or DJ_3 and DJ_4 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.

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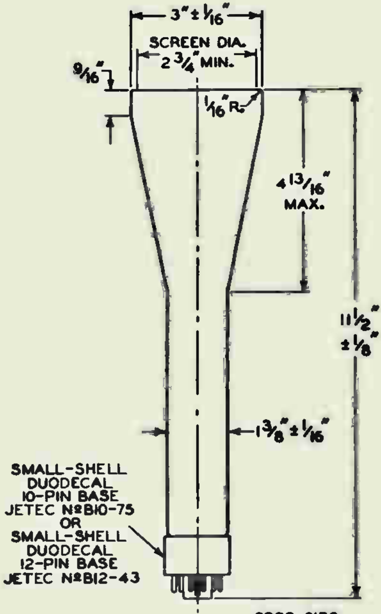
OSCILLOGRAPH TUBE



92CS-9130

℄ 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 ± 10°. ANGLE BETWEEN DJ_1 - DJ_2 TRACE AND DJ_3 - DJ_4 TRACE IS 90° ± 1°.

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.

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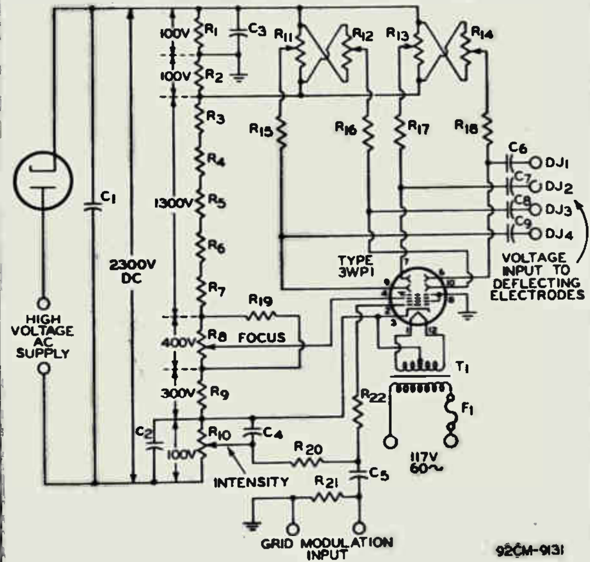
3WP1

OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



C1: 0.5 µf, 3000 volts
C2: 8 µf, 250 volts
C3: 1 µf, 200 volts
C4: 1 µf, 200 volts
C5: 0.05 µf, 3000 volts
C6 C7 C8 C9: 0.05 µf, 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

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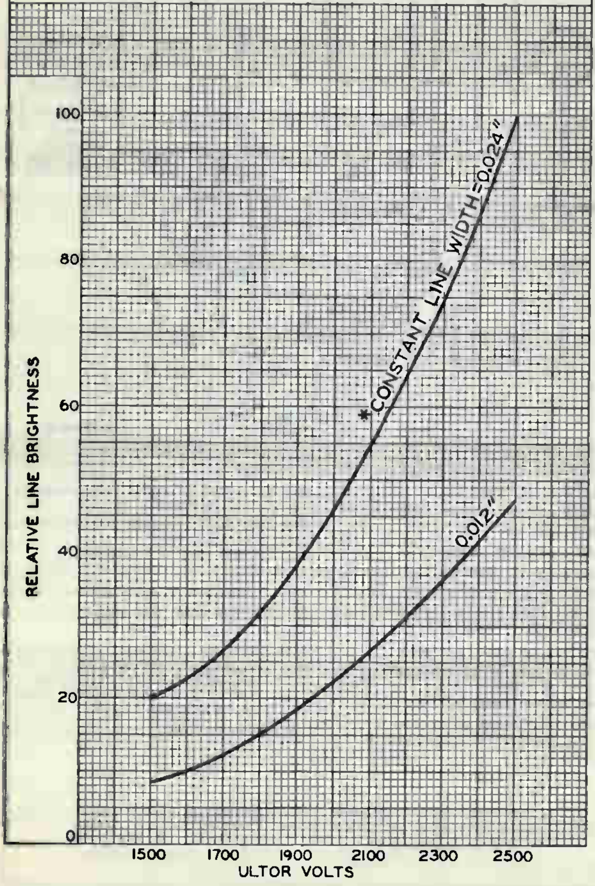
3WP1

AVERAGE CHARACTERISTICS

E_f = 6.3 VOLTS
GRID-No.3 VOLTS ADJUSTED FOR FOCUS.
GRID-No.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. 1/2 THAT AT CENTER OF LINE.



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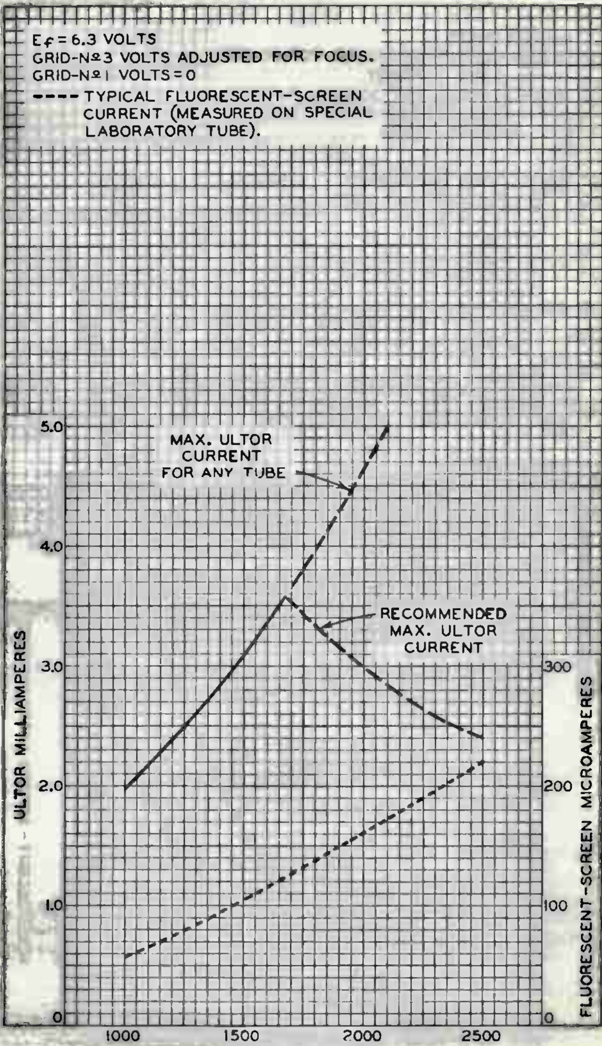
3WPI

CHARACTERISTICS



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92CM-9156

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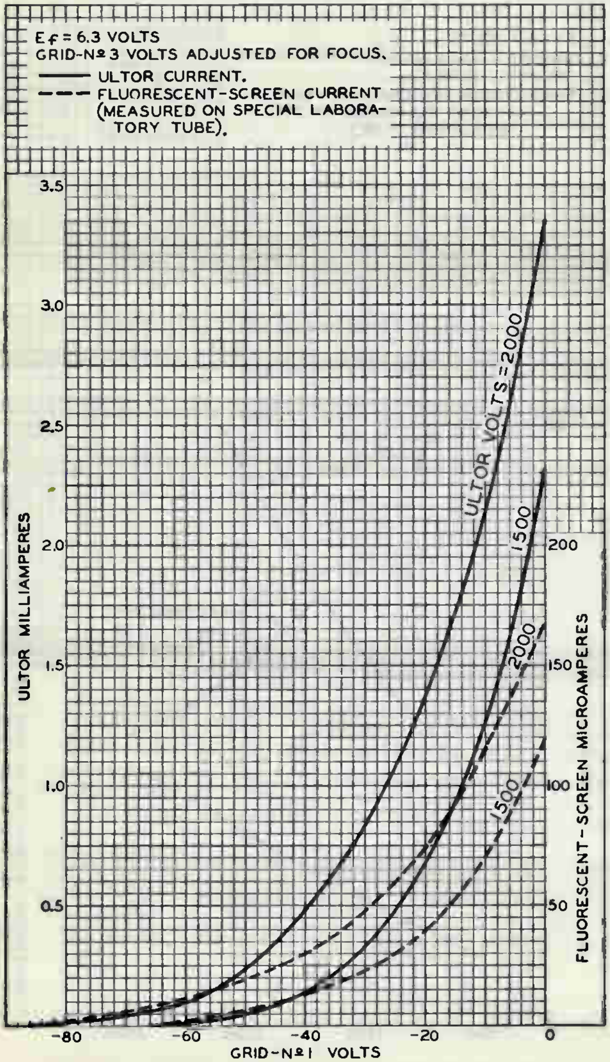
3WP1

AVERAGE CHARACTERISTICS



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92CM-9159

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3WP2

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

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.

RCA

5ABPI

OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

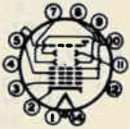
DATA

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	$\mu\mu f$
Cathode to All Other Electrodes	5	$\mu\mu f$
DJ_1 to DJ_2	2.5	$\mu\mu f$
DJ_3 to DJ_4	1.3	$\mu\mu f$
DJ_1 to All Other Electrodes	9	$\mu\mu f$
DJ_2 to All Other Electrodes	9	$\mu\mu f$
DJ_3 to All Other Electrodes	5	$\mu\mu f$
DJ_4 to All Other Electrodes	6	$\mu\mu f$
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 Diheptal 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 DJ_3
Pin 8 - Deflecting Electrode DJ_4



Pin 9 - Ultor (Grid No.2, Grid No.4)
Pin 10 - Deflecting Electrode DJ_2
Pin 11 - Deflecting Electrode DJ_1
Pin 12 - No. Conn.
Pin 14 - Heater
Cap - Post-Ultor (Grid No.5, Collector)

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 is deflected toward pin 5. With DJ_3 positive with respect to DJ_4, 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 DJ_1 and DJ_2 by

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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° ± 1.5°.

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 (Ec_5) between 2000 and 6000 volts and any ultor voltage (Ec_4) between 1500** and 2600 volts*

Grid-No.3 Voltage for Focus . .	20% to 34.5% of Ec_4 . . .	volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	2.6% to 4.3% of Ec_4 . . .	volts
Grid-No.3 Current for Any Operating Condition	-15 to +10 . . .	μamp
Deflection Factors:#		
When $Ec_5 = 2 \times Ec_4$		
DJ_1 & DJ_2	26.5 to 36	v dc/in./kv of Ec_4
DJ_3 & DJ_4	18 to 24	v dc/in./kv of Ec_4
When $Ec_5 = Ec_4$		
DJ_1 & DJ_2	21.5 to 29	v dc/in./kv of Ec_4
DJ_3 & DJ_4	14.5 to 19.5	v dc/in./kv of Ec_4
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.

5ABP1

5ABP1

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 DJ_3 and DJ_4 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.

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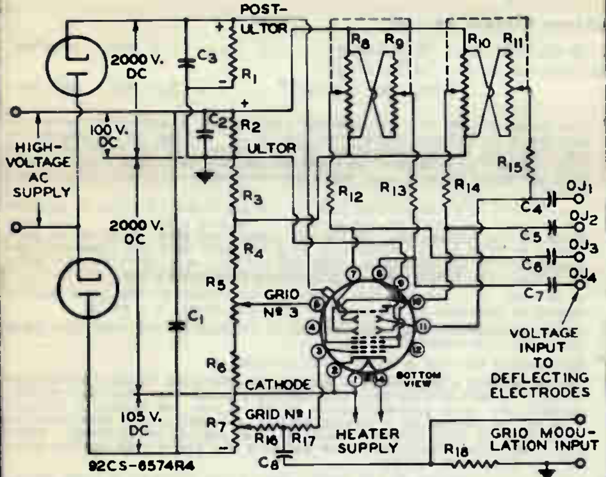
5ABP1

OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



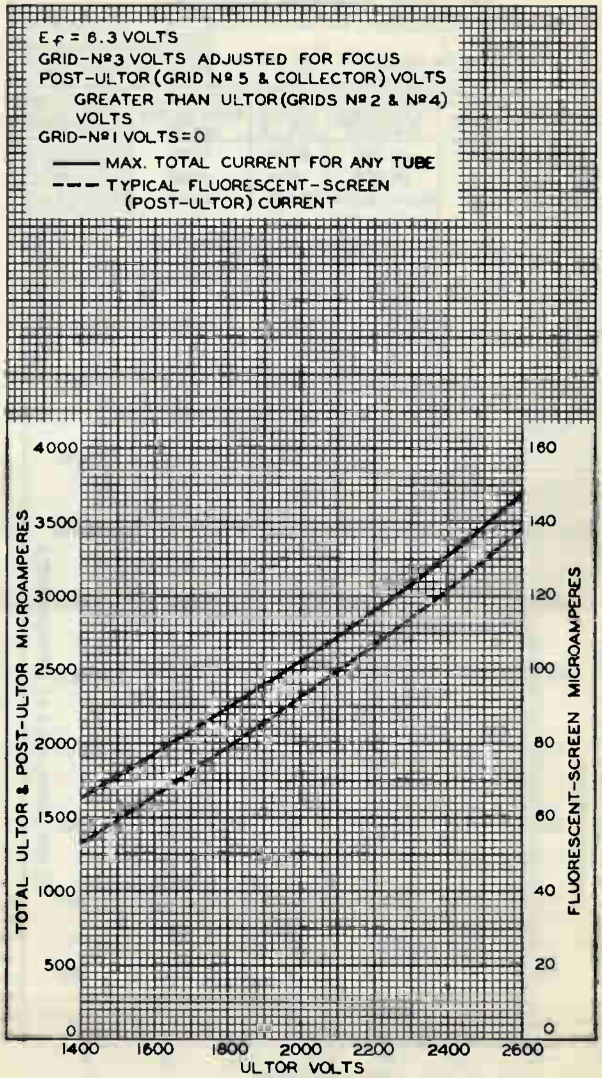
C1: 0.1 μf, 2500 Volts
C2: 1.0 μf, 200 Volts
C3: 0.1 μf, 2500 Volts
C4 C5 C6 C7: 0.05-μf, Blocking Capacitors*
C8: 0.0001 μf, 2500 Volts
R1: 50 Megohms (Five 10-Megohm, 1-Watt Resistors in Series)
R2 R3: 2 Megohms, 0.5 Watt
R4: 5.5 Megohms, 2 Watts
R5: 2-Megohm Potentiometer
R6: 1.5 Megohms, 0.5 Watt
R7: 0.5-Megohm Potentiometer
R8 R9: 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 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.

RCA

5ABP1

CHARACTERISTICS



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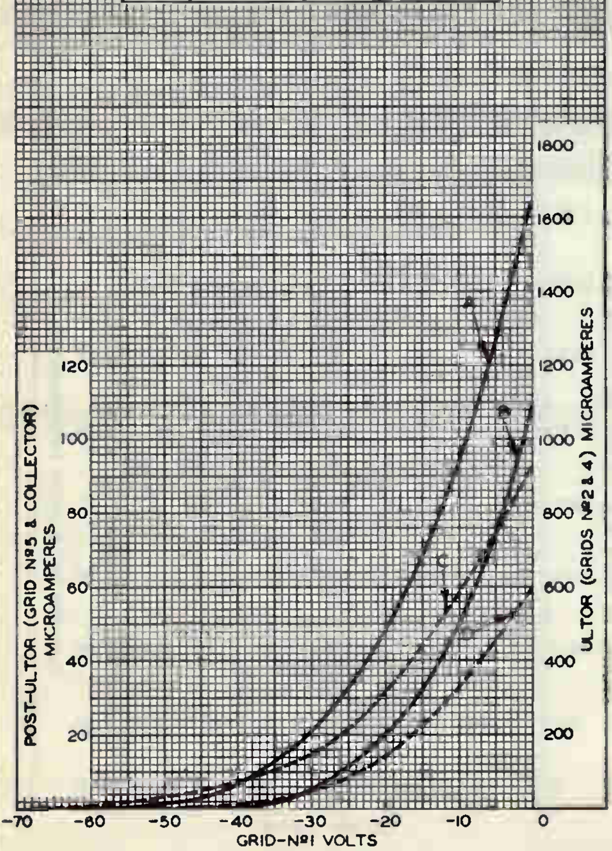
5ABP1

AVERAGE CHARACTERISTICS

E_f = 8.3 VOLTS
GRID-№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



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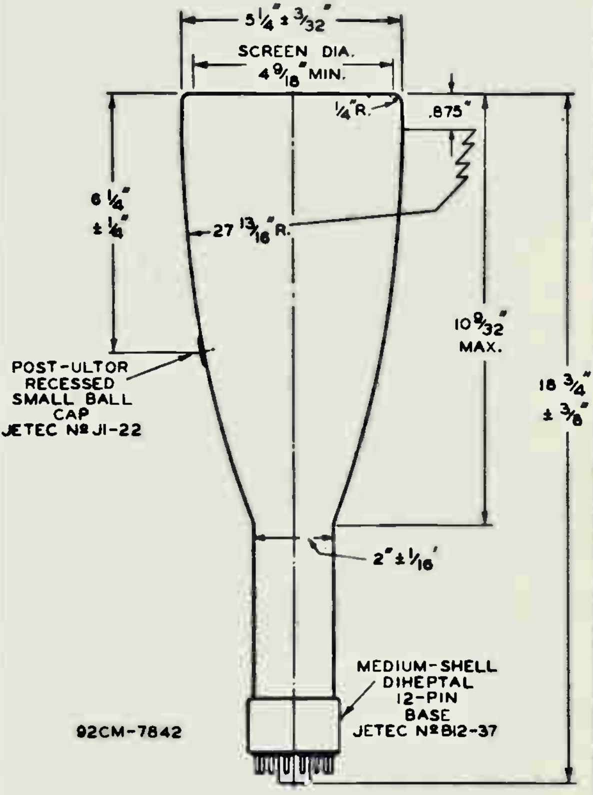
5ABP1

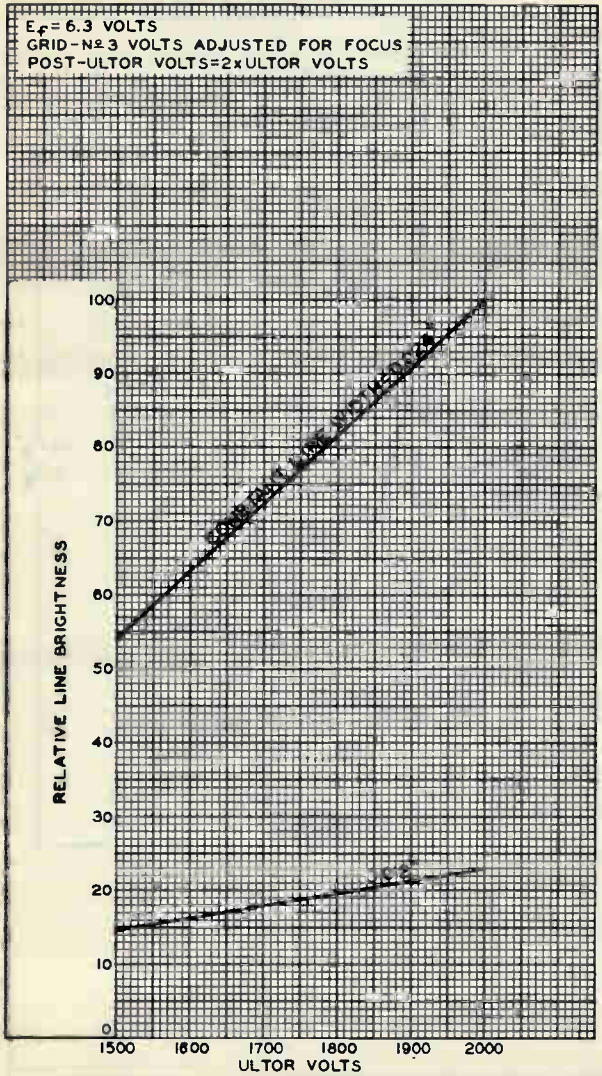
OSCILLOGRAPH TUBE



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

5ABP1

TYPICAL CHARACTERISTICS



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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

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5ADP1
OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR

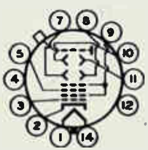
ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

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 DJ_1 to deflecting electrode DJ_2	1.7 to 3.1	μμf
Deflecting electrode DJ_3 to deflecting electrode DJ_4	0.7 to 1.3	μμf
DJ_1 to all other electrodes	4.4 to 9.2	μμf
DJ_2 to all other electrodes	4.4 to 9.2	μμf
DJ_3 to all other electrodes	2.8 to 5.3	μμf
DJ_4 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 DJ_3
Pin 8 - Deflecting Electrode DJ_4



Pin 9 - Ultor (Grid No.2, Grid No.4)
Pin 10 - Deflecting Electrode DJ_2
Pin 11 - Deflecting Electrode DJ_1
Pin 12 - No Connection
Pin 14 - Heater
Cap - Post-Ultor (Grid No.5, Collector)

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5ADPI

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_5}) 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 Extinction of Undeflected Focused Spot	-2.25% to -3.75% of E_{c_4}	volts
Grid-No.3 Current for Any Operating Condition.	-15 to +10	μamp
Deflection Factors:#		
When $E_{c_5} = 2 \times E_{c_4}$:		
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 $E_{c_5} = E_{c_4}$:		
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.

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5ADP1

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

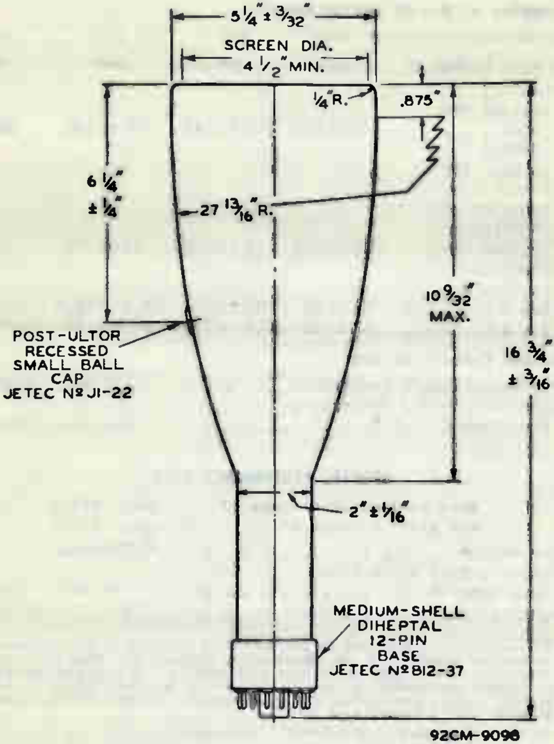
With post-ultor voltage of	3000	volts
and ultor voltage of	1500	volts
Line Width♦	0.030 max.	inch
Peak Grid-No.1 Drive from Spot Cutoff♦.	45 max.	volts
Raster Shape.	§	

\# The deflecting electrodes in the 5ADP1 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.

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

♦ 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 DJ_1 and DJ_2. 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).

§ 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.



℄ 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, ±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° ±1°.

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.

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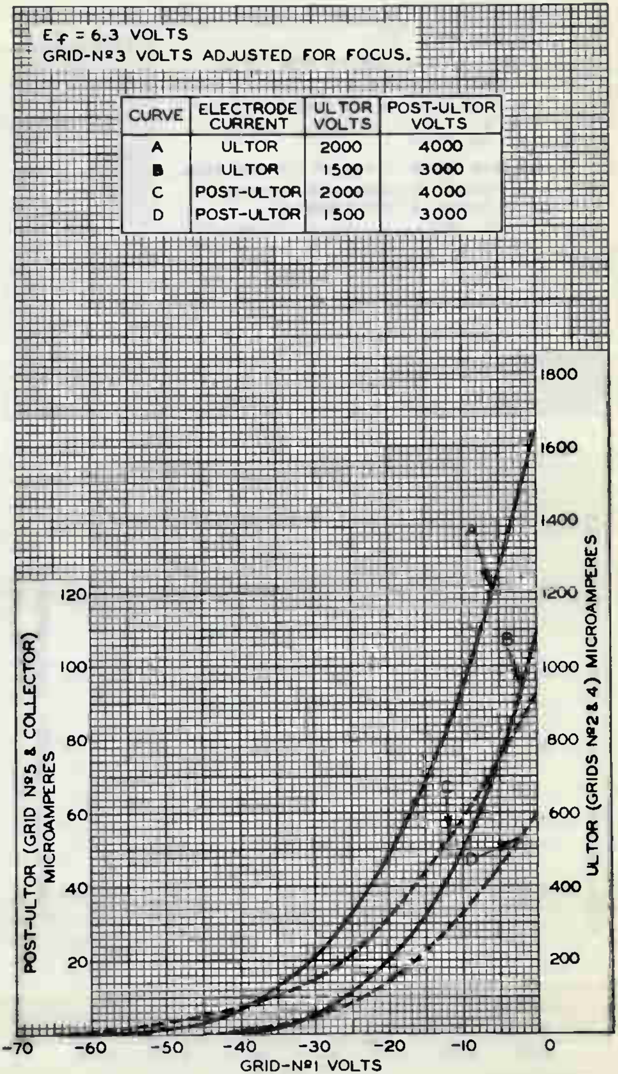
5ADP1

AVERAGE CHARACTERISTICS

E_f = 6.3 VOLTS
GRID-No.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



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92CM-9099

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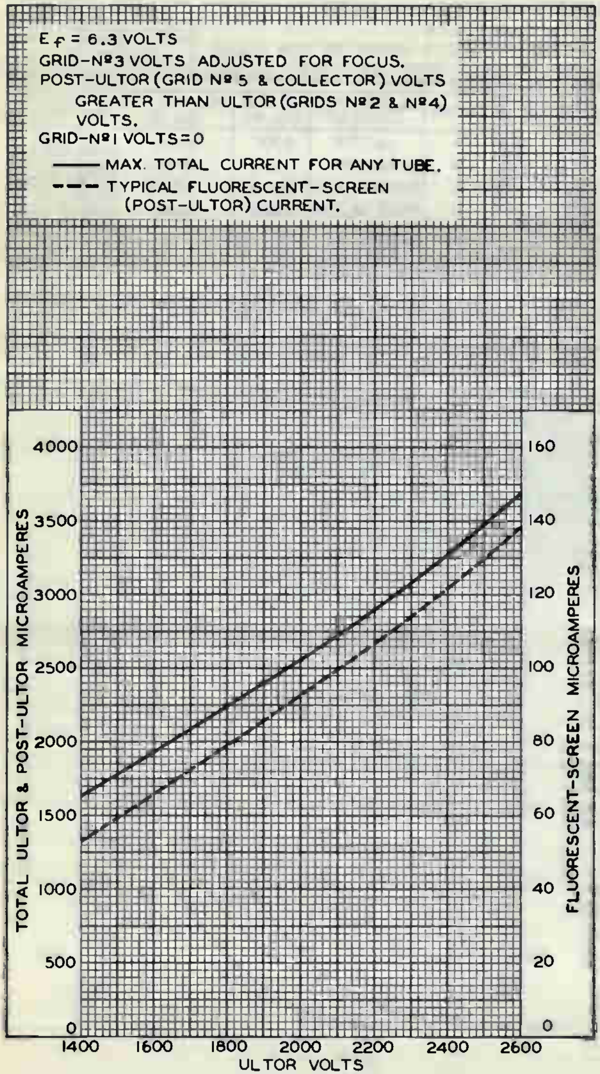
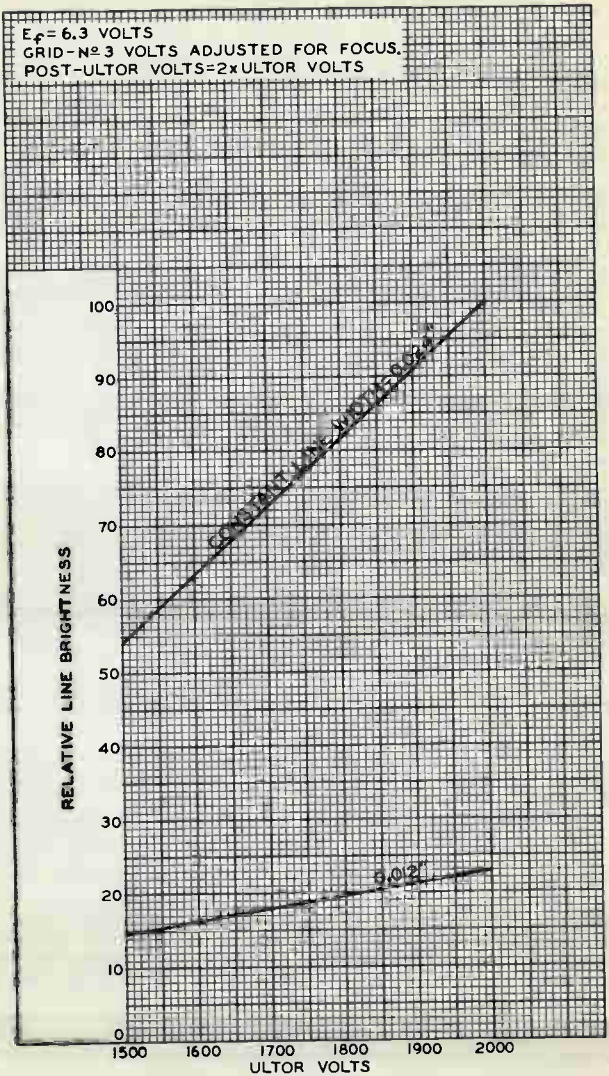
5ADP1

CHARACTERISTICS



5ADP1

TYPICAL CHARACTERISTICS



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5AUP24

COLOR FLYING-SPOT CATHODE-RAY TUBE

HIGH-RESOLUTION CAPABILITY — ALUMINIZED SCREEN
ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION

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

DATA

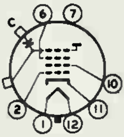
General:

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

Direct Interelectrode Capacitances:
  Grid No.1 to all other electrodes . . . . . 8 μμf
  Cathode to all other electrodes . . . . . 5 μμf
  External conductive neck coating to ultor . . . . {500 max. μμf / 100 min. μμf}

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" ± 3/8"
Greatest Diameter . . . . 5" ± 1/8"
Minimum Useful Screen Diameter . . . . 4-1/4"
Operating Position . . . . Any
Weight (Approx.) . . . . 1.4 lbs
Cap . . . . Recessed Small Cavity (JETEC No.J1-21)
Socket . . . . *See Operating Considerations*
Base . . Small-Shell Duodecal 7-Pin (JETEC Group 4, 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 Coating

Maximum Ratings, *Design-Center Values:*

ULTOR 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-peak value	2 max.	volts

← Indicates a change.

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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 μa .	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 focused spot	2 to 5 times E_{c1}	volts
Grid-No.1 Voltage for visual extinction of undeflected focused 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 μa. . . .	170	μa
Grid-No.2 Current.	-15 to +15	μa

Examples of Use of Design Ranges:

For ultor voltage of	*27000*	*volts*
Grid-No.3 Voltage for focus with ultor current of 200 μa .	4600 to 5800	volts
Grid-No.2 Voltage when circuit design utilizes fixed grid-No.1 voltage of -70 volts for visual extinction of undeflected focused spot	140 to 350	volts
Grid-No.1 Voltage for visual extinction of undeflected focused 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

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 6 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.

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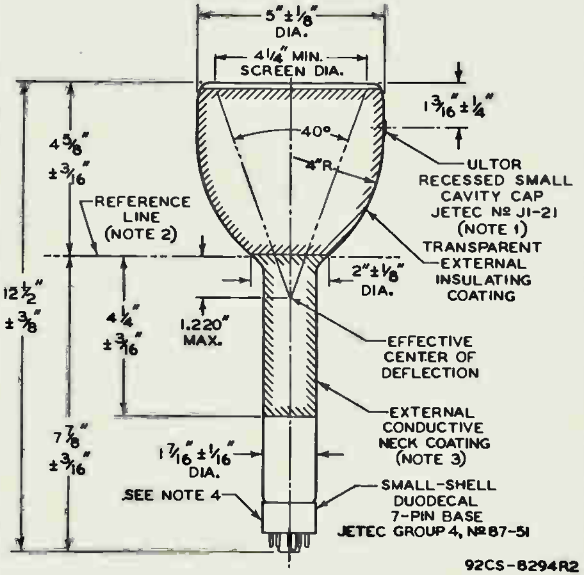
5AUP24

COLOR 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 ± 10°. ULTOR TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION 3.

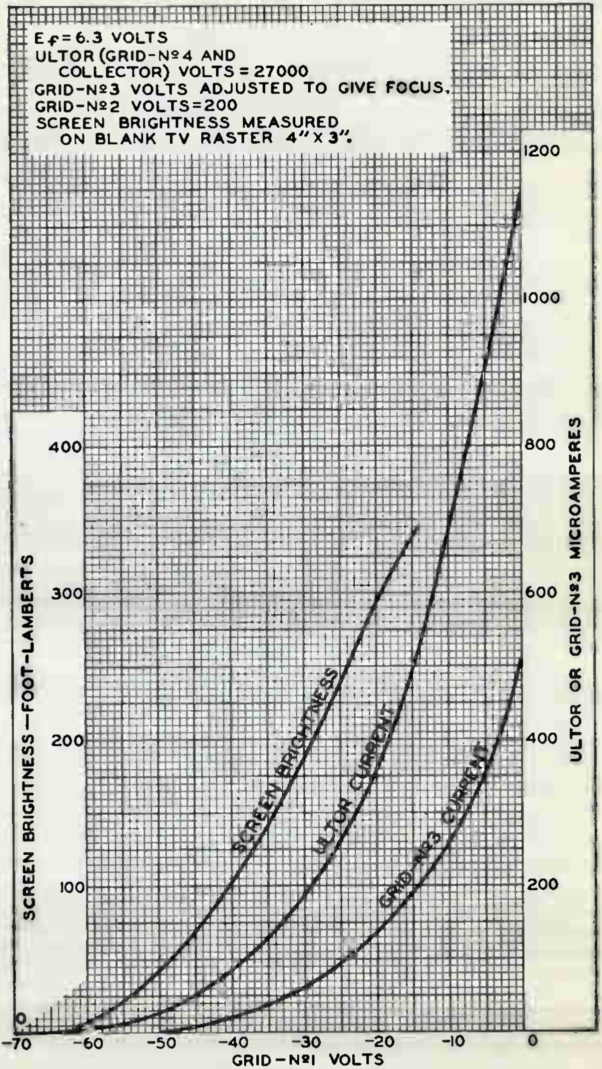
NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No. G-110 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY INTERSECTION OF PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: EXTERNAL CONDUCTIVE NECK COATING MUST BE GROUNDED.

NOTE 4: ℄ 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

AVERAGE CHARACTERISTICS



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

92CM-8343R1

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5AYP4

VIEW-FINDER KINESCOPE

METAL-BACKED SCREEN

ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

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

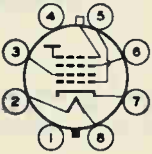
Direct Interelectrode Capacitances:

Grid No.1 to all other electrodes	6	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor●	750 max.	μμf
	500 min.	μμf

Faceplate, Spherical	Clear Glass
Phosphor (For curves, see front of this section)	P4-Sulfide Type, Metal-Backed
Fluorescence	White
Phosphorescence	White
Persistence	Short
Focusing Method	Electrostatic
Deflection Method	Magnetic
Deflection Angle (Approx.)	53°
Overall Length	11-9/16" ± 3/8"
Greatest Diameter of Bulb	4-15/16" ± 3/32"
Minimum Useful Screen Diameter	4-1/4"
Picture Size (within minimum-useful-screen area)	3-3/8" x 2-1/2"
Weight (Approx.)	1 lb 6 oz
Mounting Position	Any
Ultor● Terminal	Recessed Small Ball Cap (JETEC No.J1-22)
Bulb	J-39-1/2
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 – Grid No.3
Pin 7 – Cathode
Pin 8 – Heater
Cap – Ultor (Grid No.4, Collector)

Maximum Ratings, *Design-Center Values*:

ULTOR VOLTAGE●	10000 max.	volts
GRID-No.3 VOLTAGE	1500 max.	volts
GRID-No.2 VOLTAGE	410 max.	volts

● 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 5AYP4, the ultor function is performed by grid No.4. Since grid No.4 and collector are connected together within the 5AYP4, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.

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VIEW-FINDER KINESCOPE

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.	180 max.	volts
Heater positive with respect to cathode.	180 max.	volts

Equipment Design Ranges:

For any ultor voltage (E_{c_4}) between 5000 and 10000 volts and grid-No.2 voltage (E_{c_2}) between 200 and 410 volts*

Grid-No.3 Voltage for Focus with Ultor Current of 100 μamp	9.8% to 14.1% of E_{c4}	volts
Grid-No.1 Voltage for Visual Extinction of Focused Raster	8.5% to 23.5% of E_{c2}	volts
Max. Grid-No.3 Current** . .	*See Curves*	
Grid-No.2 Current.	−15 to +15	μamp
Field Strength of Adjustable Centering Magnet	0 to 8	gausses

Examples of Use of Design Ranges:

For ultor voltage of	*7000*	*10000*	*volts*
and grid-No.2 voltage of	*200*	*300*	*volts*
Grid-No.3 Voltage for Focus with Ultor Current of 100 μamp. . . .	680 to 990	980 to 1410	volts
Grid-No.1 Voltage for Visual Extinction of Focused Raster	−17 to −47	−25 to −71	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 5000 volts.

** Grid-No.3 current increases as the ultor voltage is decreased.

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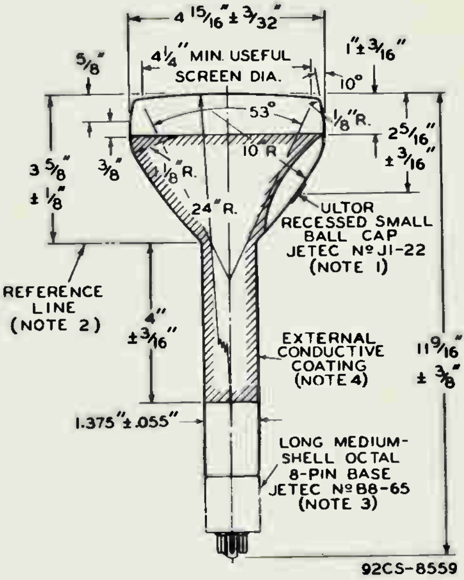
5AYP4

VIEW-FINDER KINESCOPE



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 ± 10°. 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.

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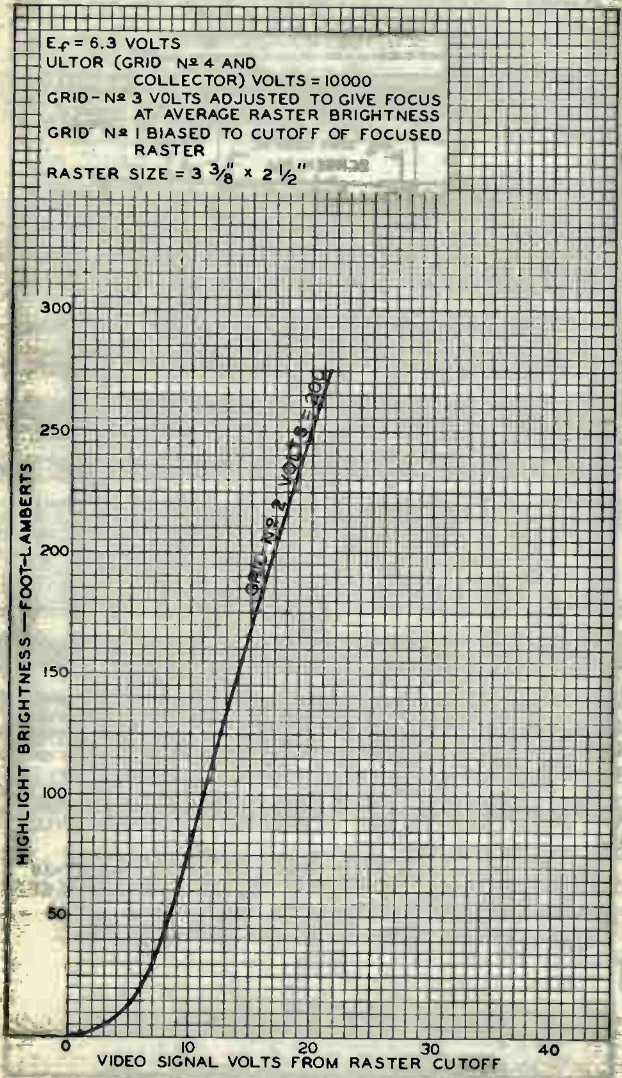
5AYP4

AVERAGE GRID-DRIVE CHARACTERISTIC



Projection Kinescope

P4 – Aluminized Silicate Phosphor Screen

Electrostatic Focus — **Magnetic Deflection**

Forced-Air Cooled

For Use with Reflective Optical Systems

ELECTRICAL

Heater Current at 6.3 volts	0.6 A
Focusing Method	Electrostatic
Deflection Method	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
Minimum Useful Screen Diameter	4.50"
Minimum Optical-Quality-Circle Diameter	4.25"
Refractive Index of Faceplate	1.519
Phosphor, Aluminized	P4 Silicate Type
C.I.E. Coordinates:	
x-coordinate	0.333
y-coordinate	0.347
Luminance	White
Persistence	Medium

MECHANICAL

Tube Dimensions:	
Overall Length	12.19" + 0.37" −0.38"
Greatest Diameter of Bulb	5.00" ± 0.12"
Base	Small-shell duodecal 7-pin, (JEDEC No.B7-51)
Anode Lead	Molded-on, Insulated Cable, 48" Long
Bulb	J40H1
Operating Position	Any
Weight (Approx.)	1-1/2 lb

MAXIMUM AND MINIMUM RATINGS, Absolute-Maximum Values

Face Temperature	100 max. °C
Anode Voltage	42,000 max. V

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 µA
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 Extinction 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	±15 µA
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.	MΩ
Grid-No.3 Circuit Resistance (unbypassed)	0.1	MΩ

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
Cathode Circuit Resistance (unbypassed)	1	kΩ
Heater Circuit Resistance (bypassed) to one side of heater	10	kΩ

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

[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

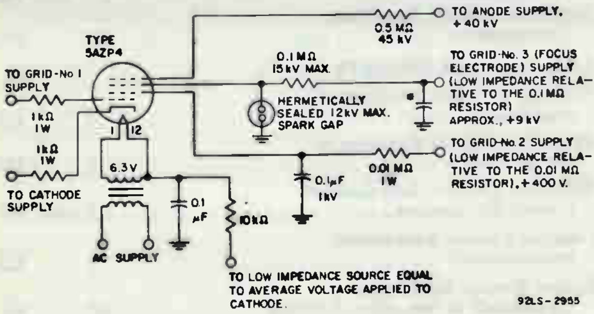
The high voltages at which this type is operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Precautions include the enclosing of high-potential terminals and the use of interlocking switches to break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

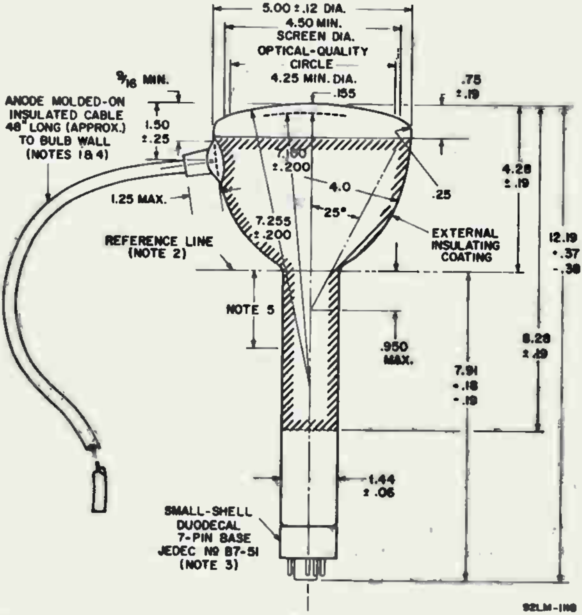
These rays can constitute a health hazard unless the tube is adequately shielded. Make sure that the shielding provides the required protection against personal injury.

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 ±20°. Anode-cable connection is on same side as vacant pin position No.3

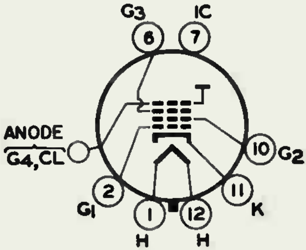
Note 2: Reference line is determined by position where gauge 1.500" + 0.003" – 0.000" I.D. and 2" long will rest on bulb cone.

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.

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

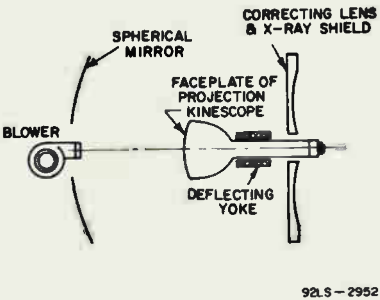
Pin 12: Heater

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

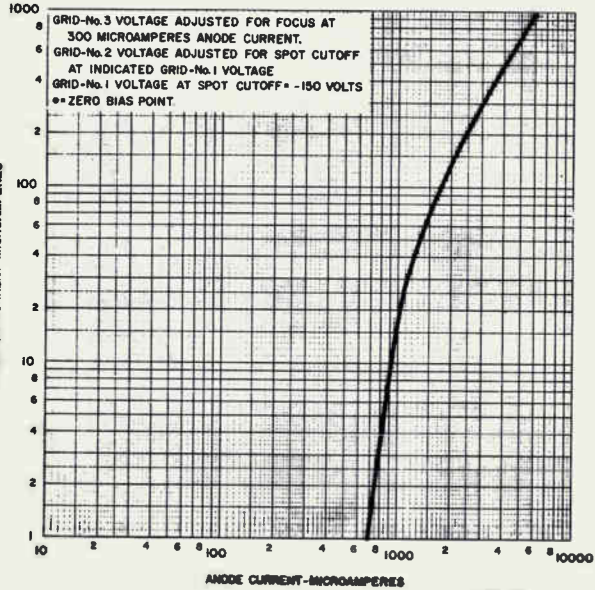
Note: Socket contacts for vacant pin positions No.3, 4, 5, 8, and 9 should be removed so that maximum insulation is provided for pins No.6 and 7.

REFLECTIVE OPTICAL SYSTEM

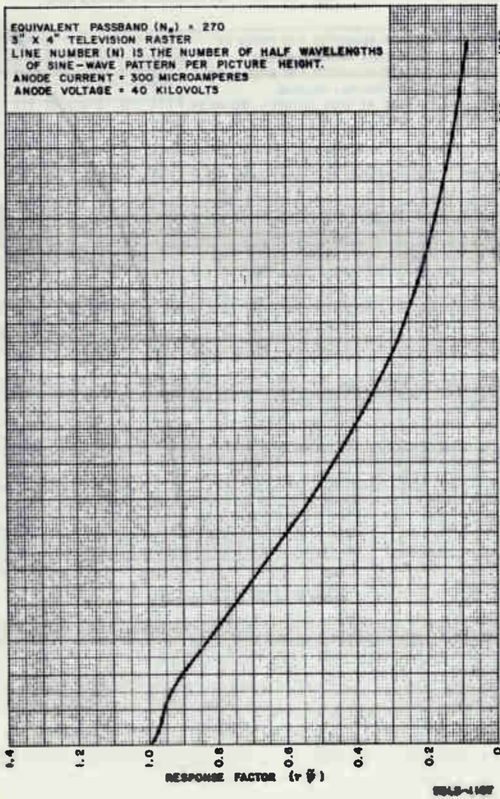
Arrangement of Typical Optical System and Air-Cooling System for Television Projector Using Reflective Optical Principles.



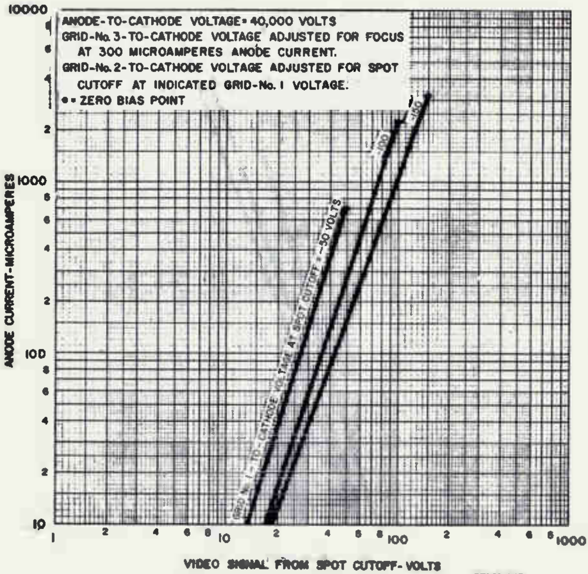
TYPICAL GRID-No.3 CURRENT CHARACTERISTIC



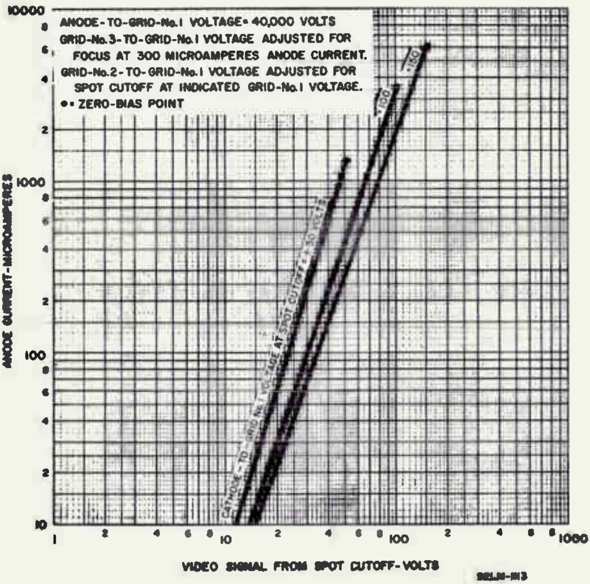
TYPICAL SINE-WAVE RESPONSE



TYPICAL DRIVE CHARACTERISTICS
GRID-DRIVE SERVICE

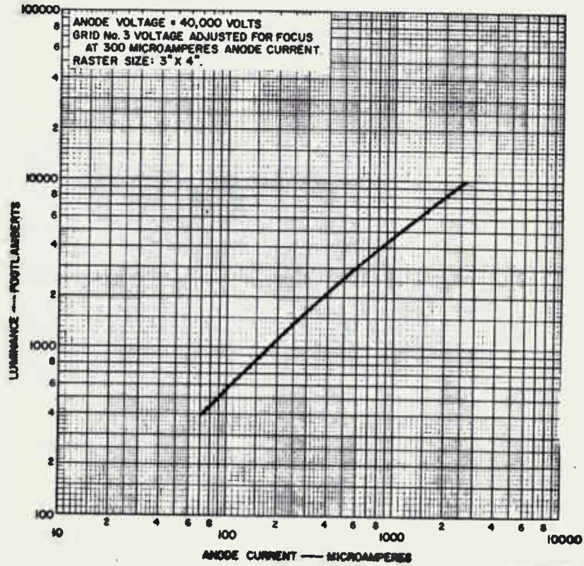


TYPICAL DRIVE CHARACTERISTICS
CATHODE-DRIVE SERVICE

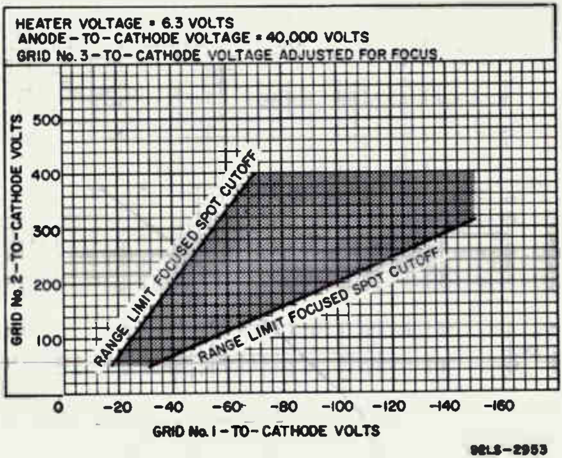


92LM-1113

TYPICAL LUMINANCE CHARACTERISTIC



CUTOFF DESIGN CHART



5BP1-A

HIGH-VACUUM CATHODE-RAY TUBE

Supersedes 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 2 - No Connection
Pin 3 - Deflecting Electrode DJ_1
Pin 4 - Anode No.1
Pin 5 - Internal Con. Do not use
Pin 6 - Deflecting Electrode DJ_4

Pin 7 - Anode No.2, Grid No.2
Pin 8 - Deflecting Electr. DJ_2
Pin 9 - Deflecting Electr. DJ_3
Pin 10 - Grid No.1
Pin 11 - Heater, Cathode

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

The angle between the trace produced by DJ_3 and DJ_4 and its intersection with the plane through the tube axis and pin 1 does not exceed 10°.

The angle between the trace produced by DJ_3 and DJ_4 and the trace produced by DJ_1 and DJ_2 is 90° ± 3°.

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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▲	Between -50 and +10		uamp.
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.

▲ 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 DJ_1 and DJ_2. 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.

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5CP1-A
OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR

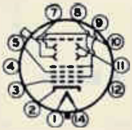
ELECTROSTATIC FOCUS   ELECTROSTATIC DEFLECTION

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	μμf
Cathode to All Other Electrodes	9	μμf
DJ_1 to DJ_2	2	μμf
DJ_3 to DJ_4	2	μμf
DJ_1 to All Other Electrodes	9	μμf
DJ_2 to All Other Electrodes	9	μμf
DJ_3 to All Other Electrodes	7	μμf
DJ_4 to All Other Electrodes	8	μμf
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		4-1/2"
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		$14J_1$

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid No.1
Pin 4 - Internal Con. Do not use
Pin 5 - Anode No.1
Pin 7 - Deflecting Electrode DJ_3
Pin 8 - Deflecting Electrode DJ_4



Pin 9 - Anode No.2, Grid No.2
Pin 10 - Deflecting Electr.DJ_2
Pin 11 - Deflecting Electr.DJ_1
Pin 12 - No Connection
Pin 14 - Heater
Cap - Anode No.3

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 is deflected toward pin 5. With DJ_3 positive with respect to DJ_4, 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 DJ_1 and DJ_2 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 DJ_1 and DJ_2 and the trace produced by DJ_3 and DJ_4 is 90° ± 3°.

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5CP1-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 (Eb_3) between 2000** and 4000 volts and any anode-No.2 voltage (Eb_2) between 1500▲ and 2000 volts*

→Anode-No.1 Voltage	18.7 to 34.5% of Eb_2 . . .	volts
→Grid-No.1 Voltage♦	1.5% to 4.5% of Eb_2 . . .	volts
Anode-No.1 Current of any Operating Condition . .	-15 to +10 . . .	μamp
Deflection Factors:		
	When $Eb_3 = 2 \times Eb_2$	
DJ1 & DJ2	39 to 53 v dc/in./kv of Eb_2	
DJ3 & DJ4	33 to 45 v dc/in./kv of Eb_2	
	When $Eb_3 = Eb_2$	
DJ1 & DJ2	31 to 42 v dc/in./kv of Eb_2	
DJ3 & DJ4	27 to 37 v dc/in./kv of Eb_2	
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.

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5CP1-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.

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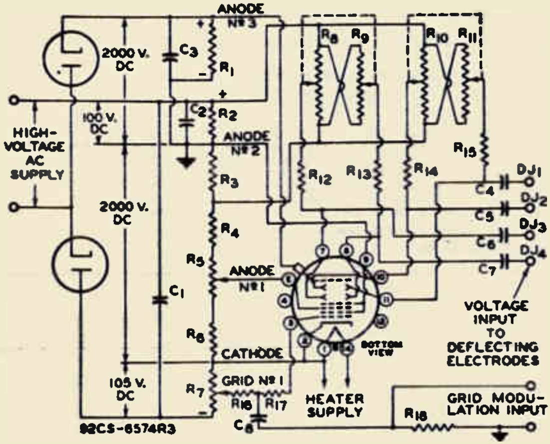
5CP1-A

OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



C1: 0.1 μf, 2500 Volts
C2: 1.0 μf, 200 Volts
C3: 0.1 μf, 2500 Volts
C4 C5 C6 C7: 0.05-μf, Blocking Capacitors*
C8: 0.0001 μf, 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: 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.

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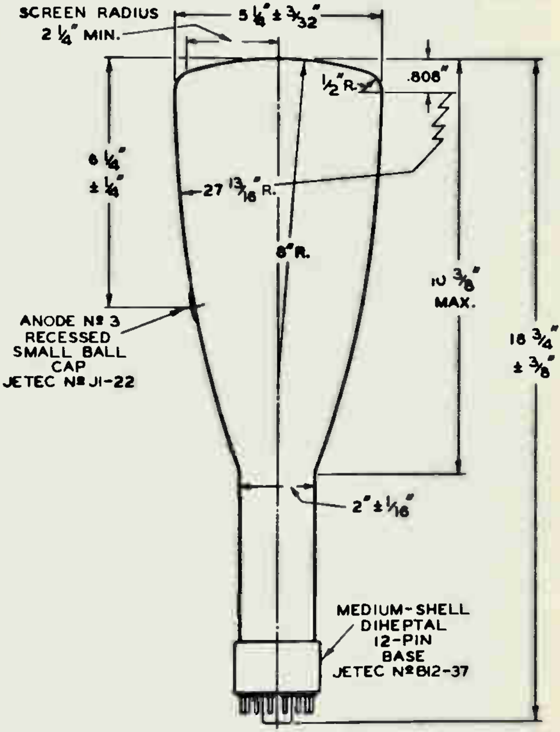
5CP1-A
OSCILLOGRAPH TUBE



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

92CM-6408R4

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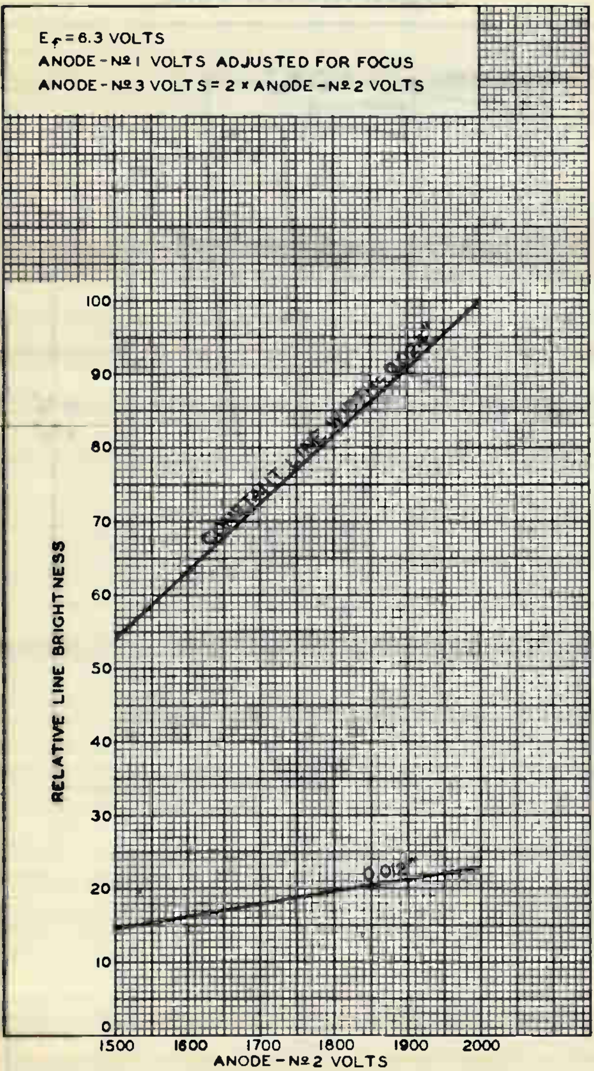
CHARACTERISTICS



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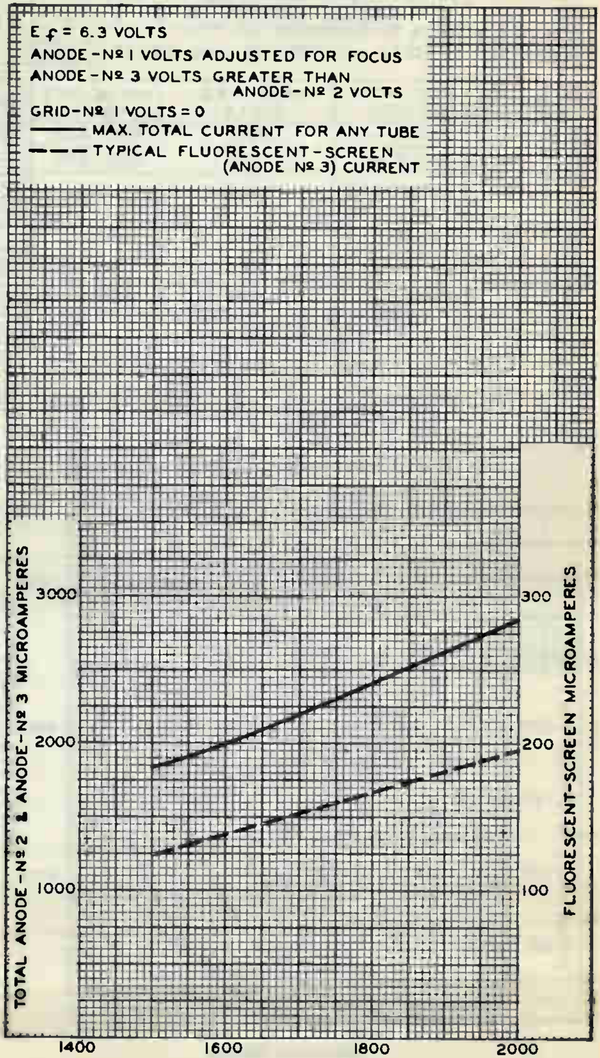
5CP1-A

CHARACTERISTICS



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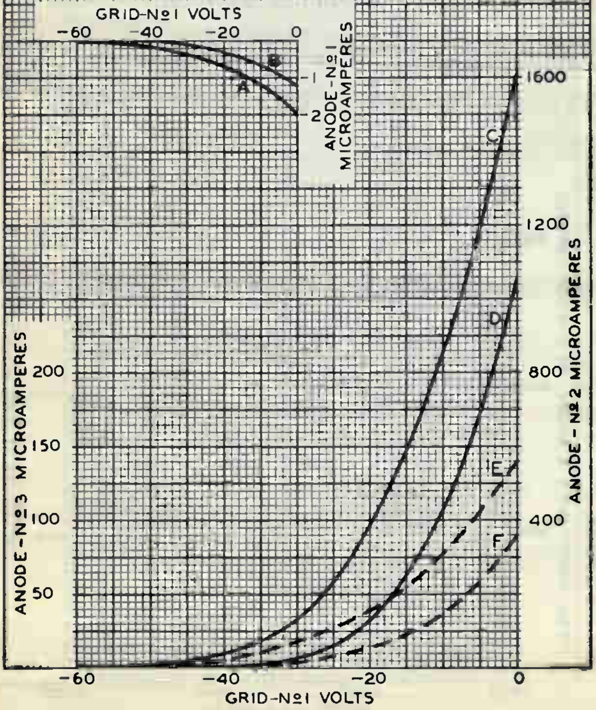
5CP1-A

AVERAGE CHARACTERISTICS

E_f = 6.3 VOLTS
ANODE-No.1 VOLTS ADJUSTED TO GIVE FOCUS

CURVE	ELECTRODE CURRENT	ANODE-No.2 VOLTS	ANODE No.3 VOLTS
A	ANODE No.1	2000	2000-4000
B	ANODE No.1	1500	1500-3000
C	ANODE No.2	2000	4000
D	ANODE No.2	1500	3000
E	ANODE No.3	2000	4000
F	ANODE No.3	1500	3000



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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.

View-Finder Kinescope

MAGNETIC FOCUS — MAGNETIC DEFLECTION

GENERAL DATA

Electrical:

Direct Interelectrode Capacitances:		
Cathode to all other electrodes.	8	pf
Grid No.1 to all other electrodes.	5	pf
Heater Current at 6.3 volts.	600	ma

Optical:

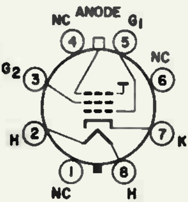
Phosphor (For curves, see front of this section)	P4—Sulfide Type
Fluorescence	White
Phosphorescence.	White
Persistence.	Short
Focusing Method.	Magnetic
Deflection Method.	Magnetic
Deflection Angle (Approx.)	53°

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.B8-65)
  - 5-Pin (JEDEC Group 1, No.B5-80)
- Medium-Shell Octal 8-Pin:
  - 8-Pin (JEDEC Group 1, No.B8-11)

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

Typical Operation:

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

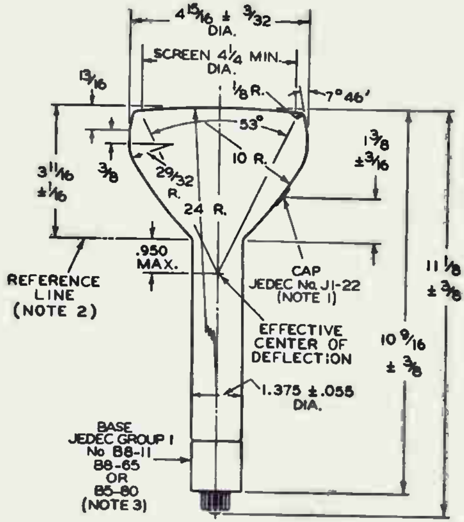
Maximum Circuit Values:

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

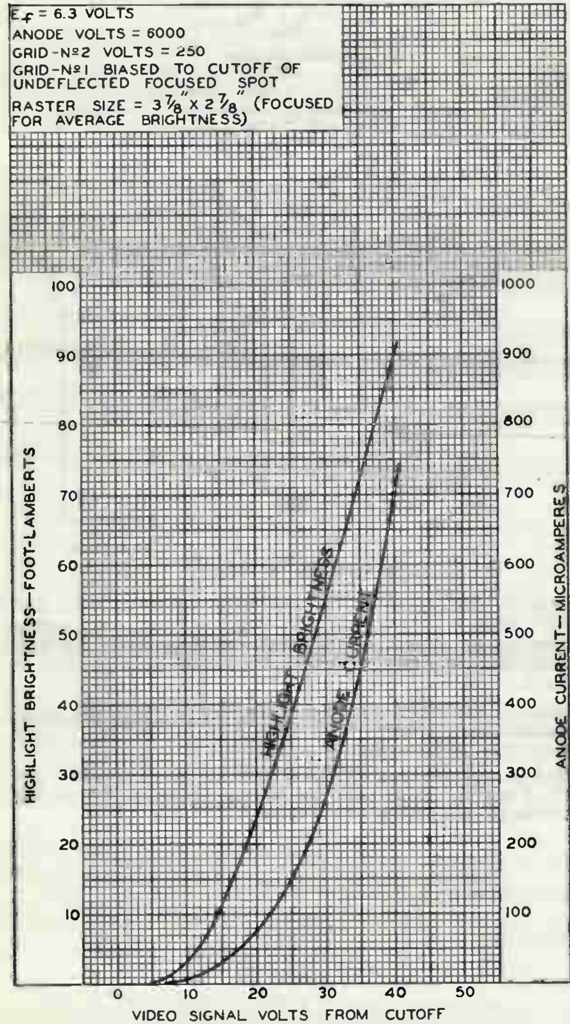
DIMENSIONS IN INCHES

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 ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

AVERAGE GRID-DRIVE CHARACTERISTICS



92CM-6683R1

5FP7-A

OSCILLOGRAPH TUBE

MAGNETIC FOCUS — MAGNETIC DEFLECTION

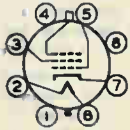
DATA

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	μμf ←
Cathode to All Other Electrodes	5	μμf
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		11-1/8" ± 3/8"
Greatest Diameter of Bulb		4-15/16" ± 3/32"
Minimum Useful Screen Diameter		4-1/4"
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.

OSCILLOGRAPH TUBE

Grid-No.1 Voltage°	-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

° 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.

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5FP14-A
OSCILLOGRAPH TUBE

MAGNETIC FOCUS | MAGNETIC 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	μμf
Cathode to all other electrodes	5	μμf
Faceplate, Spherical		Clear Glass
Phosphor (For curves, see front of this Section)		P14
Fluorescence		Purple
Phosphorescence		Orange
Persistence		Medium Long
Focusing Method		Magnetic
Deflection Method		Magnetic
Deflection Angle (Approx.)		53°
Overall Length		11-1/8" ± 3/8"
Greatest Diameter of Bulb		4-15/16" ± 3/32"
Minimum Useful Screen Diameter		4-1/4"
Weight (Approx.)		1 lb 2 oz
Mounting Position		Any
Cap		Recessed Small Ball (JETEC No.J1-22)
Bulb		J39-1/2
Base		Medium-Shell Octal 8-Pin (JETEC No.B8-11)
Basing Designation for BOTTOM VIEW		5AN

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 - Ultor (Grid No.3, Collector)

Maximum Ratings, ***Design-Center Values:***

ULTOR 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 HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	125 max.	volts

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

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5FP14-A

OSCILLOGRAPH TUBE

Equipment Design Ranges:

With any ultor voltage (E_{c_3}) between 4000# and 8000 volts and grid-No.2 voltage (E_{c_2}) between 150 and 700 volts

Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	−10% to −28% of E_{c_2}	volts
Grid-No.2 Current.	−15 to +15	μamp
Focusing-Coil Current (DC)oo	$\left[\sqrt{E_{c_3}/4000} \times 96\right] \pm 15\%$	ma
Spot Position.	##	

Examples of Use of Design Ranges:

With ultor voltage of	*4000*	*5000*	*volts*
and grid-No.2 voltage of	*250*	*250*	*volts*
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	−25 to −70	−25 to −70	volts
Focusing-Coil Current (DC) .	96 ± 15%	107 ± 15%	ma

Maximum Circuit Values:

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

SPECIAL PERFORMANCE DATA

Line Width:

For Ultor Voltage of 4000 Volts.	0.010 max.▲	inch
For Ultor Voltage of 5000 Volts.	0.009 max.▲	inch

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

oo For specimen focusing coil similar to JETEC Focusing Coil No.106 positioned with air gap toward faceplate and center line of air gap 2-3/4" from Reference Line *(See Dimensional Outline)* and ultor current of 200 microamperes.

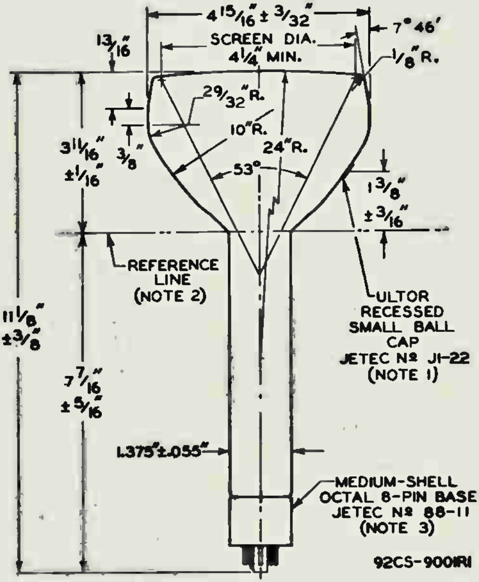
With the tube shielded from extraneous fields, the center of the undeflected, unfocused, low-intensity spot will fall within a circle having a 9-mm radius concentric with the center of the tube face.

▲ With JETEC Deflecting Yoke No.120, or equivalent, and under the following conditions: heater voltage of 6.3 volts, ultor current of 200 microamperes, grid-No.2 voltage of 250 volts, and a 49-line raster. Raster width is adjusted to 11.4 cm and focusing-coil current is 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).

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5FP14-A

OSCILLOGRAPH TUBE



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 ± 10°. ULTOR TERMINAL IS ON SAME SIDE OF TUBE AS PIN 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.

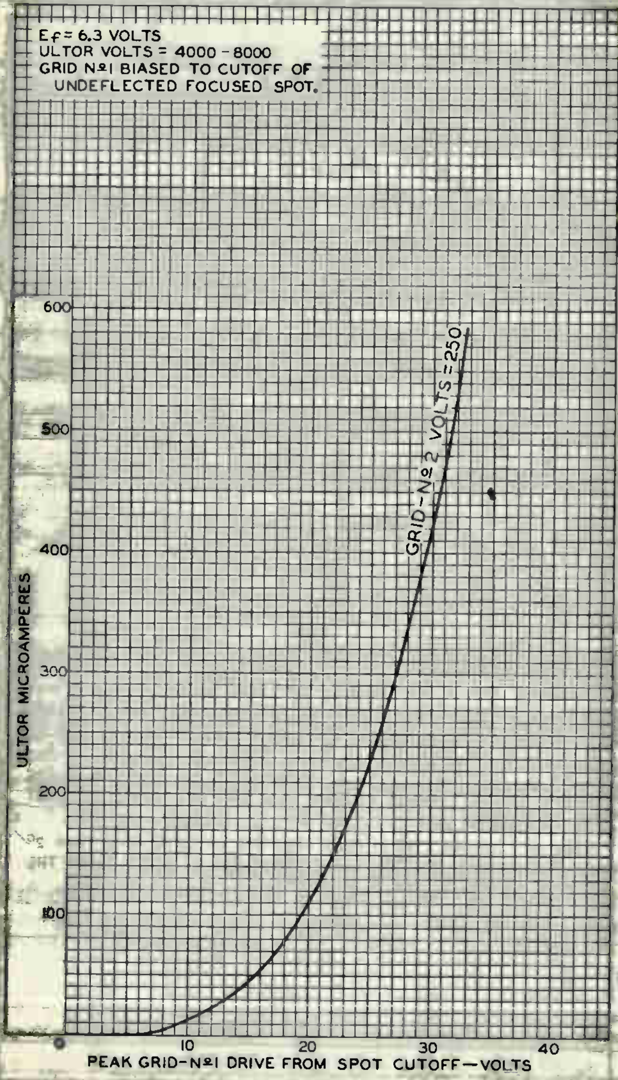
NOTE 3: CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5FP14-A

AVERAGE GRID-DRIVE CHARACTERISTIC



RCA

5UPI

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

General:

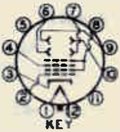
Heater, for Unipotential Cathode:
- Voltage . . . . 6.3 ± 10% . . . . ac or dc volts
- Current . . . . 0.6 . . . . amp

Direct Interelectrode Capacitances (Approx.):
- Grid No.1 to All Other Electrodes . . . . 8.0 . . . $\mu\mu$f
- DJ1 to DJ2 . . . . 2.5 . . . $\mu\mu$f
- DJ3 to DJ4 . . . . 2.5 . . . $\mu\mu$f
- DJ1 to All Other Electrodes . . . . 11.0 . . . $\mu\mu$f
- DJ2 to All Other Electrodes . . . . 8.0 . . . $\mu\mu$f
- DJ3 to All Other Electrodes . . . . 7.0 . . . $\mu\mu$f
- DJ4 to All Other Electrodes . . . . 8.0 . . . $\mu\mu$f

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 2 - Grid No.1
Pin 3 - Cathode
Pin 4 - Anode No.1
Pin 5 - Internal Con. Do Not Use
Pin 6 - Deflecting Electrode DJ3
Pin 7 - Deflecting Electrode DJ4



Pin 8 - Anode No.2, Grid No.2
Pin 9 - Deflecting Electrode DJ2
Pin 10 - Deflecting Electrode DJ1
Pin 11 - Internal Con. Do Not Use
Pin 12 - Heater

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

The angle between the trace produced by DJ_1 and DJ_2 and its intersection with the plane through the tube axis and pin 1 does not exceed 10°.

The angle between the trace produced by DJ_3 and DJ_4 and the trace produced by DJ_1 and DJ_2 is 90° ± 3°.

DEC. 20, 1946 TENTATIVE DATA

5UP1

5UP1

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 (Eb_2) 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:			
DJ1 & DJ2	28 to 38.5	v dc/in./kv of E_{b2}	
DJ3 & DJ4	23 to 31	v dc/in./kv of E_{b2}	

Examples of Use of Design Ranges:

For anode-No.2 voltages of	*1000*	*2000*		*volts*
Anode-No.1 Voltage . . .	170 - 320	340 - 640	. .	volts
Max. Grid-No.1 Voltage for Visual Cutoff	-45	-90	. .	volts
Deflection Factors:				
DJ1 & DJ2	28 - 38.5	56 - 77	volts dc/in.	
DJ3 & DJ4	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.

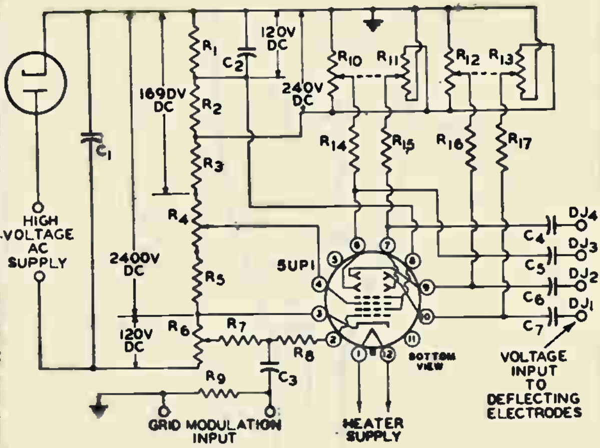
5UPI

RCA

5UPI

OSCILLOGRAPH TUBE

TYPICAL CIRCUIT

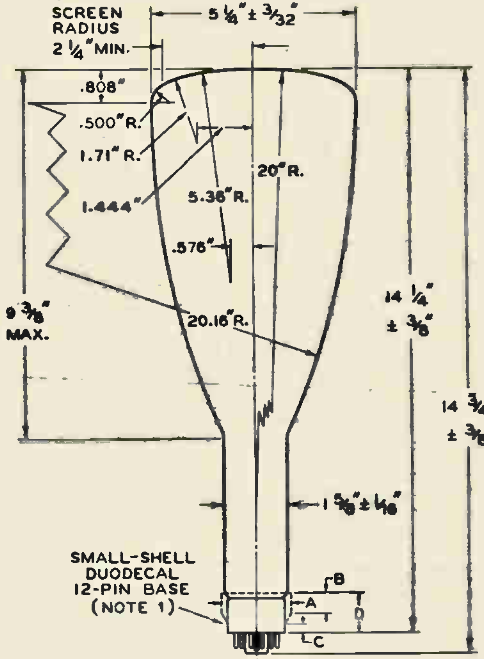


92CM-6819

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 μf, 2500 Volts
C2: 1 μf., 200 Volts
C3: 0.0001 μf, 2500 Volts
C4 C5 C6 C7: 0.1 μf., 600 Volts

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.

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:

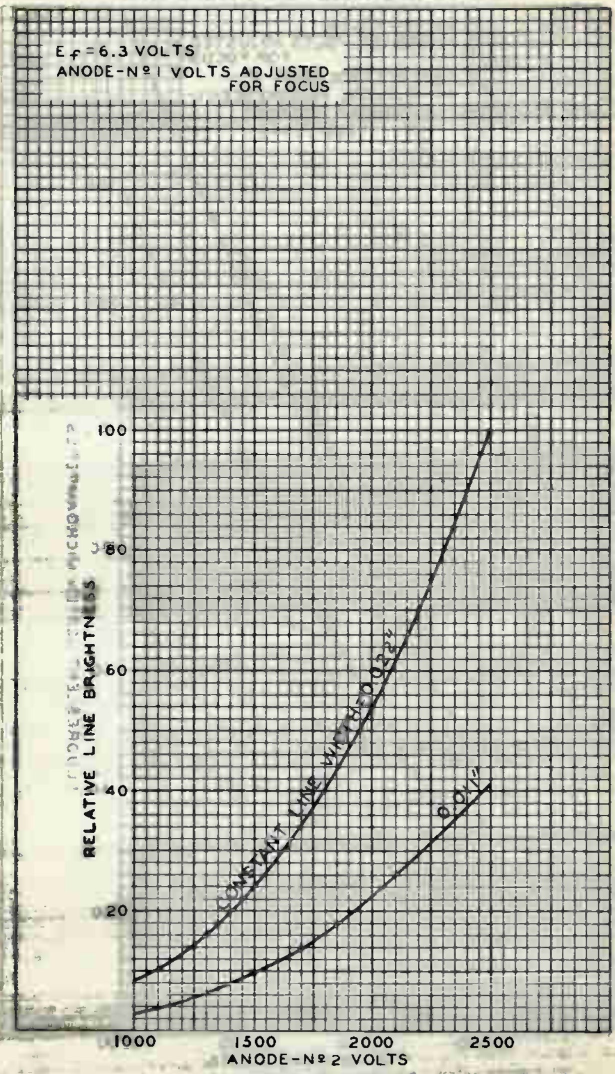
A = 1.85" MAX., B = 0.500", C = 0.200" MIN., D = 0.925".

92CM-6763

5UP1

5UP1

AVERAGE CHARACTERISTICS



NOV. 7, 1946

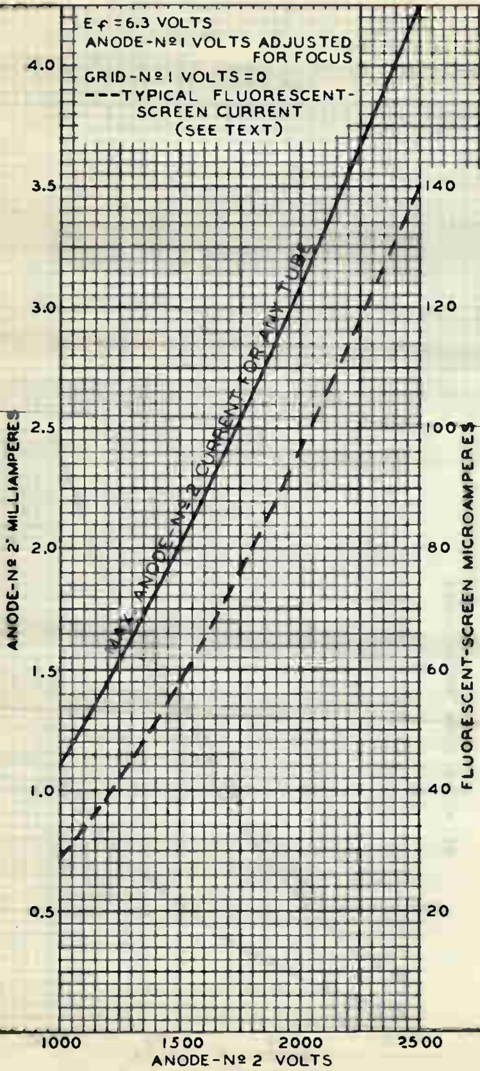
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-6808

5UP1

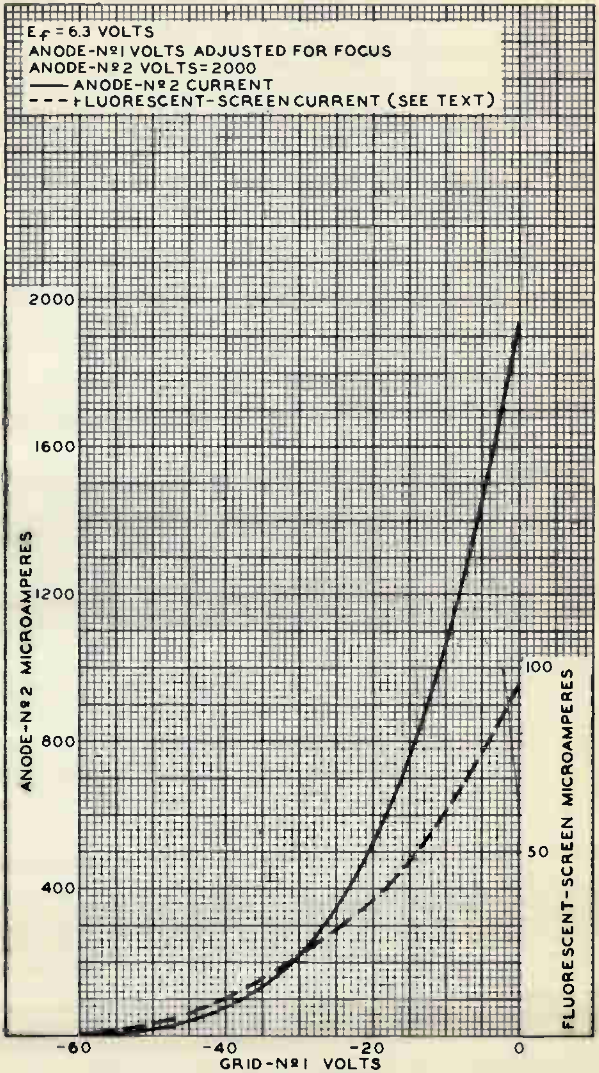
5UP1

CHARACTERISTICS



5UP1

AVERAGE CHARACTERISTICS



5UP7

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 μsec)

[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.

RCA

5WPII

TRANSCRIBER KINESCOPE

ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

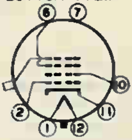
Voltage	6.3	ac or dc volts
Current	0.6	amp

Direct Interelectrode Capacitances:

Grid No.1 to All Other Electrodes	7.5	μμf
Cathode to All Other Electrodes	5	μμf
External Conductive Coating to Anode No.2	500 max.	μμf
	100 min.	μμf

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" ± 3/8"
Greatest Diameter of Bulb	5" ± 1/8"
Minimum Useful Screen Diameter	4-1/4"
Raster Size (Approx.)	2-1/2" x 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.

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5WP11

5WP11

TRANSCRIBER KINESCOPE

Anode-No.1 Voltage Range for Anode-No.2 Current of 20 µamp.	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	µamp
Max. Anode-No.1 Current.	25	µamp
Grid-No.2 Current Range.	-15 to +15	µamp

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 ± 80% 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 then 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.

5WP11

TRANSCRIBER KINESCOPE

The screen of the 5WP11 has highly actinic blue radiation, and is particularly effective for photography. The presistence 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

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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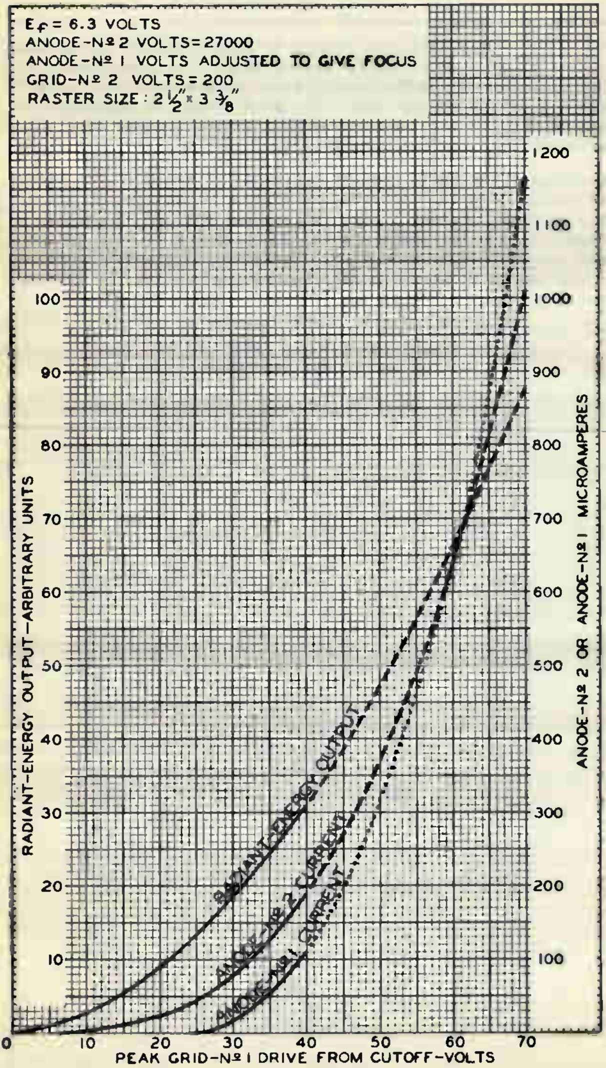
5WP11

AVERAGE CHARACTERISTICS



RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

RCA

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

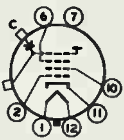
Direct Interelectrode Capacitances:
- Grid No.1 to all other electrodes . . . . . 8 μμf
- Cathode to all other electrodes . . . . . . 5 μμf
- External conductive neck coating to ultor . . {500 max. μμf / 100 min. μμf}

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 Coating

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.

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 µa 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	µa

→ **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	µa

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.

RCA

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.

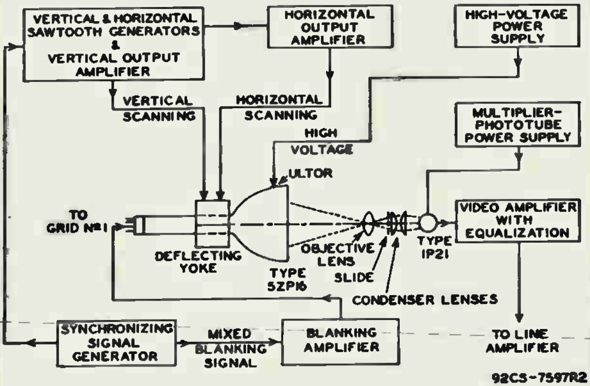
Underscanning over a protracted period should be avoided because an underscanned area of the screen will be burned and thus give diminished radiation when the raster is again scanned to full size and be slightly noticeable in the reproduced picture. Furthermore, it is inadvisable to permit a modulated 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.

FLYING-SPOT CATHODE-RAY TUBE

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

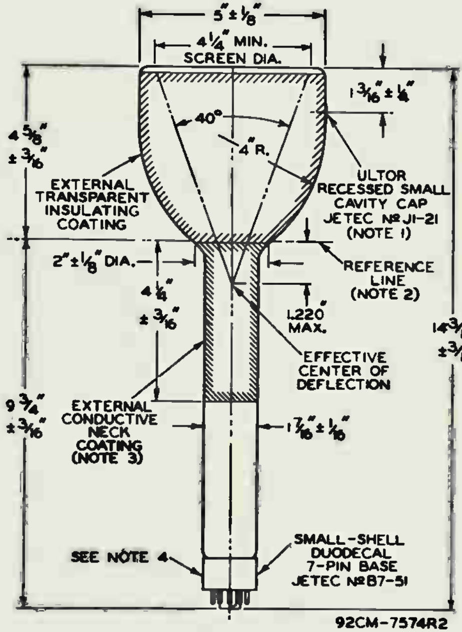


Devices and arrangements shown or described herein may use patents of RCA or others. Information contained herein is furnished without responsibility by RCA for its use and without prejudice to RCA's patent rights.

RCA

5ZP16

FLYING-SPOT CATHODE-RAY TUBE



92CM-7574R2

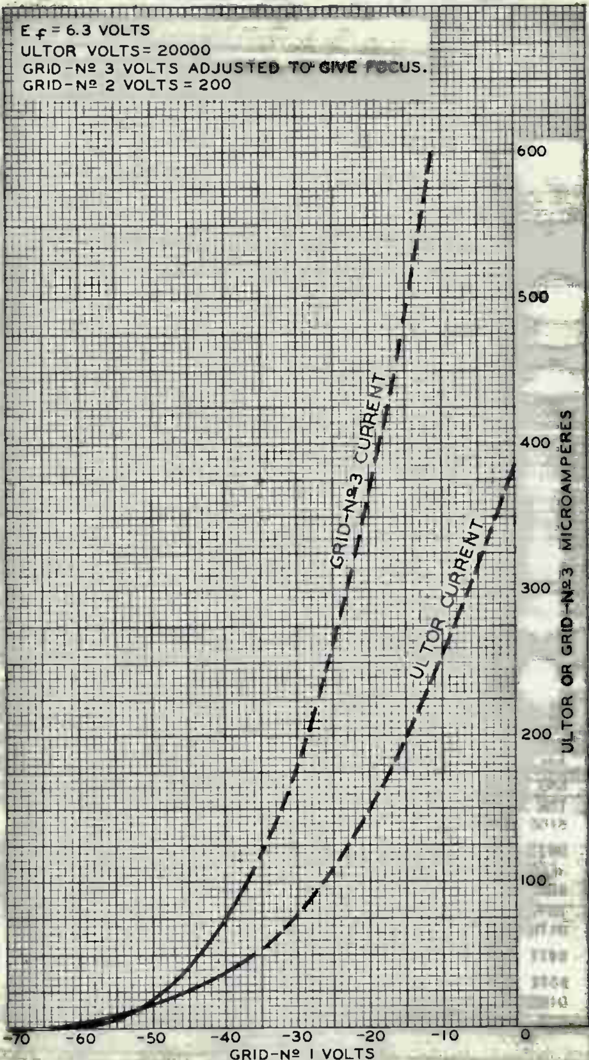
NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION 3 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 10°. THE ULTOR TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION 3.

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

AVERAGE CHARACTERISTICS



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92CM-7575RI
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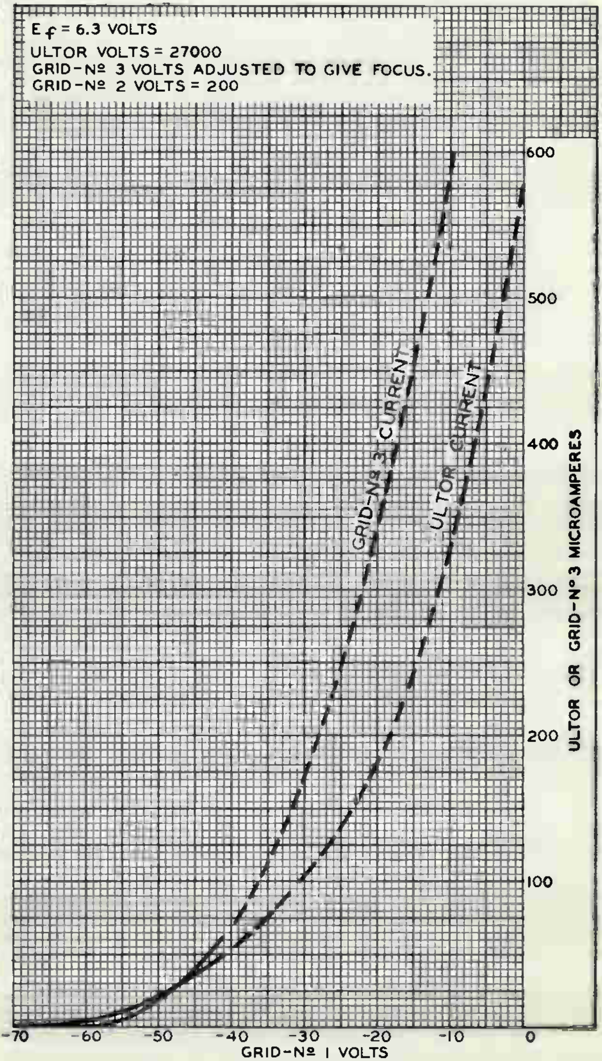
RCA

5ZP16

AVERAGE CHARACTERISTICS



ELECTRON TUBE DIVISION

92CM-7576R1

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7BP7-A
OSCILLOGRAPH TUBE

MAGNETIC FOCUS MAGNETIC DEFLECTION

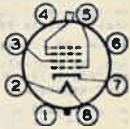
DATA

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 μμf
Grid No.2 to All Other Electrodes	7 μμf
Cathode to All Other Electrodes	5 μμf
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	13-1/4" ± 3/8"
Greatest Diameter of Bulb	7" ± 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□	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○	-25 to -70	-25 to -70	volts
Focusing-Coil Current▲	75 to 102	99 to 135	ma
Spot Position	#	-	

●,□,*,○,▲,#: See next page.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

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.

RCA

7MP7

OSCILLOGRAPH TUBE

MAGNETIC FOCUS | MAGNETIC DEFLECTION

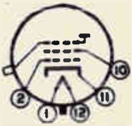
DATA

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	μμf
Cathode to All Other Electrodes	5	μμf
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" ± 3/8"
Greatest Diameter of Bulb		7-3/16" ± 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.

Typical Operation:

Ultor 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 ultor voltage. In general, the ultor 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 ultor 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

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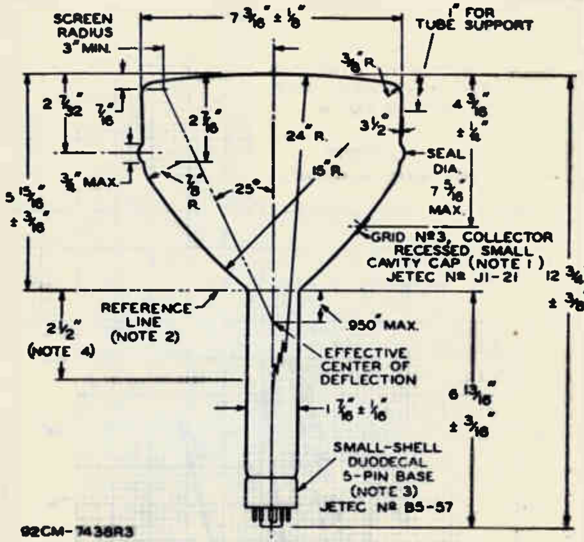
7MP7
OSCILLOGRAPH TUBE



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 ± 10°. 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. D. AND 2" LONG WILL REST ON BULB CONE.

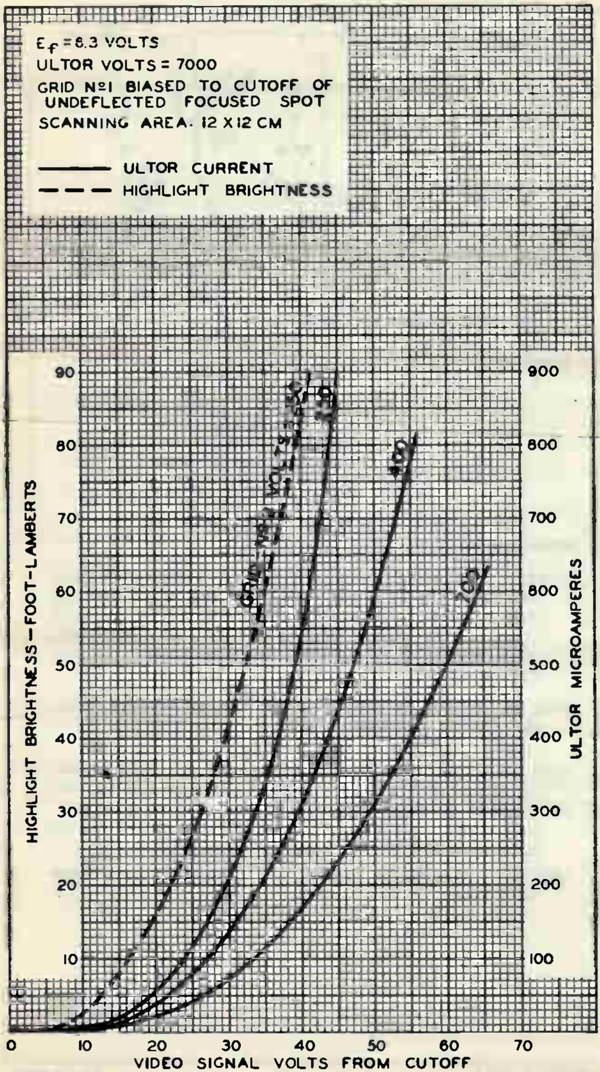
NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED: IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING DIAMETER OF 1-7/8".

NOTE 4: LOCATION OF DEFLECTING YOKE MUST BE WITHIN THIS SPACE.

RCA

7MP7

AVERAGE GRID-DRIVE CHARACTERISTICS



JULY 18, 1951

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7450R1

Projection Kinescopes

FORCED-AIR COOLED
ELECTROSTATIC FOCUS

MAGNETIC 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 No.1 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

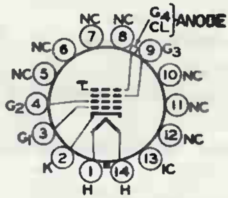
The specified air flow should be delivered perpendicularly from a nozzle having a diameter of about 2 inches onto the face of the tube while it is in operation. See REFLECTIVE OPTICAL SYSTEM. In a typical system with air filter, the total system static pressure is approximately 0.25 inch of water. The 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 Bulb
(Excluding side cap or cable) . . . . 7 ± 3/16 in
Cap . . . . Medium (JEDEC No.C1-5)
Base. . . . . . Plastic Filled, Small-Shell Diheptal 14-Pin, (JEDEC No.B14-15)

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)



14N

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	280	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	180	V
Heater positive with respect to cathode	180	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} plus E_{kg1} voltage	V
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.

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Grid-No.3 Current	See footnote[d]	
Grid-No.2 Current	-15 to +15	μA

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	μA

← Indicates a change.

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 160 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-cathode 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 µA 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.

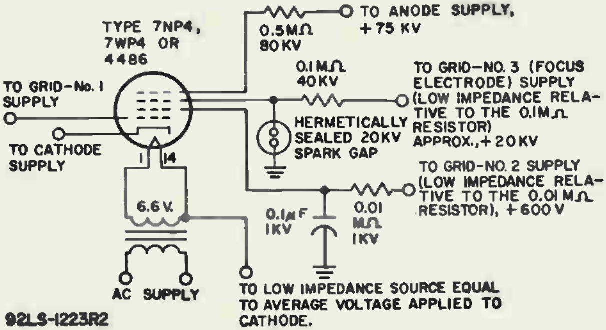
2. Never exceed the rated maximum anode current of 2 milliamperes.

3. Never overscan the screen because the beam will strike the neck and liberate occluded gas which may cause internal arcing.

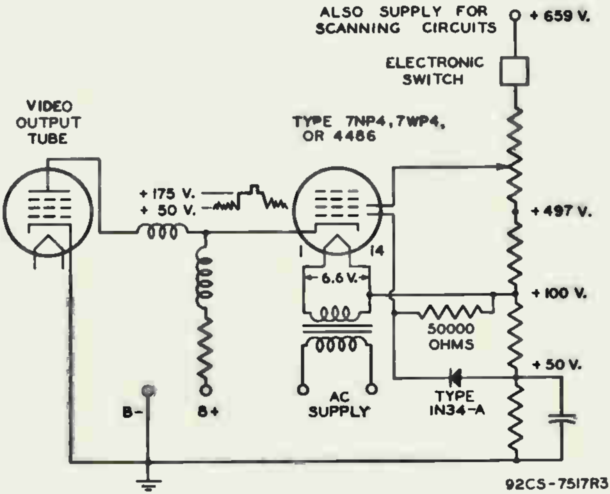
4. Never fail to operate this tube in its equipment at intervals of about 2 months to keep the tube in condition.

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

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



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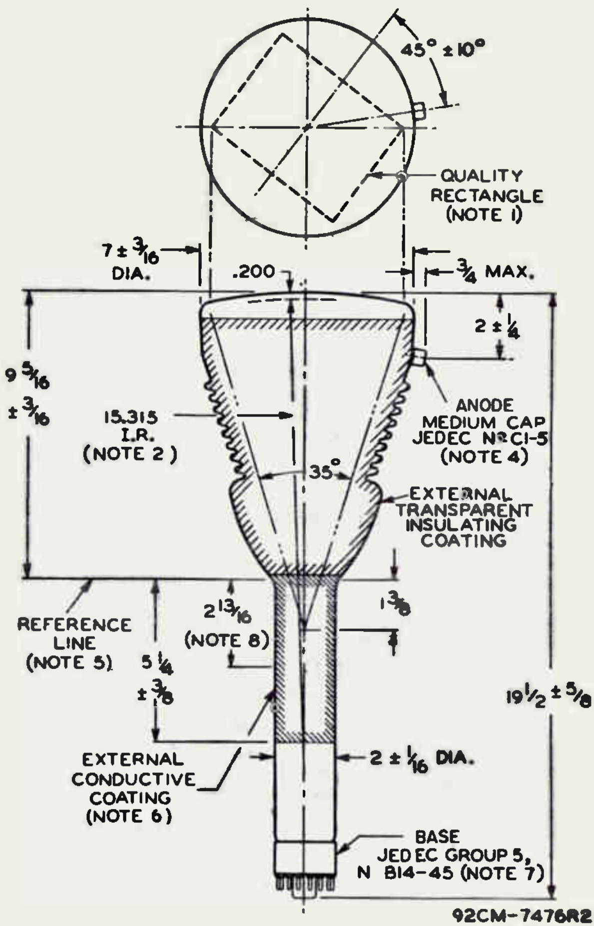
DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

See Notes on next page.

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° ± 10° 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 ± 10°. The anode terminal is on same side as Pin No.9.

Note 5: Reference line is determined by position where gauge 2.100 ± 0.001 inch I.D. and 3 inches long will rest on bulb cone.

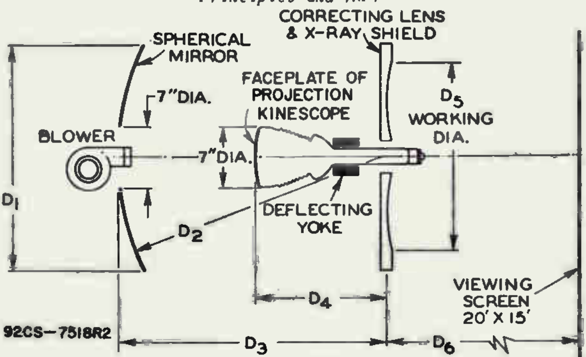
Note 6: External conductive coating must be grounded.

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

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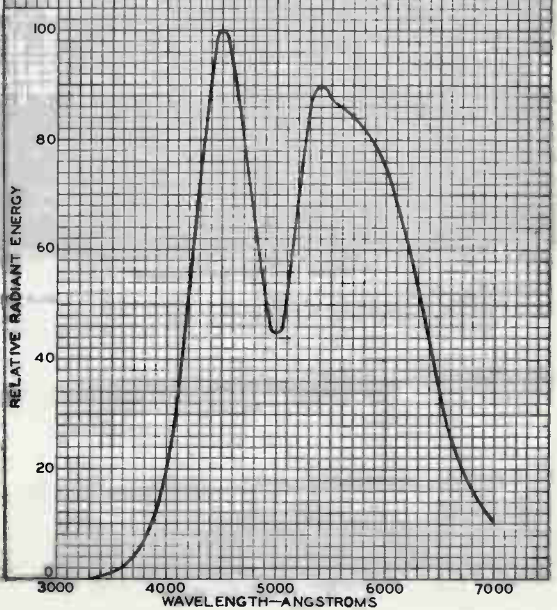
Spectral-Energy Emission Characteristic of Phosphor No.6

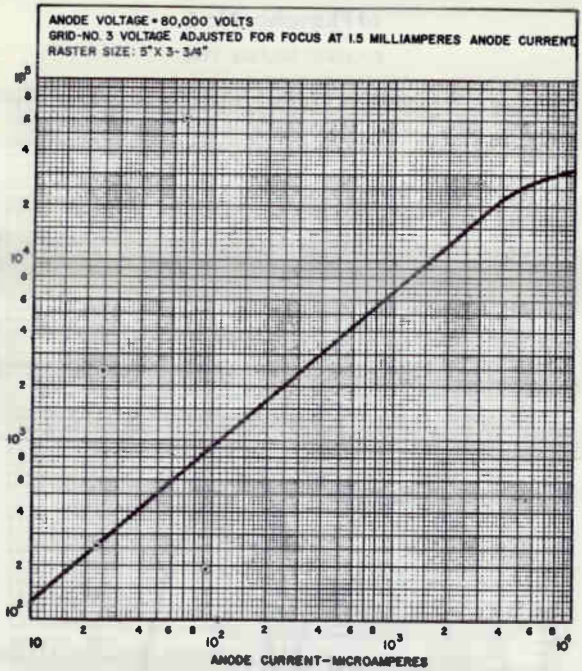
SILICATE-SULFIDE TYPE

COLOR	I.C.I. COORDINATES	
	X	Y
6300° K	0.317	0.331



92CM-7458R1

Typical Luminance Characteristic



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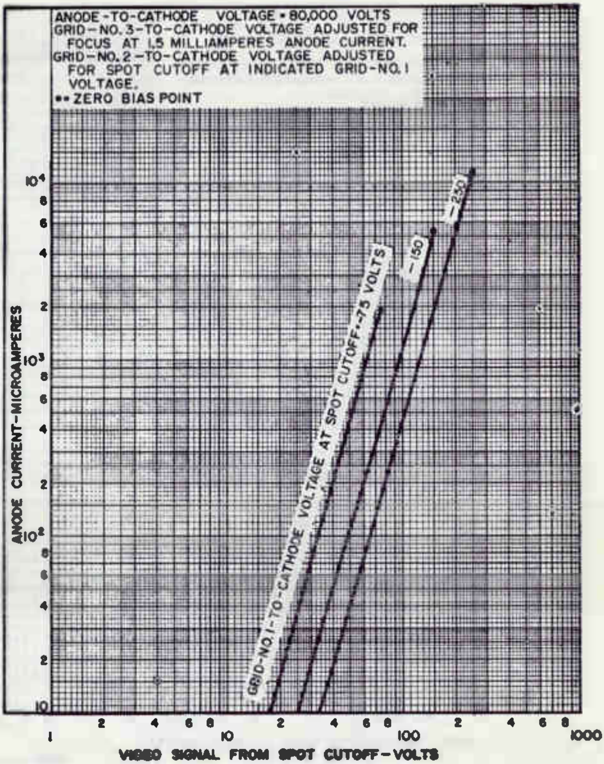
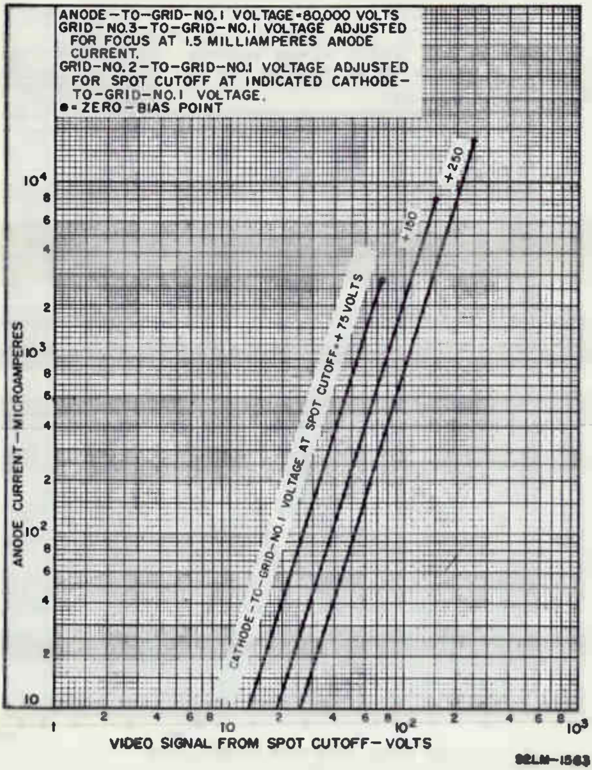
Typical Drive Characteristics

GRID-DRIVE SERVICE



Typical Drive Characteristics

CATHODE-DRIVE SERVICE



RCA

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

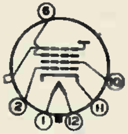
Direct Interelectrode Capacitances (Approx.):

Grid No.1 to All Other Electrodes	6	$\mu\mu f$
Cathode to All Other Electrodes	5	$\mu\mu f$

Faceplate	Clear Glass
Phosphor, Metal-Backed°	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"
Minumum 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. B6-63)

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 (Ultor)

Maximum Ratings, *Design-Center Values:*

ULTOR• 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

° For curves, see front of this Section.

• In the 7TP4, grid No.4 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.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

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 µamp. . .	11.6% to 15.8% of E_u	volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot.	11% to 25.7% of E_{c2}	volts
Grid-No.3 Current**.	See Curves	
Grid-No.2 Current.	-15 to +15	µamp
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 µamp . .	1160 to 1580	volts
Grid-No.1 Voltage for Visual Extinction of Undeflected 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.

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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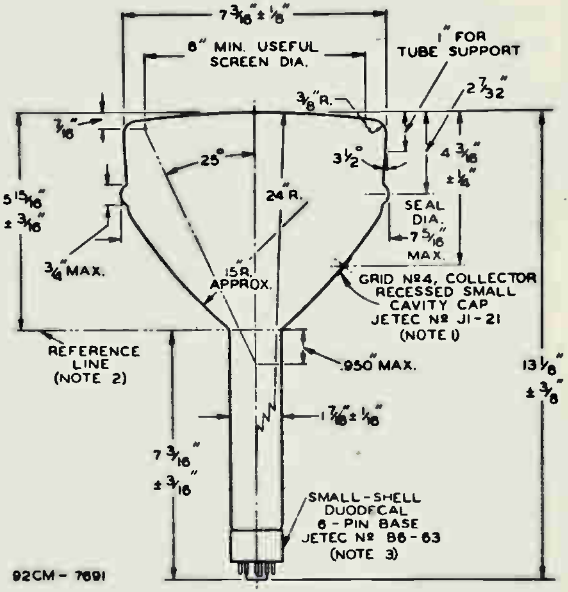
7TP4

MONITOR KINESCOPE

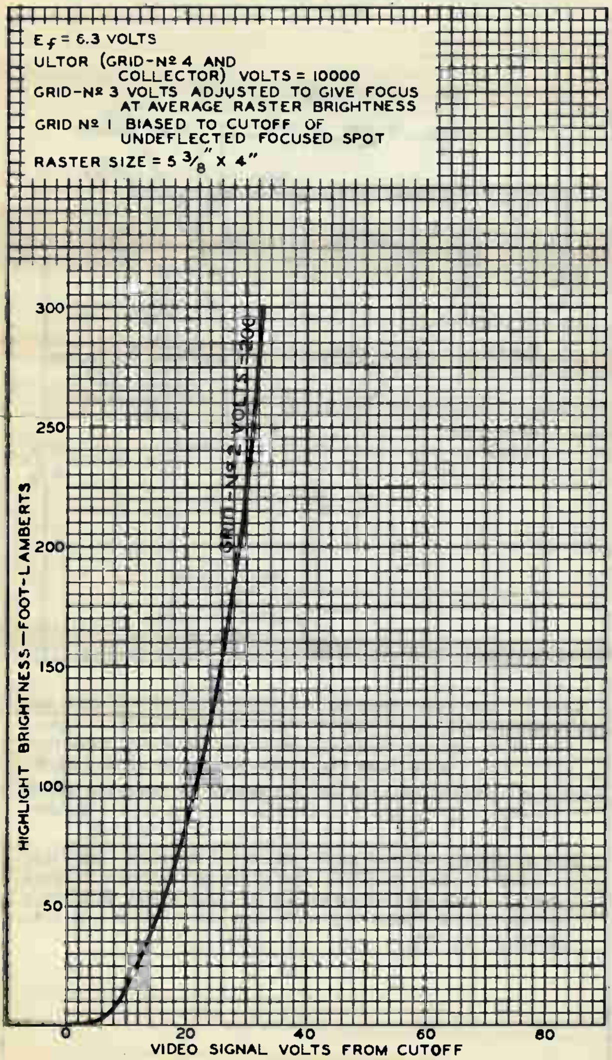


NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN No.6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND BULB TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS OF ± 10°. BULB TERMINAL IS ON SAME SIDE AS PIN No.6.

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".

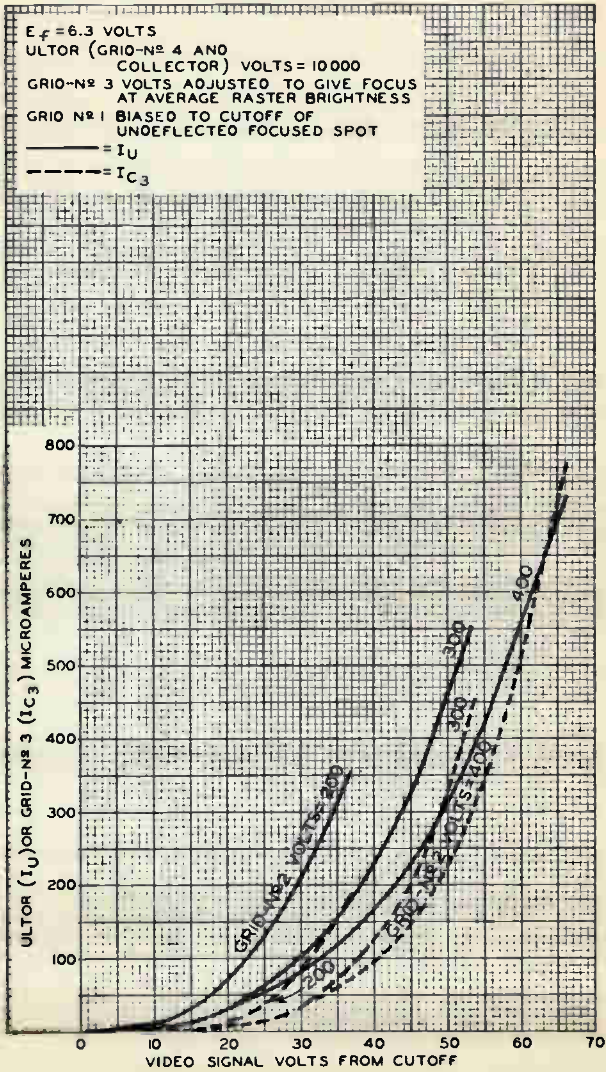
AVERAGE GRID-DRIVE CHARACTERISTICS



RCA

7TP4

AVERAGE GRID-DRIVE CHARACTERISTICS



OCT. 3, 1951

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7688

7VPI

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS — ELECTROSTATIC DEFLECTION

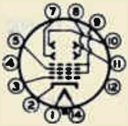
DATA

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	$\mu\mu f$
DJ_1 to DJ_2	3	$\mu\mu f$
DJ_3 to DJ_4	2	$\mu\mu f$
DJ_1 to All Other Electrodes	9	$\mu\mu f$
DJ_2 to All Other Electrodes	9	$\mu\mu f$
DJ_3 to All Other Electrodes	7	$\mu\mu f$
DJ_4 to All Other Electrodes	7	$\mu\mu f$
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" ± 3/8"
Greatest Diameter of Bulb		7" ± 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 DJ_3
Pin 8 - Deflecting Electrode DJ_4



Pin 9 - Ultor● (Grid No.2, Grid No.4, Collector)
Pin 10 - Deflecting Elect. DJ_2
Pin 11 - Deflecting Elect. DJ_1
Pin 12 - Internal Connection - Do Not Use
Pin 14 - Heater

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 is deflected toward pin 5. With DJ_3 positive with respect to DJ_4, the spot is deflected toward pin 2.

The plane through the tube axis and pin 5 may vary from the trace produced by DJ_1 and DJ_2 by an angular tolerance (measured about the tube axis) of ±10°. Angle between $DJ_1 - DJ_2$ trace and $DJ_3 - DJ_4$ trace is 90° ± 3°.

●: See next page.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7VPI

7VPI

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 Undeflected Focused Spot	2.8% of E_u	volts
Grid-No.3 Current	-15 to +10	μamp
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:

For ultor voltage of	*1500*	*3000*	*volts*
Grid-No.3 Voltage for Focus	400 to 600	800 to 1200	volts
Maximum Grid-No.1 Voltage for Visual Extinction of Undeflected 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°	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.

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

#,##,°: See next page.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

7VPI

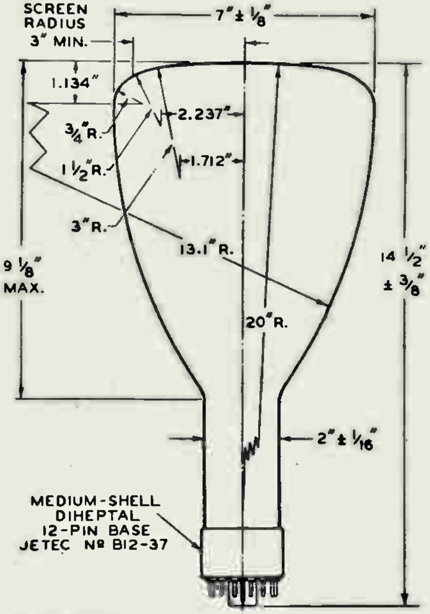
OSCILLOGRAPH TUBE

\# 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.

○ 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.

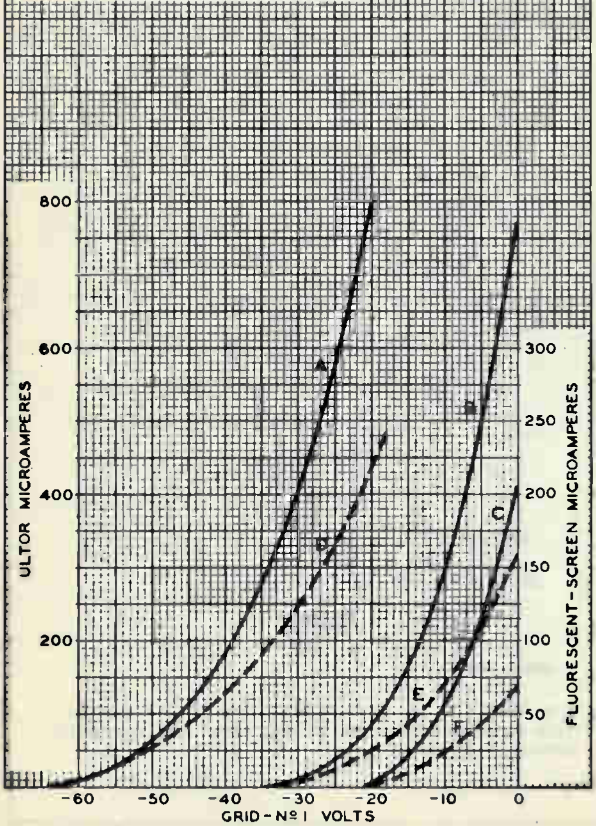
RCA

7VPI

AVERAGE CHARACTERISTICS

E_f = 6.3 VOLTS
GRID-Nº 3 VOLTS ADJUSTED FOR FOCUS

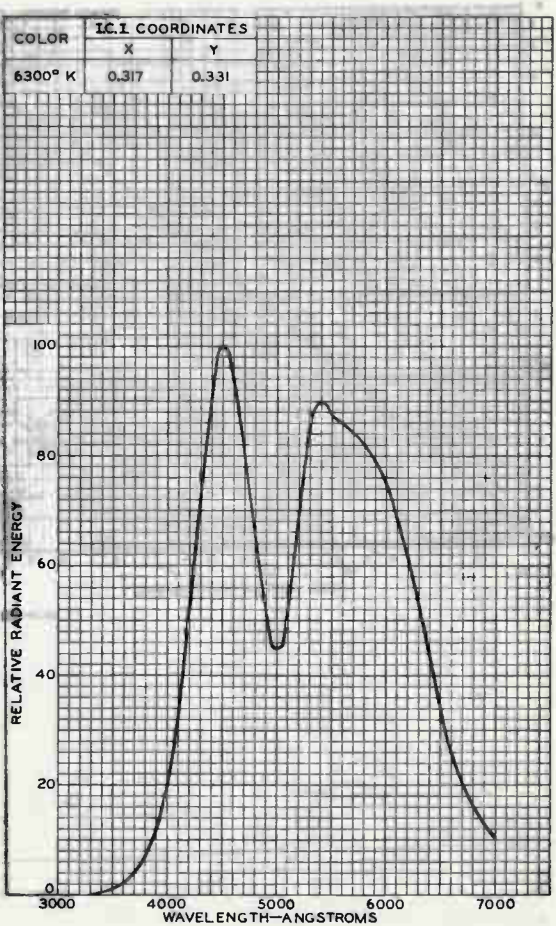
CURVE	CURRENT	ULTOR VOLTS
A	ULTOR	3000
B	ULTOR	1500
C	ULTOR	1000
D	FLUORESCENT SCREEN	3000
E	FLUORESCENT SCREEN	1500
F	FLUORESCENT SCREEN	1000



TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

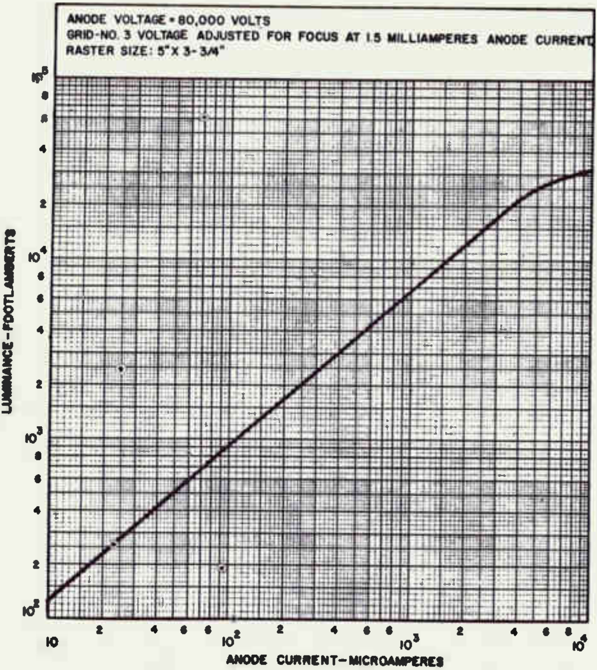
Spectral-Energy Emission Characteristic of Phosphor No.6

SILICATE-SULFIDE TYPE



92CM-7458R1

Typical Luminance Characteristic



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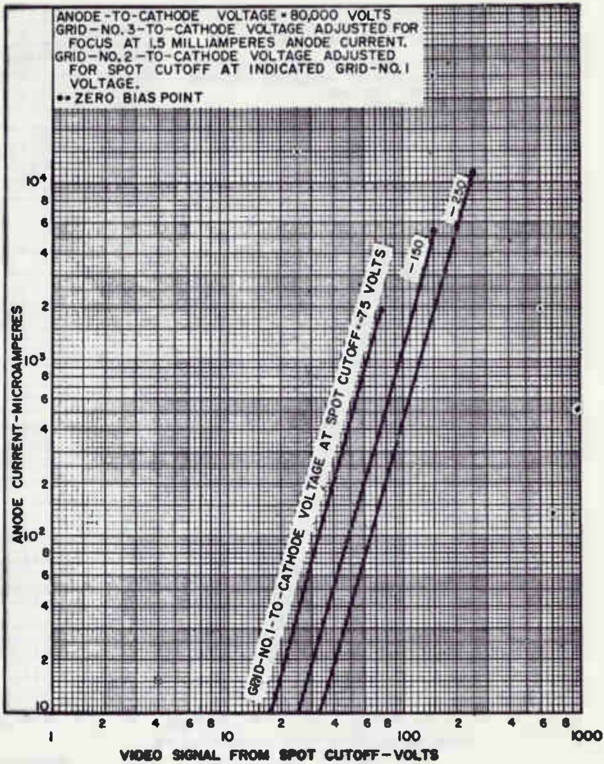
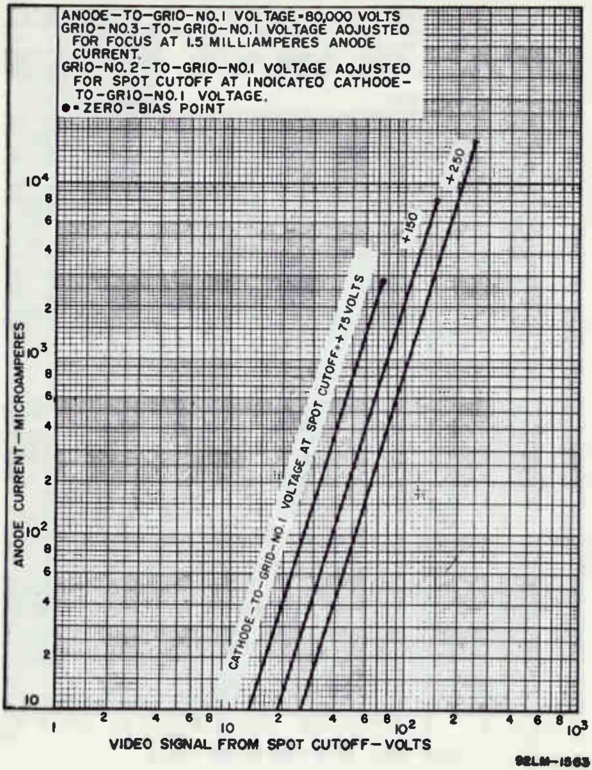
Typical Drive Characteristics

GRID-DRIVE SERVICE



Typical Drive Characteristics

CATHODE-DRIVE SERVICE



7TP4
MONITOR KINESCOPE

METAL-BACKEO SCREEN

ELECTROSTATIC FOCUS | MAGNETIC DEFLECTION

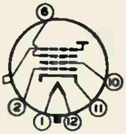
DATA

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	$\mu\mu f$
Cathode to All Other Electrodes	5	$\mu\mu f$
Faceplate		Clear Glass
Phosphor, Metal-Backed°		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"
Minumum 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. B6-63)

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 (Ultor)

Maximum Ratings, *Design-Center Values:*

ULTOR● 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

° For curves, see front of this Section.

● In the 7TP4, grid No.4 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.

TUBE DEPARTMENT
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 μamp. . .	11.6% to 15.8% of E_u	volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot.	11% to 25.7% of E_{c2}	volts
Grid-No.3 Current**.	See Curves	
Grid-No.2 Current.	-15 to +15	μamp
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 μamp . .	1160 to 1580	volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	-22 to -52	volts

Maximum Circuit Values:

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

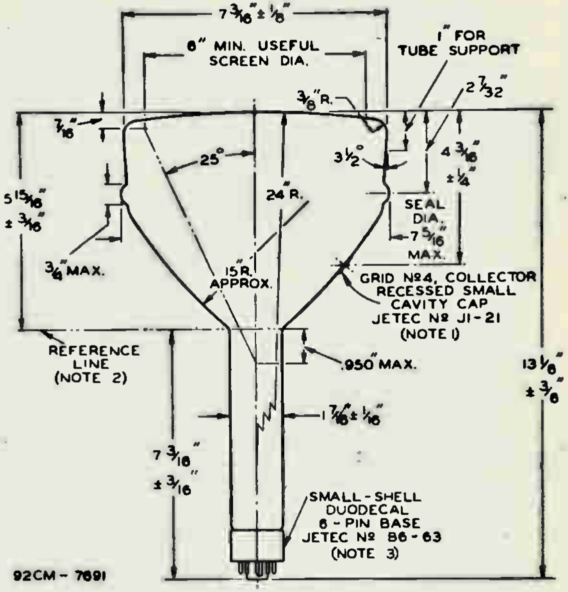
* Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 10000 volts.

** Grid-No.3 Current increases as the ultor voltage is decreased.

RCA

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 ± 10°. BULB TERMINAL IS ON SAME SIDE AS PIN No.6.

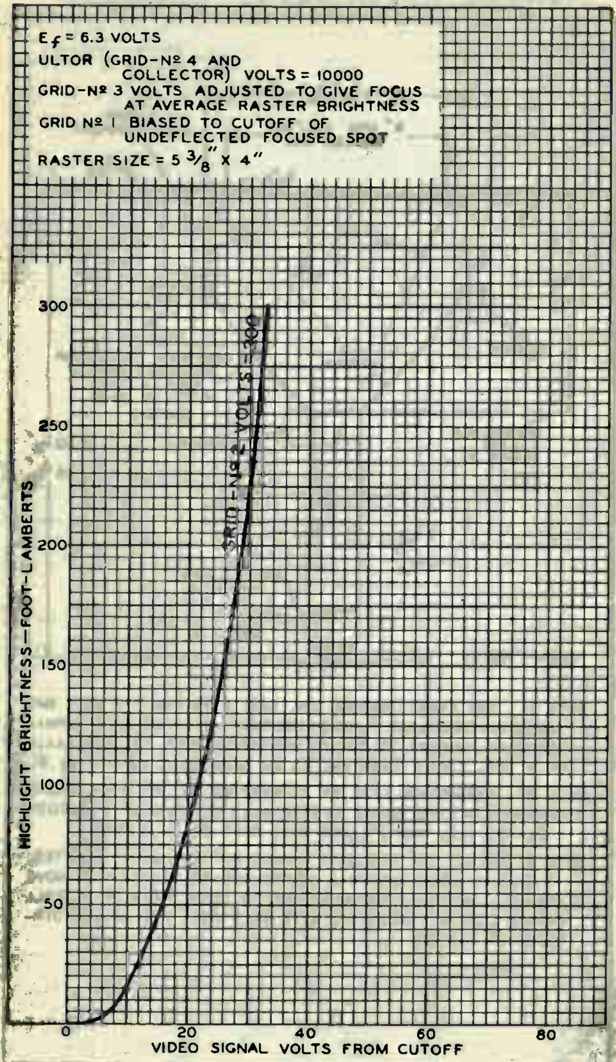
NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE REFERENCE-LINE GAUGE (JETEC No.112) 1.500" + 0.003" - 0.000" I.D. AND 2" LONG WILL REST ON BULB CONE.

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

7TP4

AVERAGE GRID-DRIVE CHARACTERISTICS



Oscillograph Tube

ELECTROSTATIC FOCUS — MEDIUM-SHORT-PERSISTENCE SCREEN
ELECTROSTATIC DEFLECTION — HIGH DEFLECTION SENSITIVITY

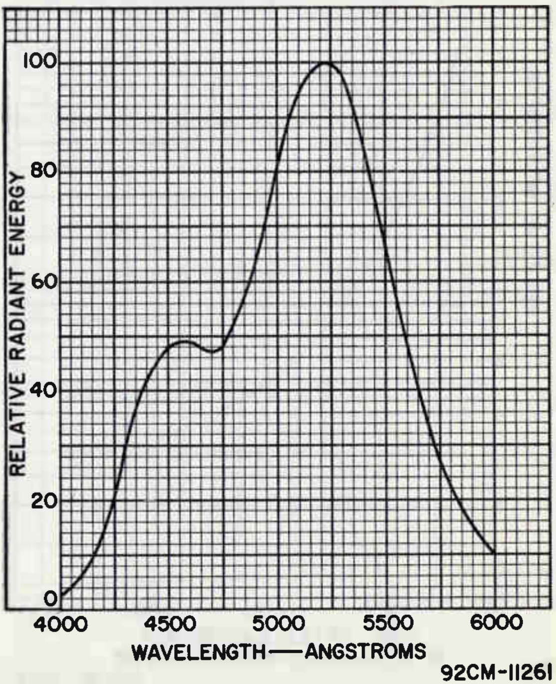
The 7VP31 is the same as the 7VP1 except for the following items:

General:

Phosphor (See accompanying curves) P31
  Fluorescence . . . . Green
  Phosphorescence. . . . . Green
    Persistence[a] . . . . .Medium Short[b] (Approx. 38 μsec)

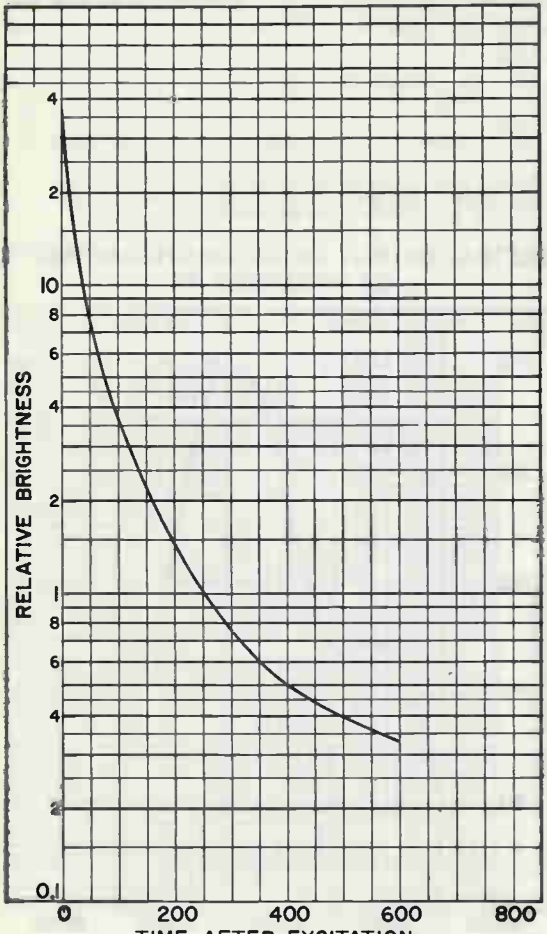
[a] Time for initial brightness to decay to 10% point.
[b] Phosphorescence may have a useful brightness for over a minute under conditions of adequate excitation and low-ambient illumination.

SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P31



92CM-11261

PERSISTENCE CHARACTERISTIC OF PHOSPHOR P31



Projection Kinescope

FORCED-AIR COOLED
ELECTROSTATIC FOCUS

MAGNETIC 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:

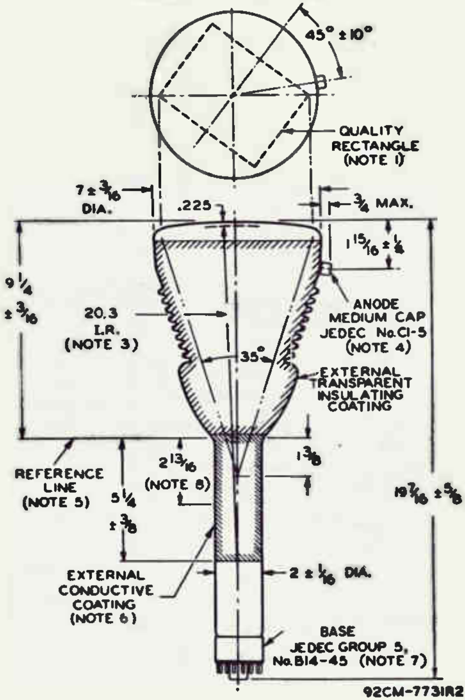
OPTICAL

Projection-Throw Distance for 20 ft x 15 ft Picture. . .80 ft

MECHANICAL

Overall Length . . . . 19-7/16 ± 5/8 in

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

See notes on other side.

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 45° ± 10° 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 ± 70°. The anode terminal is on same side as Pin No.9.

Note 5: Reference line is determined by position where gauge 2.100 inch ± 0.001 inch I.D. and 3 inch long will rest on bulb cone.

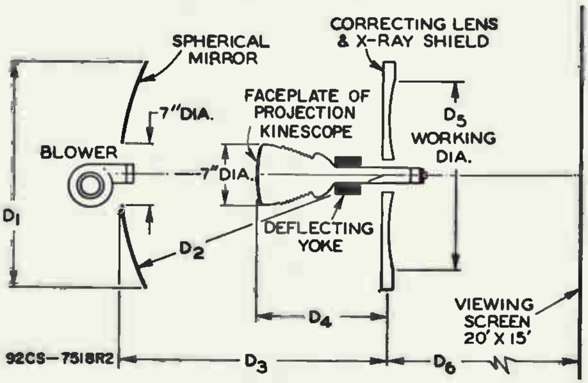
Note 6: External conductive coating must be grounded.

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

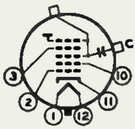
LOW-VOLTAGE ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

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. / 250 min.	μμf / 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.

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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 . . . {350 max. pf / 250 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. . . . . .Filterglass
- Light transmission (Approx.) 80%

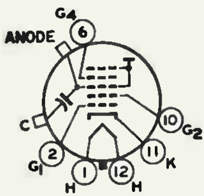
Mechanical:

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



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.	volts
	5.7 min.	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 — 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	6	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.)	80%

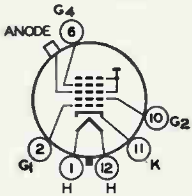
Mechanical:

Weight (Approx.)	2-1/2 lbs
Overall Length	9.75" ± .19"
Neck Length	5.81" ± .12"
Projected Area of Screen	36 sq. in.
External Conductive Coating	None

For Additional Information on Dimensions:
See *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, No.B6-63)
Basing Designation for BOTTOM VIEW . . . 12M

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)

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.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	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

[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 — **ALUMINIZED SCREEN**
ELECTROSTATIC SELF FOCUS — **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	

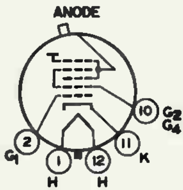
Optical:

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

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

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 — **ALUMINIZED SCREEN**

ELECTROSTATIC SELF FOCUS — **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:

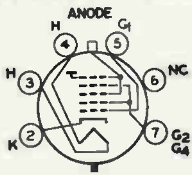
Weight (Approx.)	2 lbs
Overall Length	8.69" ± .31"
Neck Length.	5.19" ± .19"
Projected Area of Screen	39 sq. in.
External Conductive Coating.	None

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 BOTTOM VIEW 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

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

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

9WP4

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

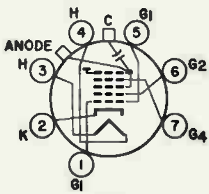
Phosphor . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate. . . . . Filterglass
Light transmission at center (Approx.) 49.5%

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
Contact area for grounding	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 - Cathode
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Grid No.1
Pin 6 - Grid No.2
Pin 7 - Grid No.4
Cap - Grid No.3, Grid No.5, Screen, Collector
C - External Conductive Coating



7GR

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

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

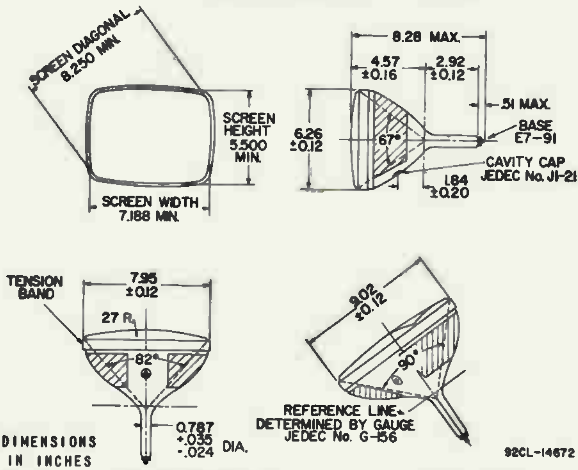
Anode Voltage	9000	V
Grid-No.4 Voltage	0 to 300	V
Grid-No.2 Voltage	100	V
Cathode Voltage	32 to 50	V
For visual extinction of focused raster		
Field Strength	0 to 8	G
Of required adjustable centering magnet		

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ

[a] Includes implosion protection hardware.

DIMENSIONAL OUTLINE (BULB J71-1/2 B1)



10SP4

RCA

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 μμf
- Cathode to all other electrodes . . . . 5 μμf

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 ←

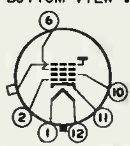
Operating Position . . . . Any

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

Bulb . . . . J84 ←

Base . . . . Small-Shell Duodecal 6-Pin (JETEC No.B6-63)
- Basing 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 - Ultor (Grid No.4, Collector)

Maximum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	20000 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.

RCA

10SP4

MONITOR KINESCOPE

Equipment Design Ranges:

For any ultor voltage (E_{c_4}) between 10000 and 20000 volts and grid-No.2 voltage (E_{c_2}) between 150 and 410 volts*

Grid-No.3 Voltage for focus with ultor current of 100 μa.	11.7% to 15.9% of E_{c_4}	volts
Grid-No.1 Voltage for visual extinction of 8" x 6" raster	9% to 24% of E_{c_2}	volts
Maximum Grid-No.3 Current**.	*See Curves*	
Grid-No.2 Current.	−15 to +15	μa
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 μa.	1400 to 1900	1640 to 2225	volts
Grid-No.1 Voltage for visual extinction of 8" x 6" raster	−18 to −48	−18 to −48	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.

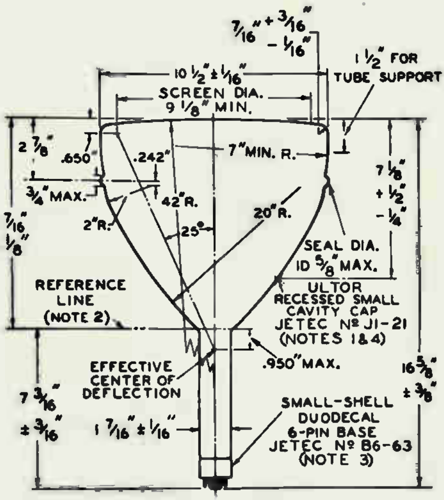
For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

→ Indicates a change.

10SP4

10SP4

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 ULTOR TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 10°. ULTOR 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.

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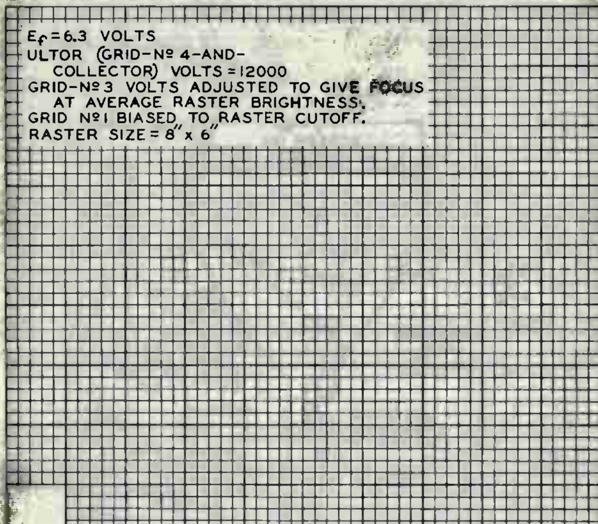
10SP4

AVERAGE GRID-DRIVE CHARACTERISTIC



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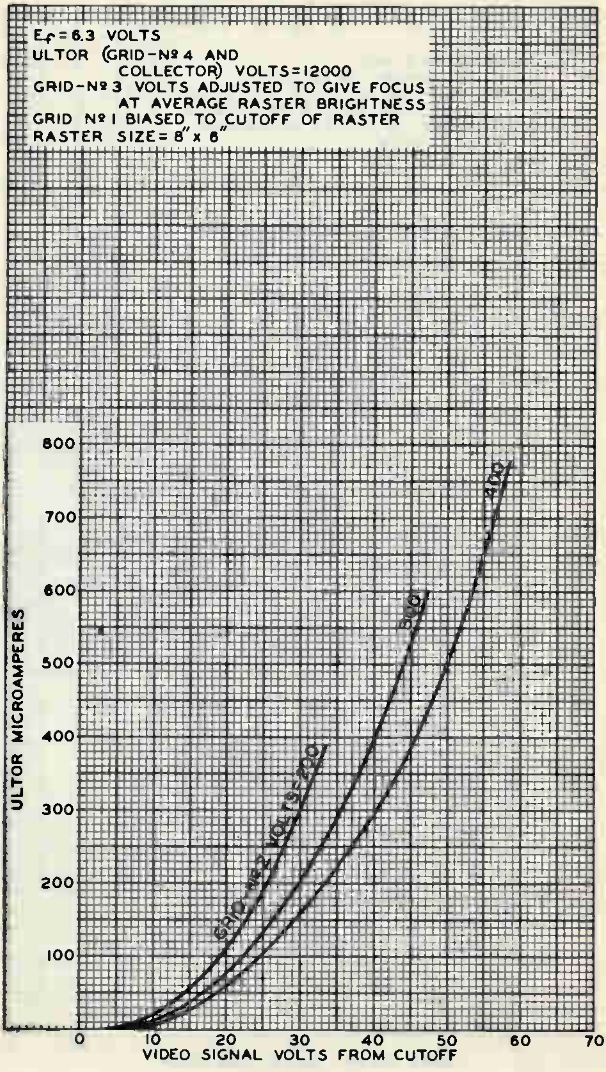
92CM-7774

RCA

10SP4

AVERAGE GRID-DRIVE CHARACTERISTICS



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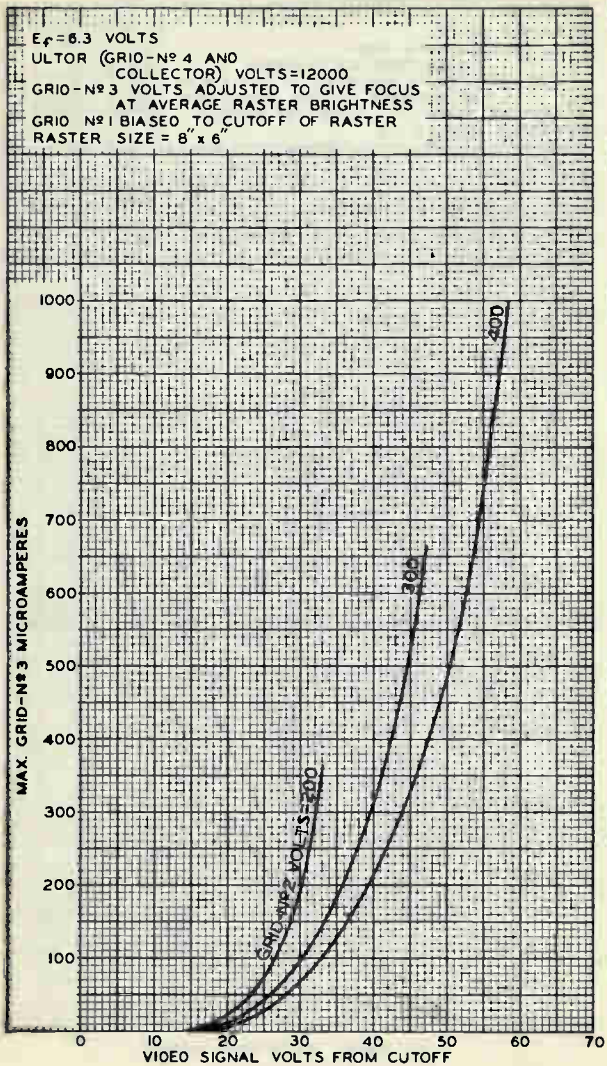
10SP4

GRID-DRIVE CHARACTERISTICS



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

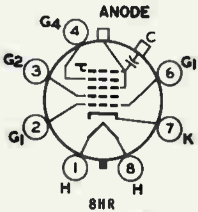
Phosphor . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate. . . . . Filterglass
Light transmission at center (approx.) 79%

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 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.	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	

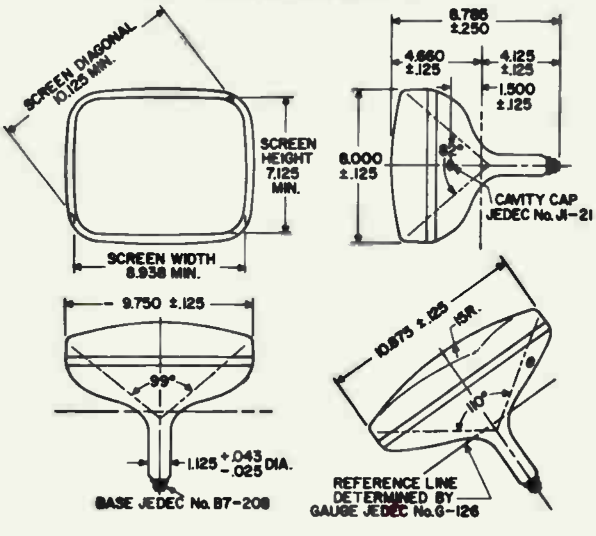
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max MΩ

[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)



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
For curves, see front of this section

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

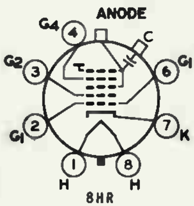
External Conductive Coating
Type (See CRT OUTLINES 1 at front of this section) . . Regular-Band
Contact area for grounding . . . . . . .Near Reference Line

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

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		

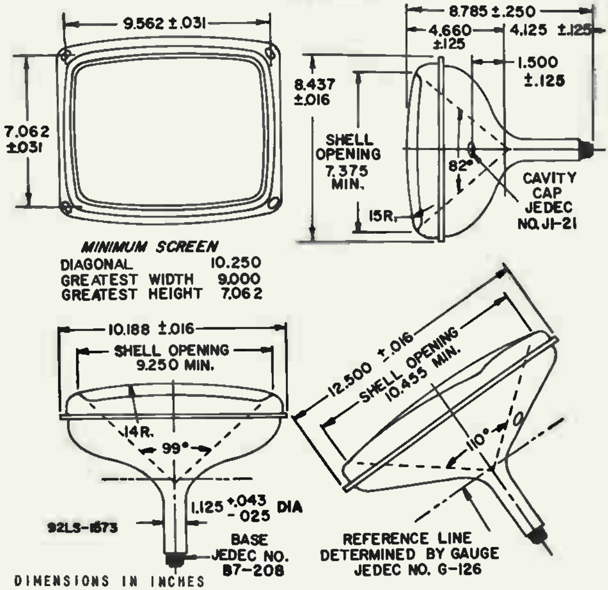
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance.	1.5 max	MΩ

* 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



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

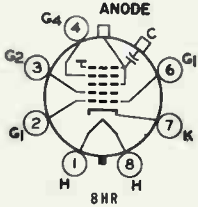
Phosphor . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate. . . . . Filterglass
Light transmission at center (approx.). 52%

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 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 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



8HR

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 value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage.	100 min—250 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 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	

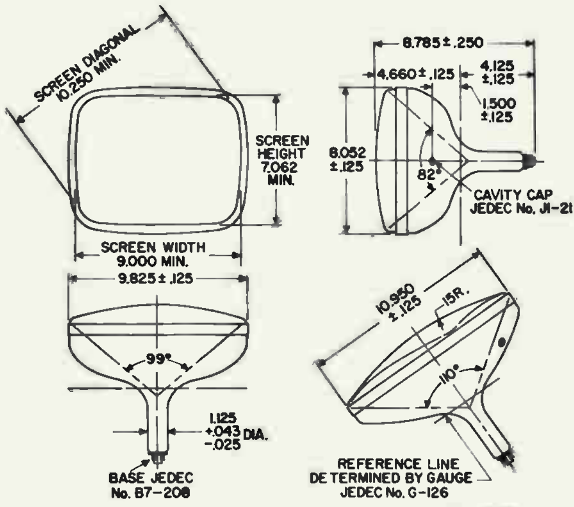
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max MΩ

• 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 J87B)



DIMENSIONS IN INCHES

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*	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

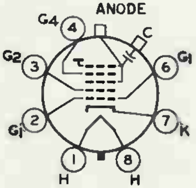
OPTICAL

Phosphor . . . . .P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate . . . . Filterglass
Light transmission at center (Approx.). 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
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)
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

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 value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage	125 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 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 extinction of focused raster		
Field Strength.	0 to 12	G
Of required adjustable centering magnet		

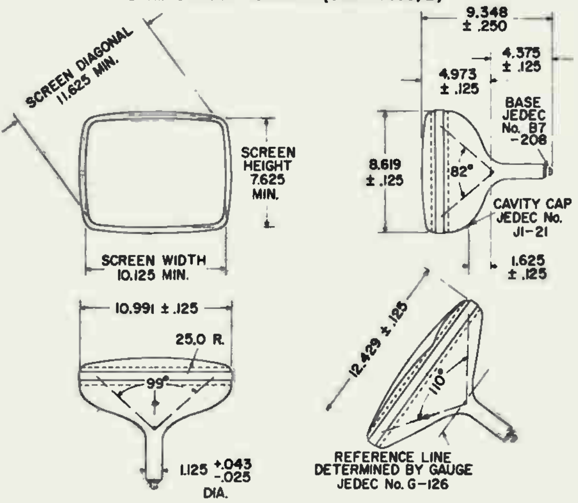
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance.	1.5 max	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 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

Picture Tube

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 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	1200 max.	pf
	800 min.	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	

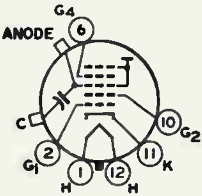
Optical:

Phosphor (For curves, see front of this section) . P4—Sulfide Type, Aluminized
Faceplate, Spherical . . . Filterglass
Light transmission (Approx.) . . . 78%

Mechanical:

Weight (Approx.) . . . 8.5 lbs
Overall Length . . . 13-3/16" ± 5/16"
Neck Length . . . 5-1/2" ± 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

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

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

ANODE VOLTAGE	15500 max.	volts
	9000 min.	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.	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.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

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

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.

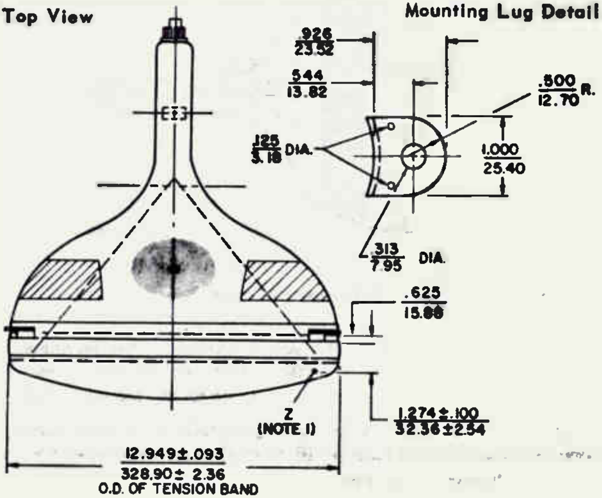
MECHANICAL

Tube Dimensions (excluding mounting lugs):

Diagonal	14.910 ± .093 in (378.21 ± 2.36 mm)
Greatest width	12.949 ± .093 in (328.90 ± 2.36 mm)
Greatest height (including tension-band clip)	10.613 ± .100 in (269.57 ± 2.54 mm)
Weight (Approx.)	11.3 lb (5.1 kg)

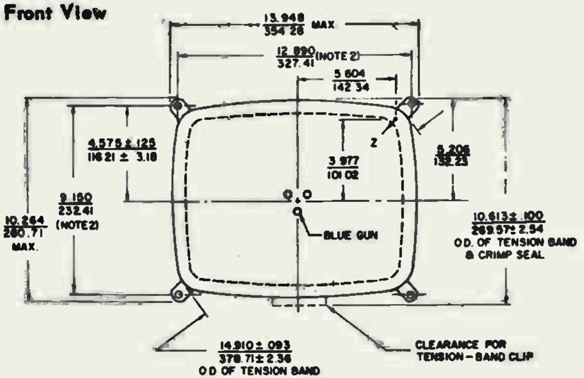
DIMENSIONAL OUTLINE

Dimensions shown are only those which are different from the corresponding dimensions for the 15NP22.

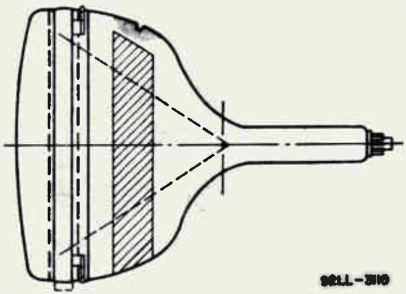


DIMENSIONAL OUTLINE (Cont'd)

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.

RCA

15GP22

TRICOLOR KINESCOPE

THREE-GUN SHADOW-MASK TYPE — ELECTROSTATIC FOCUS
ELECTROSTATIC CONVERGENCE — MAGNETIC DEFLECTION

DATA

General:

Electron Guns, Three	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	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	7.5	μμf
Cathode of Blue Gun + Cathode of Green Gun + Cathode of Red Gun to All Other Electrodes	17.5	μμf
Grid No.3 (Of Each Gun Tied within Tube to No.3 Grids of Other Two Guns) to All Other Electrodes	12	μμf
Grid No.4 (Common to the Three Guns) to All Other Electrodes	7	μμf
External Conductive Coating to Ultor*	3000 max.	μμf
	1500 min.	μμf
Faceplate, Spherical	Clear Glass	
Screen, Flat:		
Type	Metal-Backed, Tricolor, Phosphor-Dot	
Plate	Filterglass	
Light Transmission (Approx.)	70%	
Size (Rounded Sides—See Dimensional Outline)	11-1/2" x 8-5/8"	
Area	88.5 sq. in.	
Phosphor (Three Separate Phosphors, collectively)	P22	
Fluorescence and Phosphorescence of Separate Phosphors, respectively	Blue, Green, Red	
Persistence of Group Phosphorescence	Medium	
Dot Arrangement	Approx. 195,000 triangular groups, each consisting of blue dot, green dot, and red dot (total of 585,000 dots)	
Focusing Method	Electrostatic	
Convergence Method	Electrostatic	
Deflection Method	Magnetic	
Deflection Angles (Approx.):		
Horizontal	45°	
Vertical	35°	
Tube Dimensions:		
Maximum Overall Length	26-1/8"	
Greatest Diameter:		
At faceplate	14-5/8" ± 5/32"	
At metal flange	15-3/4" max.	
Weight	25 lbs	

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

15GP22

RCA 15GP22

TRICOLOR KINESCOPE

Mounting Position	Any
Ultor● Terminal	Metal Flange
Bulb	J126
Base	Small-Shell Bidecal 14-Pin (JETEC No.B14-103)

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: No Connection
Pin 6: Grids No.3
Pin 7: Cathode of Green Gun
Pin 8: Grid No.1 of Green Gun

Pin 9: Grid No.2 of Green Gun
Pin 13: Grid No.4
Pin 17: Grid No.2 of Blue Gun
Pin 18: Grid No.1 of Blue Gun
Pin 19: Cathode of Blue Gun
Pin 20: Heater
Metal Flange: Ultor (Grid No.5, Grid No.6, Collector)

Maximum Ratings, *Design-Center Values:*

ULTOR● VOLTAGE	20000 max.	volts
ULTOR INPUT	15# max.	watts
GRID-No.4 VOLTAGE	11000 max.	volts
GRID-No.3 VOLTAGE	5000 max.	volts
GRID-No.2 VOLTAGE (Each Gun)	500 max.	volts
GRID-No.1 VOLTAGE (Each Gun):		
Negative bias value	200 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_{c5}) of 18000 to 20000 volts

Grid-No.4 (Converging Electrode) Voltage†	42.5% to 51% of E_{c5}	volts
Grid-No.3 (Focusing Electrode) Voltage	12% to 19% of E_{c5}	volts

● 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 15GP22, the ultor function is performed by grid No.5. Since grid No.5, grid No.6, and collector are connected together within the tube, they are collectively referred to simply as "ultor", for convenience in presenting data and curves.

This value is the product of ultor voltage and average current measured at the ultor terminal with a dc ammeter.

† See next page.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

15GP22

TRICOLOR KINESCOPE

Grid-No.2 Voltage (Each Gun) when circuit design utilizes grid-No.1 Voltage (E_{c1}) at fixed value for raster cutoff (each gun) . . .	2 to 4.5 times E_{c1}	volts
Grid-No.1 Voltage for Visual Extinction of Focused Raster (Each Gun) when circuit design utilizes grid-No.2 voltage (E_{c2}) at fixed value (each gun)	22.5% to 50% of E_{c2}	volts
Grid-No.4 Current	-5 to +5	μamp
Maximum Grid-No.3 Current . . .	300	μamp
Grid-No.2 Current	-15 to +15	μamp
Beam-Current Ratio to Produce Illuminant-C White:		
Red Gun to Green Gun	4:1 to 1:1	
Blue Gun to Green Gun	1.5:1 to 0.5:1	
Maximum Raster Shift in Any Direction from Screen Center□ . . .	1-1/4	inches

Examples of Use of Design Ranges:

For ultor voltage of 20000 volts

Grid-No.4 (Converging Electrode) Voltage† . .	8500 to 10200	volts
Grid-No.3 (Focusing Electrode) Voltage . . .	2400 to 3800	volts
Grid-No.2 Voltage (Each Gun) when circuit design utilizes grid-No.1 voltage of -70 volts for raster cutoff (each gun) .	140 to 315	volts
Grid-No.1 Voltage for Visual Extinction of Focused Raster (Each Gun) when circuit design utilizes grid-No.2 voltage of 200 volts (each gun)	-45 to -100	volts

Circuit Values:

Grid-No.1-Circuit Resistance (Each Gun). .	1.5 max.	megohms
Dynamic Converging Voltage (Approx.)** . .	900	volts
Dynamic Focusing Voltage (Approx.)** . . .	225	volts

† This range does not include the dc component of the dynamic converging voltage.

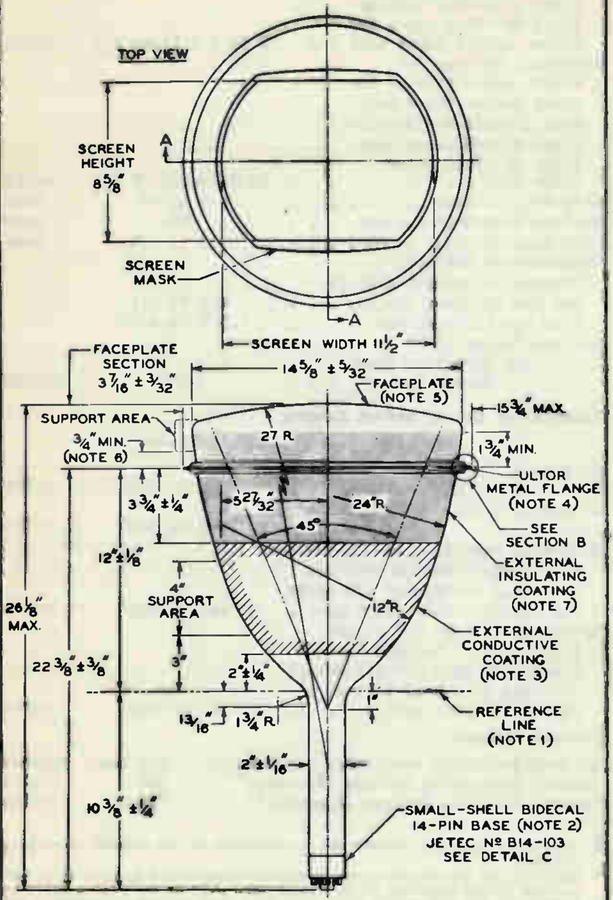
□ Centering of the raster on the screen is accomplished by passing direct current of the required value through each pair of deflecting coils to compensate for the raster shift resulting from optimum adjustments for convergence, color purity, and concentricity.

** Peak-to-peak value. This ac voltage having essentially parabolic waveform is synchronized with scanning and does not include any voltage developed during the blanking time.

RCA

15GP22

TRICOLOR KINESCOPE



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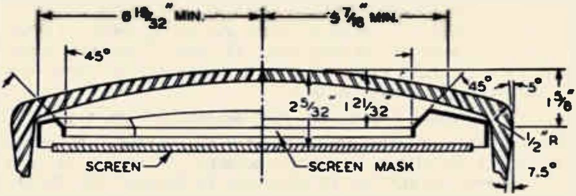
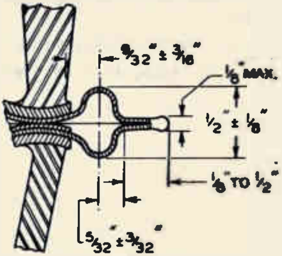
15GP22

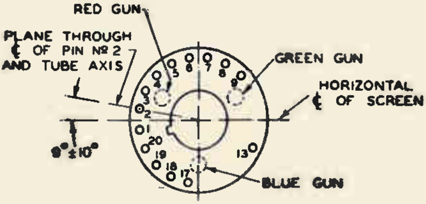
TRICOLOR KINESCOPE



ENLARGED SECTION A-A



ENLARGED SECTION B



BASE DETAIL C
BOTTOM VIEW

92CL-8072R1

15GP22

15GP22

TRICOLOR KINESCOPE

NOTE 1: REFERENCE LINE IS DETERMINED BY POSITION WHERE A CYLINDRICAL GAUGE 2.400" ± 0.001" I.D. WHICH IS HELD CONCENTRIC WITH TUBE NECK AXIS WILL REST ON 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 FACEPLATE-SECTION AXIS AND HAVING A DIAMETER OF 3".

NOTE 3: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 4: METAL FLANGE OPERATES AT HIGH VOLTAGE. ADEQUATE INSULATION MUST BE PROVIDED BETWEEN THE FLANGE AND ANY GROUNDED ELEMENT IN THE RECEIVER TO PREVENT THE POSSIBILITY OF ELECTRICAL LEAKAGE INCLUDING CORONA.

NOTE 5: MASK MATERIAL BEARING ON THE FACEPLATE MUST HAVE INSULATING QUALITIES ADEQUATE FOR ONE HALF THE APPLIED ULTOR VOLTAGE TO MINIMIZE SURFACE LEAKAGE BETWEEN METAL FLANGE AND MASK.

NOTE 6: TUBE SHOULD NOT BE SUPPORTED IN THIS AREA.

NOTE 7: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

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 . . .	6	pf
Cathode to all other electrodes	5	pf
External conductive coating to anode[a] .	1300 max.	pf
	800 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	

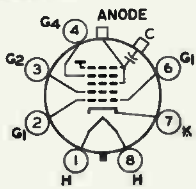
Optical:

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 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

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

[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

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] .	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

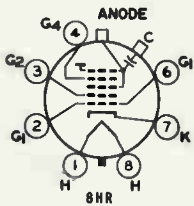
Phosphor. . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate . . . . Filterglass
Light transmission at center (Approx.). 54%

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 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 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

Grid-No.2 Voltage	20 min—60 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[b]	100	V
Grid-No.2 Voltage	30	V
Cathode Voltage	22 to 45	V
For visual extinction of focused raster		
Field Strength	0 to 8	G
Of required adjustable centering magnet		

MAXIMUM CIRCUIT VALUE

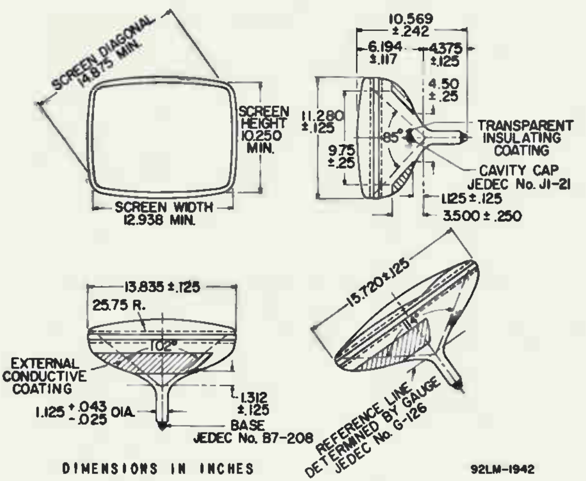
Grid-No.1 Circuit Resistance	1.5 max	MΩ

[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 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 *X-RADIATION PRECAUTIONS* at front of this section

DIMENSIONAL OUTLINE (BULB J125 B2A)



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
External conductive coating to anode.	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

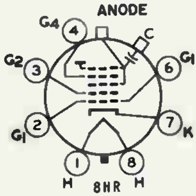
Phosphor. . . . . .P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate . . . . Filterglass
Light transmission at center (Approx.). 54%

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 (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	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		
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	-100 to 300	V
Grid-No.2 Voltage	300	V
Cathode Voltage	28 to 60	V
For visual extinction of focused raster		
Field Strength	0 to 8	G
Of required adjustable centering magnet		

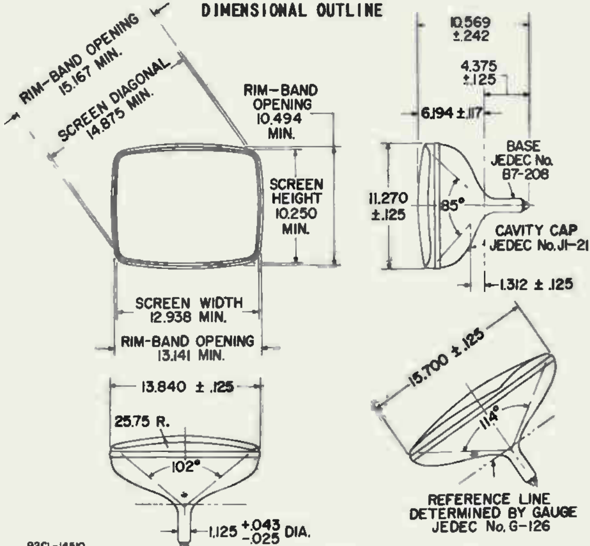
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ

[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



DIMENSIONS IN INCHES

Picture Tube

NO ION-TRAP MAGNET REQUIRED

MAGNETIC FOCUS — 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	2000 max	pF
	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
For curves, see front of this section	
Faceplate	Filterglass
Light Transmission (Approx.)	66%

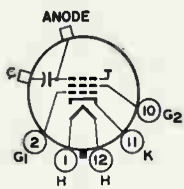
MECHANICAL

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	
Type	Regular-Band
Contact area for grounding	Near Reference-Line

For Additional Information on Coatings and Dimensions
See *Picture-Tube Dimensional-Outlines* and *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.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	17500 max	V
Grid-No.2 Voltage	450 max	V
Grid-No.1 Voltage		
Negative bias value	140 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	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

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

16TP4

PICTURE TUBE

RECTANGULAR GLASS TYPE

MAGNETIC FOCUS — MAGNETIC DEFLECTION

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 . . . . 2000 max. μμf / 750 min. μμf

Faceplate, Spherical . . . . Filterglass

Phosphor (For Curves, see front of this Section) . P4—Sulfide Type

Deflection Angles (Approx.):
- Diagonal . . . . 70°
- Horizontal . . . . 65°
- Vertical . . . . 50°

Electron Gun . . . . Ion-Trap Type Requiring External Single-Field Magnet

Tube Dimensions:
- Overall length . . . . 18-1/8" ± 3/8"
- Greatest width . . . . 14-3/4" ± 1/8" ←
- Greatest height . . . . 11-1/2" ± 1/8" ←
- Diagonal . . . . 16-1/8" ± 1/8" ←
- Neck length . . . . 6-7/8" ± 3/16"
- Radius of curvature of faceplate (External surface) . . 27"

Screen Dimensions (Minimum):
- Greatest width . . . . 13-1/2"
- Greatest height . . . . 10-1/8"
- Diagonal . . . . 14-7/8"

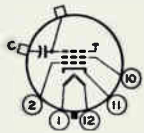
Operating Position . . . . Any

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

Base . . Small-Shell Duodecal 5-Pin (JETEC 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 - Ultor (Grid No.3, Collector)
C - External Conductive Coating

Maximum Ratings, *Design-Center Values:*

ULTOR 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

← Indicates a change.

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

RCA

16TP4

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 . . .	150 max.	volts
Heater positive with respect to cathode.	150 max.	volts

Maximum Circuit Values:

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

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

RCA

16WP4-A

PICTURE TUBE

ROUND GLASS TYPE

MAGNETIC FOCUS — MAGNETIC DEFLECTION

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 . . . . { 1500 max. μμf; 750 min. μμf }

Faceplate, Spherical . . . . .Filterglass

Phosphor (For curves, see front of this Section) . P4—Sulfide Type

Deflection Angle (Approx.) . . . . 70°

Electron Gun . . . . .Ion-Trap Type Requiring External Single-Field Magnet ←

Overall Length . . . . 17-3/4" ± 3/8"

Greatest Diameter of Bulb. . . . . 15-7/8" ± 1/8"

Minimum Useful Screen Diameter . . . . 14-1/2"

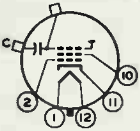
Operating Position . . . . .Any

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

Base . . .Small-Shell Duodecal 5-Pin (JETEC 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▲ - Ultor (Grid No.3, Collector)
C - External Conductive Coating

Maximum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	16000 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 . . .	125 max.	volts
Heater positive with respect to cathode.	125 max.	volts

Maximum Circuit Values:

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

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

▲ Cap may be aligned with either vacant pin position 6 or vacant pin position 3.

← Indicates a change.

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

RCA

17CP4
PICTURE TUBE

RECTANGULAR METAL-SHELL TYPE

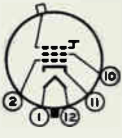
MAGNETIC FOCUS — MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:	
Voltage	6.3 ac or dc volts
Current	0.6 ± 10% amp
Faceplate, Spherical	Frosted Filterglass
Phosphor (For curves, see front of this Section)	P4—Sulfide Type
Deflection Angles (Approx.):	
Diagonal	70°
Horizontal	66°
Vertical	50°
Electron Gun	Ion-Trap Type Requiring External Single-Field Magnet
Tube Dimensions:	
Maximum overall length	19"
Greatest width at lip	15-15/16" ± 1/8"
Greatest height at lip	12-1/4" ± 1/8"
Diagonal at lip	16-13/16" ± 3/16"
Neck length	7-3/16" ± 3/16"
Radius of curvature of faceplate (External surface)	30"
Screen Dimensions (Minimum):	
Greatest width	14-3/8"
Greatest height	10-11/16"
Diagonal	15-1/4"
Operating Position	Any
Ultor Terminal	Metal-Shell Lip
Base	Small-Shell Duodecal 5-Pin (JETEC 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	16000 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

←indicates a change.

RCA

17CP4

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

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

RCA

17GP4

PICTURE TUBE

RECTANGULAR METAL-SHELL TYPE

ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION

DATA

General:

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

Faceplate, Spherical . . . . Frosted Filterglass

Phosphor (For curves, see front of this Section) . . P4—Sulfide Type

Deflection Angles (Approx.):
- Diagonal . . . . 70°
- Horizontal . . . . 66°
- Vertical . . . . 50°

Electron Gun . . . . Ion-Trap Type Requiring External Single-Field Magnet

Tube Dimensions:
- Maximum overall length . . . . 19-5/16"
- Greatest width at lip . . . . 15-15/16" ± 1/8"
- Greatest height at lip . . . . 12-1/4" ± 1/8"
- Diagonal at lip . . . . 16-13/16" ± 3/16"
- Neck length . . . . 7-1/2" ± 3/16"
- Radius of curvature of faceplate (External surface) . . 30" ←

Screen Dimensions (Minimum):
- Greatest width . . . . 14-3/8"
- Greatest height . . . . 10-11/16"
- Diagonal . . . . 15-1/4"

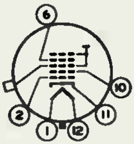
Operating Position . . . . Any

Ultor Terminal . . . . Metal-Shell Lip

Base . . Small-Shell Duodecal 6-Pin (JETEC Group 4, No. B6-63) ←

Basing Designation for BOTTOM VIEW . . . . 12M ←

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	5000 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.

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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

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

17BJP4

Picture Tube

RECTANGULAR GLASS TYPE | **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS | **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

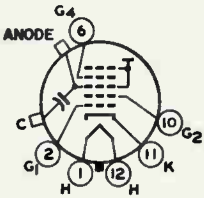
Optical:

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.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

← Indicates a change.

→ **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

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

→ indicates a change.

Picture Tube

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE — **ALUMINIZED SCREEN**

MAGNETIC FOCUS — **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 ± 60	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:

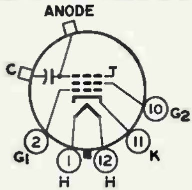
See *Picture-Tube Dimensional-Outlines and Bulb J133B/D* sheets at front of this section

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

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.	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

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

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PICTURE TUBE

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

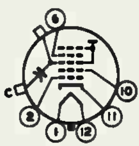
ALUMINIZED SCREEN
MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3	volts
Current	0.6 ± 10%	amp
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.	μμf
	1200 min.	μμf
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" ± 3/8"	
Greatest width	15-5/8" ± 1/8"	
Greatest height	12-3/4" ± 1/8"	
Diagonal	16-9/16" ± 1/8"	
Neck length	5-1/2" ± 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▲ 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 (Ec_5k) between 12000 and 16000 volts and grid-No.2 voltage (Ec_2k) between 200 and 500 volts*

Grid-No.4 Voltage for focus§	-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 Ec_1k except video drive is a positive voltage	
Grid-No.4 Current	-25 to +25	μa
Grid-No.2 Current	-15 to +15	μa
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

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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 ($E_{c_5g_1}$) between 12000 and 16000 volts and grid-No.2-to-grid-No.1 voltage ($E_{c_2g_1}$) 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_{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 voltage	
Grid-No.4 Current	-25 to +25	μa

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Grid-No.2 Current.	-15 to +15	μa
Field Strength of Adjustable Centering Magnet*	0 to 8	gausses
Examples of Use of Design Ranges:		
With ultor-to-grid-No.1 voltage of.	16000	*volts*
and grid-No.2-to-grid-No.1 voltage of.	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

▲ 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.

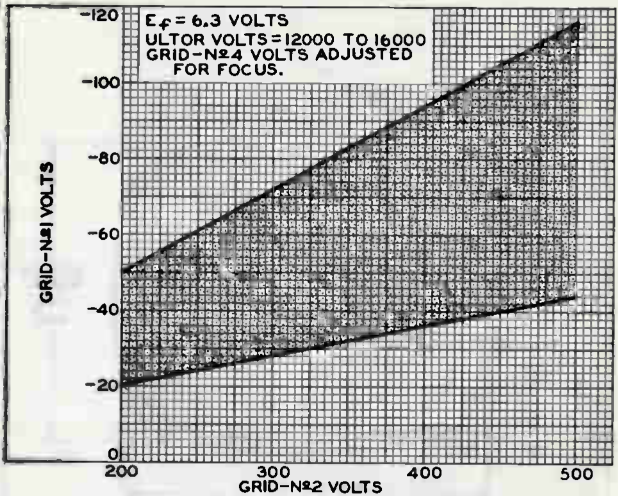
■ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

For X-ray shielding considerations, see sheet
X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section

17CFP4

RASTER-CUTOFF-RANGE CHARTS

GRID-DRIVE SERVICE



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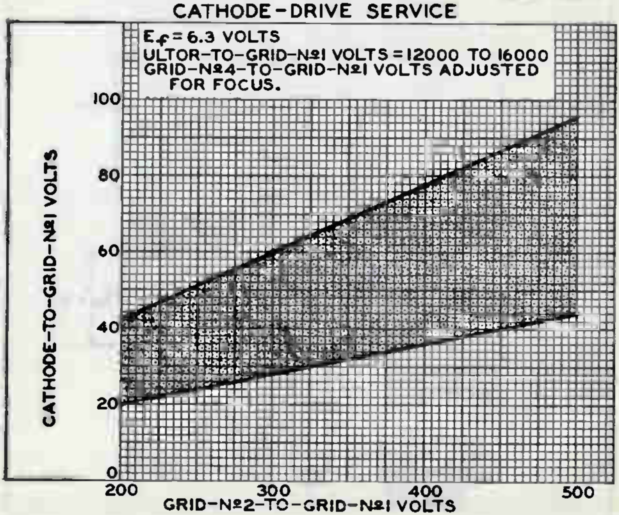
CATHODE-DRIVE SERVICE



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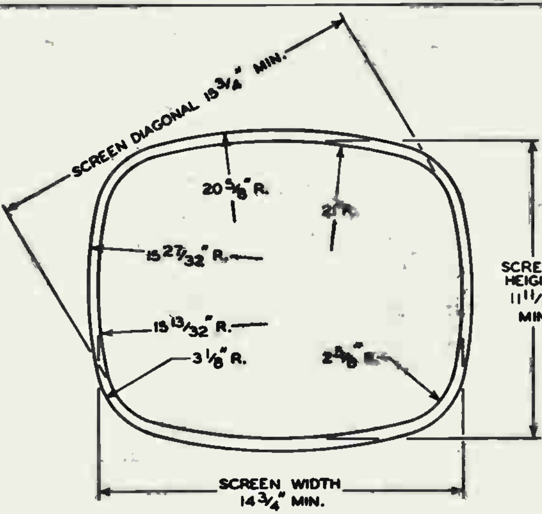
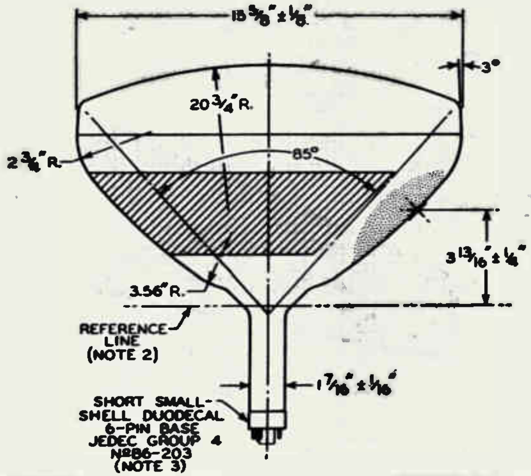
PICTURE TUBE

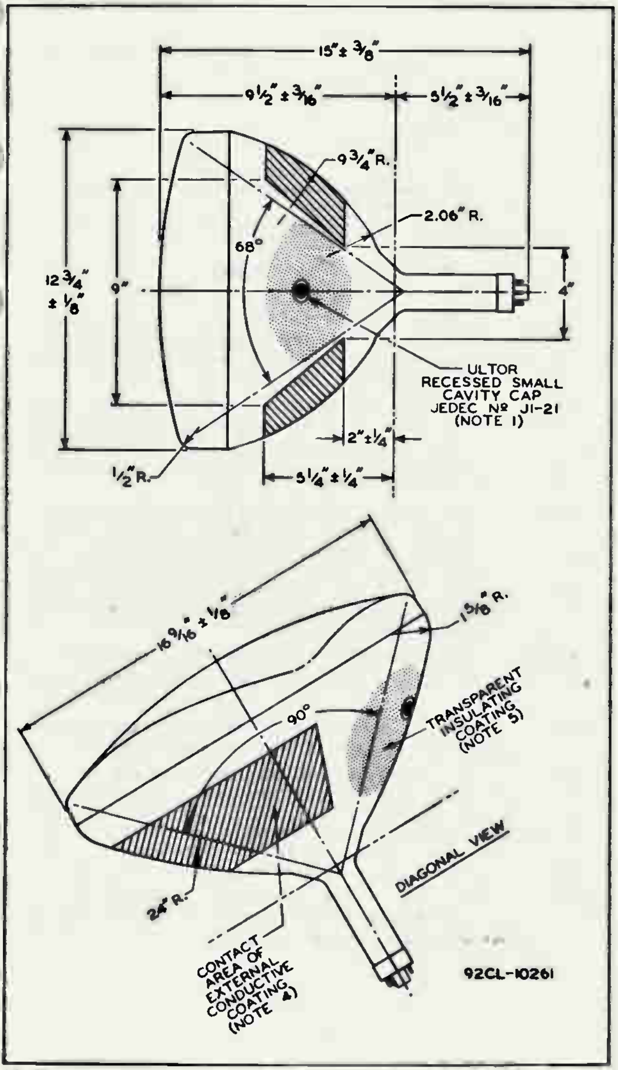




17CFP4

17CFP4

PICTURE TUBE



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17CFP4

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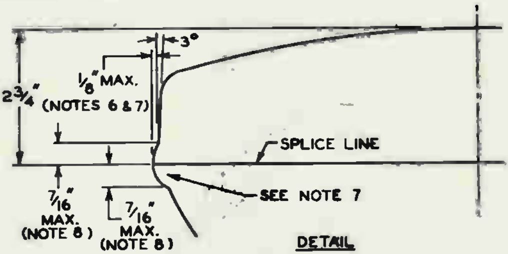

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 30°. ULTOR TERMINAL IS ON SAME SIDE AS PIN 6.

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 LINT-LESS CLOTH.

NOTE 6: MEASURED 2-9/32" ± 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.

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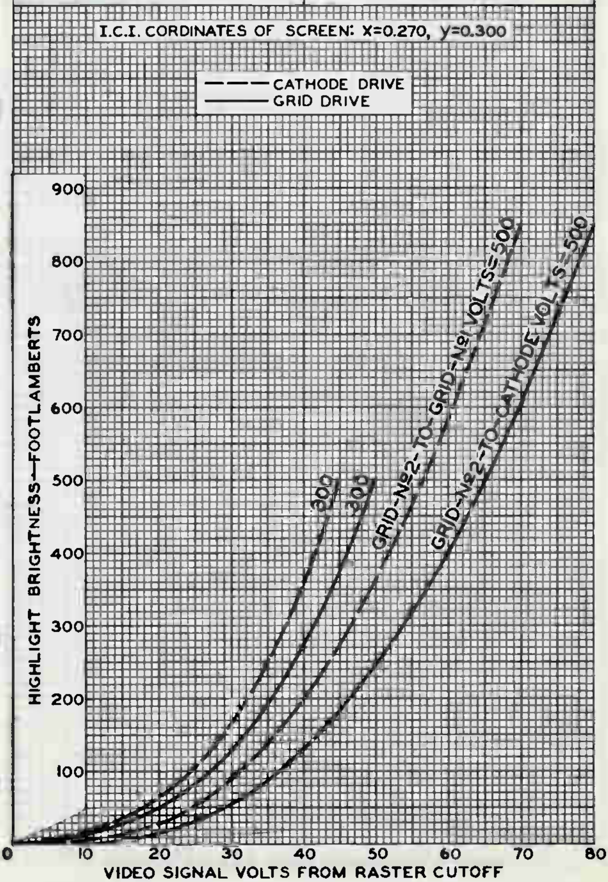
AVERAGE DRIVE CHARACTERISTICS

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 = 14" x 10½"	RASTER SIZE = 14" x 10½"



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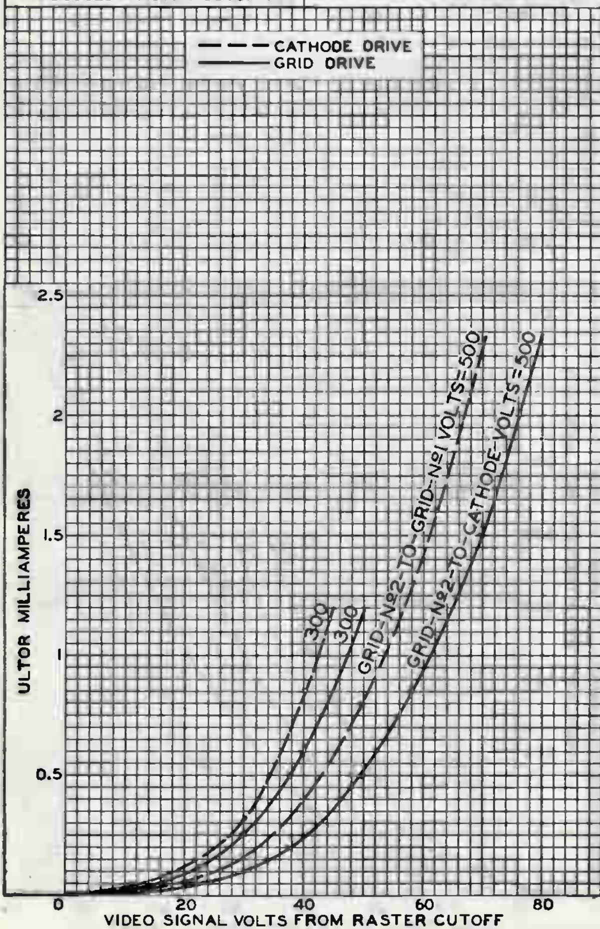
17CFP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
Ef = 6.3 VOLTS ULTOR-TO-GRID-No.1 VOLTS = 12000 TO 16000 CATHODE BIASED POSITIVE WITH RESPECT TO GRID No.1 TO GIVE FOCUSED RASTER CUTOFF.	Ef = 6.3 VOLTS ULTOR VOLTS = 12000 TO 16000 GRID No.1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.



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. . .	6	μμf
Cathode to all other electrodes. . . .	5	μμf
External conductive coating to ultor .	1700 max.	μμf
	1200 min.	μμf
Electron Gun	Type Requiring No Ion-Trap Magnet	

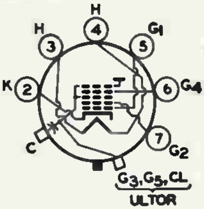
Optical:

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 *Picture-Tube Dimensional-Outlines* and *Bulb J132-1/2 A/B* 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

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	***14500***	***volts***
and grid-No.2-to-grid-No.1 voltage of	***50***	***volts***
Grid-No.4-to-Grid-No.1 Voltage for focus	-200 to +350	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

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 — **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.	pf
	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

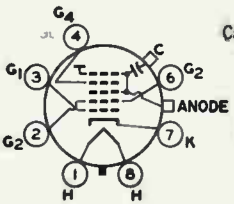
Optical:

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 J132-1/2 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 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

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

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section

RCA

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	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor	1500 max. / 1000 min.	μμf
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" ± 3/16"
Greatest width		15-5/8" ± 1/8"
Greatest height		12-3/4" ± 1/8"
Diagonal		16-9/16" ± 1/8"
Neck length		4-1/8" ± 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

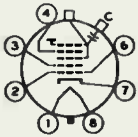
17DSP4

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▲ 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_{c_5h}) between 12000* and 18000 volts and grid-No.2 voltage (E_{c_2h}) between 200 and 500 volts

Grid-No.4 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	

17DSP4

PICTURE TUBE

Grid-No.4 Current.	-25 to +25		μa
Grid-No.2 Current.	-15 to +15		μa
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

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PICTURE TUBE

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage (Ec_5g_1) between 12000● and 18000 volts and grid-No.2-to-grid-No.1 voltage (Ec_2g_1) between 225 and 640 volts

Grid-No.4-to-Grid-No.1 Voltage for focus§.	0 to 400	volts
Cathode-to-Grid-No.1 Voltage (Ek_{g_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 Ek_{g_1} except video drive is a negative value	
Grid-No.4 Current	-25 to +25	μa
Grid-No.2 Current	-15 to +15	μa
Field Strength of Adjustable Centering Magnet*. . . .	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 extinction 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

▲ 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 17DSP4 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 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

* Distance from *Reference Line* for suitable PM centering magnet should not exceed 2-1/8". 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

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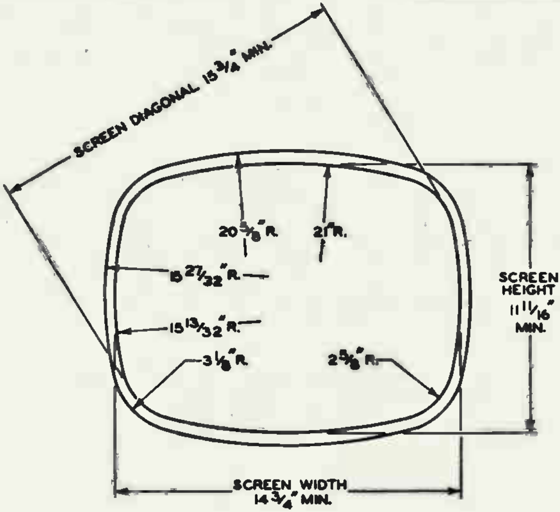
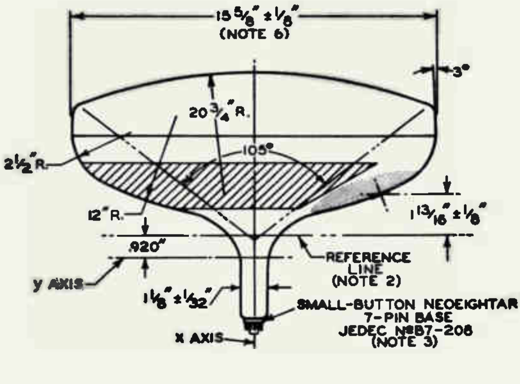
17DSP4

PICTURE TUBE





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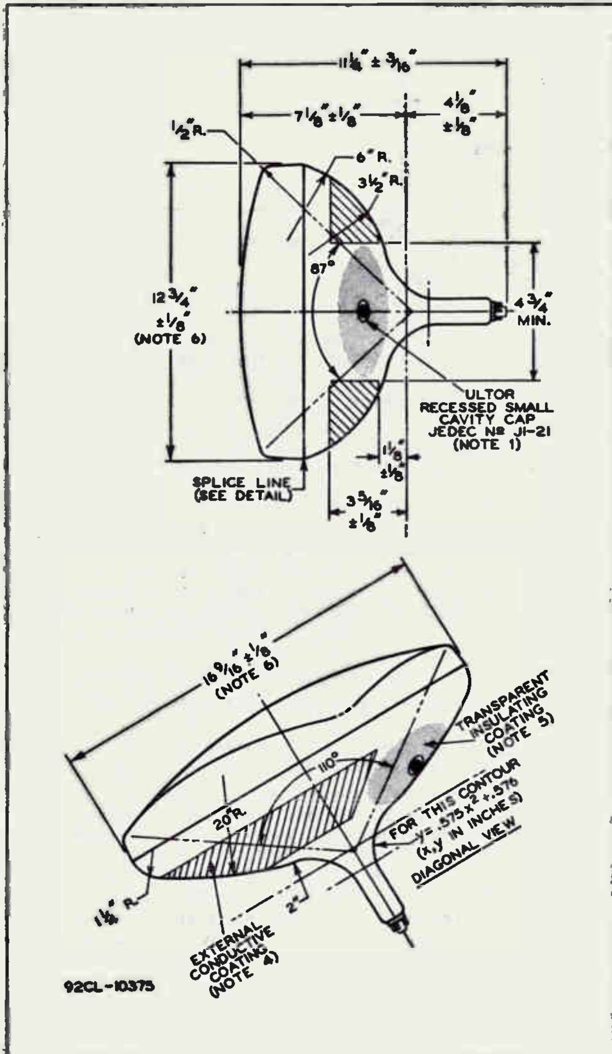
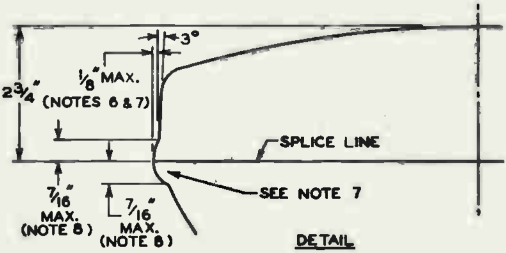
17DSP4

PICTURE TUBE



17DSP4

17DSP4
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 ± 30°. 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 LINTLESS CLOTH.

NOTE 6: MEASURED 2-9/32" ± 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. SUPPORTS MUST BE SPACED FROM THE TUBE BY THE USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.

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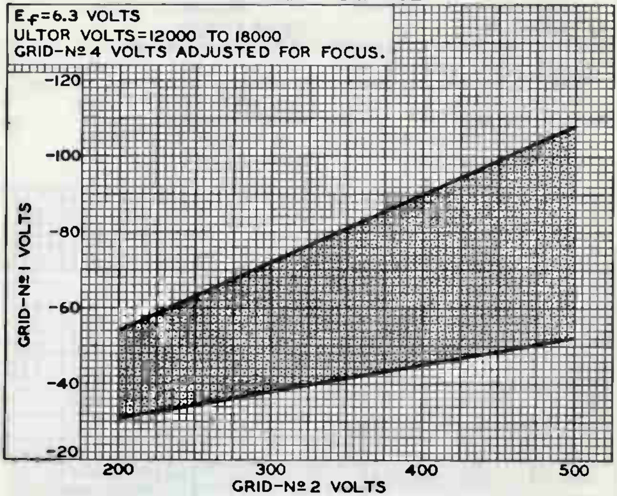
17DSP4

RASTER-CUTOFF-RANGE CHARTS

GRID-DRIVE SERVICE



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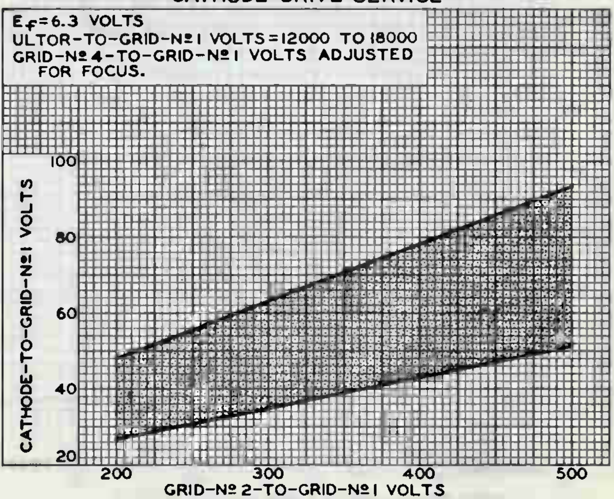
CATHODE-DRIVE SERVICE



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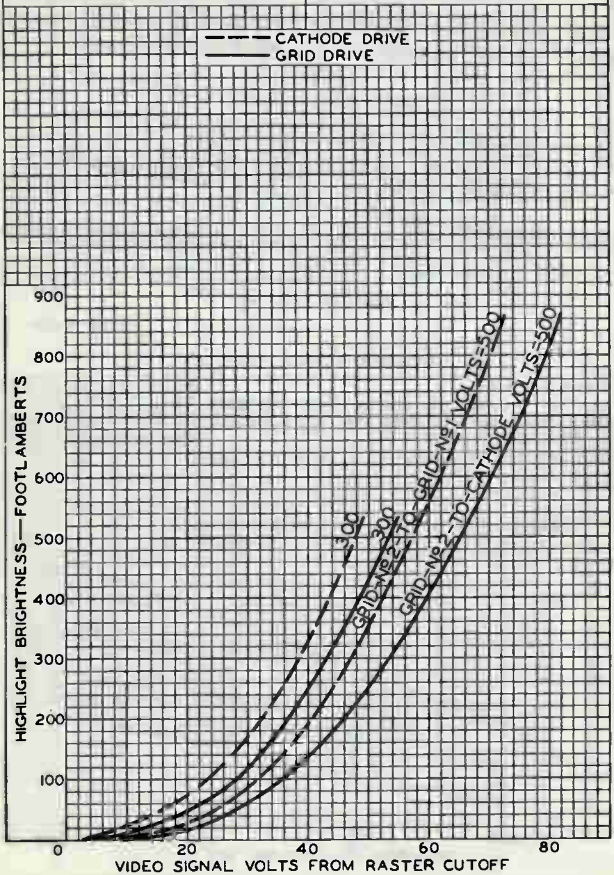
17DSP4

17DSP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS	E_f = 6.3 VOLTS
ULTOR-TO-GRID-№1 VOLTS = 16000	ULTOR VOLTS = 16000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID №1 TO GIVE FOCUSED RASTER CUTOFF.	GRID №1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.
RASTER FOCUSED AT AVERAGE BRIGHTNESS.	RASTER FOCUSED AT AVERAGE BRIGHTNESS.
RASTER SIZE = 14" x 10½"	RASTER SIZE = 14" x 10½"



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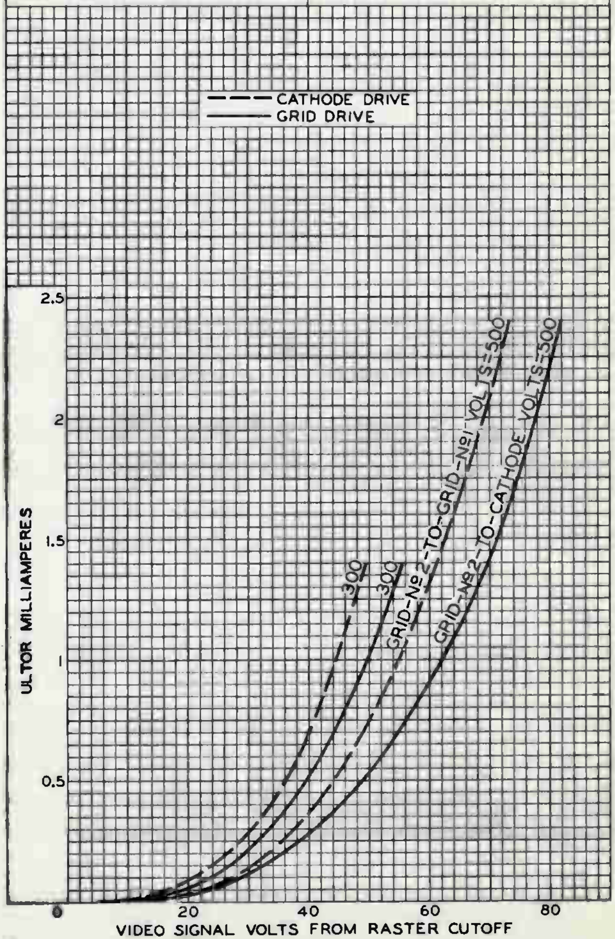
17DSP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f=6.3 VOLTS ULTOR-TO-GRID-No.1 VOLTS=12000 TO 18000 CATHODE BIASED POSITIVE WITH RESPECT TO GRID No.1 TO GIVE FOCUSED RASTER CUTOFF.	E_f=6.3 VOLTS ULTOR VOLTS=12000 TO 18000 GRID No.1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.



Picture Tube

RECTANGULAR GLASS TYPE — **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS — **70° MAGNETIC DEFLECTION**

GENERAL DATA

Electrical:

Heater Current at 6.3 volts . . . . 600 ± 10% ma
Direct Interelectrode Capacitances:
  Grid No.1 to all other electrodes . . . . . 6.5 μμf
  Cathode to all other electrodes . . . . . . 5 μμf
  External conductive coating to ultor. . . . {1500 max. μμf; 750 min. μμf}
Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

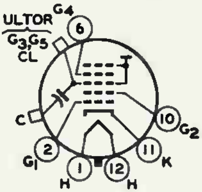
Optical:

Faceplate . . . . Filterglass
  Light transmission (Approx.). 74%
Phosphor (for curves, see front of this section). . P4—Sulfide Type, Aluminized

Mechanical:

Operating Position. Any
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 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 - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

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	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor	1500 max.	μμf
	1000 min.	μμf
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" ± 1/4"	
Greatest width	15-5/8" ± 1/8"	
Greatest height	12-3/4" ± 1/8"	
Diagonal	16-9/16" ± 1/8"	
Neck length	3-9/16" ± 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)	

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-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 ($E_{c_4}k$) between 12000 and 16000 volts and grid-No. 2 voltage ($E_{c_2}k$) between 400 and 550 volts

Grid-No. 3 Voltage for focus§	0 to 400 volts
Grid-No. 1 Voltage (Ec_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 μa
Grid-No. 2 Current.	-15 to +15 μa

Field Strength of Adjustable Centering Magnet• . .	0 to 12		gausses

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.	volts
	12000•	min.	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.	volts
	300	min.	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 ($E_{c_4 g_1}$) *between 12000 and 16000 volts and grid-No.2-to-grid-No.1 voltage* ($E_{c_2 g_1}$) *between 400 and 690 volts*

Grid-No.3-to-Grid-No.1 Voltage for focus§.	0 to 400	volts

Cathode-to-Grid-No.1 Voltage (Ek_{g_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 Ek_{g_1} except video drive is a negative voltage		
Grid-No.3 Current	-25 to +25		μa
Grid-No.2 Current	-15 to +15		μa
Field Strength of Adjustable Centering Magnet▲. .	0 to 12		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	*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.

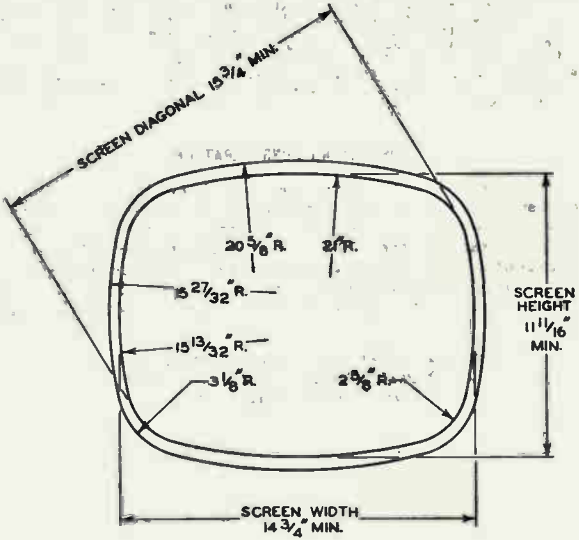
♦ Distance from *Reference Line* for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 5/16-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

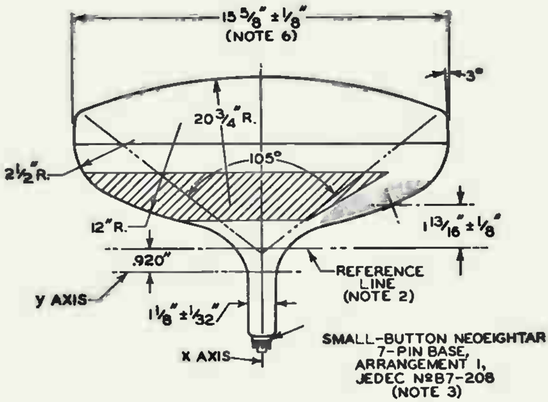
■ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

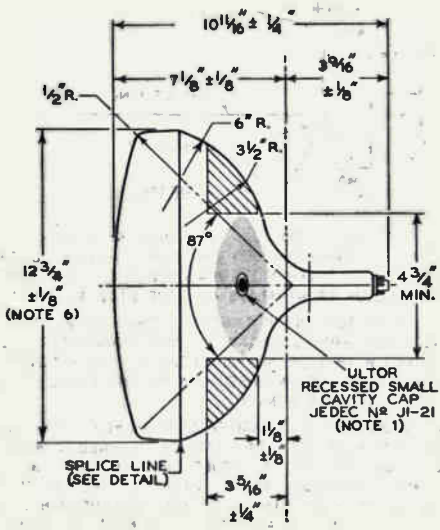
OPERATING CONSIDERATIONS

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 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.

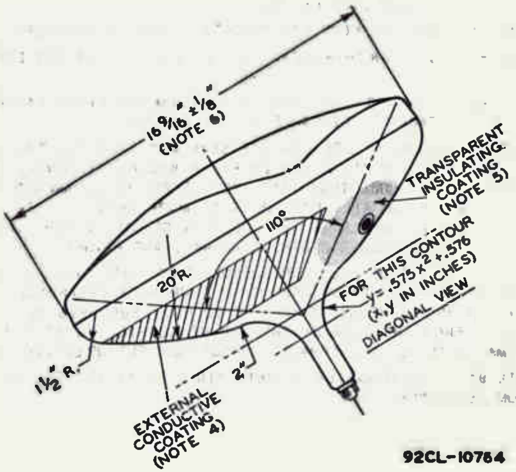
For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section


SCREEN DIAGONAL 15 3/4" MIN.
20 5/8" R.
21" R.
15 27/32" R.
15 13/32" R.
3 1/8" R.
2 5/8" R.
SCREEN HEIGHT 11 11/16" MIN.
SCREEN WIDTH 14 3/4" MIN.


15 5/8" ± 1/8" (NOTE 6)
3°
20 3/4" R.
105°
2 1/2" R.
12" R.
1 13/16" ± 1/8"
.920"
REFERENCE LINE (NOTE 2)
Y AXIS
1 1/8" ± 1/32"
X AXIS
SMALL-BUTTON NEOEIGHTAR 7-PIN BASE, ARRANGEMENT 1, JEDEC No B7-208 (NOTE 3)

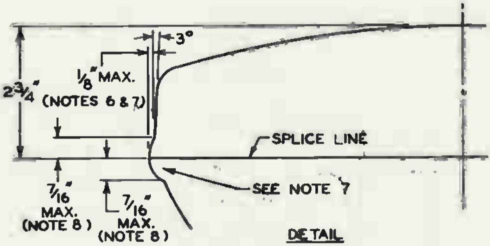


10 11/16" ± 1/4"
7 1/8" ± 1/8"
3 9/16" ± 1/8"
1/2" R.
6" R.
3 1/2" R.
87°
12 3/8" ± 1/8" (NOTE 6)
4 3/4" MIN.
ULTOR RECESSED SMALL CAVITY CAP JEDEC Nº J1-21 (NOTE 1)
1 1/8" ± 1/8
SPLICE LINE (SEE DETAIL)
3 5/16" ± 1/4"



16 9/16" ± 1/8" (NOTE 6)
TRANSPARENT INSULATING COATING (NOTE 5)
110°
20" R.
FOR THIS CONTOUR y = .575x² + .576 (x,y IN INCHES)
DIAGONAL VIEW
1 1/2" R.
2"
EXTERNAL CONDUCTIVE COATING (NOTE 4)

92CL-10764



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 ± 30°. 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 LINTLESS CLOTH.

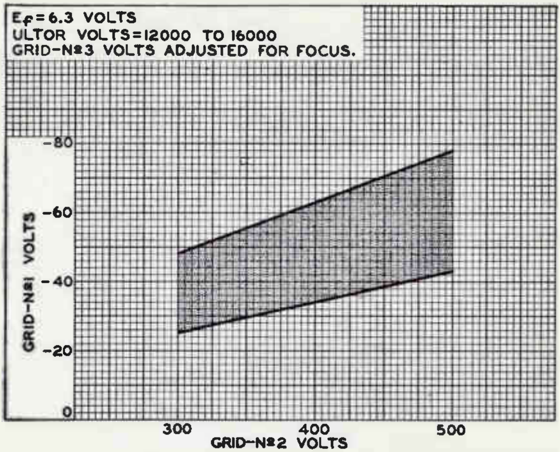
NOTE 6: MEASURED 2-9/32" ± 1/32" FROM THE PLANE TANGENT TO THE SURFACE OF THE FACEPLATE AT THE TUBE AXIS.

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. SUPPORTS MUST BE SPACED FROM THE TUBE BY THE USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.

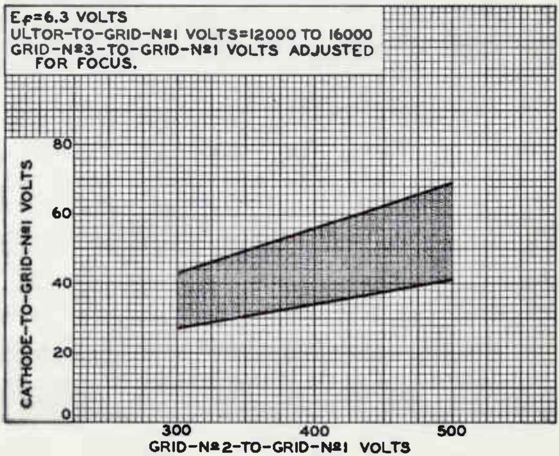
NOTE 9: NECK DIAMETER IS MAINTAINED TO AT LEAST 2-7/16" FROM REFERENCE LINE.

RASTER-CUTOFF-RANGE CHARTS
Grid-Drive Service



92CS-9930

Cathode-Drive Service



92CS-9931

Color Picture Tube

Perma-Chrome
90° Rectangular
Blue-Gun-Down Operation

Banded-Type Implosion Protection
Hi-Lite Screen
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	1500 max. pF 1000 min. pF

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)

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 µA

Grid-No.2 Current . . . . –5 to +5 µA

To Product 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 supplied 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 . . . . ± 0.45 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. 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.

[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.

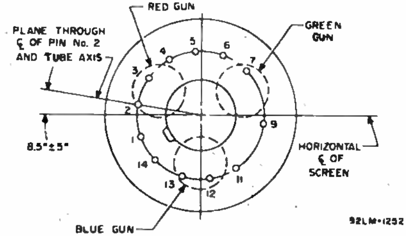
X-RADIATION WARNING

Because the 17EZP22 is designed to be operated at anode voltages as high as 22.5 kilovolts (design-maximum value), shielding of the 17EZP22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

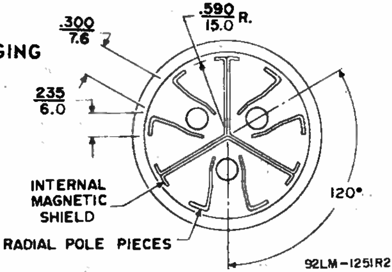
BASE SPECIFICATION – JEDEC No. 14BH

Pin 1: Heater
Pin 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.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
Cap: Anode (Grid No.3, Grid No.5, Screen, Collector)
C: External Conductive Coating

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 (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.

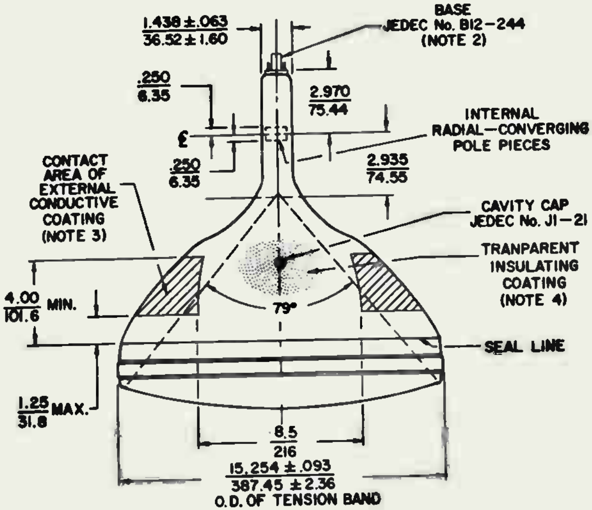
Note 3: The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

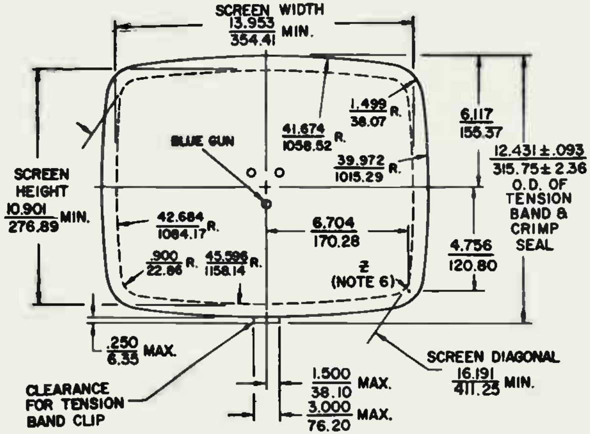
Note 4: To clean this area, wipe only with soft, dry, lintless cloth.

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.

DIMENSIONAL



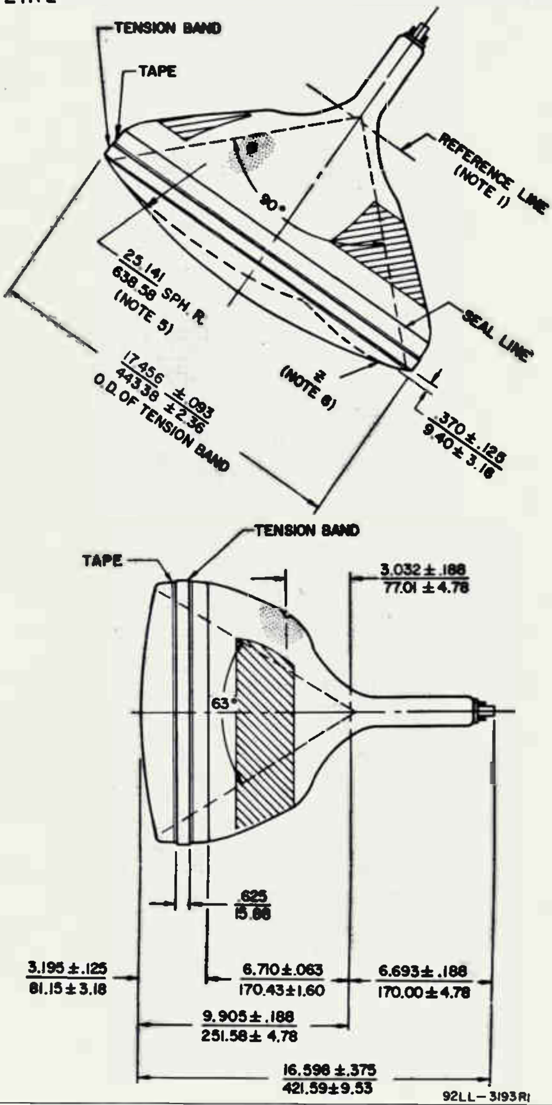


SAGITTAL HEIGHTS AT POINTS $\frac{.125}{3.18}$ BEYOND EDGE OF MIN. SCREEN

DIAGONAL $\frac{1.398}{35.51}$ WIDTH $\frac{1.040}{26.42}$ HEIGHT $\frac{.642}{16.31}$

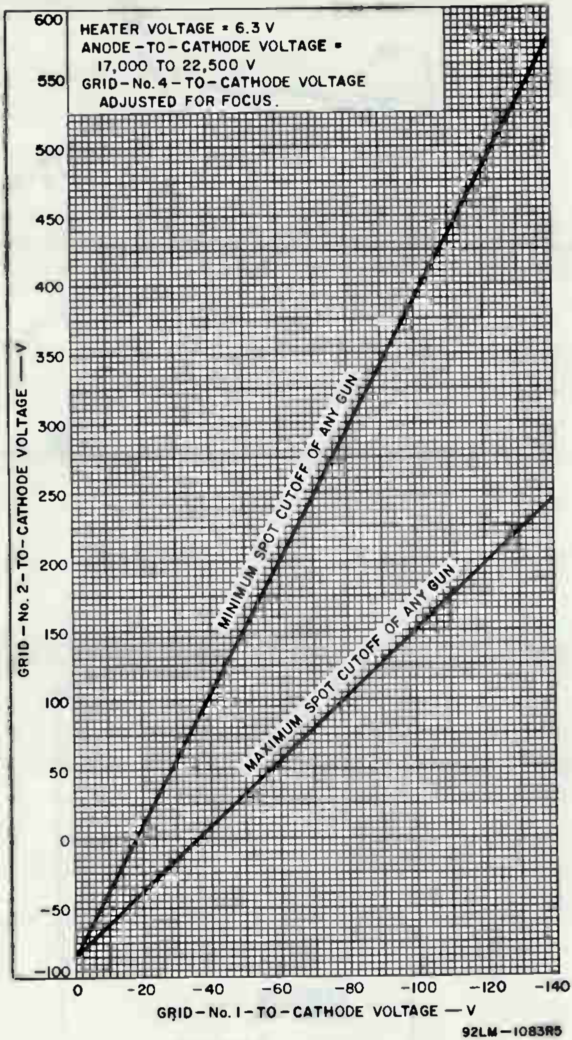
Dimensions in Inches / mm unless otherwise noted

OUTLINE



TENSION BAND
TAPE
REFERENCE LINE (NOTE 1)
90°
25.141 / 638.58 SPH. R. (NOTE 5)
SEAL LINE
Z (NOTE 6)
17.456 ±.093 / 443.38 ±2.36 O.D. OF TENSION BAND
.370±.125 / 9.40±3.18
TENSION BAND
TAPE
3.032±.188 / 77.01±4.78
63°
.625 / 15.88
3.195±.125 / 81.15±3.18
6.710±.063 / 170.43±1.60
6.693±.188 / 170.00±4.78
9.905±.188 / 251.58±4.78
16.598±.375 / 421.59±9.53
92LL-3193R1

CUTOFF DESIGN CHART



Picture Tube

RECTANGULAR GLASS TYPE — **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS — **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 No Ion-Trap Magnet	

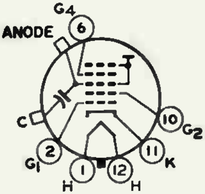
Optical:

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.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

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

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 — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 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 No Ion-Trap Magnet

Optical:

Phosphor (For curves, see front of this Section). P4—Sulfide Type, Aluminized
Faceplate, Cylindrical . . . . .Filterglass
Light transmission (Approx.) 66%

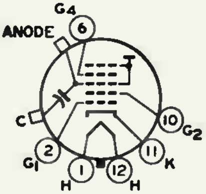
Mechanical:

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 (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 . . . . 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

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

Picture Tube

RECTANGULAR GLASS TYPE — **ALUMINIZED SCREEN**
MAGNETIC FOCUS — **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 ± 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.)	74%

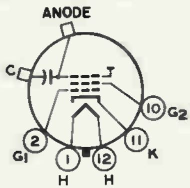
Mechanical:

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, Dimensions, and Deflection Angles:
See *Picture-Tube Dimensional-Outlines and Bulb J133 C/E* 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

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

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	

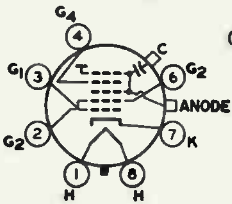
Optical:

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

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.	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	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

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.	μμf
	1000 min.	μμf
Electron Gun . . . . .Type Requiring No Ion-Trap Magnet		

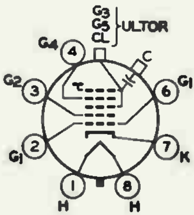
Optical:

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 *Picture-Tube Dimensional-Outlines* and *Bulb J149 C* 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

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

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
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

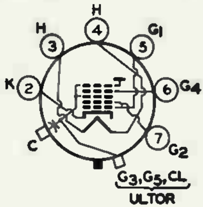
Mechanical:

Operating Position	Any
Weight (Approx.)	14 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 *Picture-Tube Dimensional-Outlines* and *Bulb J149 A* 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

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

ULTOR-TO-GRID-No.1 VOLTAGE	19800 max.	volts
	12000 min.	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.	volts
	40 min.	volts
CATHODE-TO-GRID-No.1 VOLTAGE	100 max.	volts
HEATER VOLTAGE	7 max.	volts
	5.8 min.	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

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		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.	μμf
	1000 min.	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. 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	23000 max.	volts
	15000 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_{c3k}) 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

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.	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	700 max.	volts
	350 min.	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.	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-to-grid-No.1 voltage ($E_{c_5g_1}$) of	*20000*	*volts*
and grid-No.2-to-grid-No.1 voltage ($E_{c_2g_1}$) 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

▲ 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:

$$\sqrt{\frac{Ec_5k \text{ or } Ec_5g_1 \text{ (volts)}}{16000 \text{ (volts)}}} \times 8 \text{ gausses}$$

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.*

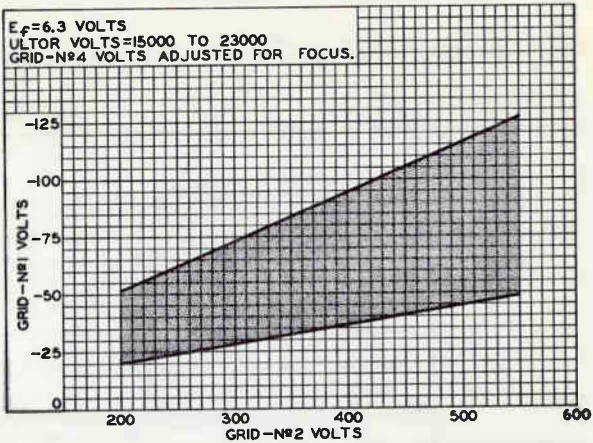
OPERATING CONSIDERATIONS

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.

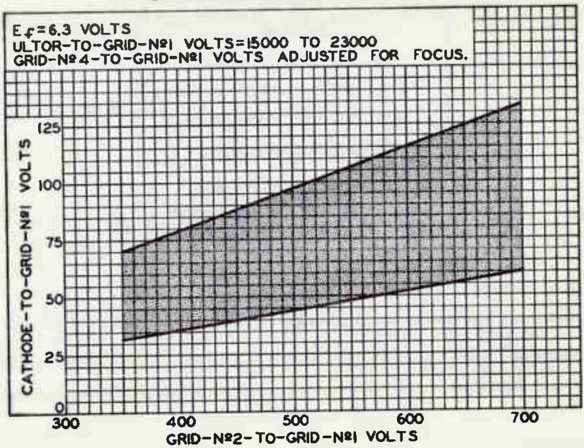
RASTER-CUTOFF-RANGE CHARTS

Grid-Drive Service

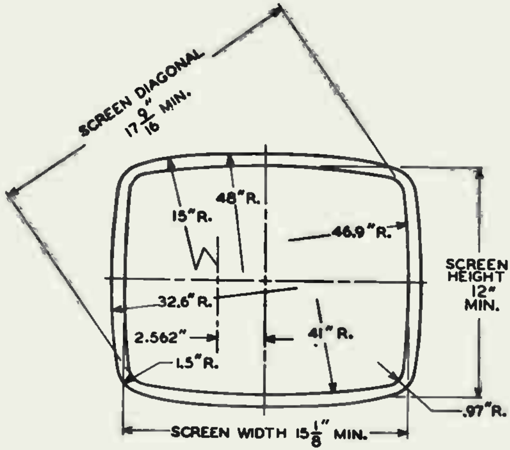


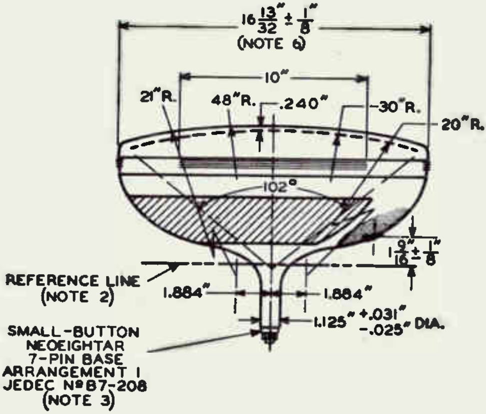
92CS-10790

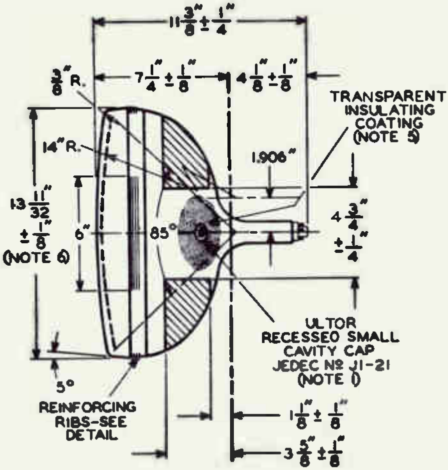
Cathode-Drive Service

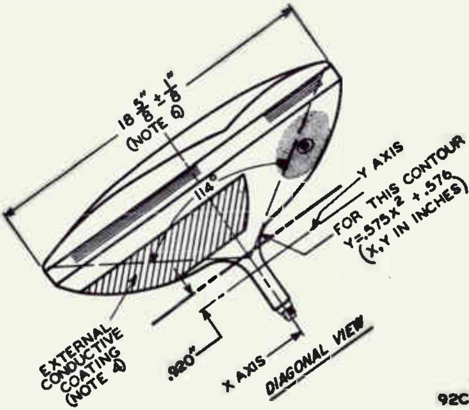


92CS-10819

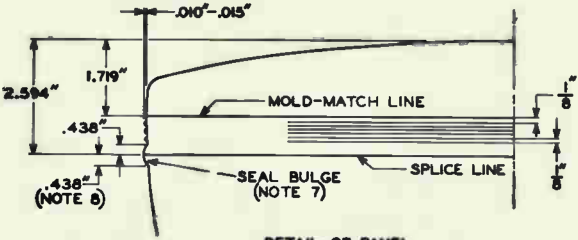

SCREEN DIAGONAL
17 9/16" MIN.
48" R.
15" R.
46.9" R.
SCREEN HEIGHT 12" MIN.
32.6" R.
2.562"
41" R.
1.5" R.
.97" R.
SCREEN WIDTH 15 1/8" MIN.


16 13/32" ± 1/8"
(NOTE 6)
10"
21" R.
48" R.
.240"
30" R.
20" R.
102°
1 9/16 ± 1/8"
REFERENCE LINE
(NOTE 2)
1.884"
1.884"
1.125" +.031" -.025" DIA.
SMALL-BUTTON
NEOEIGHTAR
7-PIN BASE
ARRANGEMENT 1
JEDEC Nº B7-208
(NOTE 3)





92CL-10670R1



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 ± 30°. 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.

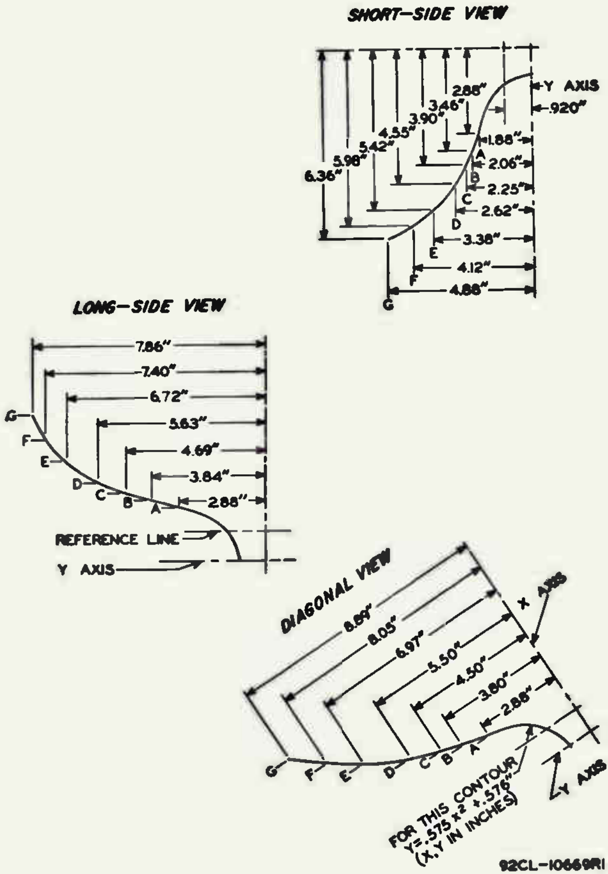
NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

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



92CL-10669R1

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.

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	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	

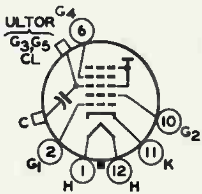
Optical:

Faceplate . . . . . Filterglass
Light transmission (Approx.) 78%
Phosphor (For curves, see front of this section) . . P4—Sulfide Type, Aluminized

Mechanical:

Operating Position . . . . . Any
Weight (Approx.) . . . . . 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 *Picture-Tube Dimensional-Outlines* and *Bulb J149 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

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

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
LOW GRID-No.2 VOLTAGE	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 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.	μμf
	1000 min.	μμf

Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

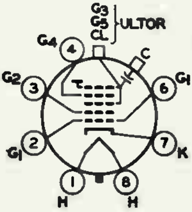
Optical:

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 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 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

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

ULTOR-TO-GRID-No.1 VOLTAGE.	20000 max.	volts
	10000 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.	70 max.	volts
	40 min.	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.	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-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

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

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

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	pF
	1400 min	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, Aluminized

For curves, see front of this section

Faceplate . . . . Filterglass

Light transmission (Approx.). 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

Type. . . . . .Regular-Band

Contact area for grounding. . . . . Near Reference Line

For Addition Information on Coatings and Dimensions

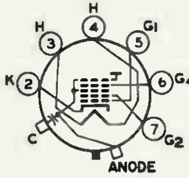
See *Picture-Tube Dimensional-Outlines* and *Bulb J149A* sheets at front of this section

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 - 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	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	MΩ

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]	
Type	Regular-Band
Contact area for grounding	Near Reference Line

For Additional Information on Coatings and Dimensions

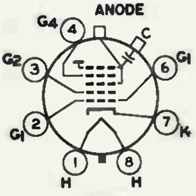
See *Picture-Tube Dimensional-Outlines* and *Bulb J149F* sheets at front of this section

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



8HR

← Indicates a change.

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	MΩ

[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 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

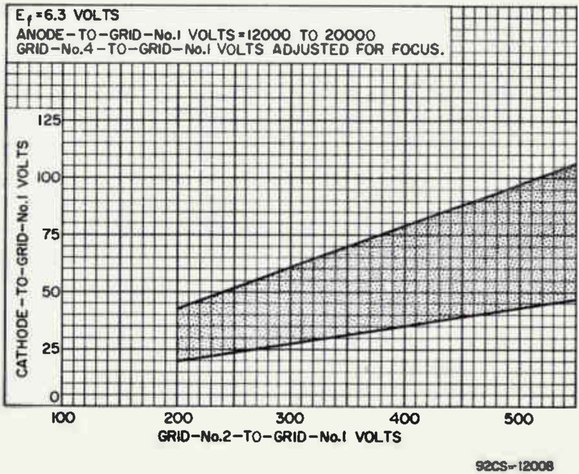
[c] Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/4 inches. The specified centering magnet compensates only for the effect which mechanical tube tolerances may have on the location of the undeflected, focused spot with respect to the center of the tube face. Maximum field strength of adjustable centering magnet equals

$$\sqrt{\frac{\text{Anode volts}}{\text{16000 volts}}} \times 8 \text{ gauss}$$

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.

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



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 item:

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	pF←
	1250 min	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

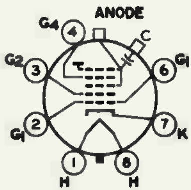
Phosphor . . . . P4—Sulfide Type, Aluminized
(For Curves, see front of this section)

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 *Picture-Tube Dimensional-Outlines* and *Bulb J149 F* 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.

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 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]	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	MΩ

[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-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

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[a].	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

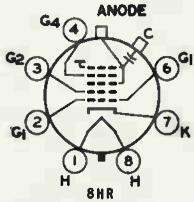
Phosphor . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate. . . . . Filterglass
Light transmission at center (Approx.) . . . . 48 %

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 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.	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

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

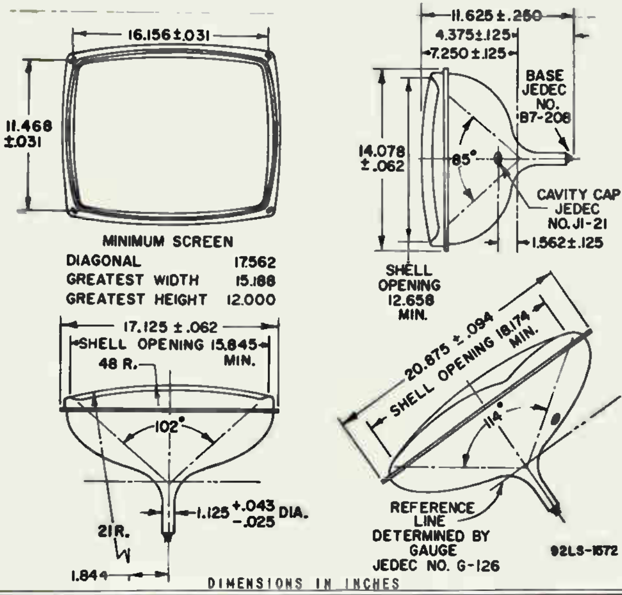
Anode Voltage	16000	V
Grid-No.4 Voltage	0 to 400	V
Grid-No.2 Voltage	300	V
Cathode Voltage	28 to 62	V
For visual extinction of focused raster		
Field Strength	0 to 8	G
Of required adjustable centering magnet		

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ

● Includes implosion protection hardware.

DIMENSIONAL OUTLINE
(Bulb J149 F)



DIMENSIONS IN INCHES

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

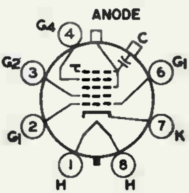
Phosphor	P4—Sulfide Type, Aluminized
For curves, see front of this section	
Faceplate	Filterglass
Light transmission at center (Approx.)	48%

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 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 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater



8HR

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 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 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 ≤ 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		

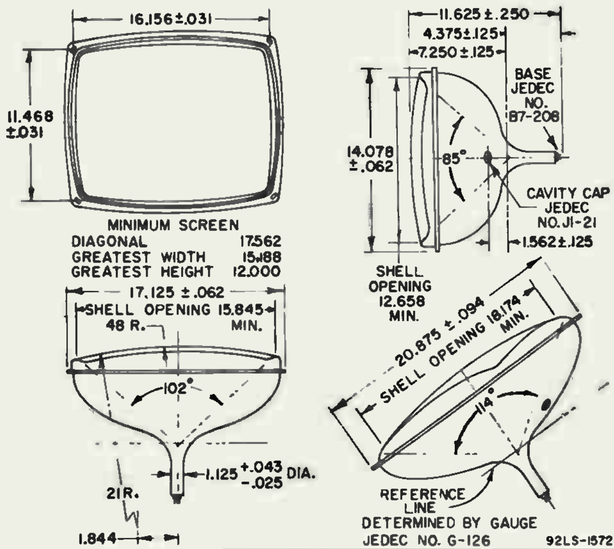
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance.	1.5 max	MΩ

[a] Includes implosion protection hardware.

DIMENSIONAL OUTLINE
(Bulb J149 F)

DIMENSIONS IN INCHES



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	pF
	1000 min	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

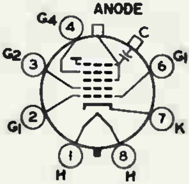
Weight (Approx.)	15 lb
Overall Length	11.625 ± 0.250 in
Neck Length	4.375 ± 0.125 in
Projected Area of Screen	172 sq in
External Conductive Coating	
Type	Modified-Band
Contact area for grounding	Near Reference Line

For Additional Information on Coatings and Dimensions
See *Picture-Tube Dimensional-Outlines and Bulb J149 F* 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



8HR

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to Grid No.1

Anode Voltage	21000 max 12000 min	V V
Grid-No.4 (Focusing) Voltage		
Positive value	1250 max	V
Negative value	400 max	V
Grid-No.2 Voltage	60 max 25 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	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	MΩ

[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

Color Picture Tube

RECTANGULAR TUBE 90° MAGNETIC DEFLECTION
ALUMINIZED TRICOLOR PHOSPHOR-DOT "Hi-Lite" SCREEN
(Utilizing a Rare-Earth Red-Emitting Phosphor)
MAGNETIC CONVERGENCE 3 ELECTROSTATIC-FOCUS GUNS

For Use in Color-TV Receivers

The 19EXP22 is the same as the 19EYP22 except for the following items:

OPTICAL

Faceplate . . . . Filterglass
Light transmission (Approx.). 69%
Faceplate does not have an integral protective window.[a]

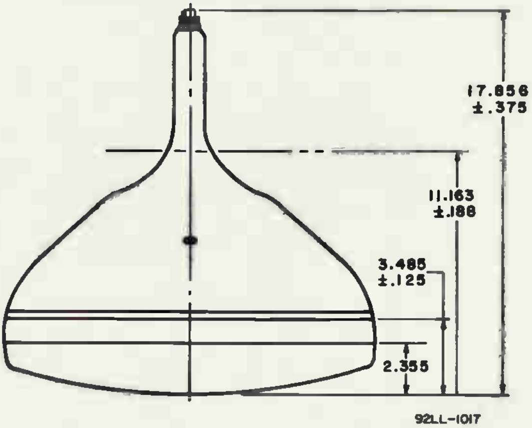
MECHANICAL

Tube Dimensions
Overall length. . . . . .17.856 ± .375 in
Weight (Approx.). . . . . 21 lb

[a] It is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of the 19EXP22 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

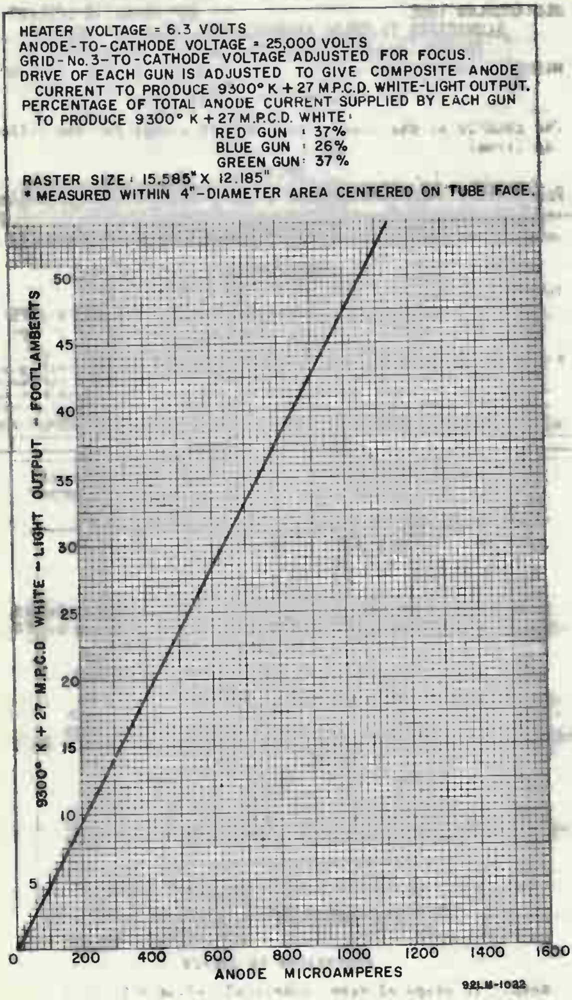
Dimensions shown are only those which are different from the corresponding dimensions for the 19EYP22



DIMENSIONS IN INCHES

Note: In diagonal view, spherical radius = 27.3" R.

Typical Light-Output Characteristic



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Color Picture Tube

RECTANGULAR TUBE — 90° MAGNETIC DEFLECTION

ALUMINIZED TRICOLOR PHOSPHOR-DOT "Hi-Lite" Screen
(Utilizing a Rare-Earth Red-Emitting Phosphor)

INTEGRAL FILTERGLASS PROTECTIVE WINDOW
(Treated to Minimize Specular Reflection)

MAGNETIC CONVERGENCE — ELECTROSTATIC-FOCUS GUNS

For Use in Color-TV Receivers

ELECTRICAL

Electron Guns, Three . . . . Red, Blue, Green
  Axes tilted toward tube axis
Heater, of Each Gun
  Series connected within tube with each of the other two heaters
    Current at 6.3 volts[a] . . . . 800 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.3 to all other electrodes	6.5	pF
External conductive coating to anode	2000 max	pF
	1500 min	pF

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—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.) . . . . 0.023 in

MECHANICAL

Tube Dimensions

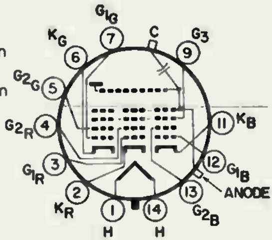
Overall length	18.048 ± .375 in
Neck length	6.693 ± .188 in
→ Diagonal	19.422 ± .093 in
Greatest width	16.977 ± .093 in
Greatest height	13.664 ± .093 in

Screen Dimensions, Minimum (Projected)

Diagonal	18.075 in
Greatest width	15.585 in
Greatest height	12.185 in
Area	180 sq in

Weight (Approx.) . . . 24 lb
Operating Position . . . Anode Cap Contact on Top
Cap . . . Recessed Small Cavity (JEDEC No.J1-21)
Pin Position Alignment . . . Pin 12 Aligns Approx. with Anode Cap
Base . . . Small-Button Diheptar 12-Pin (JEDEC No.B12-244)
Basing Designation for BOTTOM VIEW . . . 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, 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	27500 max 20000 min	V V
Total Anode Current, Long-Term Average	750 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

→ Indicates a change.

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Heater Voltage (AC or DC)

Under operating conditions[a]	{6.9 max / 5.7 min	V / V
Under standby conditions[c]	5.5 max	V

Peak Heater-Cathode Voltage (Each gun)

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 . . .	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 voltage between 20000 and 27500 V

Grid-No.3 Voltage . . . . 16.8% to 20% of anode V
Focusing electrode

Grid-No.2 and Grid-No.1 Voltages . . . See accompanying *Cutoff Design Chart*
For visual extinction of 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 V)

Grid-No.3 Current (Total) . . . . -45 to +15 µA

Grid-No.2 Current . . . . -5 to +5 µA

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 supplied by each gun (Average).	37	26	37	%

	Red to Blue			*Red to Green*		
	Min	*Typ*	*Max*	*Min*	*Typ*	*Max*
Ratio of cathode currents. . . .	1.00	1.40	2.00	0.75	1.00	1.80

Displacements, Measured at Center of Screen

Raster centering displacement:		
Vertical.	-0.45 to +0.45	in
Horizontal.	-0.47 to +0.47	in
Lateral convergence displacement of blue beam with respect to converged red and green beams.	-0.25 to +0.25	in
Radial convergence displacement excluding effects of dynamic convergence (Each beam)	-0.37 to +0.37	in

Maximum Required Correction for Register[d] (Including Effect of Earth's Magnetic Field when Using Recommended Components) . . 0.005 max in
Measured at center of screen in any direction

EXAMPLES OF USE OF DESIGN RANGES

Unless otherwise specified, voltage values are for each gun and are positive with respect to cathode

Anode Voltage	25000	V
Grid-No.3 Voltage	4200 to 5000	V
Grid-No.2 Voltage When circuit design utilizes grid-No.1 voltage of −150 V 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 V	−95 to −190	V
Heater Voltage		
Under operating conditions[a]	6.3	V
Under standby conditions	5	V

LIMITING CIRCUIT VALUES

High-Voltage Circuits

Grid-No.3 Circuit Resistance . . . 7.5 max MΩ

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.

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 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 1/4 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.

[b] For curve, see *Group Phosphor P22—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.

GENERAL CONSIDERATIONS

X-Radiation Warning. Because the 19EYP22 is designed to be operated at anode voltages as high as 27.5 kilovolts (design-maximum value), shielding of the 19EYP22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

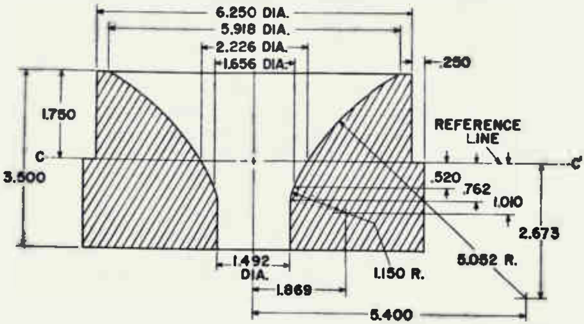
Orientation. The 19EYP22 must be operated with tube axis in a horizontal position and with the blue gun uppermost (i.e., anode cap on top).

The deflecting yoke should not be used for supporting the picture tube because it should be centered on the neck and be free to move along the neck for a distance of approximately 1/2 inch 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 in order to prevent overheating and possible damage to the tube.

Misregister Compensation. Proper operation of the 19EYP22 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



92CM-12815

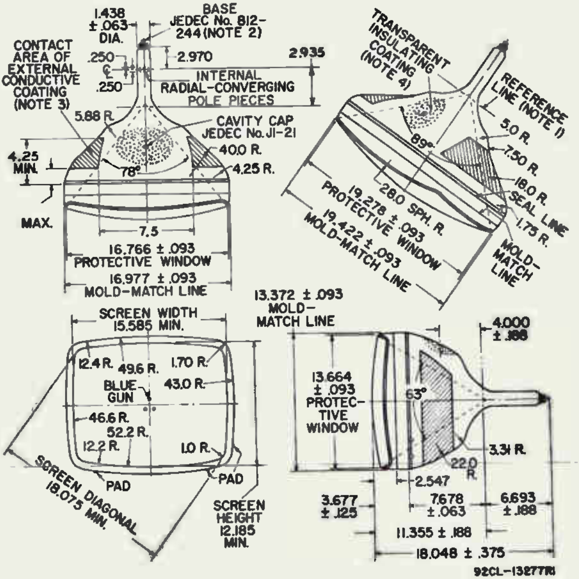
DIMENSIONS IN INCHES

Reference line is determined by plane C-C' when gauge is seated.

LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS

for Type 19EYP22 is the same as that shown for Type 25AP22A

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

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 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 circle concentric with bulb axis and have a diameter of 2 inches.

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.

Note 4: To clean this area, wipe only with soft, dry lintless cloth.

→ Indicates a change.

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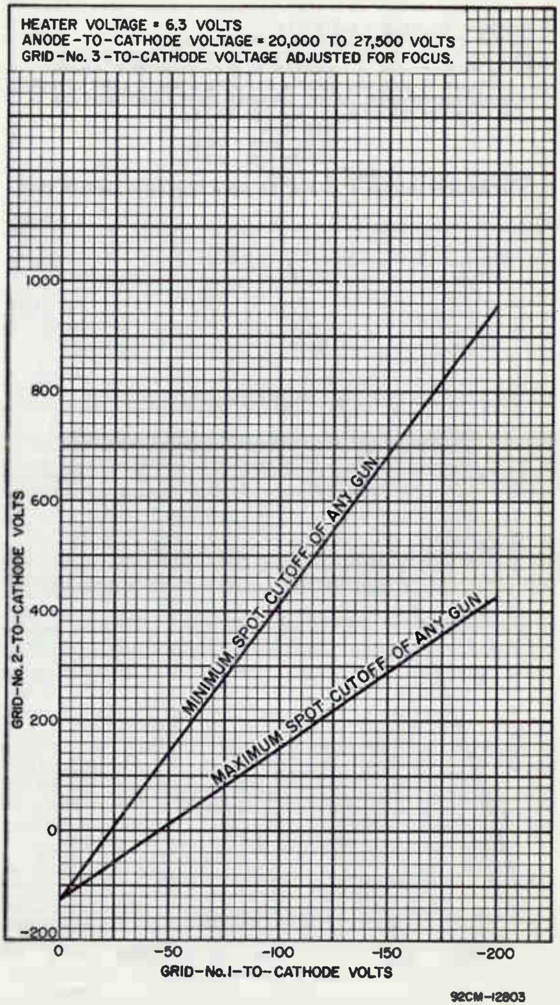
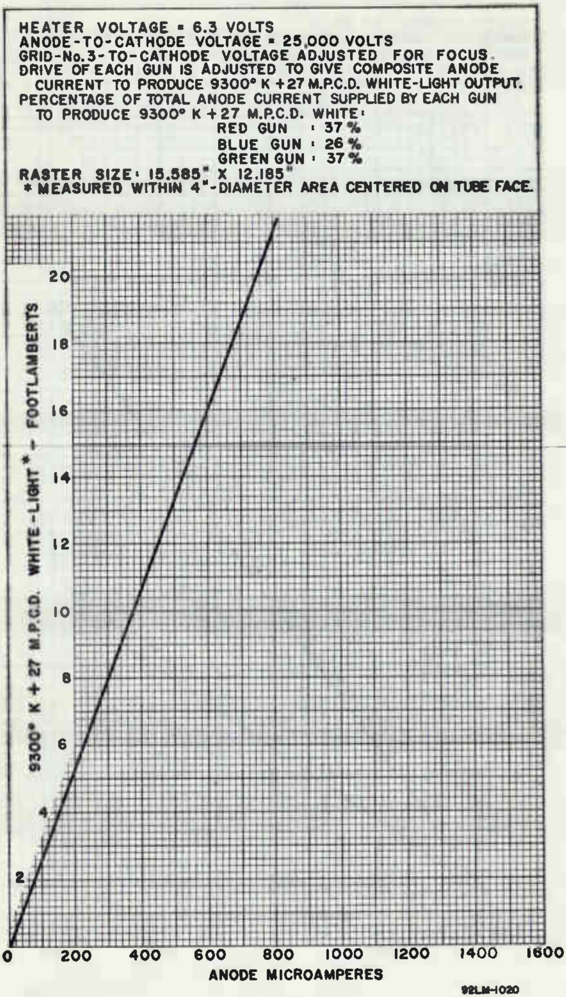
Cutoff Design Chart



Typical Light-Output Characteristic



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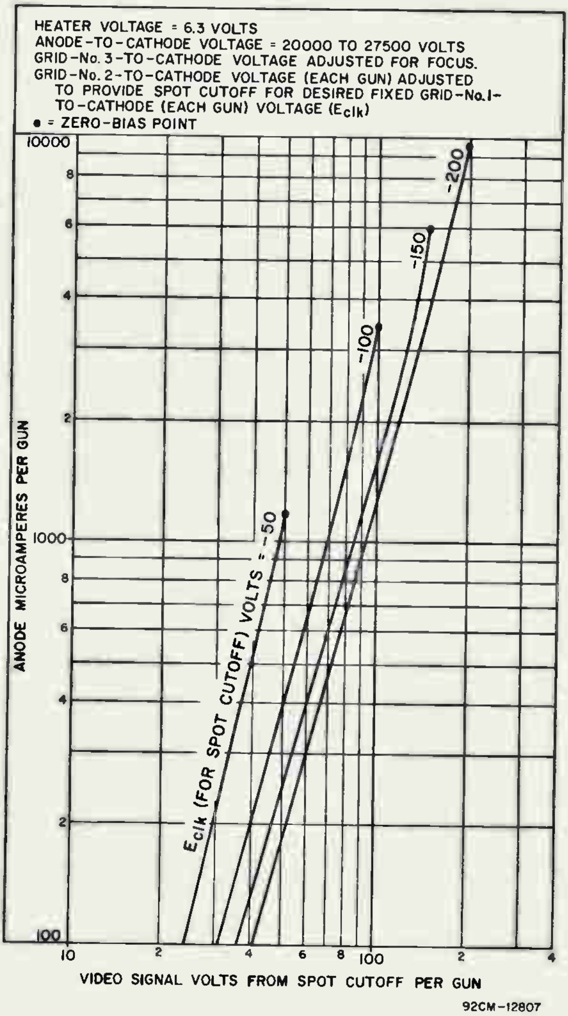
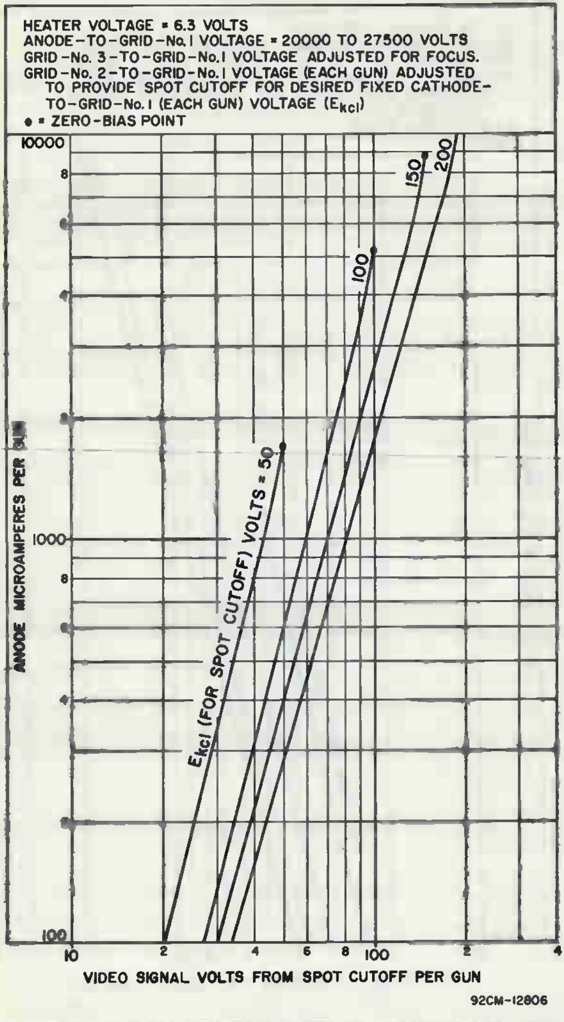
Typical Drive Characteristics

Grid-Drive Service



Typical Drive Characteristics
Cathode-Drive Service



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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

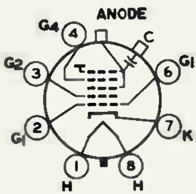
Phosphor . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate. . . . . Filterglass
Light transmission at center (approx.) 48%

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]
Type . . . . Regular-Band
Contact area for grounding . . . . Near Reference Line
For Additional Information on Coatings and Dimensions
See *Picture-Tube Dimensional-Outlines* and *Bulb J149F* 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



8HR

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		
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	16000	V
Grid-No. 4 Voltage[b]	100	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 8	G

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 10.5-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—INTEGRAL IMPLOSION PROTECTION

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[a].	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

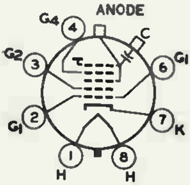
Phosphor	P4—Sulfide Type, Aluminized
For curves, see front of this section	
Faceplate.	Filterglass
Light transmission at center (approx.)	48%

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 (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



8HR

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 (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 ≤ 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	16000	V
Grid-No.4 Voltage[b]	200	V
Grid-No.2 Voltage	300	V
Cathode Voltage	28 to 62	V

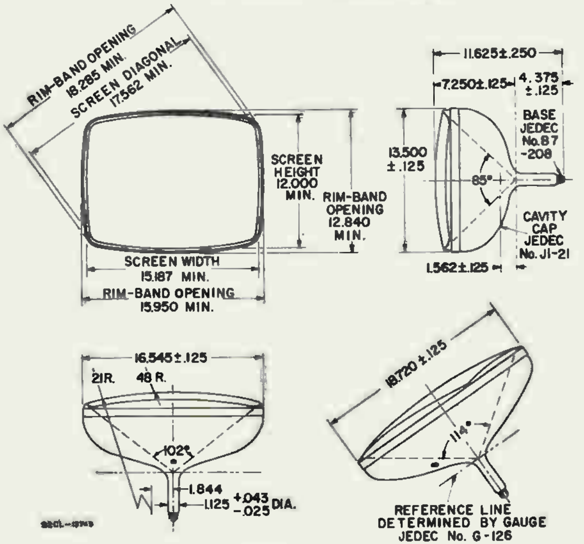
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ

[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 10.5-inch by 14-inch pattern from an RCA-2F21 monoscope, or equivalent.

DIMENSIONAL OUTLINE (BULB J149 FA)



DIMENSIONS IN INCHES

Picture Tube

PAN-O-PLY TYPE WITH MOUNTING LUGS **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 V	**450**	**mA**
Heater Warm-Up Time (Average)	**11**	**s**

Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

OPTICAL

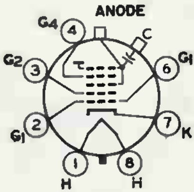
Phosphor. . . . . .P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate . . . . Filterglass
Light transmission at center (Approx.). 48%

MECHANICAL

Weight (Approx.). . . . . 15 lb
Overall Length. . . . . 11.625 ± .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.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



8HR

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
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		

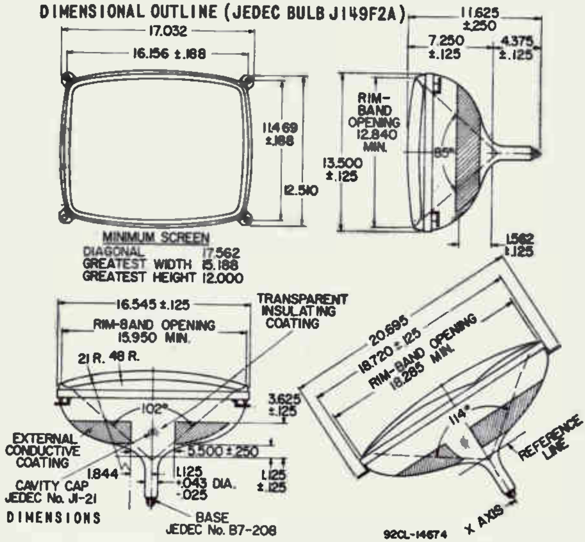
MAXIMUM CIRCUIT VALUE

Grid-No. 1 Circuit Resistance	1.5 max	MΩ

[a] Includes implosion protection hardware.

See *X-RADIATION PRECAUTIONS* at front of this section

DIMENSIONAL OUTLINE (JEDEC BULB J149F2A)



DIMENSIONS

Picture Tube

PAN-O-PLY TYPE **114° MAGNETIC DEFLECTION**

The 19GJP4A is the same as the 19DQP4 except for the following item:

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Anode Voltage.	10000 min—23000 max	V

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 an integral protective window[a]

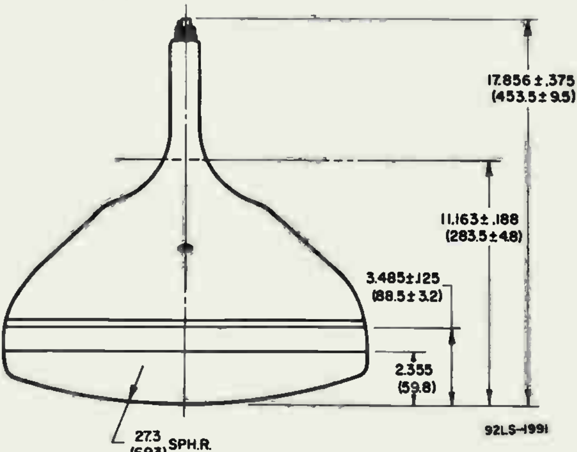
MECHANICAL

Tube Dimensions
Overall length . . . . . 17.856 ± .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.

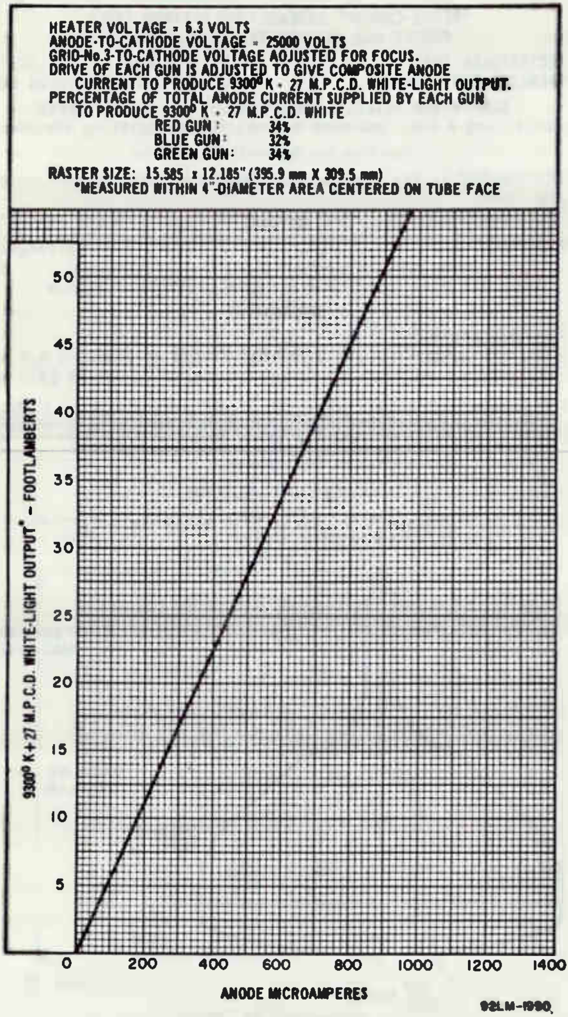
DIMENSIONAL OUTLINE

Dimensions shown are only those which are different from the corresponding dimensions for the 19GWP22



DIMENSIONS IN INCHES (mm)

Typical Light-Output Characteristic



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 µA

Grid-No.2 Current . . . . –5 to +5 µA

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 . . . . ±0.47 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. 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 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 *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.

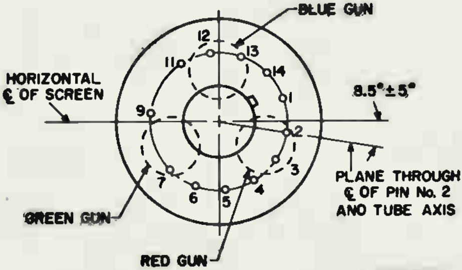
X-RADIATION WARNING

Because the 19HCP22 is designed to be operated at anode voltages as high as 27.5 kilovolts (design-maximum value), shielding of the 19HCP22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

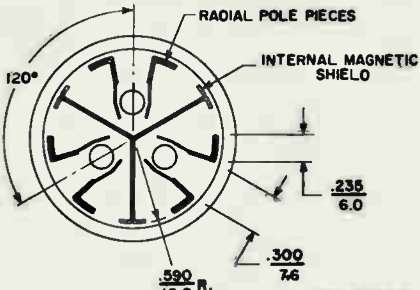
BASE SPECIFICATION (JEDEC No. 14BE)

Pin 1 - Heater
Pin 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, Grid No. 5, Screen, Collector)
C - External Conductive Coating

BOTTOM VIEW OF BASE



LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



NOTES FOR DIMENSIONAL OUTLINE

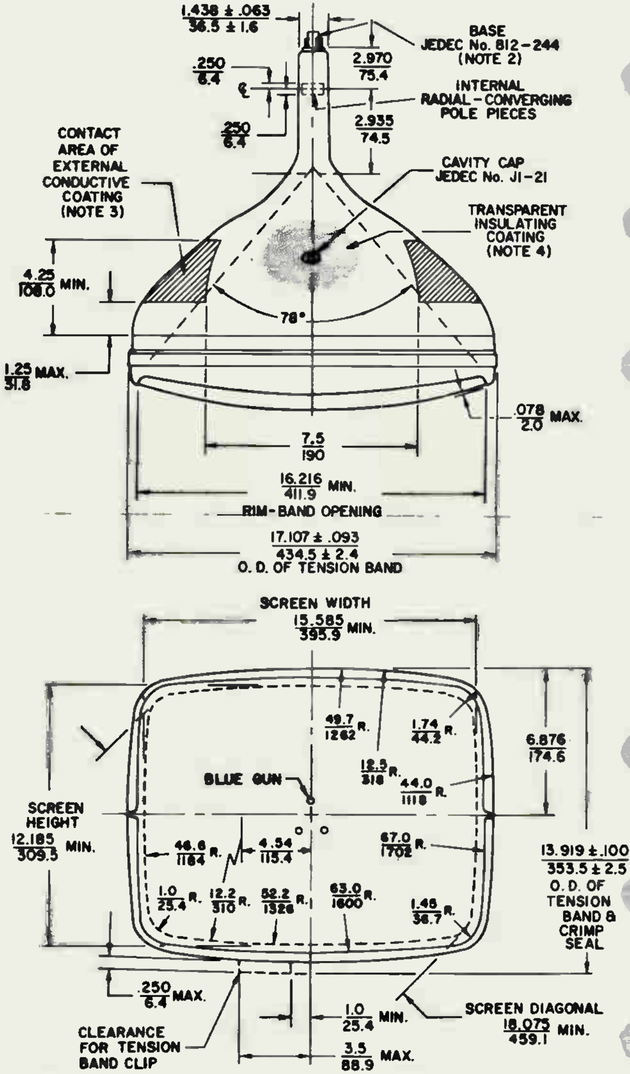
NOTE 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge JEDEC No.G162 and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C' of the gauge with the glass funnel.

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.

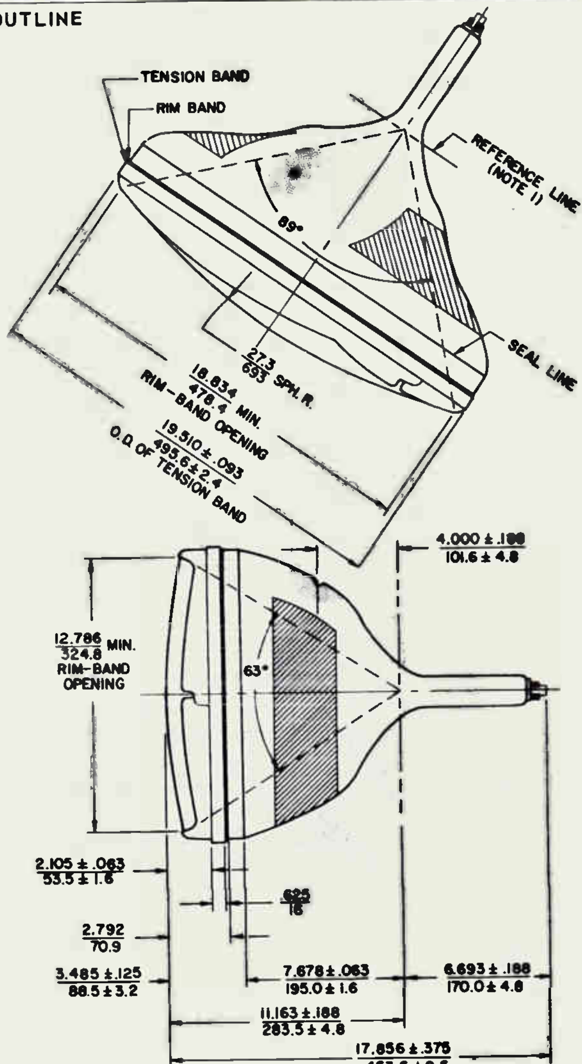
NOTE 3: The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

NOTE 4: To clean this area, wipe only with soft, dry, lintless cloth.

DIMENSIONAL



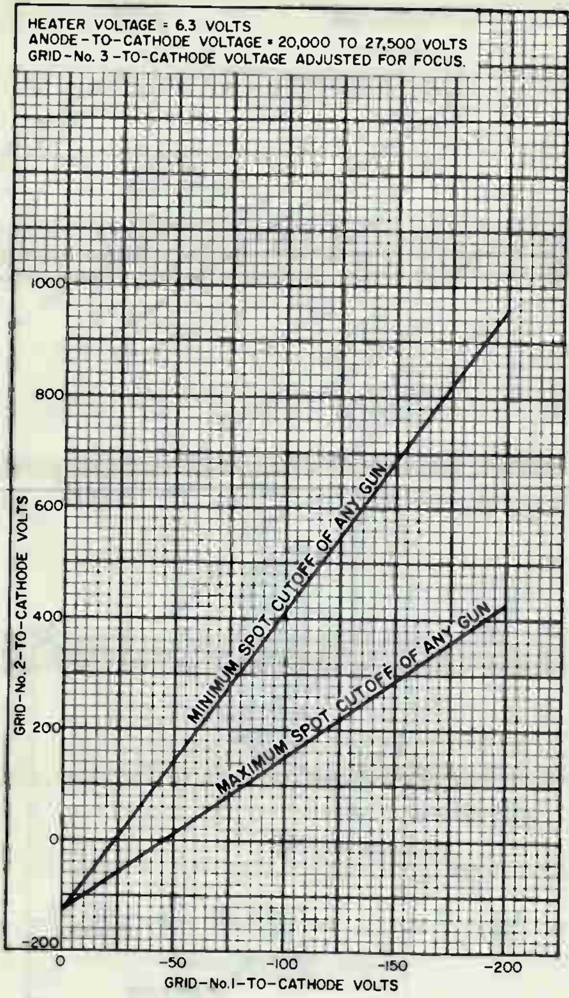
OUTLINE



Dimensions in Inches / mm

92LL-2095R2

CUTOFF DESIGN CHART



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. / 17 min.	kV / kV
Anode Current, Long-Term Average[b]	1000 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
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 Undeflected 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) . . . . ±60 μA

Grid-No.2 Current . . . . ±5 μA

Grid-No.1 Current . . . . ±5 μA

	Illum. D	Color	
To Produce White Light of	6550° K + 7 M.P.C.D.	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)
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	20 kV
Grid-No.4 Voltage	Adjusted for focus
Color Temperature	9300° 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 μA . . . . 44 fL / 151 Nit

Limiting Circuit Values

Low-Voltage Circuits:

Effective grid-No.1-to-cathode-circuit resistance (each gun) . . . . 0.75 max. MΩ

X-Radiation Characteristic:

Maximum Anode Voltage at which tha 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.

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.

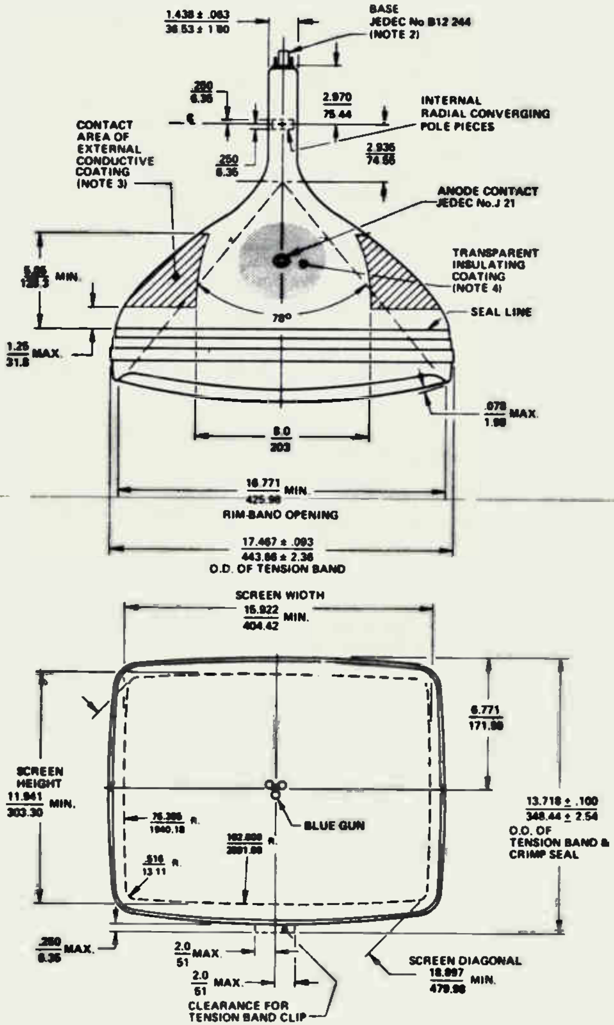
Note 3 — The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

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

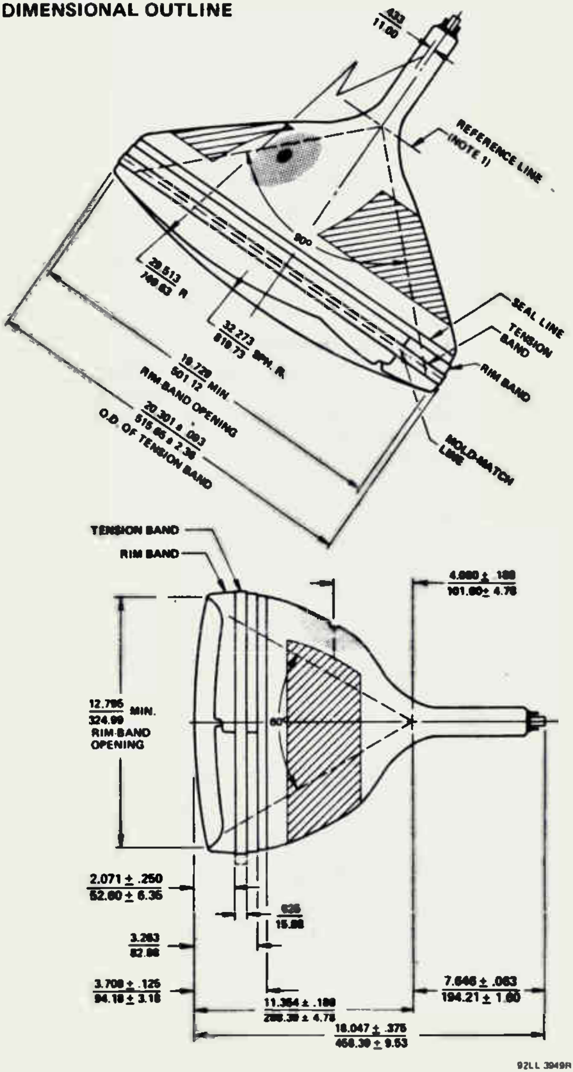
DIAGONAL	WIDTH	HEIGHT
$\frac{1.485}{37.72}$	$\frac{1.044}{26.52}$	$\frac{.582}{14.78}$

DIMENSIONAL OUTLINE

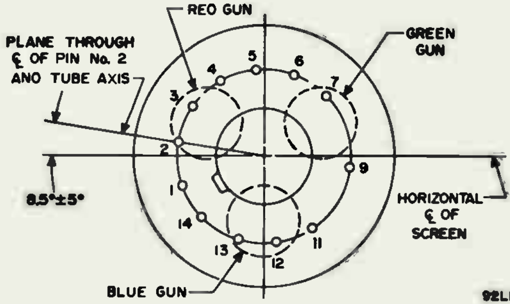


Dimensions in $\frac{\text{Inches}}{\text{mm}}$ unless otherwise noted

DIMENSIONAL OUTLINE



BOTTOM VIEW OF BASE

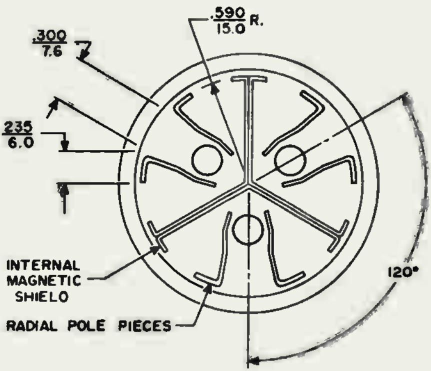


92LM-1252

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-COVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



92LM-1251R1

0.5 mR/h ISODOSE — RATE LIMIT CURVE

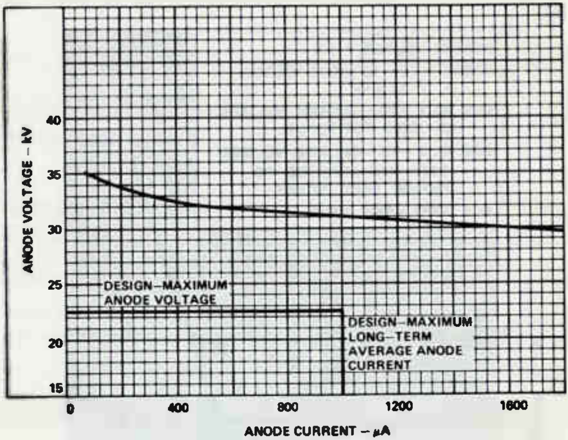


Figure 1

X-RADIATION LIMIT CURVE AT A CONSTANT ANODE CURRENT OF 300 µA (X-RADIATION AT A CONSTANT ANODE VOLTAGE VARIES LINEARLY WITH ANODE CURRENT)

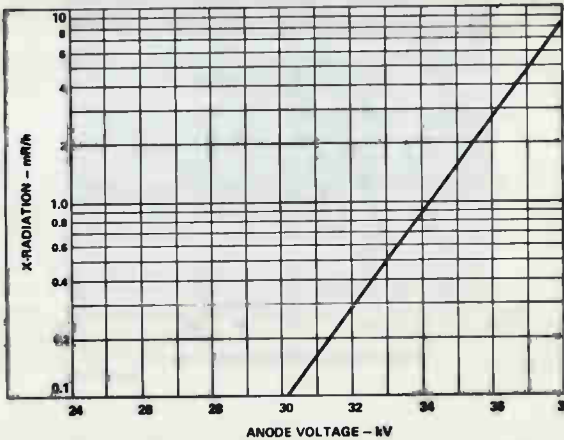
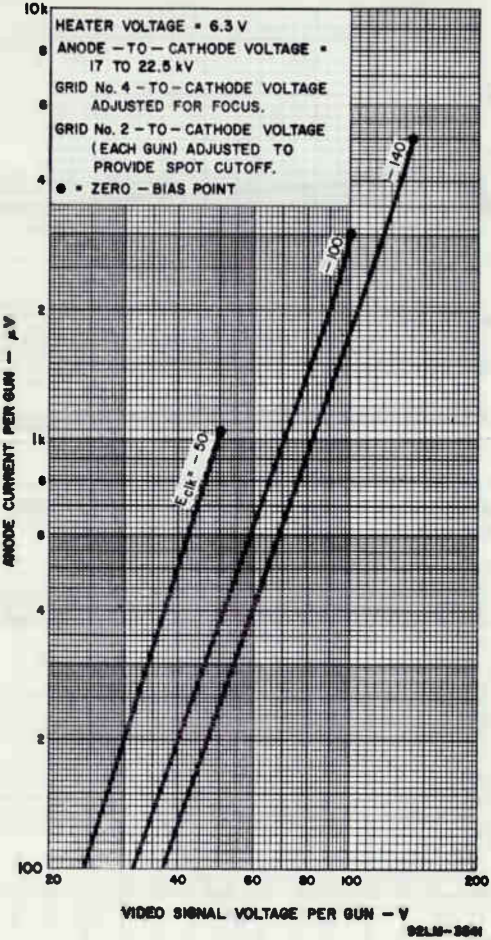


Figure 2

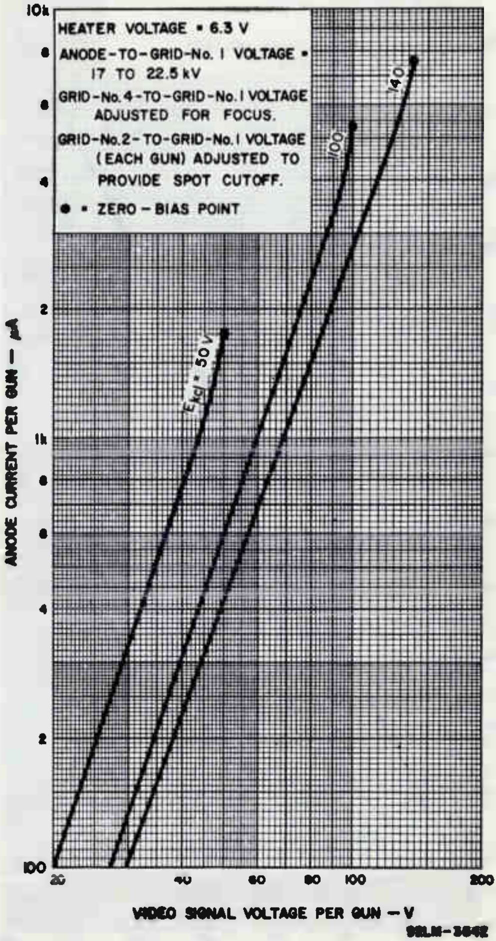
92LS-3296R1

TYPICAL DRIVE CHARACTERISTICS, GRID-DRIVE SERVICE



92LM-3641

TYPICAL DRIVE CHARACTERISTICS, CATHODE-DRIVE SERVICE



CUTOFF DESIGN CHART

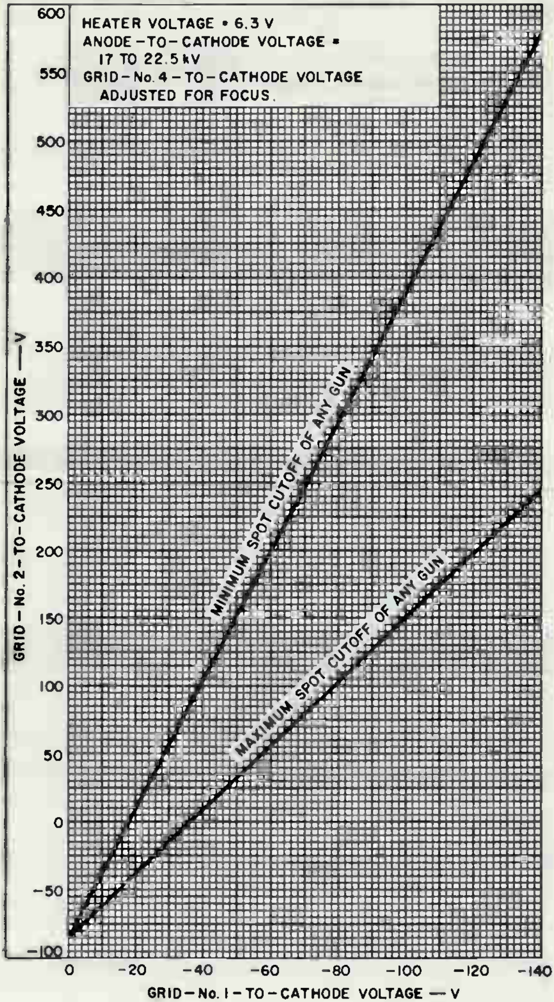


Figure 3

Color Picture Tube

Ultra-Rectangular — Hi-Lite Matrix Screen
4 x 3 Aspect Ratio — 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[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

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.	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 Undeflected 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 in 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)	±15 µA
Grid-No.2 Current	±5 µA
Grid-No.1 Current	±5 µA

	Illum. D	Color	
To Produce White Light of	6550° K + 7 M.P.C.D.	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)

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 . . . . 80 fL / 274 Nit

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° K + 27 M.P.C.D.

Limiting Circuit Values:

High-Voltage Circuits:
Grid-No.3 circuit resistance . . . . 7.5 max. MΩ

Low-Voltage Circuits:
Effective grid-No.1-to-cathode-circuit resistance (each gun) . . . . 0.75 max. MΩ

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.

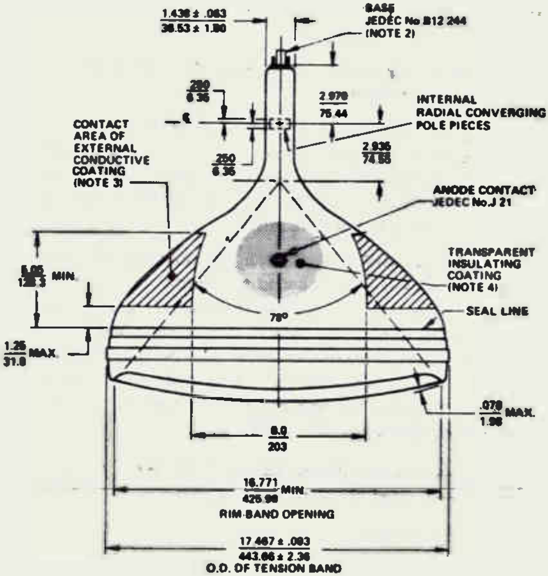
Note 3 – The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

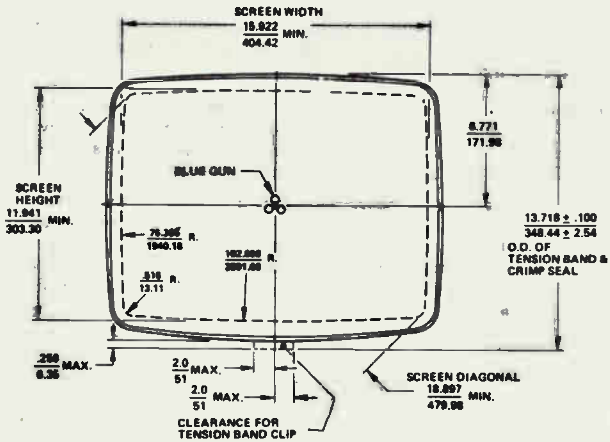
Note 4 – To clean this area, wipe only with soft, dry, lintless cloth.

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	$\frac{.582}{14.78}$

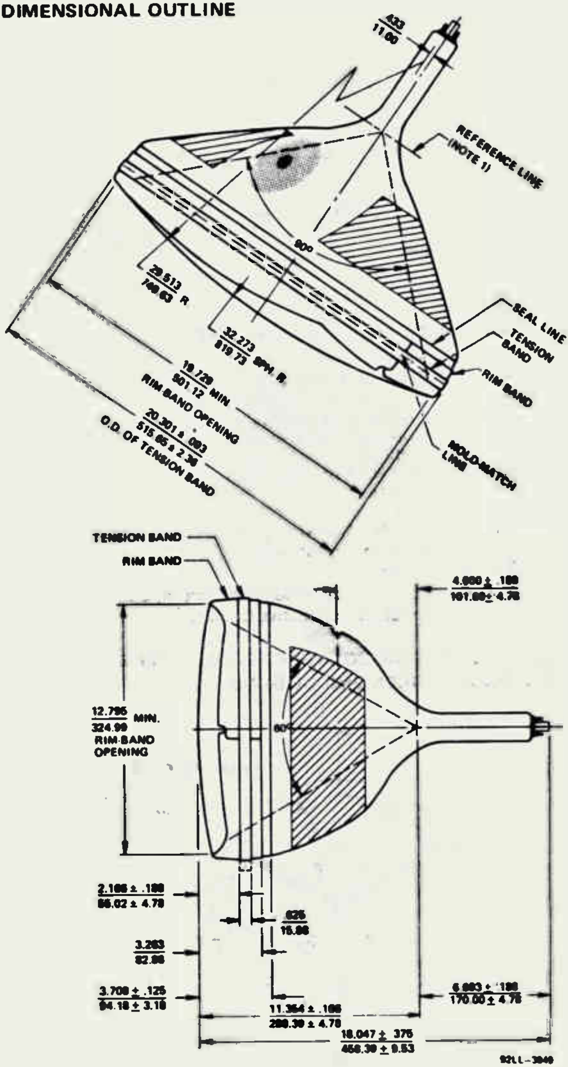
DIMENSIONAL OUTLINE



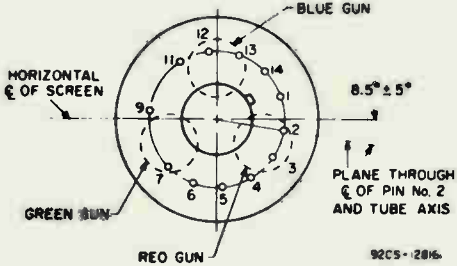


Dimensions in Inches/mm unless otherwise noted

DIMENSIONAL OUTLINE



BOTTOM VIEW OF BASE



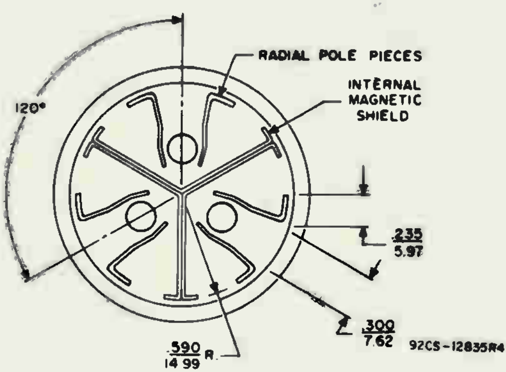
Base Specification – JEDEC No.14BE

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)

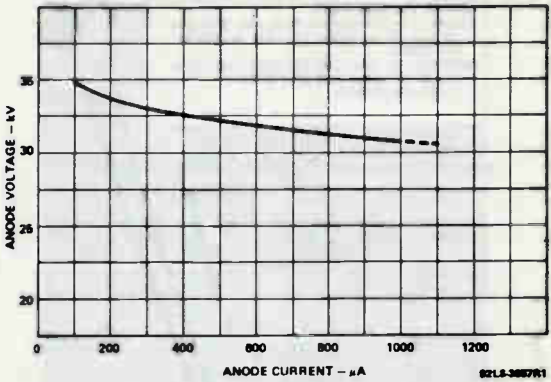


Figure 1

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)

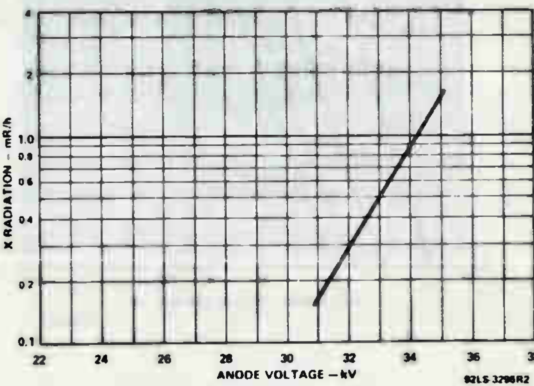
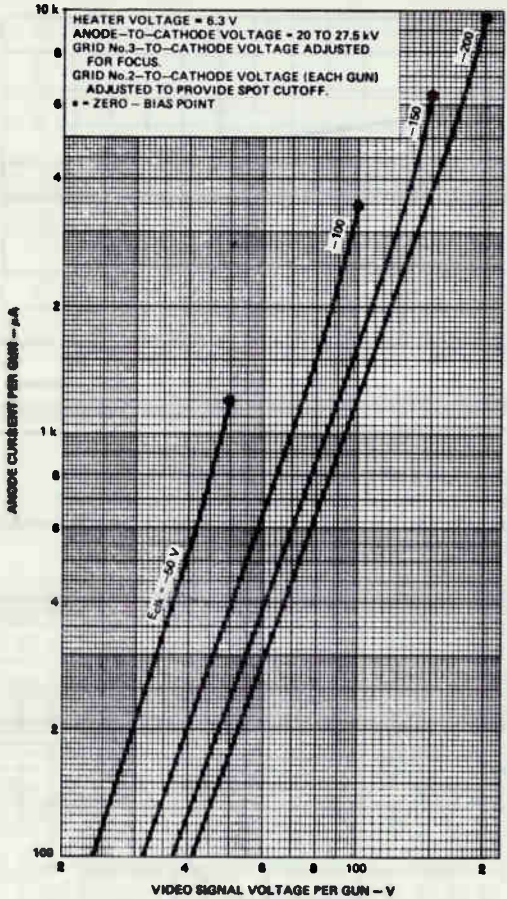
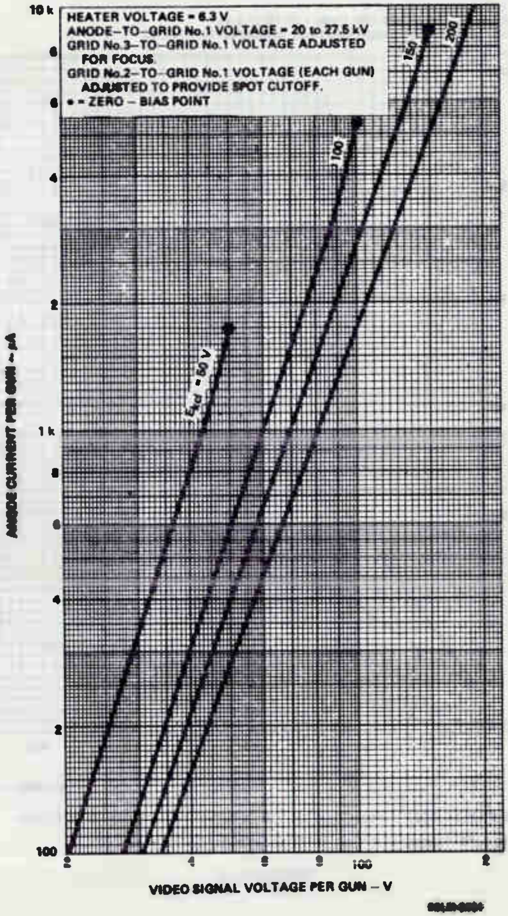


Figure 2

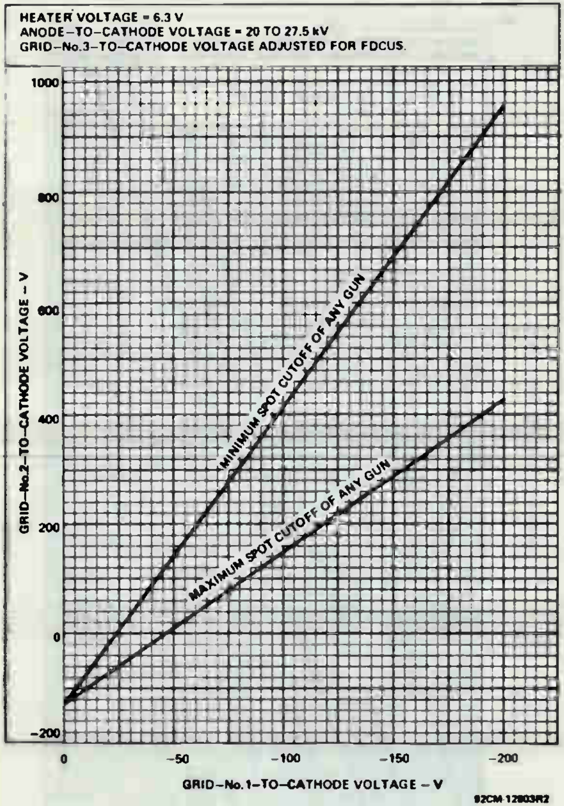
TYPICAL DRIVE CHARACTERISTICS, GRID-DRIVE SERVICE



TYPICAL DRIVE CHARACTERISTICS,
CATHODE-DRIVE SERVICE



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 — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 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.	μμf
	1000 min.	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.	volts
	11000 min.	volts
GRID-No.3 (FOCUSING) VOLTAGE:		
Positive value.	700 max.	volts
Negative value.	350 max.	volts
GRID-No.2 VOLTAGE	600 max.	volts
	300 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_{c_4k}) *of*	*16000*	*volts*
and grid-No.2 voltage (E_{c_2k}) *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.	volts
	11000 min.	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.	volts
	450 min.	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.	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-to-grid-No.1 voltage ($E_{c_ug_1}$) of	*16000*	*volts*
and grid-No.2-to-grid-No.1 voltage ($E_{c_2g_1}$) 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 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:

$$\sqrt{\frac{E_{c_4k} \text{ or } E_{c_4g_1} \text{ (volts)}}{16000 \text{ (volts)}}} \times 10 \text{ gausses}$$

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.

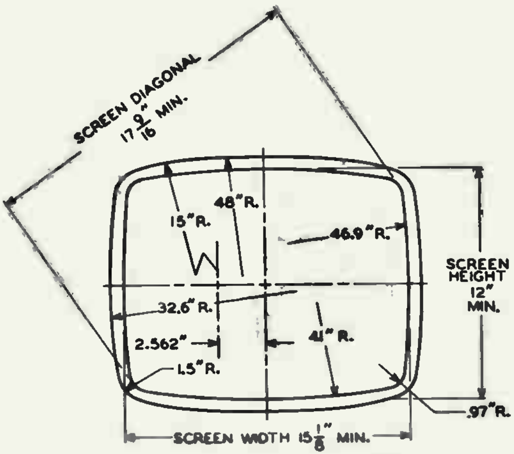
♠ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

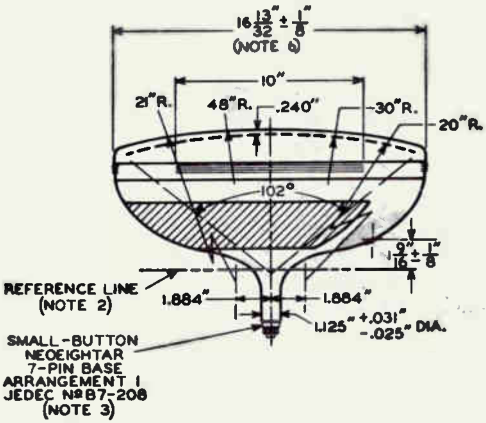
♠ See *Raster-Cutoff-Range Chart for Cathode-Drive Service*.

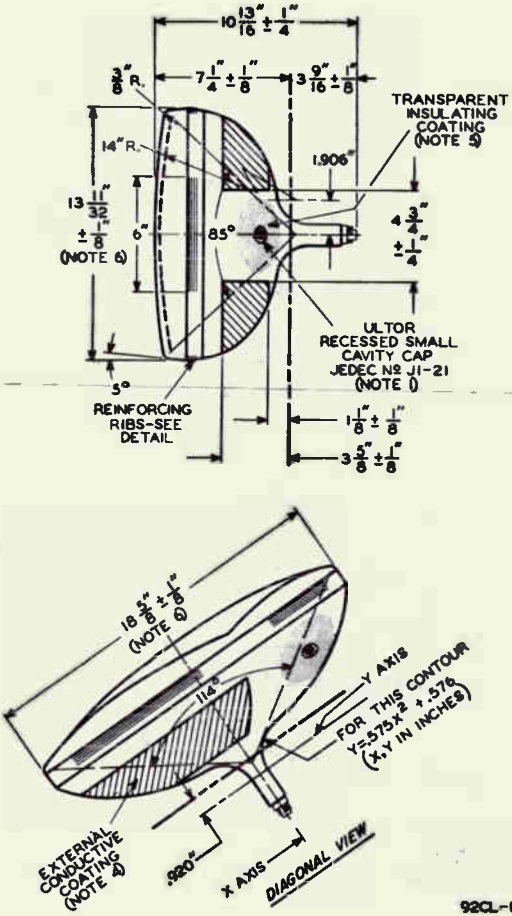
OPERATING CONSIDERATIONS

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 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.

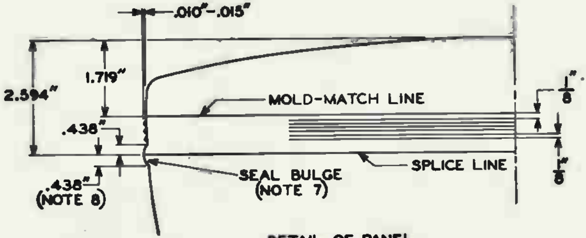

SCREEN DIAGONAL
17 9/16" MIN.
48"R.
15"R.
46.9"R.
SCREEN HEIGHT
12"
MIN.
32.6"R.
2.562"
41"R.
1.5"R.
.97"R.
SCREEN WIDTH 15 1/8" MIN.


16 13/32" ± 1/8"
(NOTE 6)
10"
21"R.
48"R.
.240"
30"R.
20"R.
102°
1 9/16" ± 1/8"
REFERENCE LINE
(NOTE 2)
1.884"
1.884"
1.125" +.031" -.025" DIA.
SMALL-BUTTON
NEOEIGHTAR
7-PIN BASE
ARRANGEMENT 1
JEDEC No B7-208
(NOTE 3)



$10\frac{13}{16}" \pm \frac{1}{4}"$
$\frac{3}{8}"$ R.
$7\frac{1}{4}" \pm \frac{1}{8}"$
$3\frac{9}{16}" \pm \frac{1}{8}"$
TRANSPARENT INSULATING COATING (NOTE 5)
14" R.
1.906"
$13\frac{11}{32}" \pm \frac{1}{8}"$ (NOTE 6)
6"
85°
$4\frac{3}{4}" \pm \frac{1}{4}"$
ULTOR RECESSED SMALL CAVITY CAP JEDEC Nº J1-21 (NOTE 1)
5°
REINFORCING RIBS-SEE DETAIL
$1\frac{1}{8}" \pm \frac{1}{8}"$
$3\frac{5}{8}" \pm \frac{1}{8}"$
$18\frac{5}{8}" \pm \frac{1}{8}"$ (NOTE 2)
114°
Y AXIS
FOR THIS CONTOUR $Y=.575X^2+.576$ (X,Y IN INCHES)
EXTERNAL CONDUCTIVE COATING (NOTE 4)
.920"
X AXIS
DIAGONAL VIEW

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 ± 30°. 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.

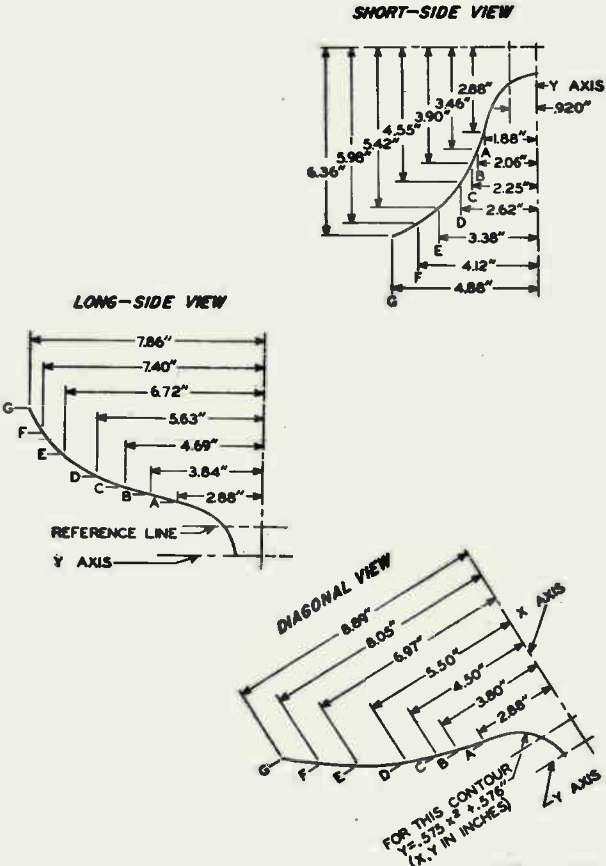
NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

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 SPACED FROM THE TUBE BY USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.

BULB-CONTOUR DIMENSIONS

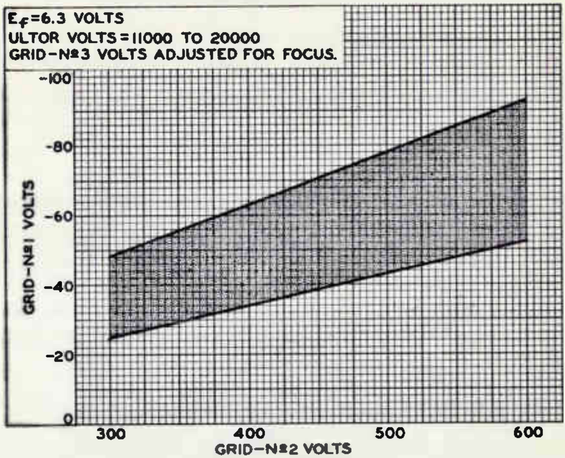


92CL-10669R1

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.

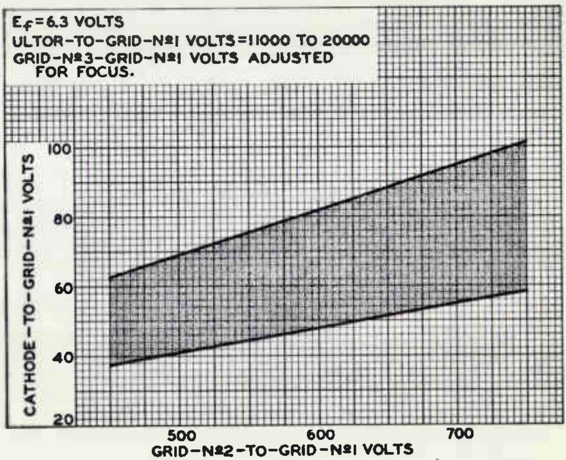
RASTER-CUTOFF-RANGE CHARTS

Grid-Drive Service



92CS-10[illegible]

Cathode-Drive Service



92CS-10818

Picture Tube

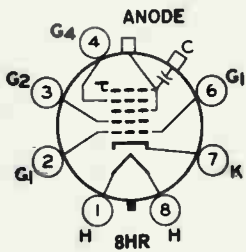
Pan-o-Ply Type — **Low-Voltage Electrostatic Focus**
114° Magnetic Deflection — **Low Grid-No.2 Voltage**

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.	pF
	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" ± .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



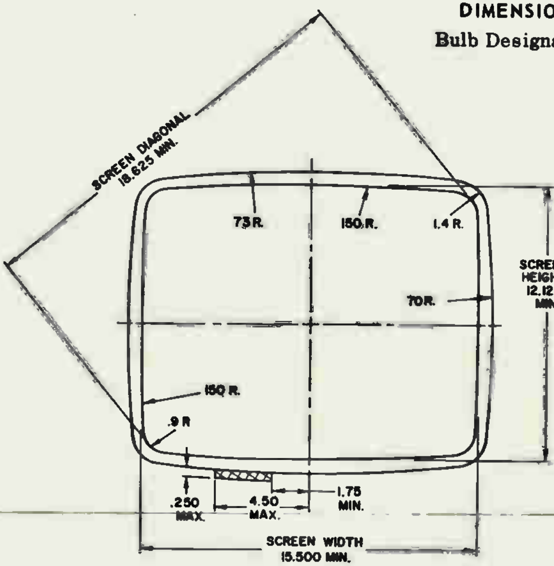
MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to grid No.1

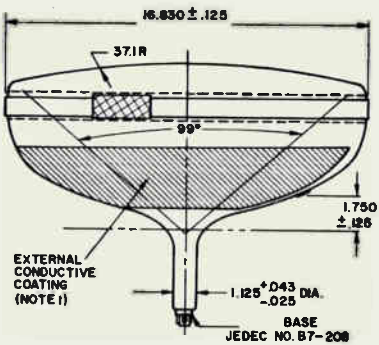
Anode Voltage	23,000 max.	V
	11,000 min.	V
Grid-No.4 Voltage:		
Positive value	1250 max.	V
Negative value	400 max.	V

DIMENSIONAL

Bulb Designation

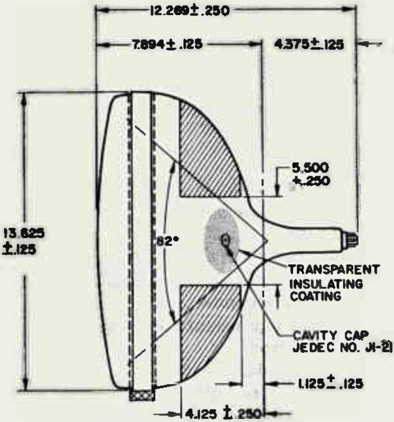


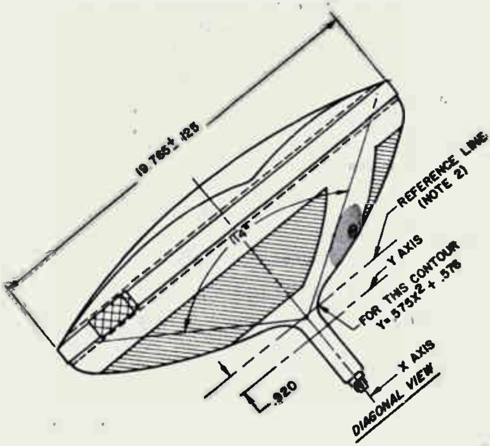
KEEP THIS SPACE CLEAR OF ANY MEHANICAL OBSTRUCTION



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.

MAXIMUM AND MINIMUM RATINGS (CONT'D)

Grid-No.2 Voltage	60 max. / 20 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	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

[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 11.25-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

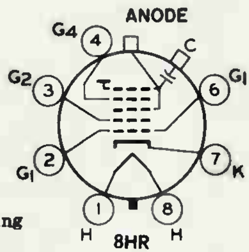
Direct Interelectrode Capacitances:

Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode[a]	2000 max.	pF
	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

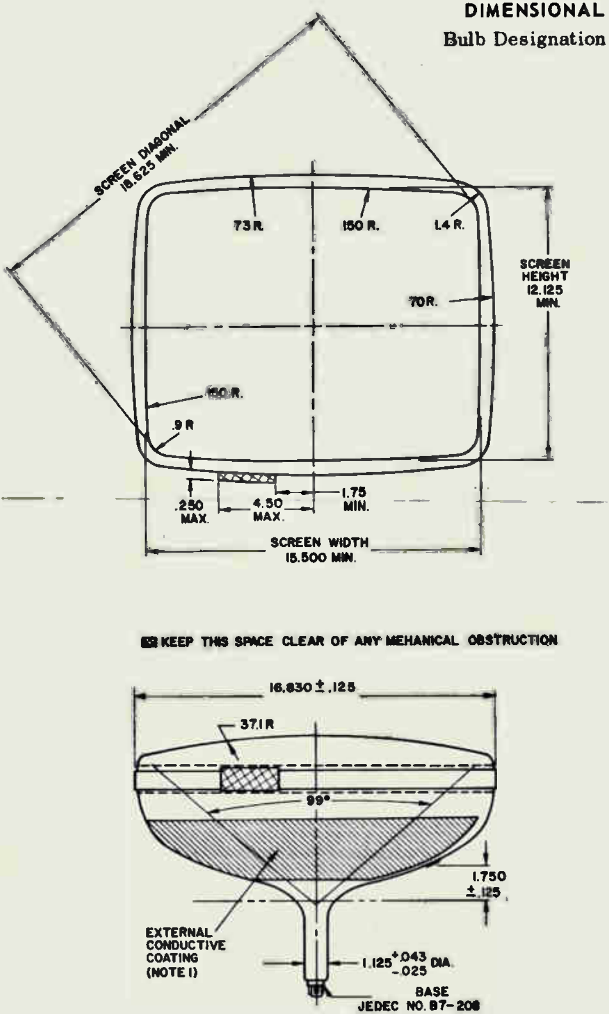


MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

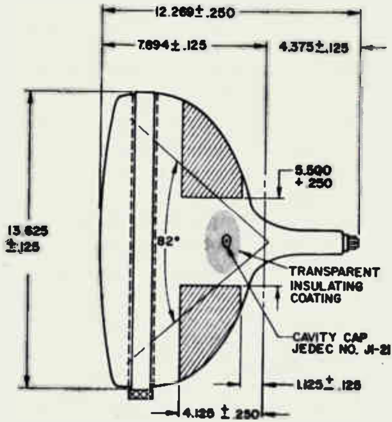
Unless otherwise specified, voltage values are positive with respect to cathode

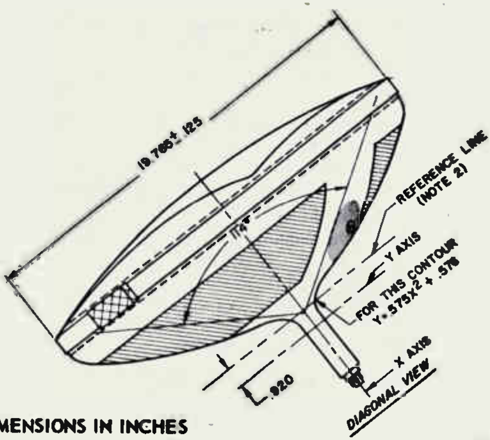
Anode Voltage	23,000 max.	V
	11,000 min.	V
Grid-No.4 Voltage:		
Positive value	1100 max.	V
Negative value	550 max.	V

DIMENSIONAL
Bulb Designation



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.

MAXIMUM AND MINIMUM RATINGS (CONT'D)

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	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

[a]Include 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 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

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.	pf
	2000 min.	pf
Electron Gun	Type Requiring No Ion-Trap Magnet	

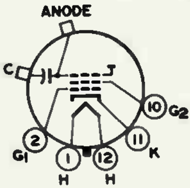
Optical:

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 . . . . 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 *Picture-Tube Dimensional-Outlines* and *Bulb J171 D/E* 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

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

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 — **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS — **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

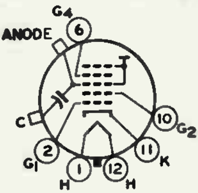
Optical:

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

Maximum Ratings, ***Design-Maximum Values:***

Anode 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 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

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

Picture Tube

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE — **ALUMINIZED SCREEN**
MAGNETIC FOCUS — **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.	2500 max.	pf
	2000 min.	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

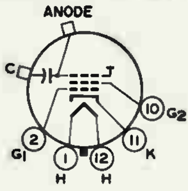
Optical:

Phosphor (For curves, see front of this Section). . .P4—Sulfide Type, Aluminized
Faceplate, Spherical . . . . .Filterglass
Light transmission (Approx.) 74%
Surface of Protective Window . . . . .Treated to reduce specular reflection

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 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

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 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~~

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section

21AXP22-A
COLOR KINESCOPE

For dynamic convergence† (Cont'd):

Vertical:

Sawtooth amplitude to provide°° . . . . 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°° . . 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:

For ultor voltage of	*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.

●,♦,†,▲,°°: See next page.

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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 (oo).

♣ 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.

oo 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.

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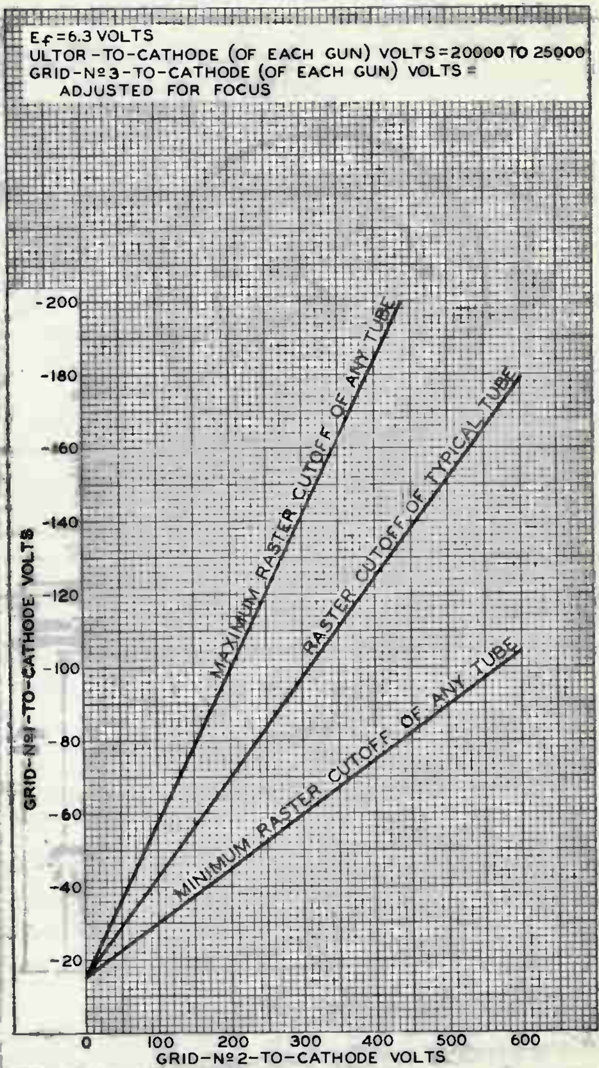
21AXP22-A

CUTOFF DESIGN CHART



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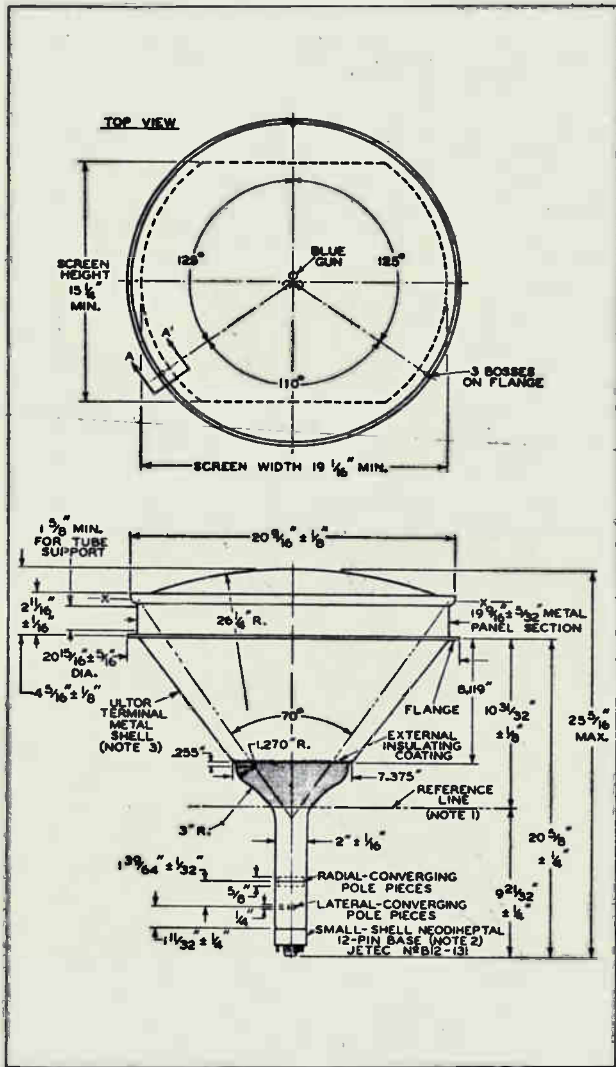
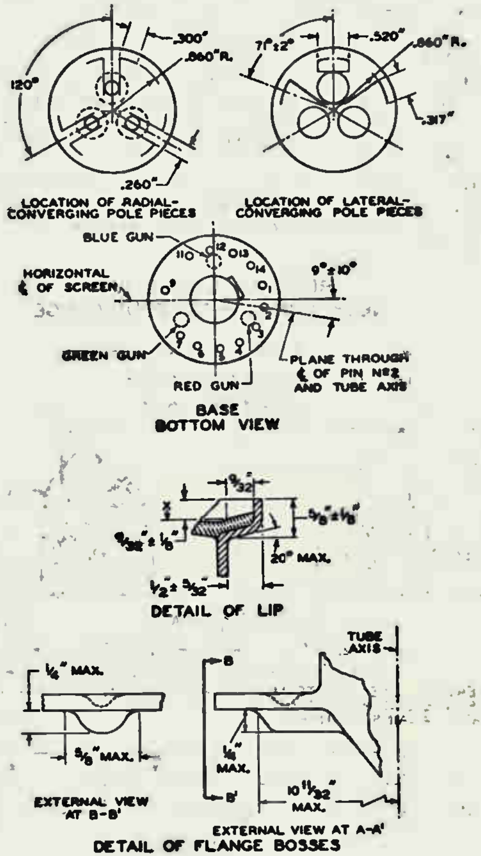


21AXP22-A
COLOR KINESCOPE



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21AXP22-A

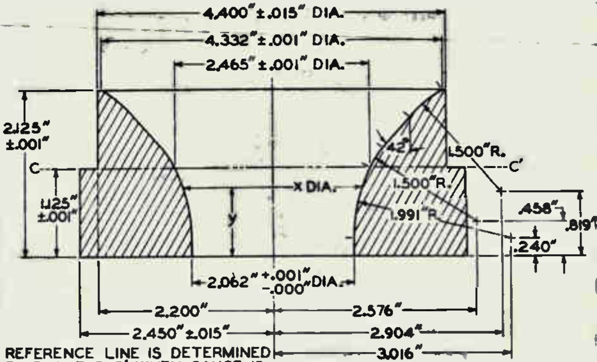
COLOR KINESCOPE

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



REFERENCE LINE IS DETERMINED BY PLANE C-C' WHEN GAUGE IS SEATED AGAINST FUNNEL

92CM-8844

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"

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21AXP22-A

COLOR KINESCOPE

y	x
0.875"	2.258" ± 0.001"
1.000"	2.352" ± 0.001"
1.125"	2.465" ± 0.001"
1.250"	2.604" ± 0.001"
1.375"	2.778" ± 0.001"
1.500"	2.990" ± 0.001"
1.625"	3.216" ± 0.001"
1.750"	3.440" ± 0.001"
1.875"	3.678" ± 0.001"
2.000"	3.958" ± 0.001"
2.125"	4.332" ± 0.001"

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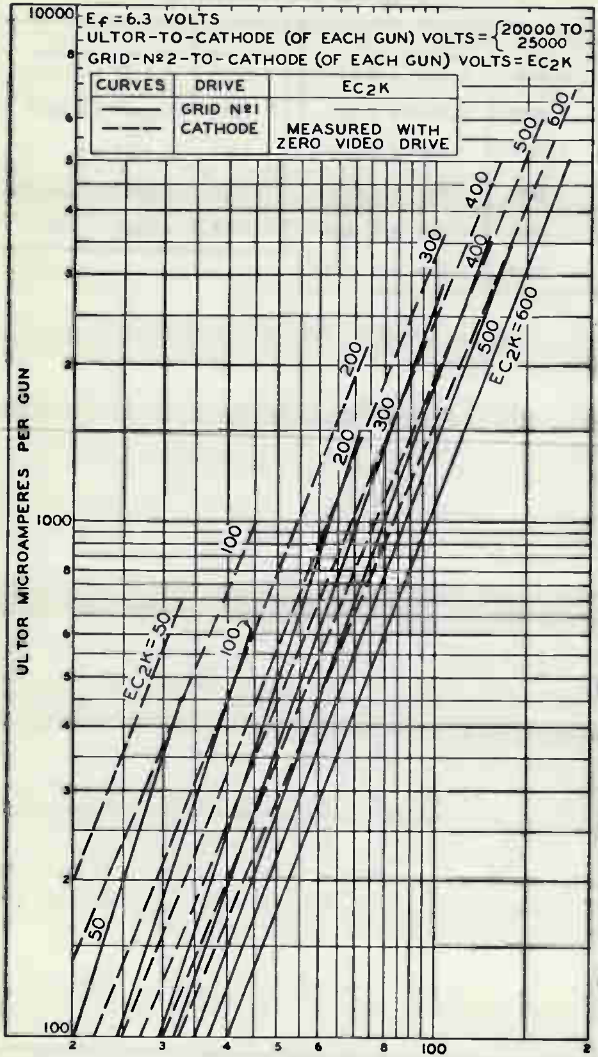
21AXP22-A

TYPICAL DRIVE CHARACTERISTICS



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21AXP22-A

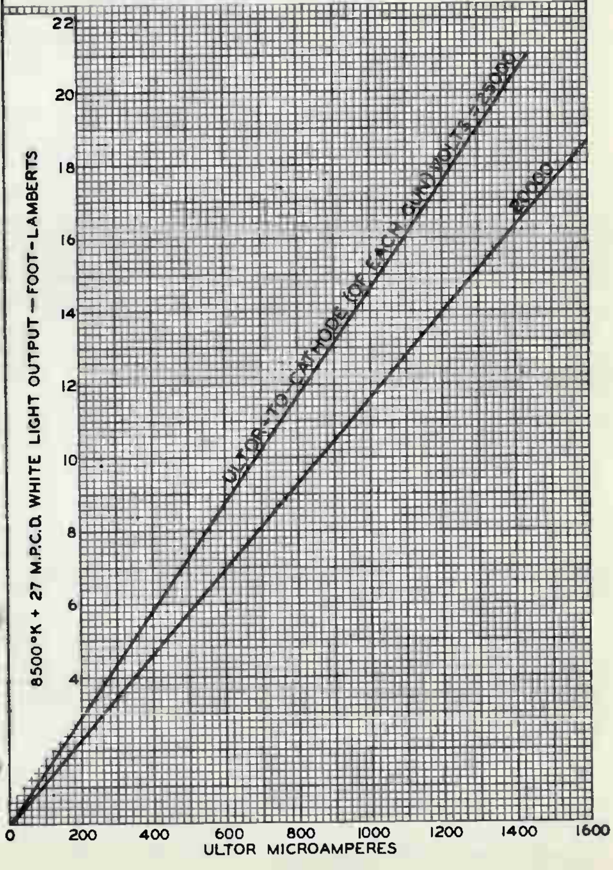
21AXP22-A

TYPICAL LIGHT-OUTPUT CHARACTERISTICS

E_f = 6.3 VOLTS
GRID-No. 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"



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21AXP22-A/21AXP22

COLOR PICTURE TUBE

THREE-GUN SHADOW-MASK TYPE — ELECTROSTATIC FOCUS
MAGNETIC CONVERGENCE — MAGNETIC DEFLECTION
ALUMINIZED TRICOLOR PHOSPHOR-DOT SCREEN

Replacement for Types 21AXP22 & 21AXP22-A

DATA

General:

Electron Guns, Three with Axes Tilted Toward Tube Axis	Red, Blue, Green
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 ± 10% amp
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	Red, Blue, Green
Persistence of group phosphorescence	Medium
Dot arrangement	Triangular group consisting of red dot, blue dot, and green 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" ± 1/8"
At flange	20-15/16" ± 5/16"
Weight (Approx.)	28 lbs
Operating Position	Tube axis horizontal (Base pin 12 on top)
Ultor Terminal	Metal Shell
Socket	Alden Nos. 214NMINSC (Radial leads), 214NMINC (Axial leads), or equivalent

♦ For Curves, see front of this Section.

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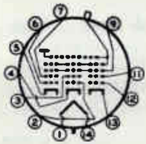
21AXP22-A/21AXP22

COLOR PICTURE TUBE

Base. . . . Small-Shell Neodiheptal 12-Pin (JEDEC No.B12-131)
Basing Designation for BOTTOM VIEW. 14W

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
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

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 50,000 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.

Low-Voltage Circuits:

Grid-No.1-Circuit Resistance (Each gun) . .	1.5 max.	megohms

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21AXP22-A/21AXP22

COLOR PICTURE TUBE

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.

X-RAY WARNING

X-ray radiation is produced by the 21AXP22-A/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 television 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 television 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.

[illegible]

[illegible]

[illegible]

21CBP4A

Picture Tube

RECTANGULAR GLASS TYPE — **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS — **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

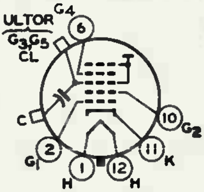
Optical:

Faceplate, Spherical. . . . . Filterglass
  Light transmission (Approx.). 74%
Phosphor (For curves, see front of this Section) . P4—Sulfide Type, Aluminized

Mechanical:

Operating Position. . . . . Any
Weight (Approx.). 24 lbs
Overall Length. 18" ± 3/8"
Neck Length . . . . 5-1/2" ± 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 D/E* 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

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.	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 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

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

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21CEP4

PICTURE TUBE

RECTANGULAR GLASS TYPE | ALUMINIZED SCREEN
LOW-VOLTAGE 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 μμf
- Cathode to all other electrodes . . . . . 5 μμf
- External conductive coating to ultor . . . {2500 max. μμf / 2000 min. μμf}

Faceplate, Spherical . . . . Filterglass
- Light transmission (Approx.) 73%

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 . . . . 14-7/16" ± 5/16"
- Greatest width . . . . 20-1/4" ± 1/8"
- Greatest height . . . . 16-3/8" ± 1/8"
- Diagonal . . . . 21-3/8" ± 1/8"
- Neck length . . . . 5-7/16" ± 1/8"

Screen Dimensions (Minimum):
- Greatest width . . . . 19-1/16"
- Greatest height . . . . 15-1/16"
- Diagonal . . . . 20-1/4"
- Projected area . . . . 262 sq. in.

Weight (Approx.) . . . . 23 lbs

Mounting Position . . . . Any

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

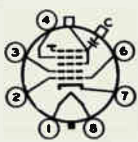
Bulb . . . . J171 (110°)

Socket . . . . Ucinite Part No.115446, or equivalent

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 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater



Cap – Ultor (Grid No.3, Grid No.5, Collector)
C – External Conductive Coating

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

21CEP4

PICTURE TUBE

GRID-DRIVE▲ SERVICE

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

Maximum Ratings, ***Design-Center Values:***

ULTOR VOLTAGE	18000	max.	volts
	12000♦	min.	volts
GRID-No.4 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	180	max.	volts
Heater positive with respect to cathode	180	max.	volts

Equipment Design Ranges:

With any ultor voltage ($E_{c_5}k$) between 12000 and 18000 volts and grid-No.2 voltage ($E_{c_2}k$) between 200 and 500 volts

Grid-No.4 Voltage for Focus§	0 to 400	volts
Grid-No.1 Voltage ($E_{c_1}k$) 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 $E_{c_1}k$ except video drive is a positive voltage	
Grid-No.4 Current	-25 to +25	μa
Grid-No.2 Current	-15 to +15	μa
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	0 to 400	0 to 400	volts
Grid-No.1 Voltage for Visual Extinction of Focused Raster	-28 to -72	-36 to -94	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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21CEP4

PICTURE TUBE

With ultor voltage of	*14000*	*16000*	*volts*
and grid-No.2 voltage of	*300*	*400*	*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

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	18000	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.	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 18000 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§	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 drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

§ 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.

•,*: See next page.

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PICTURE TUBE

Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level): White-level value. . . .	Same value as determined for E_{kg_1} except video drive is a negative voltage		
Grid-No.4 Current.	-25 to +25		μa
Grid-No.2 Current.	-15 to +15		μa
Field Strength of Adjustable Centering Magnet* .	0 to 8		gausses

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. . .	0 to 400	0 to 400	volts
Cathode-to-Grid-No.1 Voltage for Visual Extinction of Focused Raster	28 to 60	36 to 78	volts
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

● 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 21CEP4 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.

* 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

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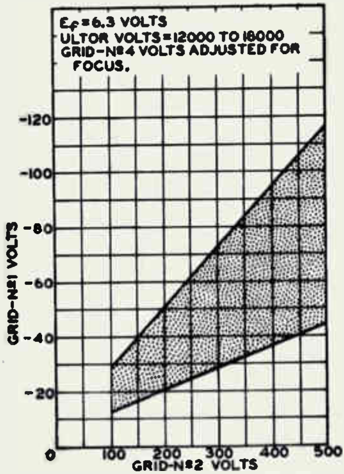
21CEP4

RASTER-CUTOFF-RANGE CHARTS

GRID-DRIVE SERVICE



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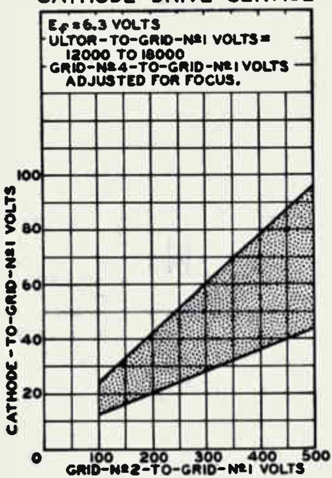
CATHODE-DRIVE SERVICE



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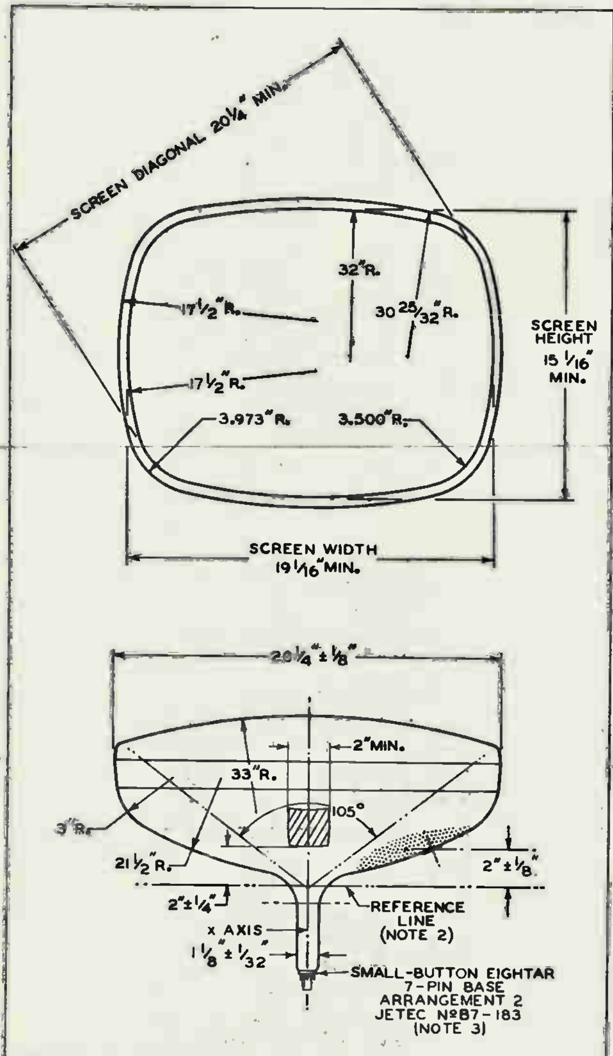
PICTURE TUBE



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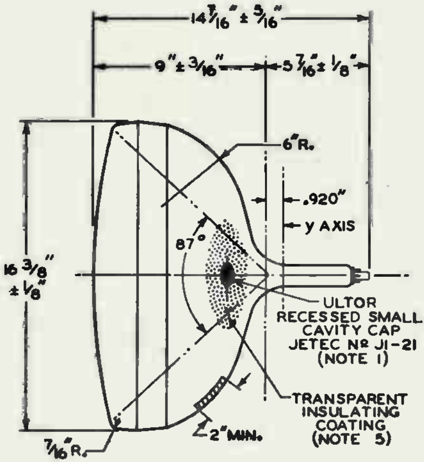
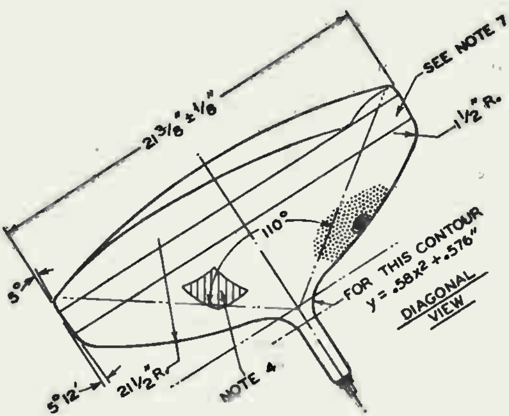
PICTURE TUBE





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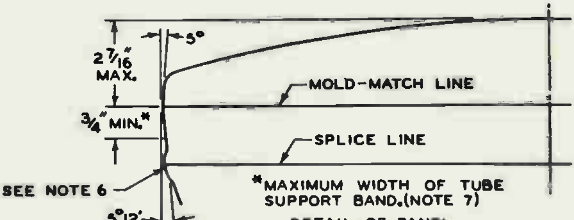
21CEP4

PICTURE TUBE



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 ± 30°. 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 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: 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.

NOTE 7: UNDISTURBED AREA BETWEEN MOLD-MATCH LINE AND SPLICE LINE IS 3/4" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF TUBE SUPPORT BAND.

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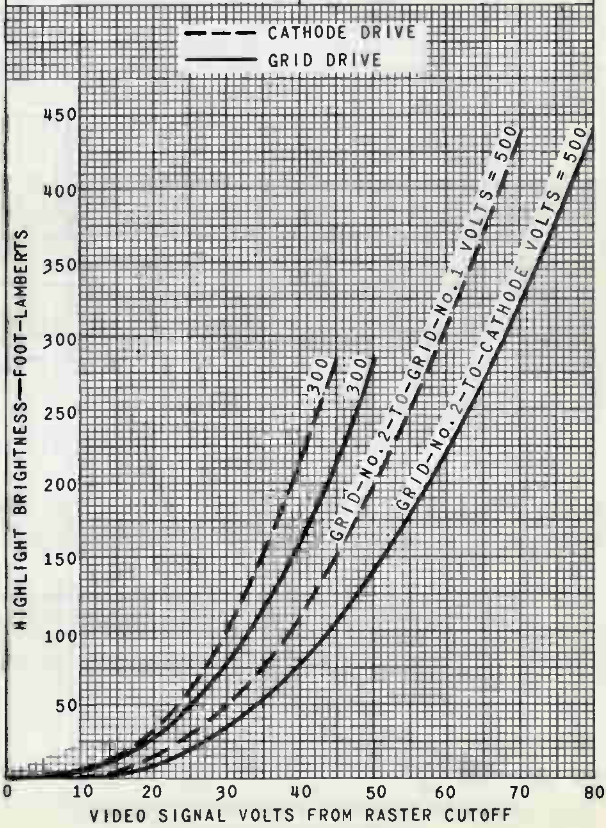
21CEP4
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-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 = 18"x13-1/2"	E_f = 6.3 VOLTS ULTOR VOLTS = 16000 GRID No.1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF. RASTER FOCUSED AT AVERAGE BRIGHTNESS. RASTER SIZE = 18"x13-1/2"



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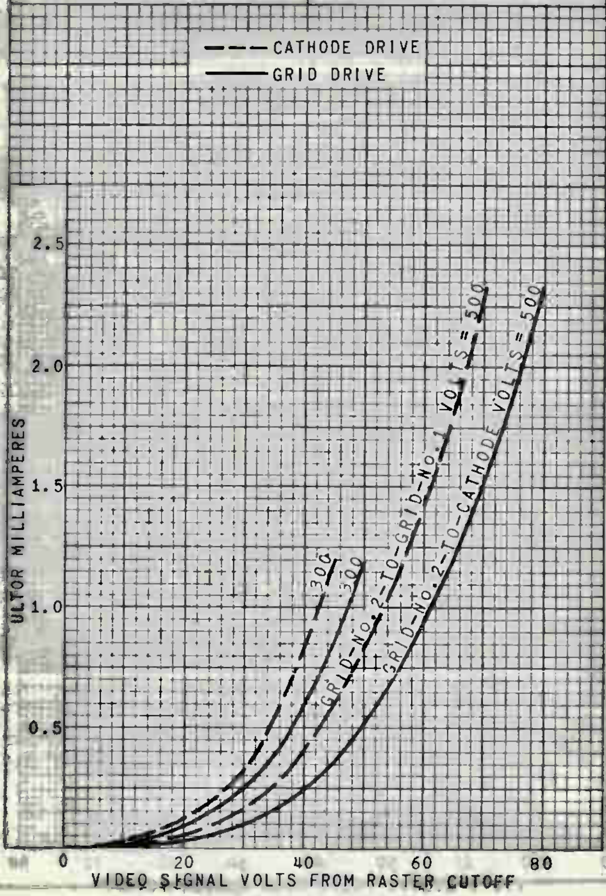
21CEP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS ULTOR-TO-GRID-No.1 VOLTS = 12000 TO 18000 CATHODE BIASED POSITIVE WITH RESPECT TO GRID No.1 TO GIVE FOCUSED RASTER CUTOFF.	E_f = 6.3 VOLTS ULTOR VOLTS = 12000 TO 18000 GRID No.1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.



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21CQP4
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 ± 5%	amp
Warm-up time (Average)	11	sec
Capacitance between External Conductive Coating and Ultor	2500 max.	μμf
	2000 min.	μμf
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.B6-185)	
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

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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
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

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

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:

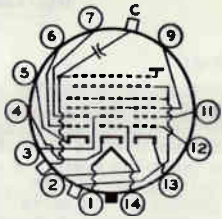
Electron Guns, Three with Axes Tilted Toward Tube Axis	Blue, Green, Red	
Heater, for Unipotential Cathode of Each Gun, Paralleled with Each of the Other Two Heaters within Tube:		
Voltage (AC or DC)▲	6.3	volts
Current at 6.3 volts	1.6	amp
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 of any gun to all other electrodes except the No.1 grids of the other two guns	7	μμf
Cathode of blue gun + cathode of green gun + cathode of red gun to all other electrodes	16	μμf
Grid No.3 (Of each gun tied within tube to No.3 grids of other two guns) to all other electrodes	9	μμf
External conductive coating to grid No.6	2500 max.	μμf
	2000 min.	μμf

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 VIEW 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
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)
Cap* 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

Equipment Design Ranges:

With ultor voltage (E_{c_4k} each gun) between 20000♦ and 25000 volts

Grid-No.3 (Focusing Electrode)-to-Cathode (Of each gun) Voltage. .	16.8% to 20% of E_{c_4k} each gun	volts
Grid-No.2-to-Cathode Voltage (Each gun) when circuit design utilizes grid-No.1-to-cathode voltage (E_{c_1k}) 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_{c_2k}) at fixed value.	See *Cutoff Design Chart*	
Variation in Raster Cutoff Between Guns in Any Tube.	± 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:		
To Produce White of 8500° K + 27 M.P.C.D. (CIE Coordinates x = 0.287, y = 0.316):		
Red gun.	49	%
Blue gun	18	%
Green gun.	33	%

Ratios of Cathode Currents:

To Produce White of 8500° K + 27 M.P.C.D. (CIE Coordinates x = 0.287, y = 0.316):●	*Min.*	*Typical*	*Max.*
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

Maximum Required Displacements of Beam Trios with Respect to Associated Phosphor-Dot Trios:
Uniform in any direction over entire screen area . . . . 0.005"♠

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 parabola 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:

For ultor voltage of	*20000*	*25000*	*volts*
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 continous 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.

The maximum dc current capability of the high-voltage power supply should be limited to a value of 1100 μa 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 ± 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 ± 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.

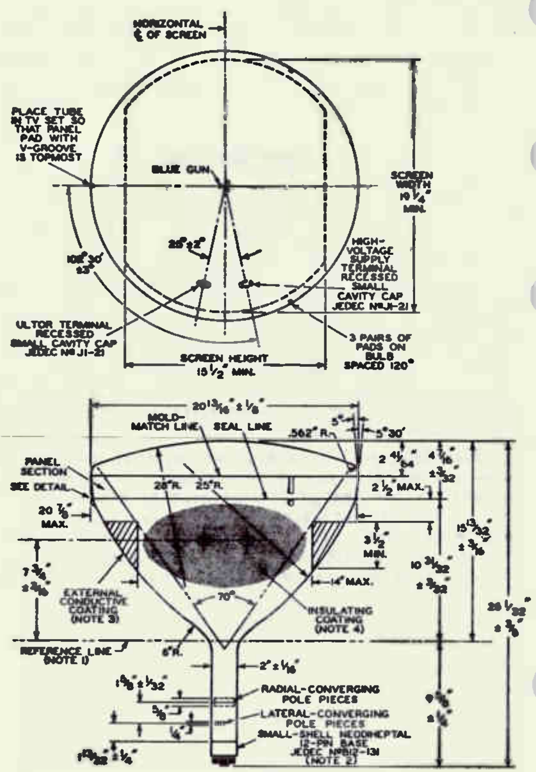
GENERAL CONSIDERATIONS

X-Ray-Warning. Because this color picture tube is designed to be operated at ultor 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.

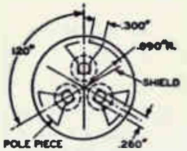
Shatter-Proof Cover Over the Tube Face. Following conventional picture-tube practice, it is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of this color picture tube to protect it from being struck accidentally and to protect against possible damage resulting 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.

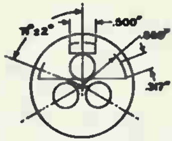
REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE
for Type 21CYP22-A is the same as that shown for Type 21AXP22-A



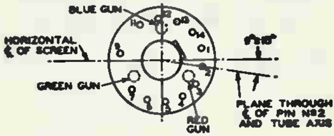
HORIZONTAL ℄ OF SCREEN
PLACE TUBE IN TV SET SO THAT PANEL PAD WITH V-GROOVE IS TOPMOST
BLUE GUN
SCREEN WIDTH 19 1/4" MIN.
HIGH-VOLTAGE SUPPLY TERMINAL RECESSED SMALL CAVITY CAP JEDEC No J1-21
ULTOR TERMINAL RECESSED SMALL CAVITY CAP JEDEC No J1-21
SCREEN HEIGHT 15 1/2" MIN.
3 PAIRS OF PADS ON BULB SPACED 120°
MOLD-MATCH LINE
SEAL LINE
PANEL SECTION
SEE DETAIL
EXTERNAL CONDUCTIVE COATING (NOTE 3)
INSULATING COATING (NOTE 4)
REFERENCE LINE (NOTE 1)
RADIAL-CONVERGING POLE PIECES
LATERAL-CONVERGING POLE PIECES
SMALL-SHELL NEODIHEPTAL 12-PIN BASE JEDEC No B12-131 (NOTE 2)



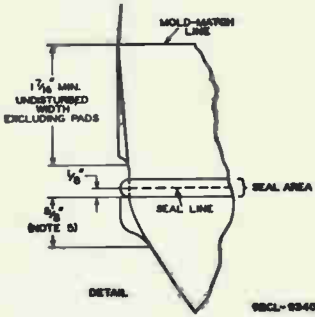
LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



LOCATION OF LATERAL-CONVERGING POLE PIECES WITH RESPECT TO GUNS



BASE BOTTOM VIEW



DETAIL

92CL-9340R2

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.

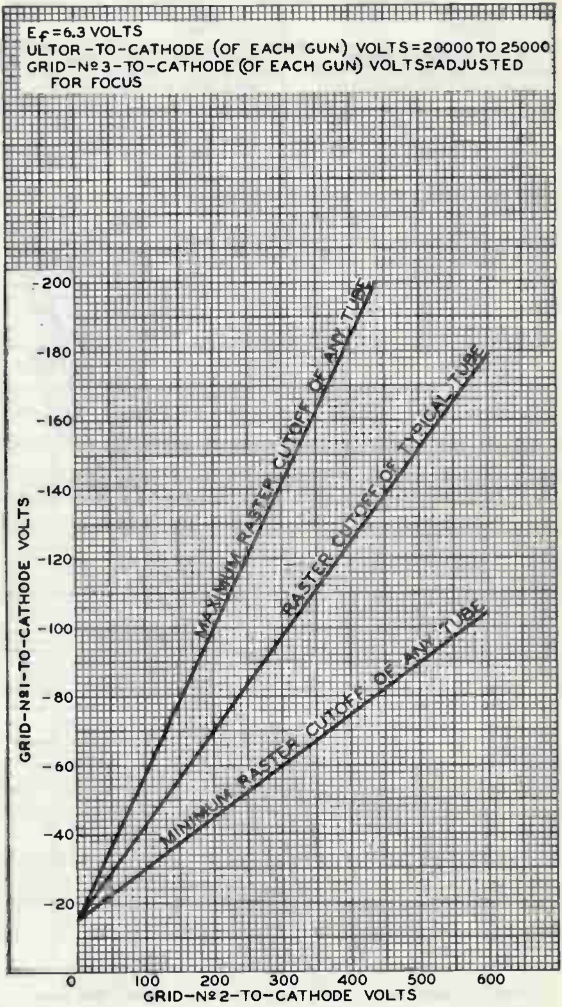
NOTE 2: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 3".

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".

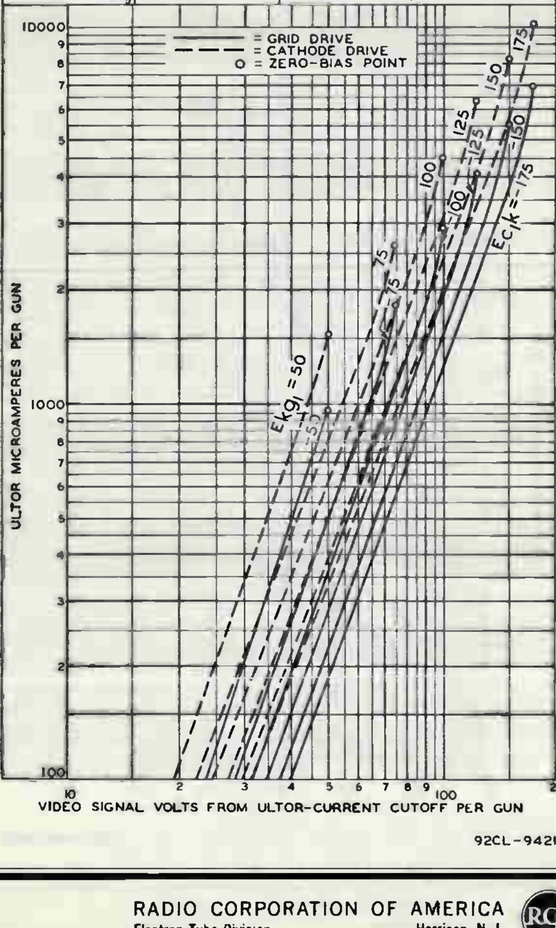
CUTOFF DESIGN CHART



92CM-8565R1

TYPICAL DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS	E_f = 6.3 VOLTS
ULTOR-TO-GRID-No1 (OF EACH GUN) VOLTS = 20000 TO 25000	ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 20000 TO 25000
GRID-No3-TO-GRID-No1 (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS	GRID-No3-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS
GRID-No2-TO-GRID-No1 VOLTS (EACH GUN) = ADJUSTED TO PROVIDE ULTOR-CURRENT CUT-OFF FOR DESIRED FIXED CATHODE-TO-GRID-No1 (EACH GUN) VOLTAGE (E_{kg_1})	GRID-No2-TO-CATHODE VOLTS (EACH GUN) = ADJUSTED TO PROVIDE ULTOR-CURRENT CUT-OFF FOR DESIRED FIXED GRID-No1-TO-CATHODE (EACH GUN) VOLTAGE (E_{c_1k})



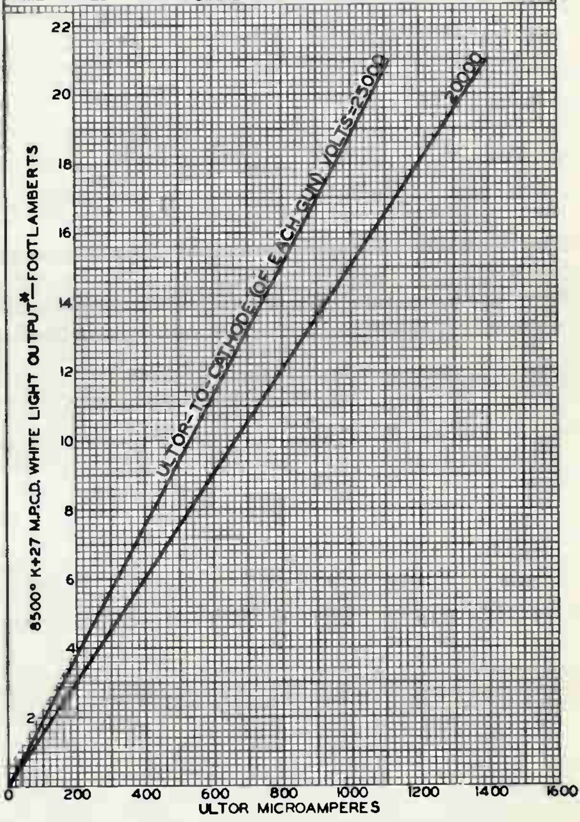
92CL-9421

TYPICAL LIGHT-OUTPUT CHARACTERISTICS

E_f = 6.3 VOLTS
GRID-No 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: 50 %
BLUE GUN: 19 %
GREEN GUN: 31 %

RASTER SIZE: 19¼" x 14½" CENTERED ON TUBE FACE.
* MEASURED WITHIN 5" DIAMETER AREA CENTERED ON TUBE FACE.

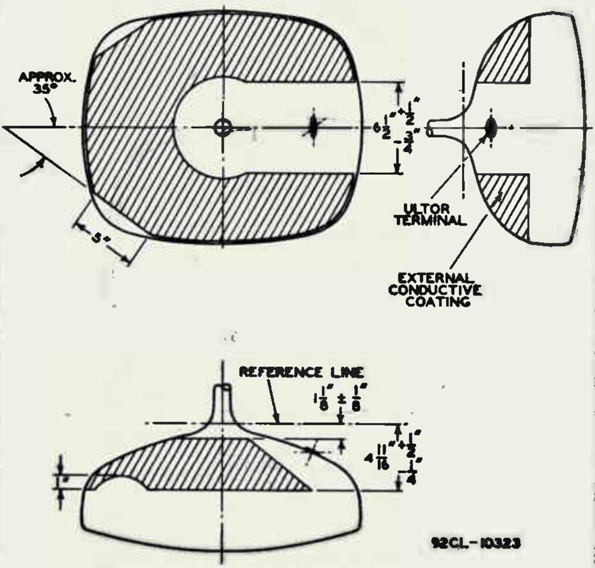


92CM-9417

21DEP4-A

PICTURE TUBE

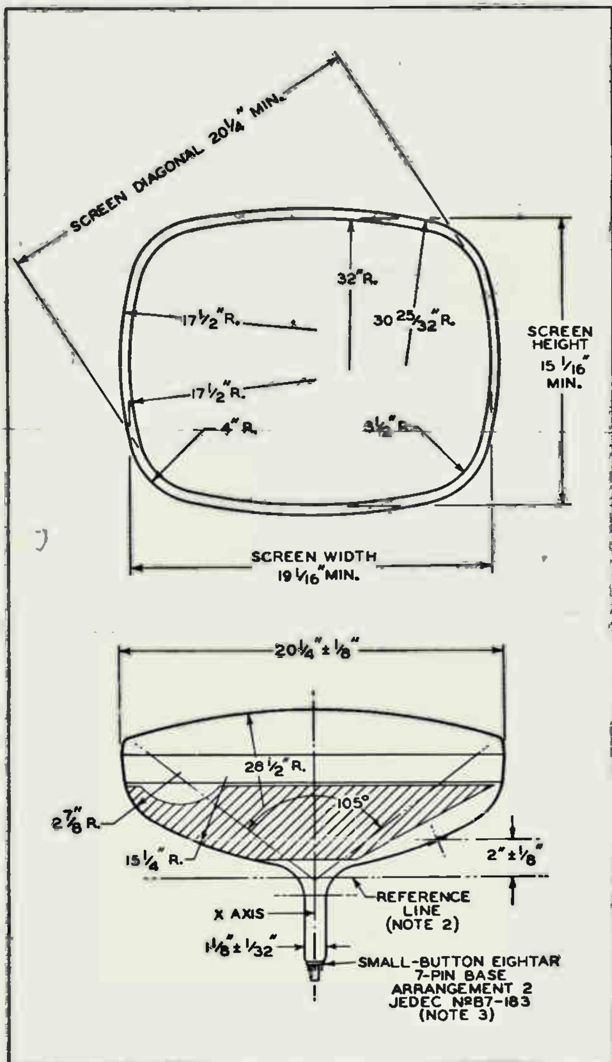
DETAIL SHOWING EXTERNAL CONDUCTIVE COATING



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

21DEP4-A

PICTURE TUBE



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

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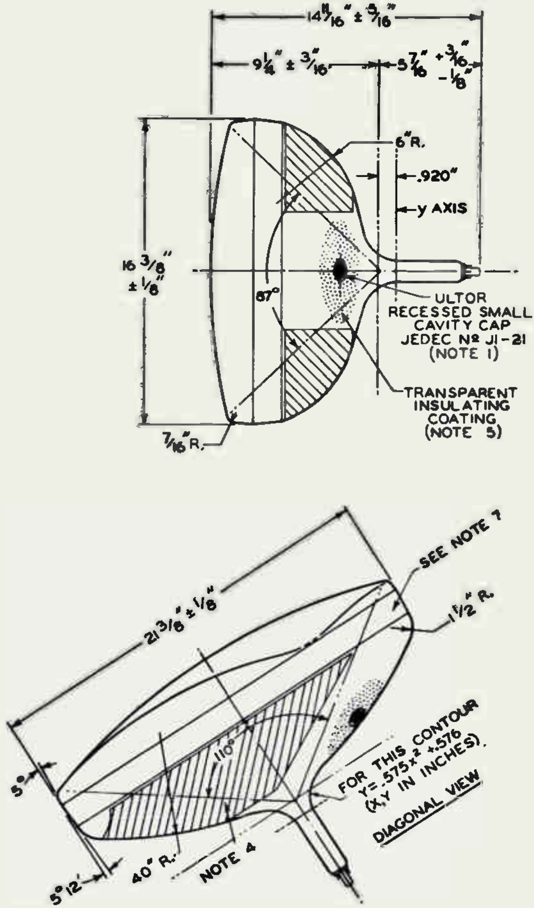
RCA

21DEP4-A

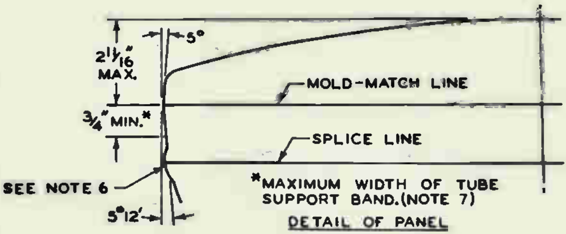
PICTURE TUBE



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

21DEP4-A

PICTURE TUBE



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 ± 30°. 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 LINT-LESS CLOTH.

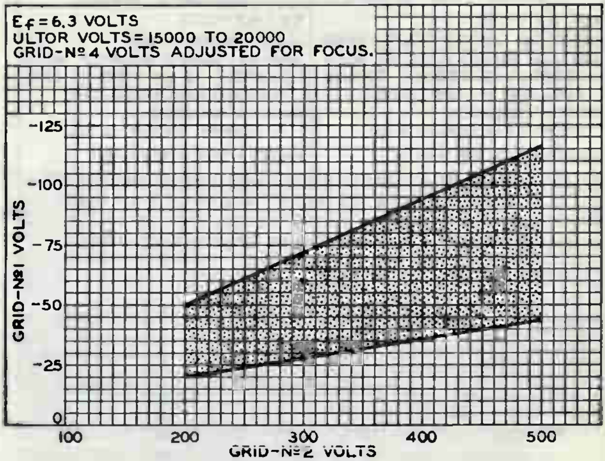
NOTE 6: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/16" BEYOND THE ENVELOPE SURFACE AT THE MOLD-MATCH LINE.

NOTE 7: UNDISTURBED AREA BETWEEN MOLD-MATCH LINE AND SPLICE LINE IS 3/4" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF TUBE SUPPORT BAND.

21DEP4-A

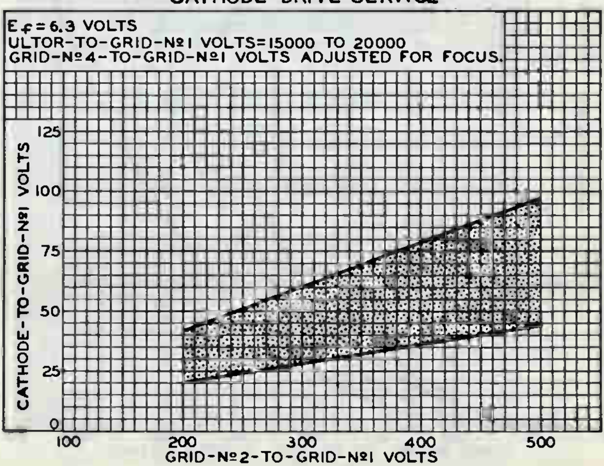
RASTER-CUTOFF-RANGE CHARTS

GRID-DRIVE SERVICE



92CS-10324

CATHODE-DRIVE SERVICE



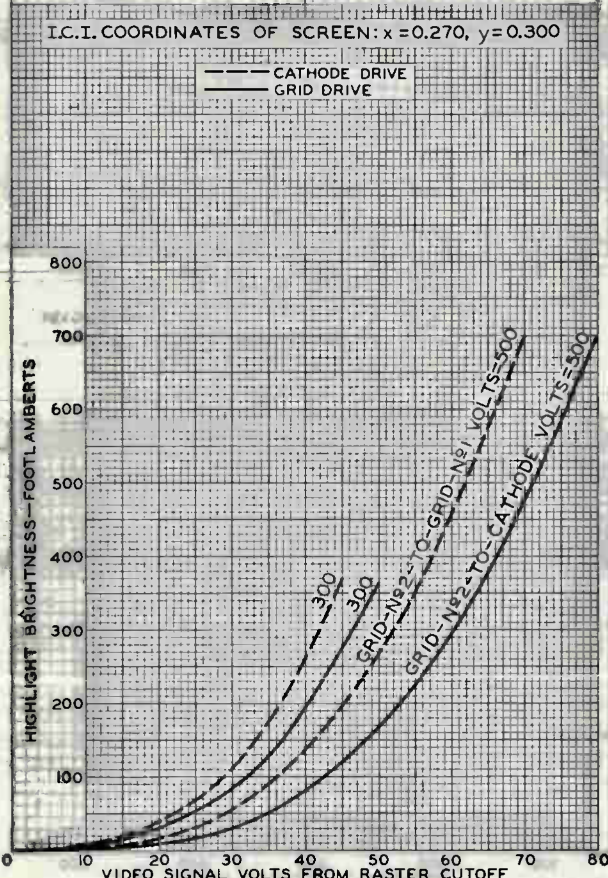
92CS-10325

RCA

21DEP4-A

AVERAGE DRIVE CHARACTERISTICS

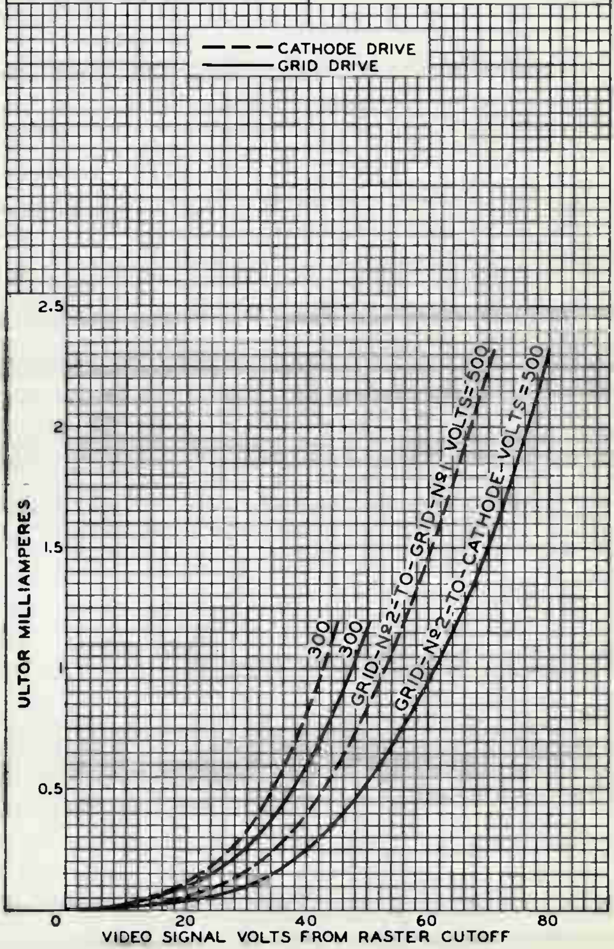
CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS	E_f = 6.3 VOLTS
ULTOR-TO-GRID-№1 VOLTS = 16000	ULTOR VOLTS = 16000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID №1 TO GIVE FOCUSED RASTER CUTOFF.	GRID №1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.
RASTER FOCUSED AT AVERAGE BRIGHTNESS.	RASTER FOCUSED AT AVERAGE BRIGHTNESS.
RASTER SIZE = 18" x 13½"	RASTER SIZE = 18" x 13½"



21DEP4-A

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f=6.3 VOLTS ULTOR-TO-GRID-№1 VOLTS= 15000 TO 20000 CATHODE BIASED POSITIVE WITH RESPECT TO GRID №1 TO GIVE FOCUSED RASTER CUTOFF.	E_f=6.3 VOLTS ULTOR VOLTS=15000 TO 20000 GRID №1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.



21DEP4-A/21DEP4/21CZP4
PICTURE TUBE

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION

With heater having controlled warm-up time

The 21DEP4-A/21DEP4/21CZP4 is the same as the 21DEP4-A.

21DHP4

Picture Tube

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 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	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor	2500 max.	μμf
	1700 min.	μμf
Electron Gun	Type Requiring No Ion-Trap Magnet	

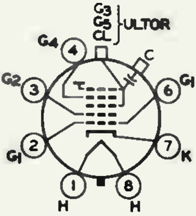
Optical:

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 *Picture-Tube Dimensional-Outlines* and *Bulb J171 G/K* 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 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

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

21DLP4
PICTURE TUBE

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

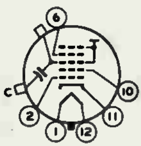
Voltage	6.3	ac or dc volts
Current	0.6 ± 10%	amp

Direct Interelectrode Capacitances:

Grid No.1 to all other electrodes	6	$\mu\mu f$
Cathode to all other electrodes	5	$\mu\mu f$
External conductive coating to ultor	2500 max.	$\mu\mu f$
	2000 min.	$\mu\mu f$

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 . . . 17" ± 3/8"
Greatest width . . . 20-1/4" ± 1/8"
Greatest height . . . 16-3/8" ± 1/8"
Diagonal . . . 21-3/8" ± 1/8"
Neck length . . . 4-1/2" ± 3/16"
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 (JETEC No.J1-21)
Bulb . . . J171D2/E1
Base . . . Short Small-Shell Duodecal 6-Pin (JETEC Group 4, No.B6-203), or Small-Shell Duodecal 6-Pin (JETEC 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

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_{c_5k}) between 12000 and 20000 volts and grid-No.2 voltage (E_{c_2k}) between 200 and 500 volts

Grid-No.4 Voltage for focus§	-50 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 $E_{c_1}k$ except video drive is a positive voltage	
Grid-No.4 Current	-25 to +25	μa
Grid-No.2 Current	-15 to +15	μa
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

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

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 ($E_{c_5g_1}$) 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§	0 to 450	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*	

▲,●,§,*,■: See next page.

RCA

21DLP4

PICTURE TUBE

Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level): White-level value (Peak negative)	Same value as determined for Ek_{g_1} except video drive is a negative voltage	
Grid-No.4 Current	-25 to +25	μa
Grid-No.2 Current	-15 to +15	μa
Field Strength of Adjustable Centering Magnet*	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor-to-grid-No.1 voltage of	*16000*	*volts*
and grid-No.2-to-grid-No.1 voltage of	*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

▲ 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 21DLP4 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.

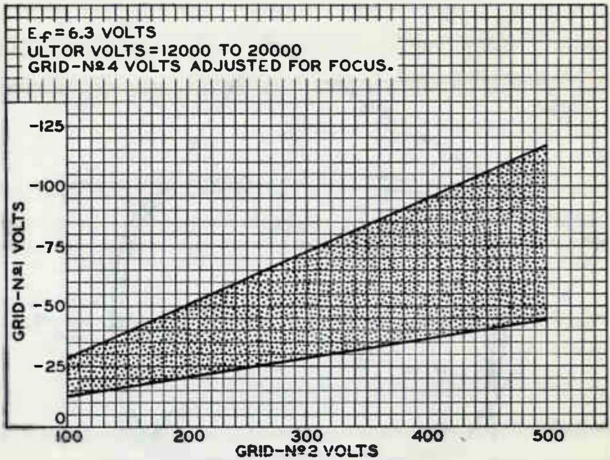
■ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

21DLP4

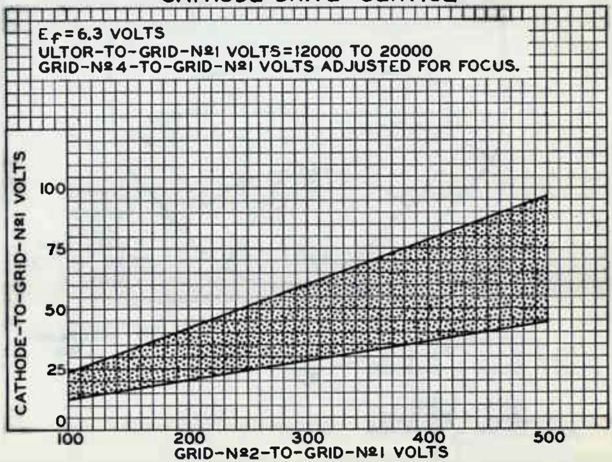
RASTER-CUTOFF-RANGE CHARTS

GRID-DRIVE SERVICE



92CS-9349V

CATHODE-DRIVE SERVICE



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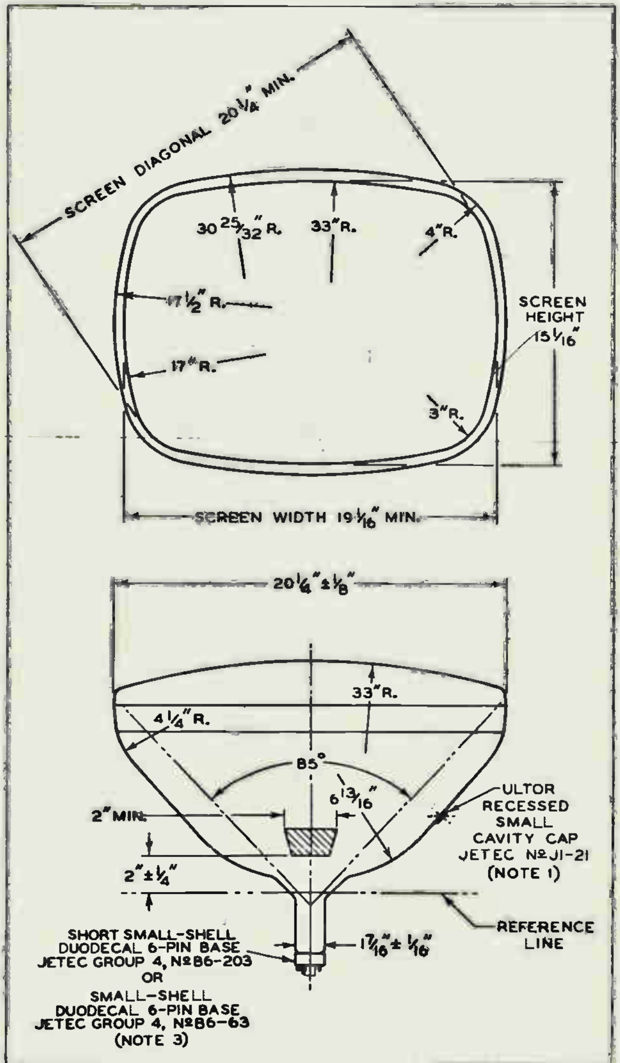
21DLP4
PICTURE TUBE



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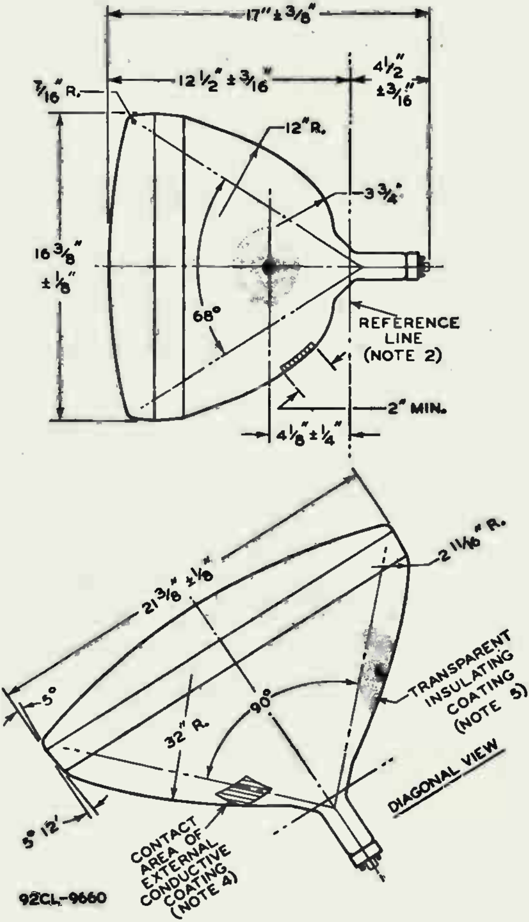
21DLP4

PICTURE TUBE



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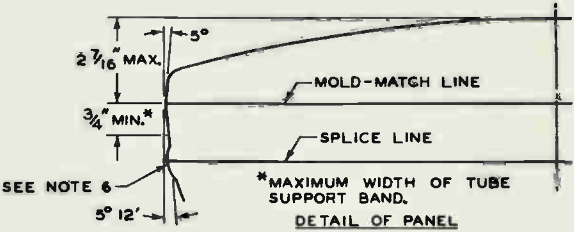
21DLP4

PICTURE TUBE



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 ± 30°. 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.

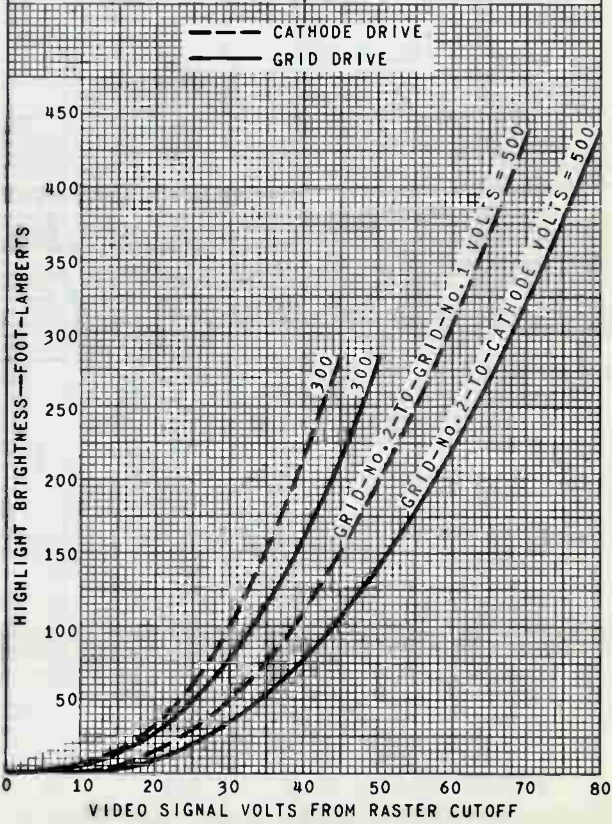
NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

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"



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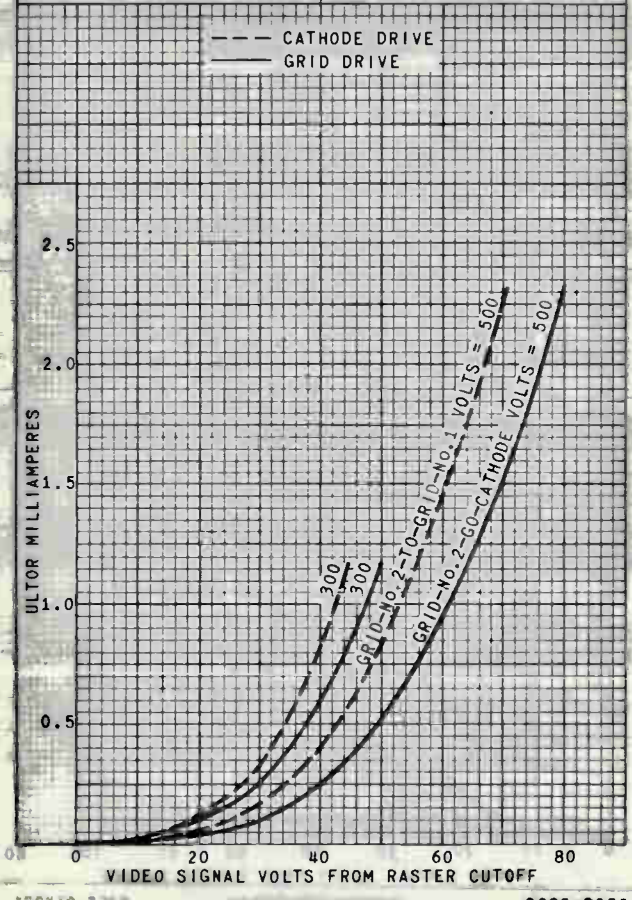
21DLP4

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 = 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.



21DSP4
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	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor	2500 max.	μμf
	2000 min.	μμf
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" ± 3/8"
Greatest width		20-1/4" ± 1/8"
Greatest height		16-3/8" ± 1/8"
Diagonal		21-3/8" ± 1/8"
Neck length		5-1/2" ± 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)

2IDSP4

2IDSP4
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. 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*

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

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21DSP4
PICTURE TUBE

Grid-No.4 Current	-25 to +25	μa
Grid-No.2 Current	-15 to +15	μa
Field Strength of Adjustable Centering Magnet*	0 to 8	gausses

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	*50*	*volts*
Grid-No.4-to-Grid-No.1 Voltage for focus	0 to 350	volts
Cathode-to-Grid-No.1 Voltage♦ 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.

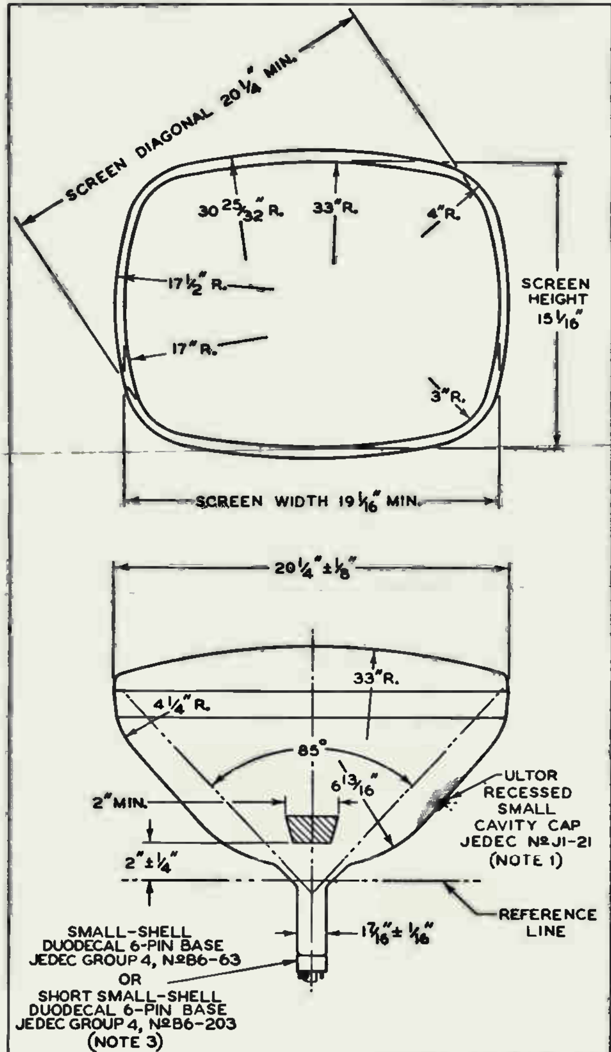
* Distance from *Reference Line* for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 7/16-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic 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 (Ek_{g_1}) 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

21DSP4

21DSP4
PICTURE TUBE



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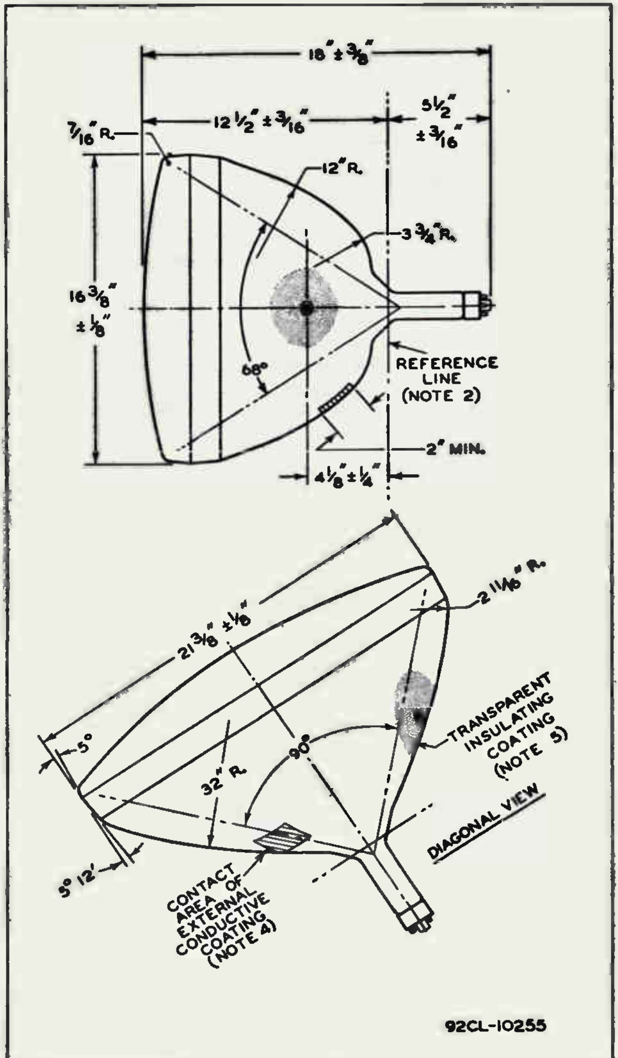
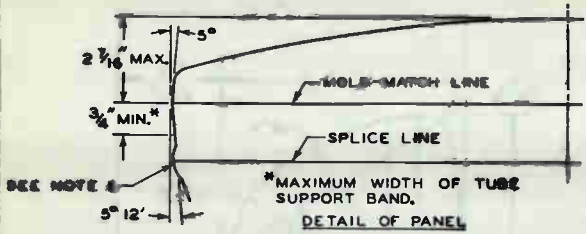
21DSP4

PICTURE TUBE



21DSP4

PICTURE TUBE



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 ± 30°. 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.

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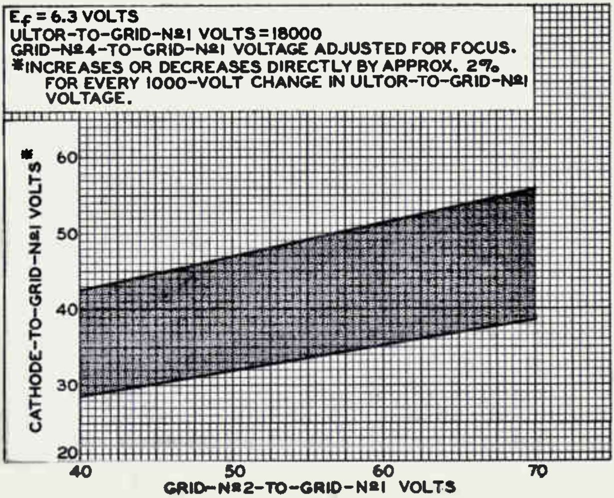
21DSP4

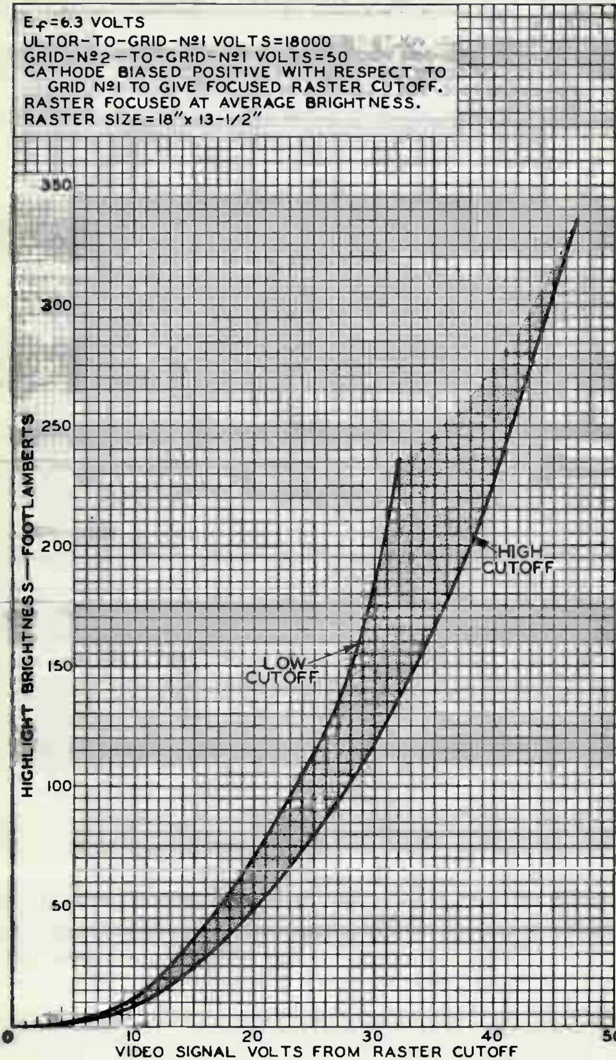
RASTER-CUTOFF-RANGE CHART



92CS-9911

21DSP4

CATHODE-DRIVE CHARACTERISTICS



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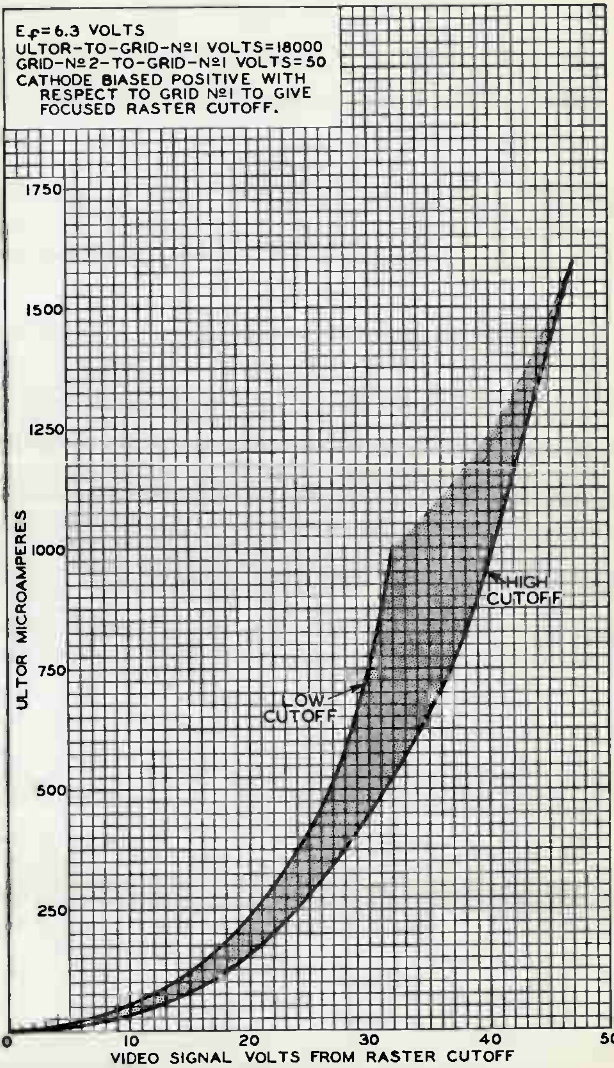
21DSP4

CATHODE-DRIVE CHARACTERISTICS



Picture Tube

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
MAGNETIC FOCUS — 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	

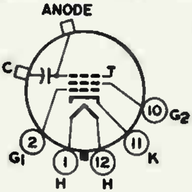
Optical:

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

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	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	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

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

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21EQP4
PICTURE TUBE

SHORT 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	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	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor	2500 max.	μμf
	2000 min.	μμf

Faceplate, Spherical	Filterglass
Light transmission (Approx.)	73%
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	12-9/16" ± 5/16"
Greatest width	20-1/4" ± 1/8"
Greatest height	16-3/8" ± 1/8"
Diagonal	21-3/8" ± 1/8"
Neck length	3-9/16" ± 1/8"
Screen Dimensions (Minimum):	
Greatest width	19-1/16"
Greatest height	15-1/16"
Diagonal	20-1/4"
Projected area	262 sq. in.
Weight (Approx.)	23 lbs
Operating Position	Any
Cap	Recessed Small Cavity (JEDEC No.J1-21)
Bulb	J171 H1/J1
Socket	Ucinite Part No.115446, or equivalent
Base	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

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PICTURE TUBE

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-Center Values:*

ULTOR VOLTAGE	18000	max.	volts
	12000[•]	min.	volts
GRID-No.3 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 18000 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	μa

21EQP4

PICTURE TUBE

Grid-No.2 Current	-15 to +15		μa
Field Strength of Adjustable Centering Magnet♦. . .	0 to 10		gausses

Examples of Use of Design Ranges:

With ultor voltage of	*16000*	*18000*	*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.	18000	max.	volts
	12000*	min.	volts
GRID-No.3-TO-GRID-No.1 VOLTAGE.	650	max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE.	690	max.	volts
GRID-No.2-TO-CATHODE VOLTAGE.	550	max.	volts
	300	min.	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 ($E_{c_ug_1}$) between 12000 and 18000 volts and grid-No.2-to-grid-No.1 voltage ($E_{c_2g_1}$) between 400 and 690 volts

Grid-No.3-to-Grid-No.1 Voltage for focus§.	0 to 400	volts

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21EQP4

PICTURE TUBE

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 voltage		
Grid-No.3 Current	-25 to +25		μa
Grid-No.2 Current	-15 to +15		μa
Field Strength of Adjustable Centering Magnet♦. . .	0 to 10		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	*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 21EQP4 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 21EQP4 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

21EQP4

PICTURE TUBE

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 2-1/4". 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

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 21EQP4 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

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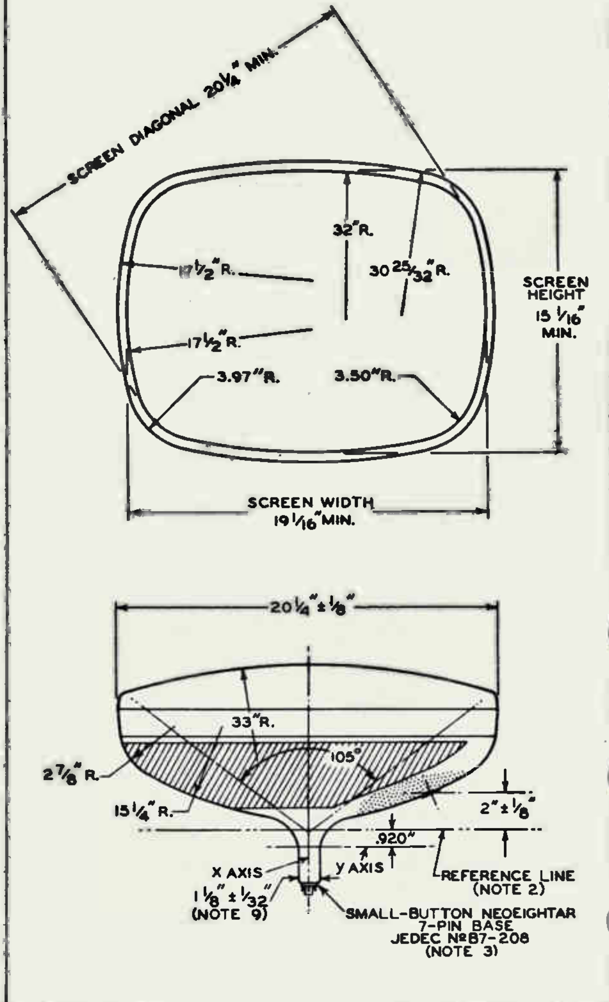
21EQP4

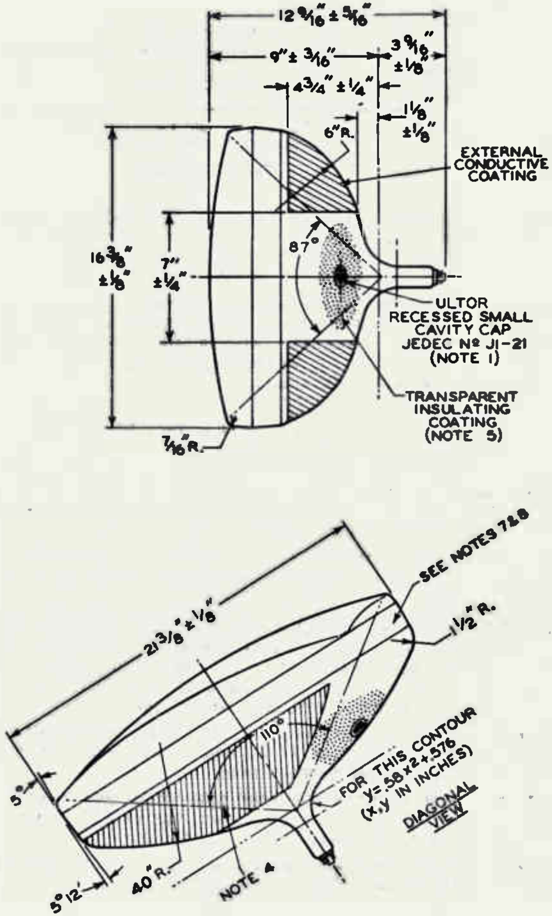
PICTURE TUBE



RCA

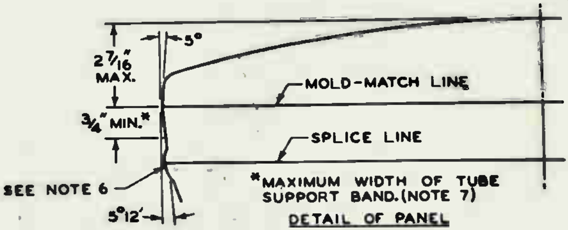
21EQP4

PICTURE TUBE



21EQP4

PICTURE TUBE



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 ± 30°. 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 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.

NOTE 7: WIDTH OF UNDISTURBED REGION BETWEEN MOLD-MATCH LINE AND SPLICE LINE IS 3/4" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF TUBE SUPPORT BAND.

NOTE 8: TUBE MOUNTING OR YOKE SUPPORT CLAMPS MUST BE SPACED FROM TUBE BY USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.

NOTE 9: NECK DIAMETER IS MAINTAINED TO AT LEAST 2-7/16" FROM REFERENCE LINE.

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

21EQP4

RCA

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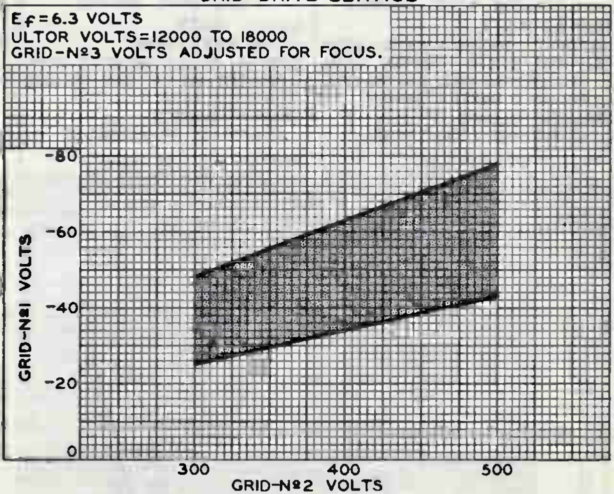
RASTER-CUTOFF-RANGE CHARTS

GRID-DRIVE SERVICE



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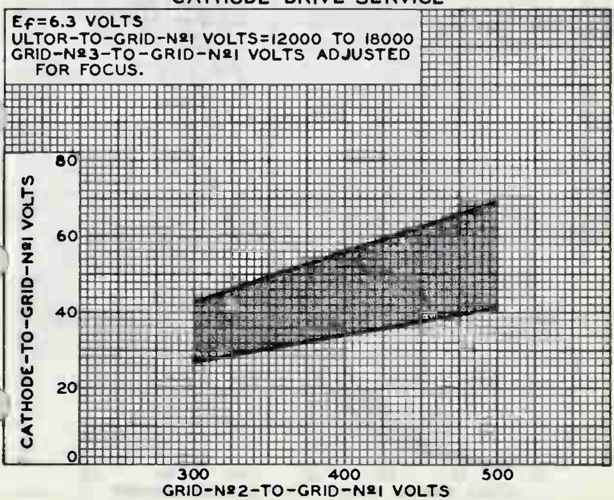
CATHODE-DRIVE SERVICE

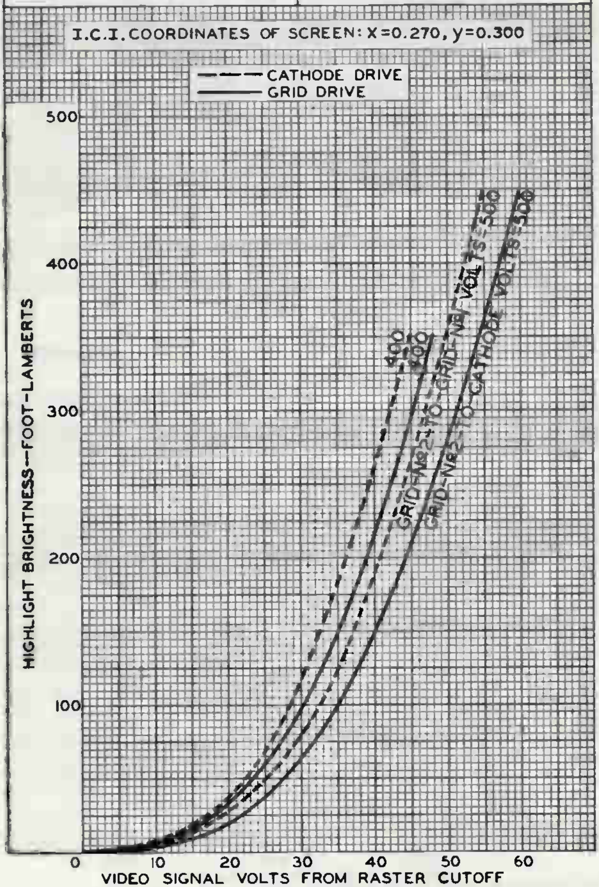


92CS-9934

21EQP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS	E_f = 6.3 VOLTS
ULTOR-TO-GRID-№1 VOLTS = 16000	ULTOR VOLTS = 16000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID №1 TO GIVE FOCUSED RASTER CUTOFF.	GRID №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" x 13½"	RASTER SIZE = 18" x 13½"



ELECTRON TUBE DIVISION 92CM-9942

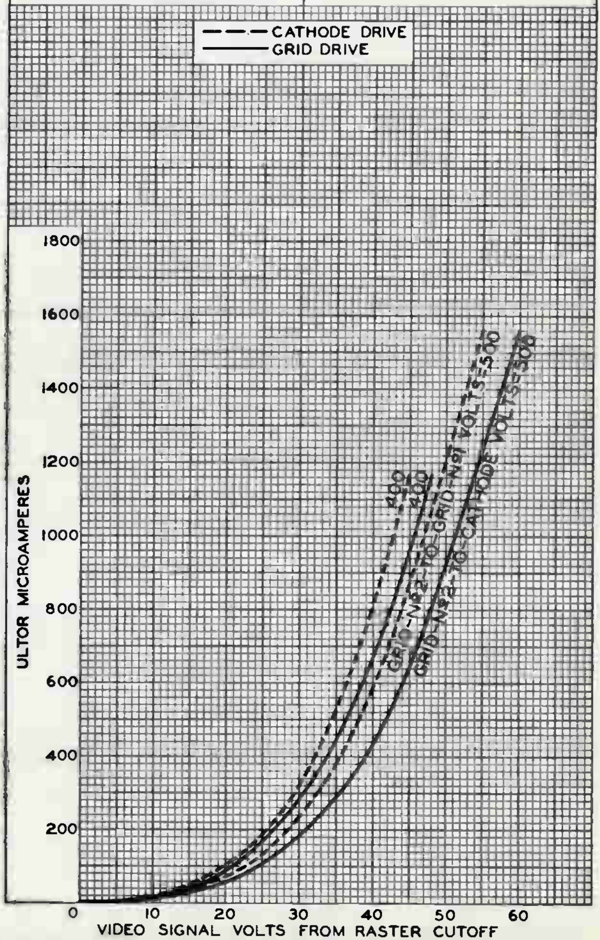
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

21EQP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS ULTOR-TO-GRID-№1 VOLTS = 12000 TO 18000 CATHODE BIASED POSITIVE WITH RESPECT TO GRID №1 TO GIVE FOCUSED RASTER CUTOFF.	E_f = 6.3 VOLTS ULTOR VOLTS = 12000 TO 18000 GRID №1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.



Monitor Kinescope

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 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 . . . . {1500 max. pf / 1200 min. pf}
Heater Current at 6.3 volts. . . . . 600 ± 60 ma
Electron Gun . . . . .Type Requiring No Ion-Trap Magnet

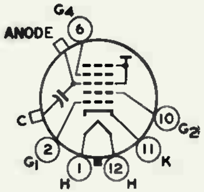
Optical:

Phosphor (For curves, see front of this Section) .P4—Sulfide Type, Aluminized
Faceplate, 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. . . . . {22000 max. volts / 12000 min. volts}

Grid-No.4 (Focusing) Voltage:		
Positive value.	1100 max.	volts
Negative value.	550 max.	volts
Grid-No.2 Voltage	700 max.	volts
Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	180 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	18000	volts
Grid-No.4 Voltage	0 to +400	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

Color Picture Tube

THREE-GUN, GRADED-HOLE, SHADOW-MASK TYPE
ALUMINIZED TRICOLOR PHOSPHOR-DOT SCREEN

ALL-GLASS ENVELOPE — ELECTROSTATIC FOCUS
MAGNETIC CONVERGENCE — MAGNETIC DEFLECTION

For Use in Color-TV Receivers

The 21FBP22 is the same as the 21FJP22 except for the following items:

Optical:

Faceplate. . . . . .Filterglass
  Light transmission (Approx.) 72%
  Faceplate does not have an integral protective window.[■]

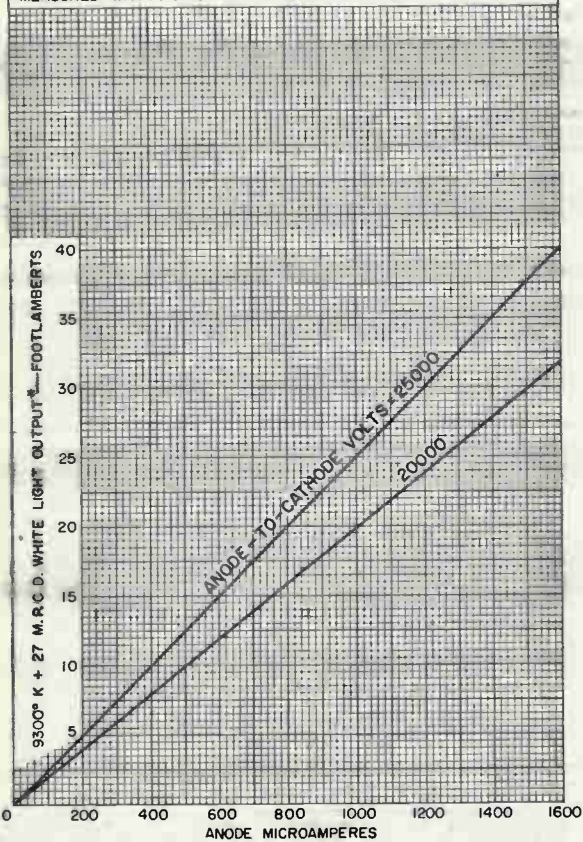
Mechanical:

Tube Dimensions:
  Overall length . . . . 25-1/32" ± 3/8"
  Diameter . . . . 20-13/16" ± 1/8"

[■] It is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of the 21FBP22 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.

TYPICAL LIGHT-OUTPUT CHARACTERISTICS

HEATER VOLTAGE = 6.3 VOLTS
GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE CURRENT
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: 42%
BLUE GUN: 28%
GREEN GUN: 30%
RASTER SIZE: 19 1/4" x 16" CENTERED ON TUBE FACE.
*MEASURED WITHIN 5"-DIAMETER AREA CENTERED ON TUBE FACE.



92CM-10853R1

Grid-No.1-to-Cathode Voltage (Each gun) for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2-to-cathode voltage ($E_{c_{2}k}$) at fixed value. . . . . .See *Cutoff Design Chart*

Variation in Raster Cutoff Between Guns in Any Tube. . . . . ± 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 (Average):

	Red Gun	*Blue Gun*	*Green Gun*	
To Produce White of 8500° K + 27 M.P.C.D. (CIE Coordinates x = 0.287, y = 0.316). .	44	26	30	%
To Produce White of 9300° K + 27 M.P.C.D. (CIE Coordinates x = 0.281, y = 0.311). .	42	28	30	%

Ratios of Cathode Currents:

	Red to Green			*Red to Blue*		
	Min.	*Av.*	*Max.*	*Min.*	*Av.*	*Max.*
To Produce White of 8500° K + 27 M.P.C.D.	0.9	1.45	2	1	1.7	2.4
To Produce White of 9300° K + 27 M.P.C.D.	0.85	1.4	1.95	0.8	1.5	2.2

Maximum Raster Centering Correction in Any Direction[d]. . . . . 7/8 inch

Adjustment to be Provided by the Following Components:

Purifying Magnet:

Maximum Required Displacements of Beam Trios in Any direction with Respect to Associated Phosphor-Dot Trios . . . . 0.005"[e]

Lateral-Converging Magnet:[f]

Maximum lateral shift of blue beam . . . . ±1/4"

Radial-Converging Magnet Assembly:

For static convergence including compensation for dc component of dynamic convergence (Each beam). . . . . Shift of ±5/8"

Examples of Use of Design Ranges:

For ultor voltage of	20000	25000	volts
Grid-No.3 (Focusing Electrode)-to-Cathode (Of each gun) Voltage. . .	3300 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.

Grid-No.3 Circuit Resistance (Each gun)	7.5 max.	megohms

Low-Voltage Circuits:

Effective Grid-No.1-to-Cathode-Circuit Resistance (Each gun).	0.75 max.	megohm

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 a 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.

[a] For Curves, see front of this Section.

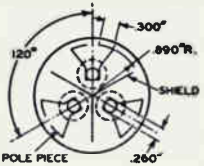
[b] For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts.

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

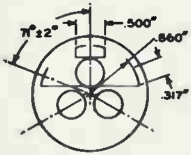
[d] Centering of the raster on the screen may be accomplished by passing direct current of the required value through each pair of deflecting coils. With all components properly adjusted, the raster centering correction is the distance from the undeflected focused beams to the center of the screen.

[e] The equivalent raster movement is about 3/4".

[f] Lateral converging magnet must shift the red beam and the green beam in opposite direction to the shift of the blue beam. Under conditions where the blue beam has been shifted 1/4", the shift of the red beam and green beam should be in the range of 1/8" to 3/8".

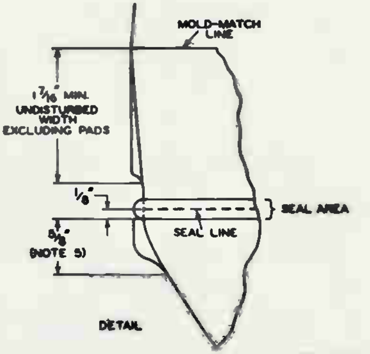


LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



LOCATION OF LATERAL-CONVERGING POLE PIECES WITH RESPECT TO GUNS

BASE
BOTTOM VIEW



92CL-10849

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.

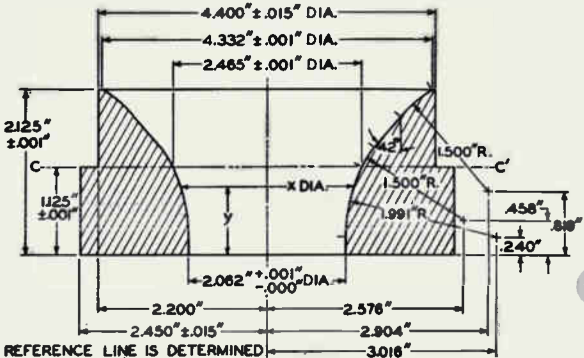
NOTE 2: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 3".

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".

REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE



REFERENCE LINE IS DETERMINED BY PLANE C-C' WHEN GAUGE IS SEATED AGAINST FUNNEL

92CM-6844

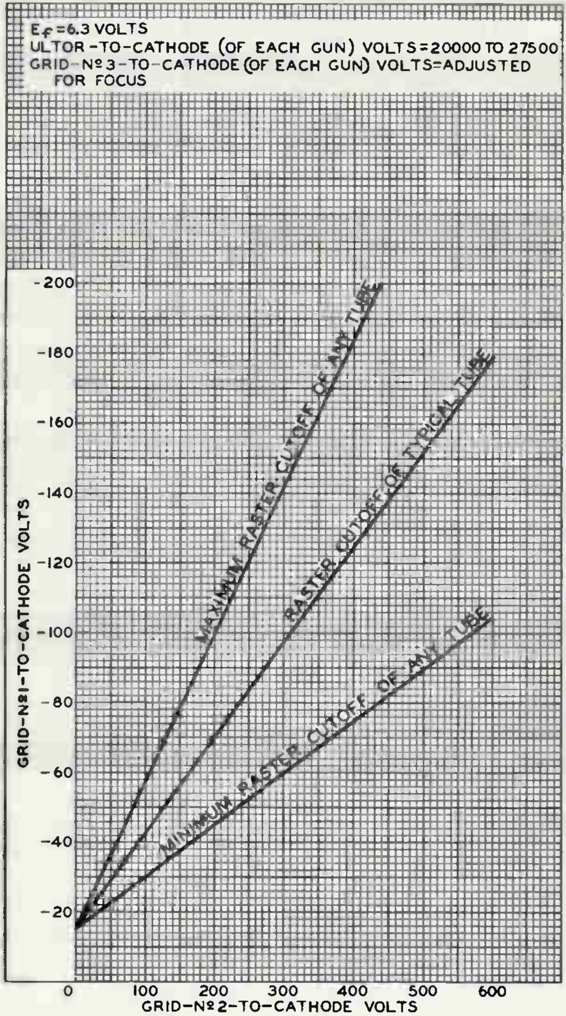
y	x	
0.000"	2.062"	+ 0.001" - 0.000"
0.125"	2.062"	+ 0.001" - 0.000"
0.250"	2.062"	+0.001" -0.000"

y	x	
0.375"	2.062"	+ 0.001" - 0.000"
0.385"	2.062"	+ 0.001" - 0.000"
0.500"	2.084"	± 0.001"
0.625"	2.122"	± 0.001"

y	x
0.750"	2.182" ± 0.001"
0.875"	2.258" ± 0.001"
1.000"	2.352" ± 0.001"
1.125"	2.465" ± 0.001"
1.250"	2.604" ± 0.001"

y	x
1.375"	2.778" ± 0.001"
1.500"	2.990" ± 0.001"
1.625"	3.216" ± 0.001"
1.750"	3.440" ± 0.001"
1.875"	3.678" ± 0.001"
2.000"	3.958" ± 0.001"
2.125"	4.332" ± 0.001"

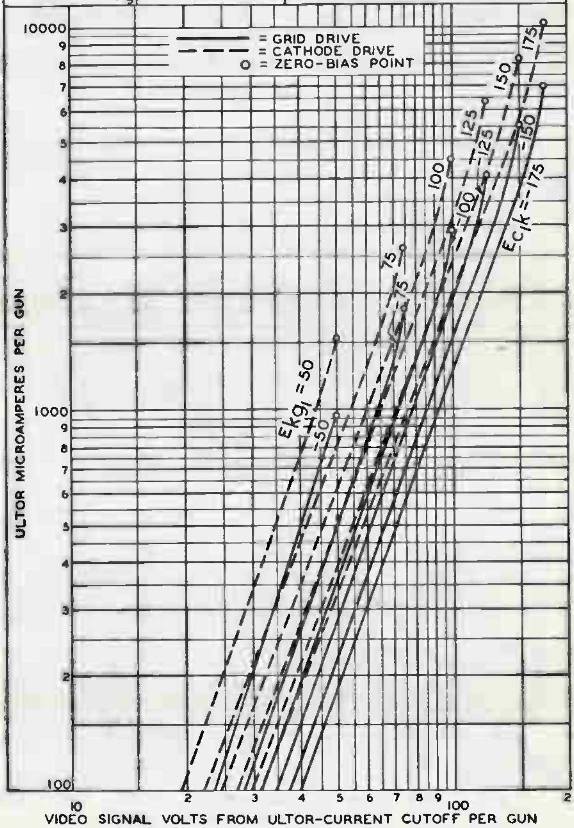
CUTOFF DESIGN CHART



92CM-10846

TYPICAL DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS	E_f = 6.3 VOLTS
ULTOR-TO-GRID-Nº1 (OF EACH GUN) VOLTS = 20000 TO 27500	ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 20000 TO 27500
GRID-Nº3-TO-GRID-Nº1 (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS	GRID-Nº3-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS
GRID-Nº2-TO-GRID-Nº1 VOLTS (EACH GUN) = ADJUSTED TO PROVIDE ULTOR-CURRENT CUT-OFF FOR DESIRED FIXED CATHODE-TO-GRID-Nº1 (EACH GUN) VOLTAGE (E_{kg_1})	GRID-Nº2-TO-CATHODE VOLTS (EACH GUN) = ADJUSTED TO PROVIDE ULTOR-CURRENT CUT-OFF FOR DESIRED FIXED GRID-Nº1-TO-CATHODE (EACH GUN) VOLTAGE (E_{c_1k})



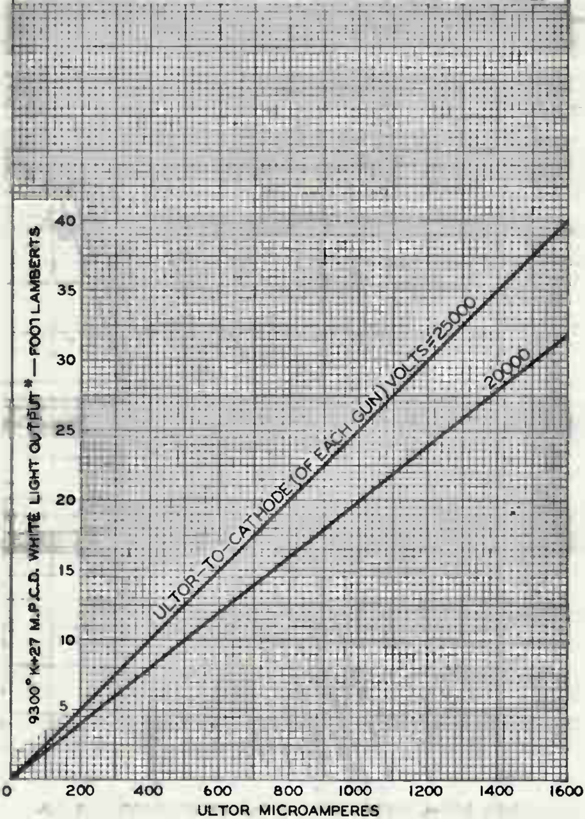
92CL-10845

TYPICAL LIGHT-OUTPUT CHARACTERISTICS

E_f=6.3 VOLTS
GRID-№ 3-TO-CATHODE (OF EACH GUN) VOLTS=ADJUSTED FOR FOCUS
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ULTOR CURRENT TO PRODUCE 9300° K+27 M.P.C.D. WHITE LIGHT OUTPUT.
PERCENTAGE OF TOTAL ULTOR CURRENT SUPPLIED BY EACH GUN TO PRODUCE 9300° K+27 M.P.C.D. WHITE:

RED GUN: 42%
BLUE GUN: 28%
GREEN GUN: 30%

RASTER SIZE: 19¼"X14½" CENTERED ON TUBE FACE.
*MEASURED WITHIN 5"-DIAMETER AREA CENTERED ON TUBE FACE.



92CM-10853

Picture Tube

SHORT RECTANGULAR GLASS TYPE — **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS — **110° 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 .	2000 max.	μμf
	1500 min.	μμf

Electron Gun . . . . .Type Requiring No Ion-Trap Magnet

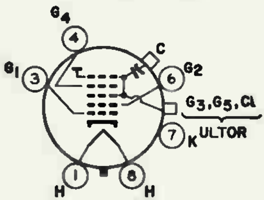
Optical:

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 . . . . 13-1/8" ± 1/4"
Neck Length. 3-7/8" ± 1/16"
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 *Picture-Tube Dimensional-Outlines* and *Bulb J171 G/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 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 – Ultor (Grid No.3, Grid No.5, Collector)
C – External Conductive Coating



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

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

Equipment Design Ranges:

With ultor voltage ($Ec_4k_{each\ gun}$) between 20000[c] and 27500 volts

Grid-No.3 (Focusing Electrode)-to-Cathode (Of each gun) Voltage. 16.8% to 20% of $Ec_4k_{each\ gun}$ volts

Grid-No.2-to-Cathode Voltage (Each gun) when circuit design utilizes grid-No.1-to-cathode voltage (Ec_1k) 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 (Ec_2k) at fixed value. . . . . .See *Cutoff Design Chart*

Variation in Raster Cutoff Between Guns in Any Tube. . . . . ± 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 (Average):

	Red Gun	*Blue Gun*	*Green Gun*	
To Produce White of 9300° K + 27 M.P.C.D. (CIE Coordinates x = 0.281, y = 0.311) . .	42	28	30	%

Ratios of Cathode Currents:

	Red to Green			*Red to Blue*		
	Min.	*Av.*	*Max.*	*Min.*	*Av.*	*Max.*
To Produce White of 9300° K + 27 M.P.C.D.	0.85	1.4	1.95	0.8	1.5	2.2

Maximum Raster Centering Correction in Any Direction[d]. . . . . 7/8 inch

Adjustment to be Provided by the Following Components:

Purifying Magnet:

Maximum Required Displacements of Beam Trios in Any direction with Respect to Associated Phosphor-Dot Trios . . . . 0.005"[e]

Lateral-Converging Magnet:[f]

Maximum lateral shift of blue beam . . . . ±1/4"

Radial-Converging Magnet Assembly:
For static convergence including compensation for dc component of dynamic convergence (Each beam). . . . . Shift of ±5/8"

Examples of Use of Design Ranges:

For ultor voltage of	*20000*	*25000*	*volts*
Grid-No.3 (Focusing Electrode)-to-Cathode (Of each gun) Voltage. .	3360 to 4000	1200 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.

Grid-No.3 Circuit Resistance (Each gun). . . . . 7.5 max. megohms

Low-Voltage Circuits:

Effective Grid-No.1-to-Cathode-Circuit Resistance (Each gun) . . . . 0.75 max. megohm

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 a 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.

[a] For Curves, see front of this Section.

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

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

[d] Centering of the raster on the screen may be accomplished by passing direct current of the required value through each pair of deflecting coils. With all components properly adjusted, the raster centering correction is the distance from the undeflected focused beams to the center of the screen.

• The equivalent raster movement is about 3/4".

f Lateral converging magnet must shift the red beam and the green beam in opposite direction to the shift of the blue beam. Under conditions where the blue beam has been shifted 1/4", the shift of the red beam and green beam should be in the range of 1/8" to 3/8"

DEFINITIONS

Beam Trio. The red beam, green beam, and blue beam passing through a common hole in the shadow mask.

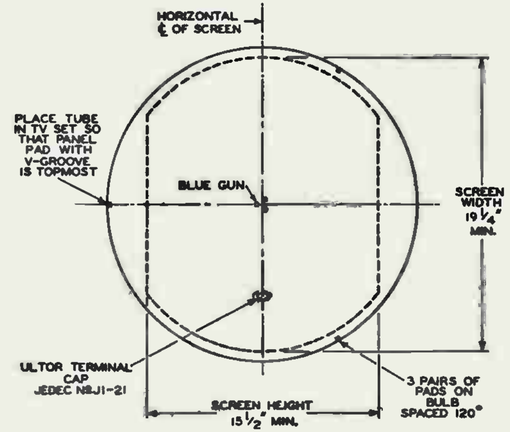
Register. Exact correspondence in position of the centers of beam trios with respect to the centers of the associated phosphor-dot trios.

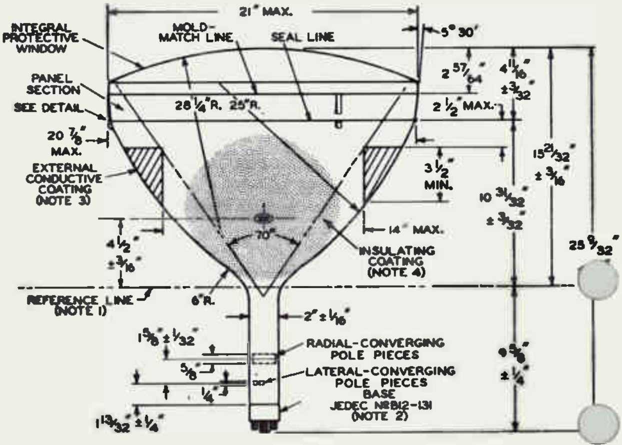
Misregister. Lack of correspondence in position of the centers of the beam trios with respect to the centers of the associated phosphor-dot trios.

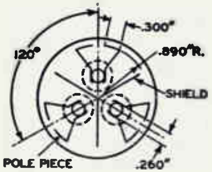
Displacement. Shift of the position of the beams with respect to the phosphor dots.

GENERAL CONSIDERATIONS

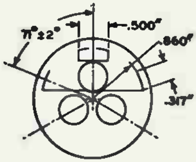
X-Ray Warning. Because this color picture tube is designed to be operated at ultor voltages as high as 27.5 kilovolts (Design-maximum value), shielding of this color picture tube for X-ray radiation may be needed to protect against possible injury from prolonged exposure at close range.


HORIZONTAL ℄ OF SCREEN
PLACE TUBE IN TV SET SO THAT PANEL PAD WITH V-GROOVE IS TOPMOST
BLUE GUN
SCREEN WIDTH 19 1/4" MIN.
ULTOR TERMINAL CAP JEDEC NoJ1-21
SCREEN HEIGHT 15 1/2" MIN.
3 PAIRS OF PADS ON BULB SPACED 120°

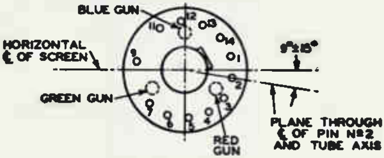

21" MAX.
INTEGRAL PROTECTIVE WINDOW
MOLD-MATCH LINE
SEAL LINE
5° 30'
PANEL SECTION
SEE DETAIL
28 1/4"R. 25"R.
2 57/64"
4 11/16" ± 3/32"
2 1/2" MAX.
20 7/8" MAX.
EXTERNAL CONDUCTIVE COATING (NOTE 3)
3 1/2" MIN.
15 21/32" ± 3/16"
10 31/32" ± 3/32"
14" MAX.
4 1/2" ± 3/16"
70°
INSULATING COATING (NOTE 4)
25 9/32"
REFERENCE LINE (NOTE 1)
6"R.
2" ± 1/16"
1 5/8" ± 1/32"
RADIAL-CONVERGING POLE PIECES
5/8"
LATERAL-CONVERGING POLE PIECES
BASE JEDEC NoB12-131 (NOTE 2)
9 5/8" ± 1/4"
1/4"
1 13/32" ± 1/4"



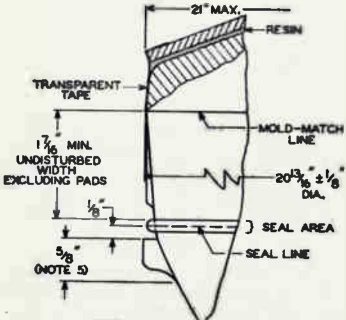
LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



LOCATION OF LATERAL-CONVERGING POLE PIECES WITH RESPECT TO GUNS



BASE
BOTTOM VIEW



DETAIL

92CL-11174

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.

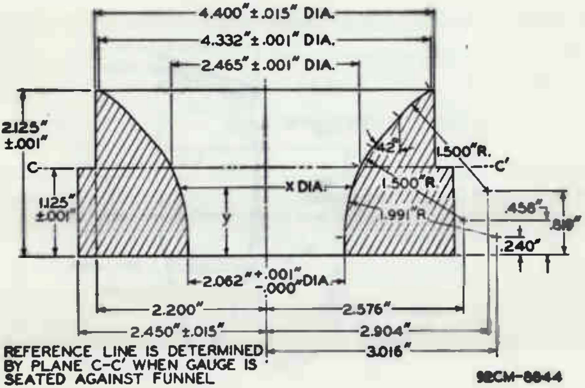
NOTE 2: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 3".

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".

REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE



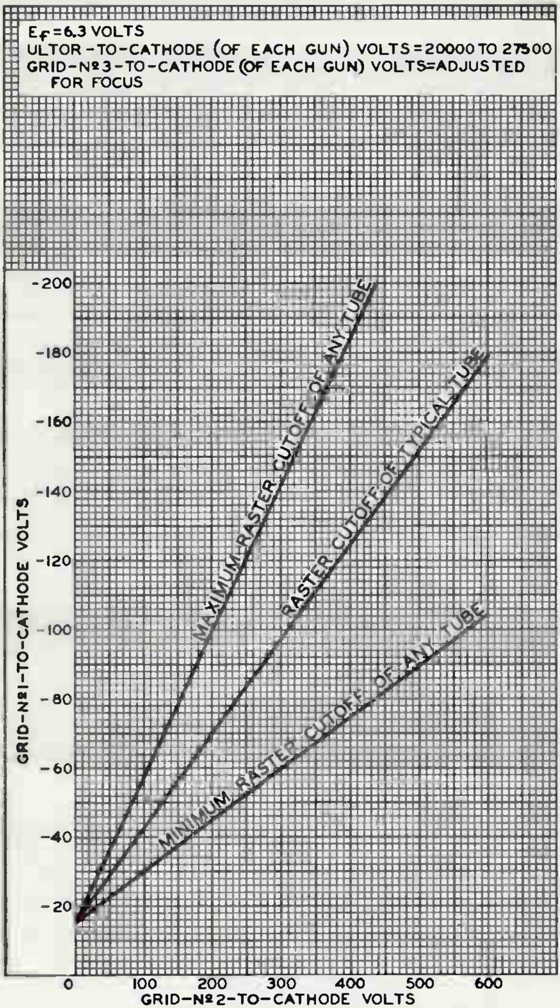
y	x	
0.000"	2.062"	+0.001" −0.000"
0.125"	2.062"	+0.001" −0.000"
0.250"	2.062"	+0.001" −0.000"

y	x	
0.375"	2.062"	+0.001" −0.000"
0.385"	2.062"	+0.001" −0.000"
0.500"	2.084"	±0.001"
0.625"	2.122"	±0.001"

y	x
0.750"	2.182" ± 0.001"
0.875"	2.258" ± 0.001"
1.000"	2.352" ± 0.001"
1.125"	2.465" ± 0.001"
1.250"	2.604" ± 0.001"

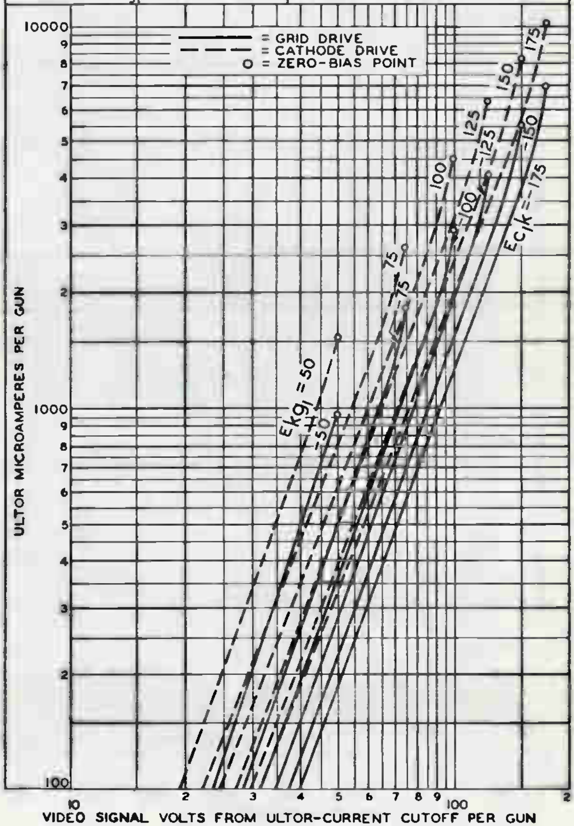
y	x
1.375"	2.778" ± 0.001"
1.500"	2.990" ± 0.001"
1.625"	3.216" ± 0.001"
1.750"	3.440" ± 0.001"
1.875"	3.678" ± 0.001"
2.000"	3.958" ± 0.001"
2.125"	4.332" ± 0.001"

CUTOFF DESIGN CHART



TYPICAL DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS ULTOR-TO-GRID-№1 (OF EACH GUN) VOLTS = 20000 TO 27500 GRID-№3-TO-GRID-№1 (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS GRID-№2-TO-GRID-№1 VOLTS (EACH GUN) = ADJUSTED TO PROVIDE ULTOR-CURRENT CUTOFF FOR DESIRED FIXED CATHODE-TO-GRID-№1 (EACH GUN) VOLTAGE (E_{kg_1})	E_f = 6.3 VOLTS ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 20000 TO 27500 GRID-№3-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS GRID-№2-TO-CATHODE VOLTS (EACH GUN) = ADJUSTED TO PROVIDE ULTOR-CURRENT CUTOFF FOR DESIRED FIXED GRID-№1-TO-CATHODE (EACH GUN) VOLTAGE (E_{c_1k})



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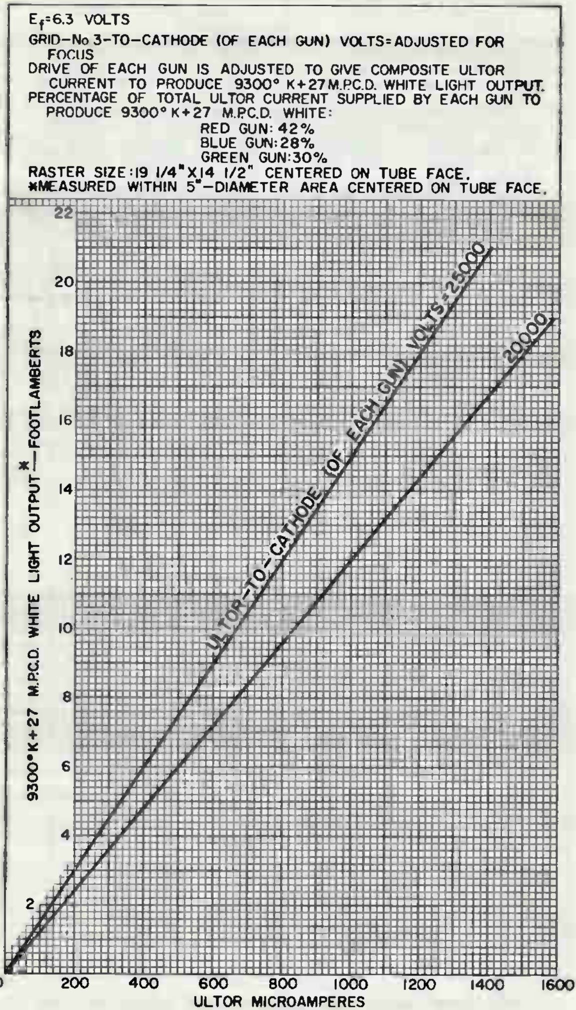
TYPICAL LIGHT-OUTPUT CHARACTERISTICS



Picture Tube

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 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%

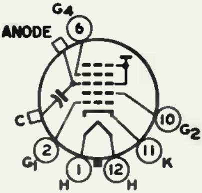
Mechanical:

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 (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
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.	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

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
NO ION-TRAP MAGNET REQUIRED

114° 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	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
For curves, see front of this section
Faceplate. . . . . Filterglass
Light transmission at center (approx.) 46%

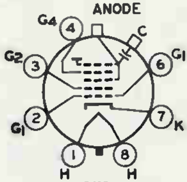
MECHANICAL

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 (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



8HR

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

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		

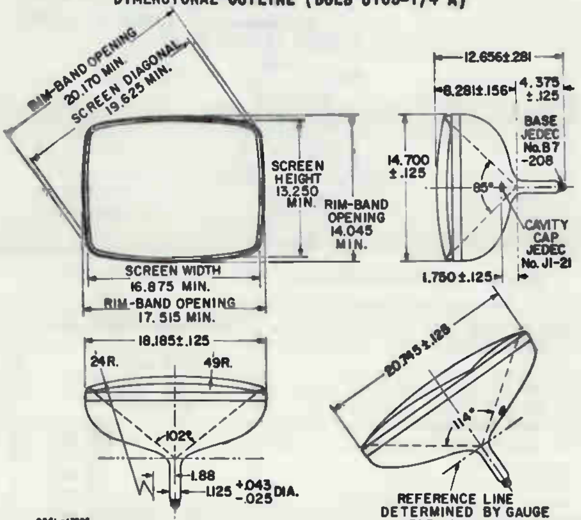
MAXIMUM CIRCUIT VALUE

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 RCA-2F21 monoscope, or equivalent.

DIMENSIONAL OUTLINE (BULB J165-1/4 A)



DIMENSIONS IN INCHES

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]

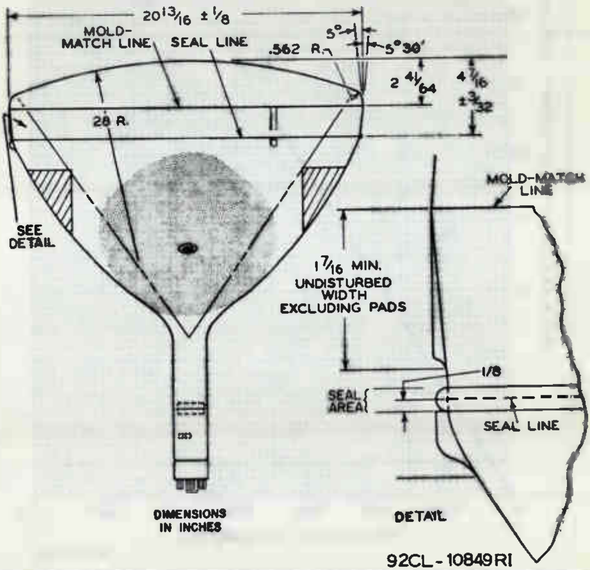
TUBE DIMENSIONS

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

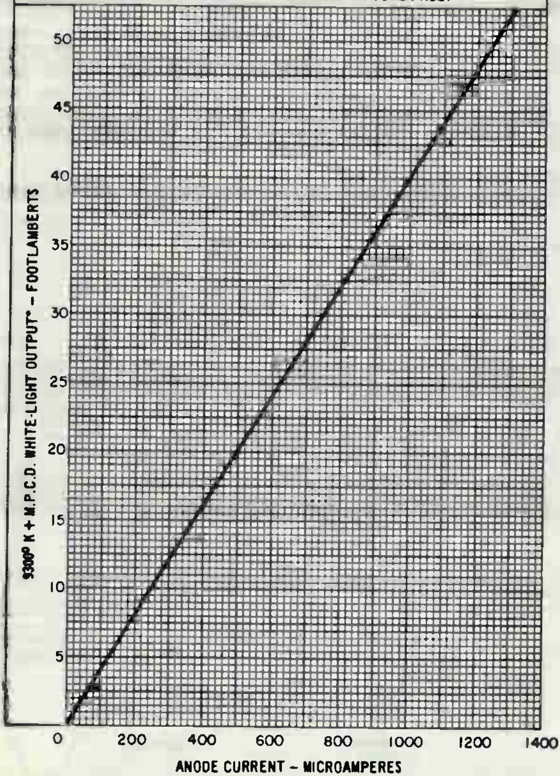


TYPICAL LIGHT-OUTPUT CHARACTERISTIC

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 9300° K + M.P.C.D. 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

Color Picture Tube

70° Round | New Rare-Earth (Red) Phosphor
Antiglare Integral Protective Window | HI-LITE Screen
Unity Current Ratios | 70° Magnetic Deflection

ELECTRICAL

Electron Guns, Three with Axes Tilted
Toward Tube Axis .... Red, Blue, Green
Heater, of Each Gun Parallel
Connected within Tube with
Each of the Other Two Heaters:

Current at 6.3 volts[a]	1.9	A
Focusing Method	Electrostatic	
Focus Lens	Bipotential	
Convergence Method	Magnetic	
Deflection Method	Magnetic	

Deflection Angles (Approx.):

Horizontal	70	deg.
Vertical	55	deg.

Direct Interelectrode Capacitance (Approx.):

Grid No.1 of any gun to all other electrodes	10	pF
Grid No.3 to all other electrodes	12	pF
All cathodes to all other electrodes	16	pF
External conductive coating to anode (Approx.)	2500 max. / 2000 min.	pF

OPTICAL

Faceplate and Protective Window .... Filterglass
Light transmission at center (Approx.) 39%
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) .... 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.) .... 0.029 in

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.	µA
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 μA

Grid-No.2 Current . . . . –5 to +5 μA

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] (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 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 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" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.

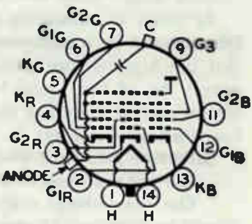
[d] Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

X-RADIATION WARNING

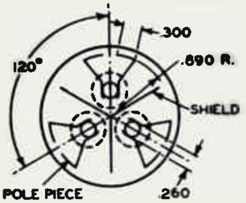
Because the 21GVP22 is designed to be operated at anode voltages as high as 27.5 kilovolts (design-maximum value), shielding of the 21GVP22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

TERMINAL DIAGRAM (Bottom View)

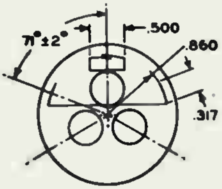
Pin 1- Heater
Pin 2- Grid No.1 of Red Gun
Pin 3- Grid No.2 of Red Gun
Pin 4- Cathode of Red Gun
Pin 5- Cathode of Green Gun
Pin 6- Grid No.1 of Green Gun
Pin 7- Grid No.2 of Green Gun
Pin 9- Grid No.3
Pin 11- Grid No.2 of Blue Gun
Pin 12- Grid No.1 of Blue Gun
Pin 13- Cathode of Blue Gun
Pin 14- Heater
Cap- Anode
C- External Conductive Coating



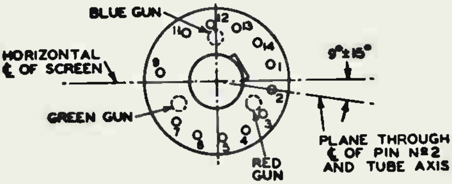
14AU



LOCATION OF RADIAL-
CONVERGING POLE PIECES
VIEWED FROM SCREEN END OF GUNS

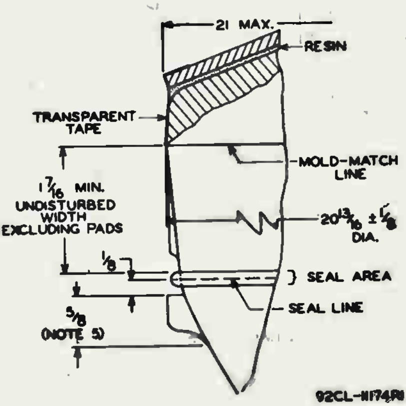


LOCATION OF LATERAL-
CONVERGING POLE PIECES
WITH RESPECT TO GUNS

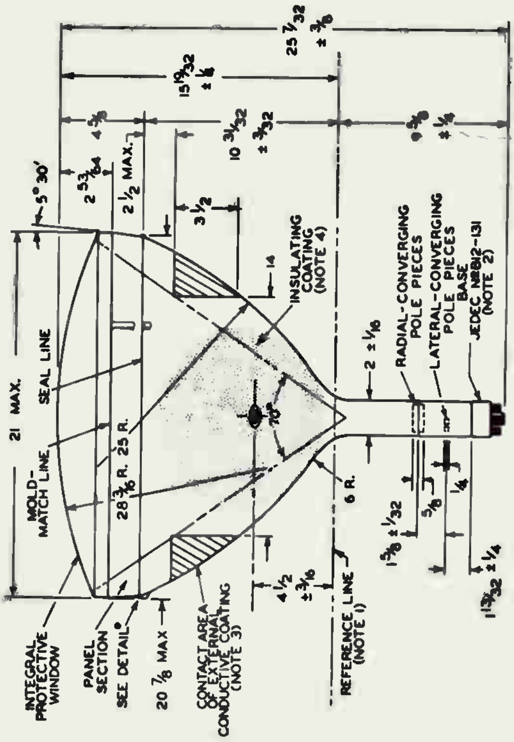


BASE
BOTTOM VIEW

DIMENSIONAL OUTLINE DETAIL

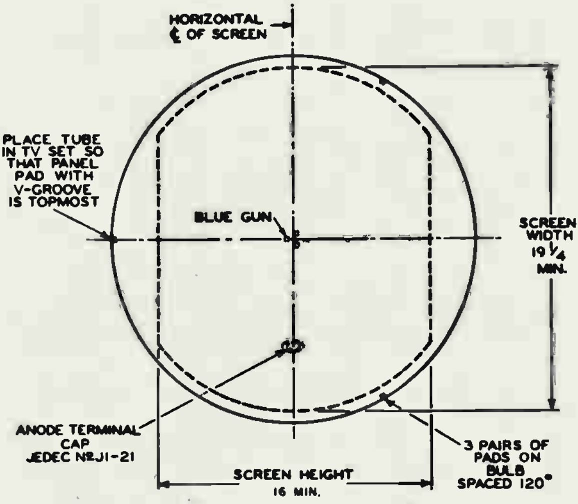


DIMENSIONAL OUTLINE



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.

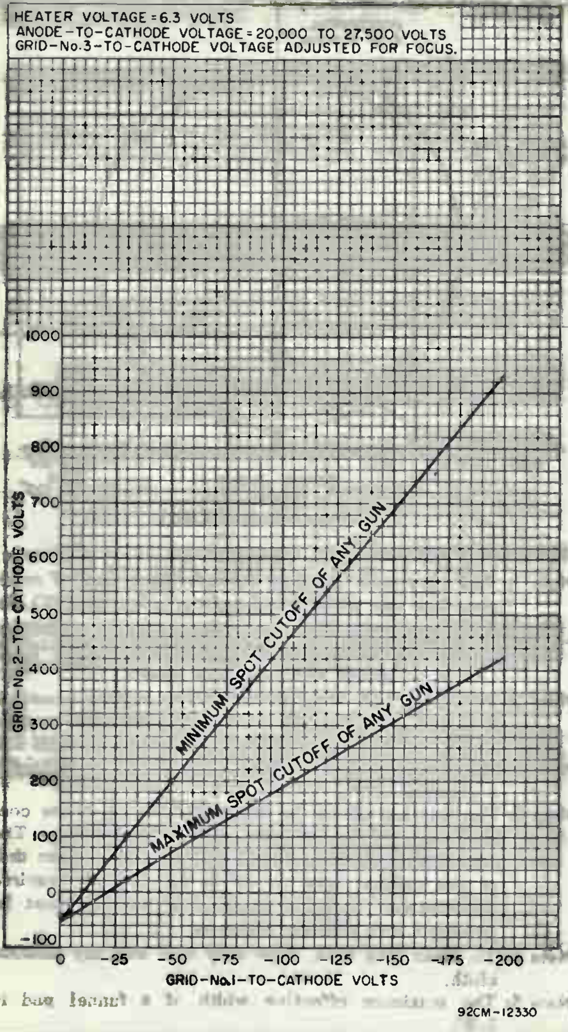
Note 2: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base shell will fall within a circle concentric with bulb axis and having a diameter of 3".

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



RCA

21MP4
PICTURE TUBE

RECTANGULAR METAL-SHELL TYPE

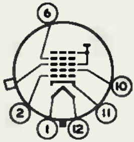
LOW-VOLTAGE ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.6 ± 10%	amp ←
Faceplate, Spherical		Frosted Filterglass
Phosphor (For curves, see front of this Section)		P4—Sulfide Type
Deflection Angles (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" ± 1/8"
Greatest height at lip		15-5/16" ± 1/8"
Diagonal at lip		20-3/4" ± 1/4"
Neck length		7-1/2" ± 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.B6-63) ←
Basing Designation for BOTTOM VIEW		12M ←

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.

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

21MP4

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

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

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	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	2250 max. pF 1750 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	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

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 Undeflected 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 in 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)	±15 μA
Grid-No.2 Current	±5 μA
Grid-No.1 Current	±5 μA

	Illum. D	Color	
To Produce White Light of	6550° K + 7 M.P.C.D.	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)

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 μA . . . . $\begin{cases} 58 \text{ fL} \\ 200 \text{ Nit} \end{cases}$

Limiting Circuit Values

High-Voltage Circuits:

Grid-No.3 circuit resistance . . . . 7.5 max. MΩ

Low-Voltage Circuits:

Effective grid-No.1-to-cathode-circuit resistance (each gun) . . . . 0.75 max. MΩ

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 . . . . 36 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 blub axis.

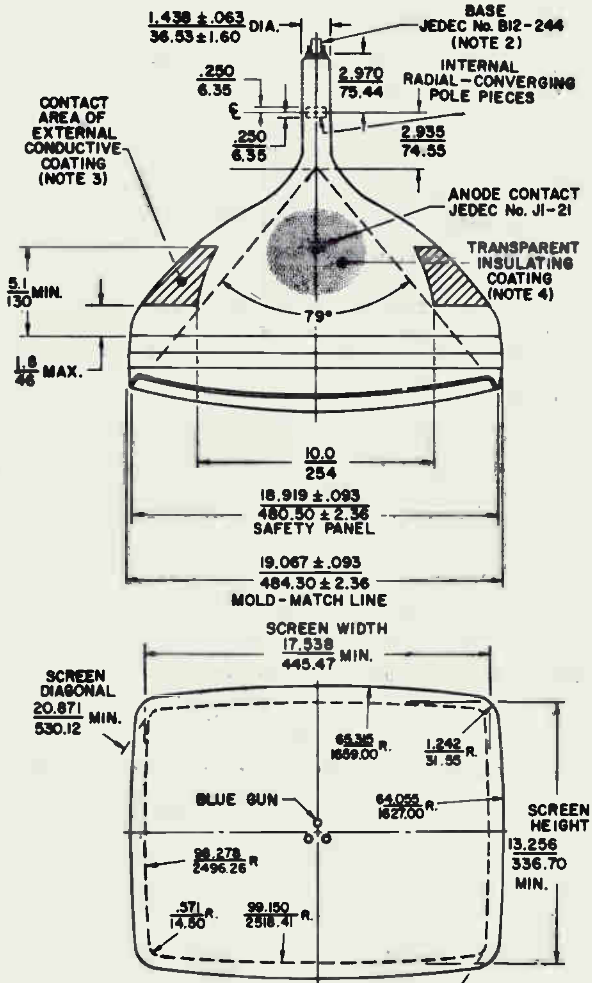
Note 3— The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

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

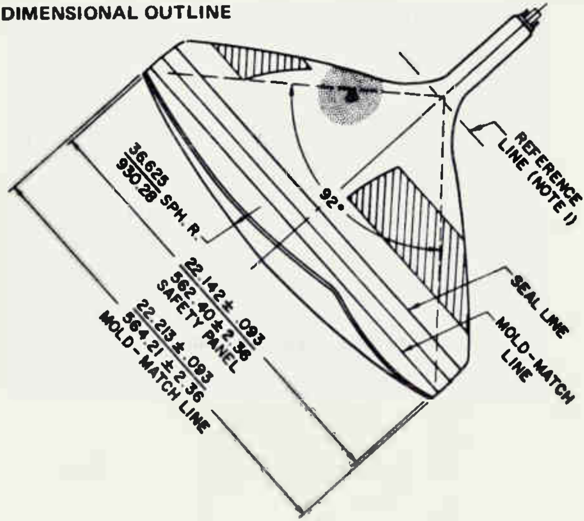
DIAGONAL $\frac{1.561}{39.65}$; HORIZONTAL $\frac{1.100}{27.94}$; VERTICAL $\frac{0.630}{16.00}$

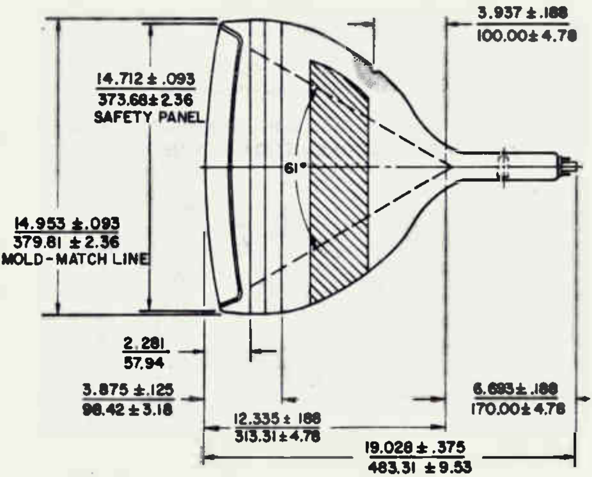
DIMENSIONAL OUTLINE



Dimensions in Inches / mm unless otherwise noted

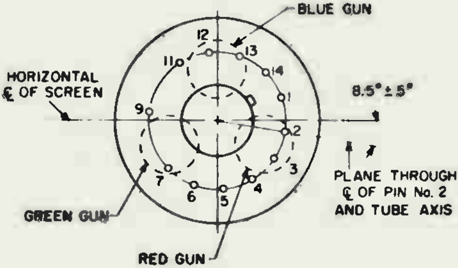
DIMENSIONAL OUTLINE





92LL-3171R3

BOTTOM VIEW OF BASE

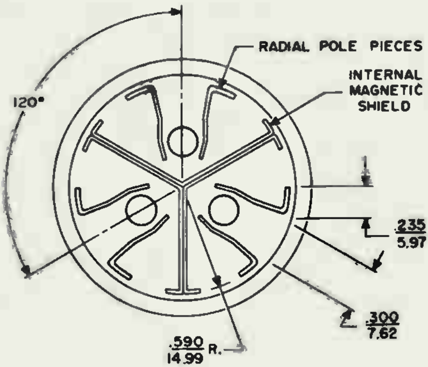


92CS-12816

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)

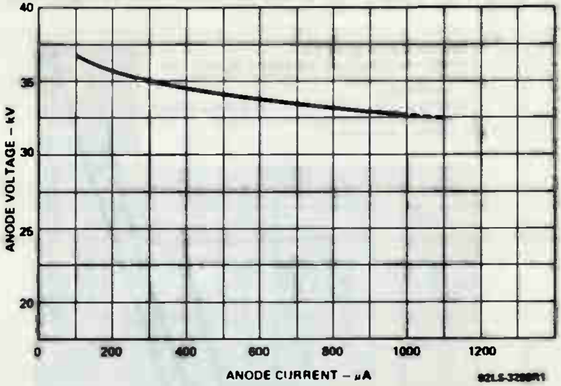


Figure I

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)

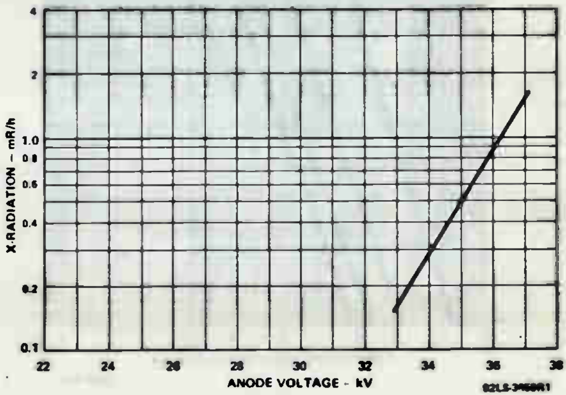
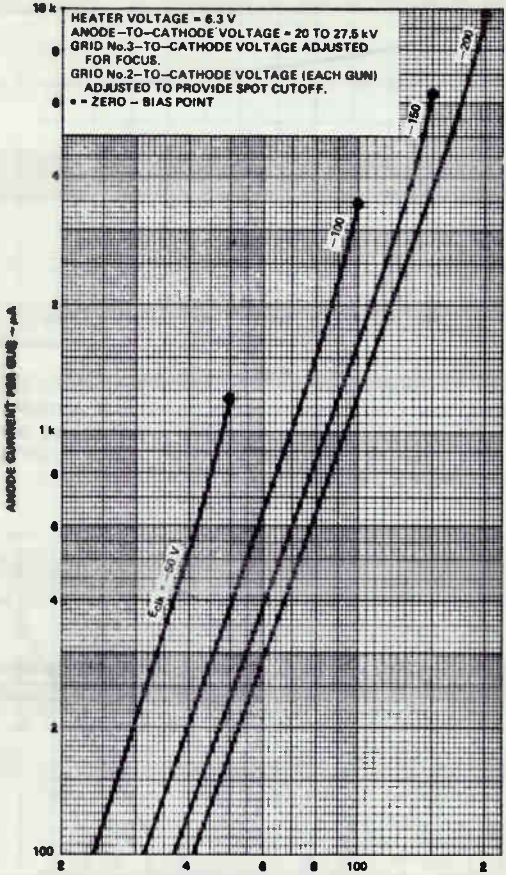
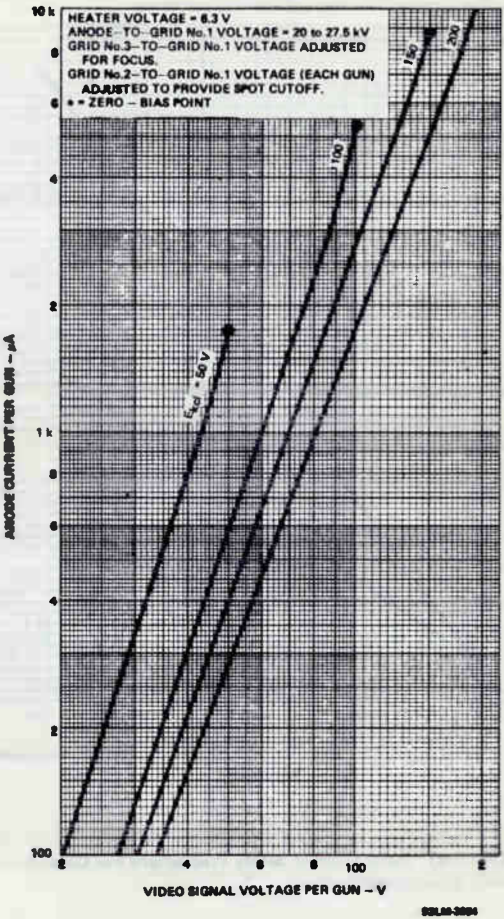


Figure 2

TYPICAL DRIVE CHARACTERISTICS, GRID-DRIVE SERVICE



TYPICAL DRIVE CHARACTERISTICS, CATHODE-DRIVE SERVICE



CUTOFF DESIGN CHART

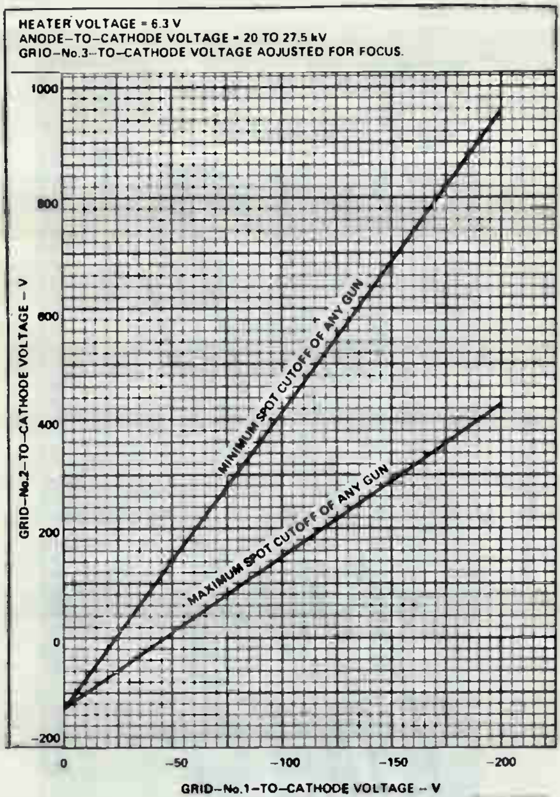


Figure 3

IMPORTANT: Refer to sheet **Safety Precautions For Color Picture Tubes** at front of this section.

Picture Tube

NO ION-TRAP MAGNET REQUIRED

MAGNETIC FOCUS 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

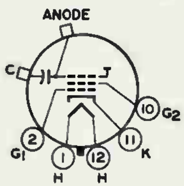
See *Picture-Tube Dimensional-Outlines* and *Bulb J165 Z* sheets at front of this section

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	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

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 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 X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

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 anode.	2500 max	pF
	2000 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.) 79%

MECHANICAL

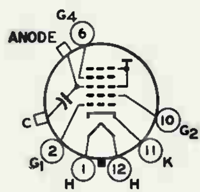
Weight (Approx.)	24 lb
Overall Length	22.438 ± 0.375 in
Neck Length.	7.500 ± 0.188 in
Projected Area of Screen	224 sq in

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* 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	V
Grid-No.4 (Focusing) Voltage		
Positive value	1100 max	V
Negative value	550 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
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 *X-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	600 ± 60	ma
Electron Gun.	Type Requiring No Ion-Trap Magnet	

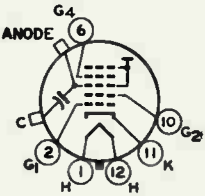
Optical:

Phosphor (For curves, see front of this section) . P4—Sulfide Type, Aluminized
Faceplate, 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

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.	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

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, 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:

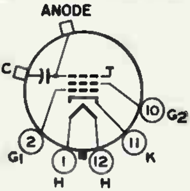
See *Picture-Tube Dimensional-Outlines and Bulb J170 B/D* sheets at front of this section

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	20000 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.	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

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section

RCA

21ZP4-A, 21ZP4-B
PICTURE TUBES
RECTANGULAR GLASS TYPES

MAGNETIC FOCUS — MAGNETIC DEFLECTION

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 . . . . {750 max. μμf; 500 min. μμf}

Faceplate, Spherical . . . . .Filterglass

Phosphor (For curves, see front of this section)	*Type 21ZP4-A*	*Type 21ZP4-B*
	P4—Sulfide Type	P4—Sulfide Type Aluminized

Deflection Angles (Approx.):
- Diagonal . . . . 70°
- Horizontal . . . . 65°
- Vertical . . . . 50°

Electron Gun . . . . .Ion-Trap Type Requiring External Single-Field Magnet

Tube Dimensions:
- Overall length . . . . 23-1/32" ± 3/8"
- Greatest width . . . . 20-1/4" ± 1/8"
- Greatest height . . . . 15-9/16" ± 1/8"
- Diagonal . . . . 21-7/32" ± 1/8"
- Neck length . . . . 7-1/2" ± 3/16"
- Radius of curvature of faceplate (External surface) . . 40"

Screen Dimensions (Minimum):
- Greatest width . . . . 19-1/16" ←
- Greatest height . . . . 14-3/16"
- Diagonal . . . . 20" ←
- Projected area . . . . 248 sq. in. ←

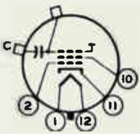
Operating Position . . . . .Any

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

Base . . Small-Shell Duodecal 5-Pin (JETEC 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 - Ultor (Grid No.3, Collector)
C - External Conductive Coating

Maximum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	18000 max.	volts
GRID-No.2 VOLTAGE	500 max.	volts

← indicates a change.

RCA

21ZP4-A, 21ZP4-B

PICTURE TUBES

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

Maximum Circuit Values:

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

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

→ Indicates a change.

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 toward tube axis
Heater, of Each Gun
  Series connected within tube with each of the other two heaters
    Current at 6.3 volts[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.3 to all other electrodes . . . . 6.5 pF
  All cathodes to all other electrodes . . . . . . 15 pF
  External conductive coating to anode . . . . . {2500 max pF / 2000 min pF}

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.) . . . . . 0.025 in (0.64 mm)

MECHANICAL

Tube Dimensions

Overall length	19.204 ± .375 in (487.8 ± 9.5 mm)
Neck length	6.693 ± .188 in (170.0 ± 4.8 mm)
Diagonal	21.721 ± .093 in (551.7 ± 2.4 mm)
Greatest width	18.976 ± .093 in (482.0 ± 2.4 mm)
Greatest height	15.236 ± .093 in (387.0 ± 2.4 mm)

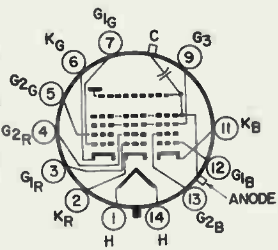
Minimum Screen Dimensions (Projected)

Diagonal	20.233 in (513.9 mm)
Greatest width	17.446 in (443.1 mm)
Greatest 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 - 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, Grid No.5, Screen, Collector)
C - External Conductive Coating



14BE

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 20,000 min	V V
Typical Anode Current, Long-Term Average	1000 max	µA
Grid-No.3 (Focusing Electrode) Voltage	6000 max	V
Peak Grid-No.2 Voltage, Including Video Signal Voltage	1000 max	V

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

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 *Cutoff Design Chart*
For visual extinction of 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 µA

Grid-No.2 Current . . . . −5 to +5 µA

To Produce White 9300°K + 27 M.P.C.D. (CIE Coordinates x = 0.281, y = 0.311)

	Red	*Blue*	*Green*	
Percentage of total anode current supplied 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	±0.47 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[c] (Including Effect of Earth's Magnet Field when Using Recommended Components)
Measured 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		
Under operating conditions[a]	6.3	V
Under standby conditions.	5.0	V

LIMITING CIRCUIT VALUES

High-Voltage Circuits

Grid-No.3 circuit resistance. . . . . 7.5 max MΩ

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 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.

[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" (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.

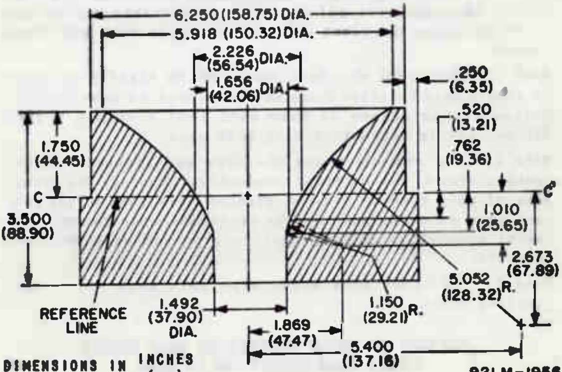
Orientation. The 22JP22 must be operated with tube axis in a horizontal position and with the blue gun uppermost (i.e., the anode contact button on top).

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.

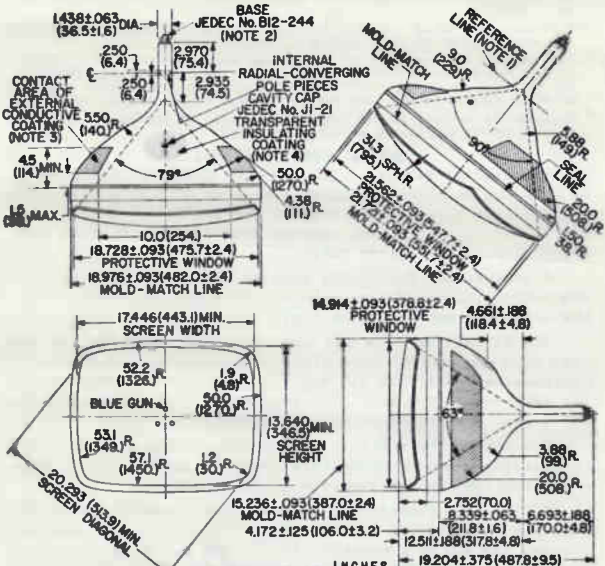
Misregister Compensation. Proper operation of the 22JP22 requires compensation for the effects of extraneous magnetic fields, the earth's magnetic field, and other causes which may produce misregister. Compensation for these effects may be accomplished by the use of a purifying magnet.

REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE JEDEC No.G162



Reference Line is determined by plane C-C' when gauge is seated.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES (mm)

92LL-1306R2

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.

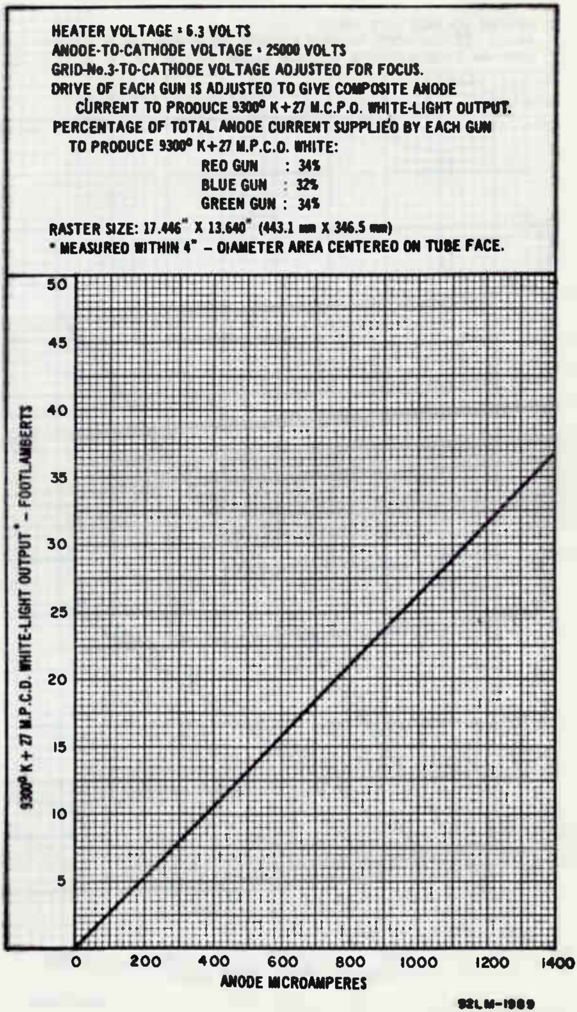
Note 4: To clean this area, wipe only with soft, dry, lintless cloth.

LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS

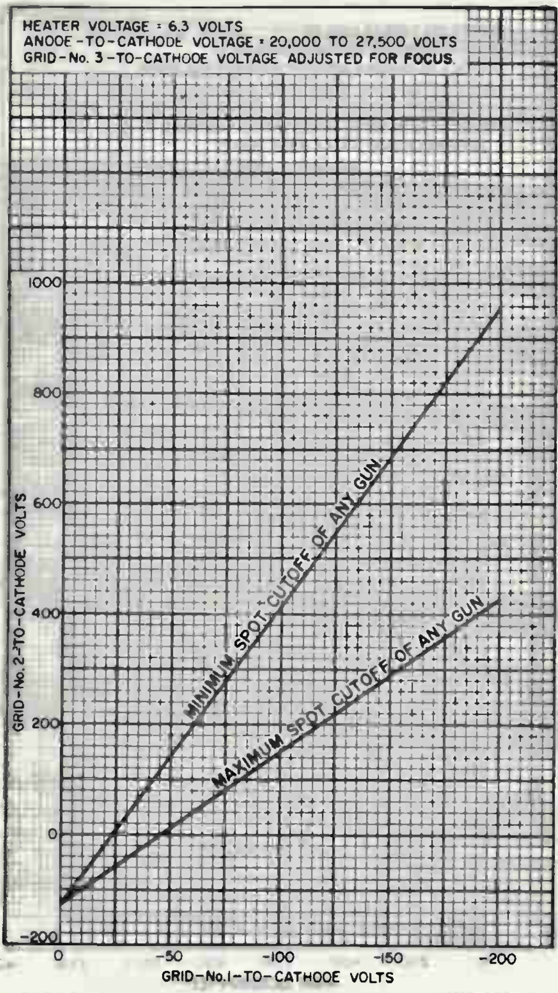
for type 22JP22 is the same as that shown for type 25XP22

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

Typical Light-Output Characteristic



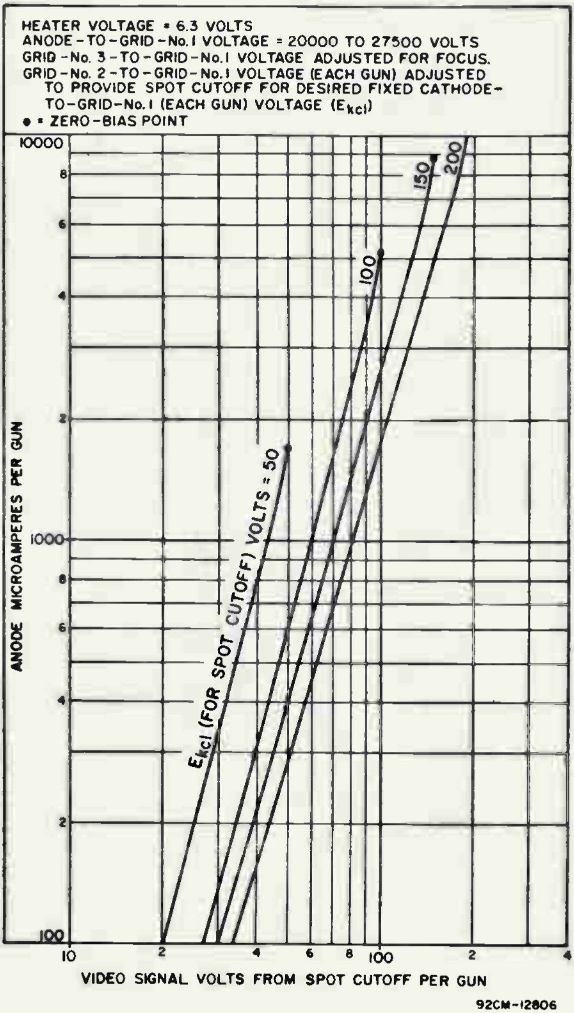
Cutoff Design Chart



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

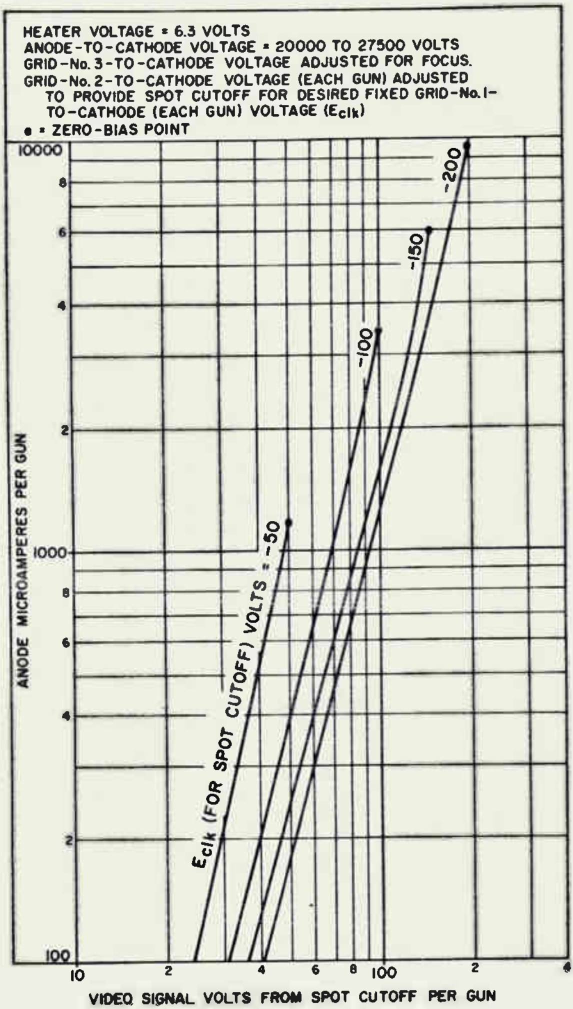
Typical Drive Characteristics

Cathode-Drive Service



Typical Drive Characteristics

Grid-Drive Service



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

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]

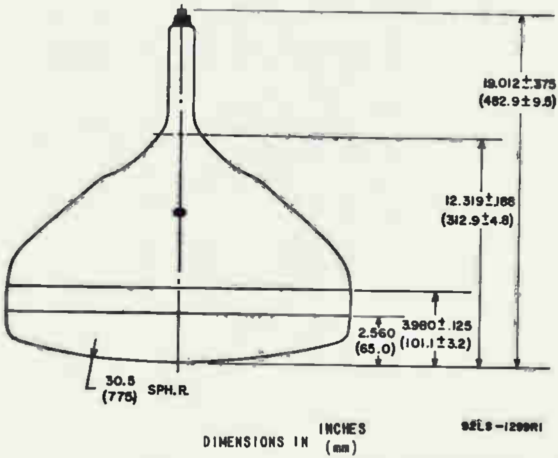
MECHANICAL

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

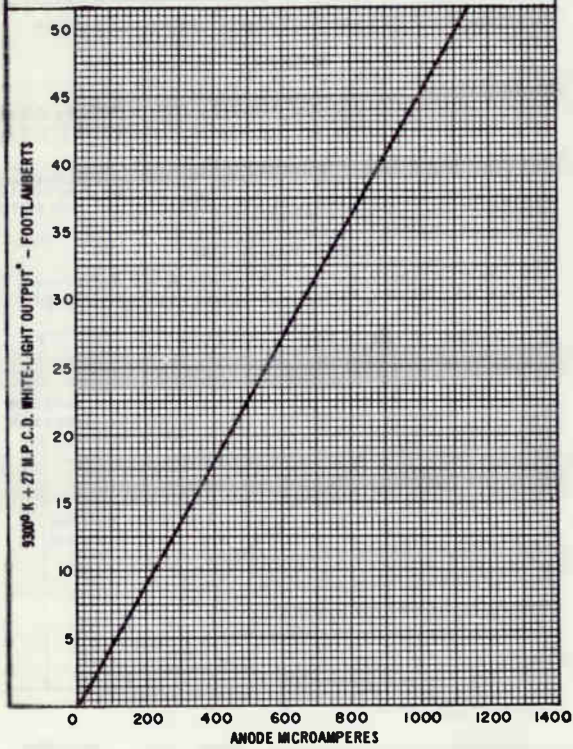


Typical Light-Output Characteristic

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)

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.	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):		
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

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	µA
Grid-No.2 Current	−5 to +5	µA

To Produce White 9300° K + 27 M.P.C.D. (CIE Coordinates x = 0.281, y = 0.311):

	Red	Blue	Green	
Percentage of total anode current supplied 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 . . . . ± 0.47 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. MΩ

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. 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.

[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" (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.

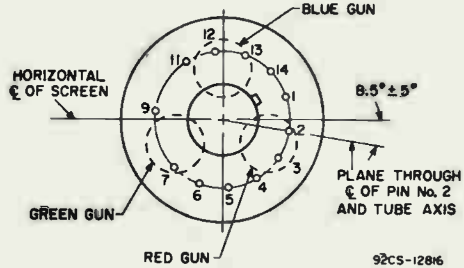
X-RADIATION WARNING

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.

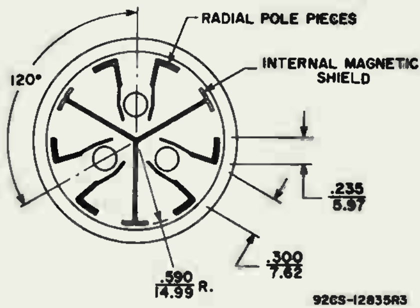
BASE SPECIFICATION – JEDEC No. 14BE

Pin 1: Heater
Pin 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

BOTTOM VIEW OF BASE



LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



NOTES FOR DIMENSIONAL OUTLINE

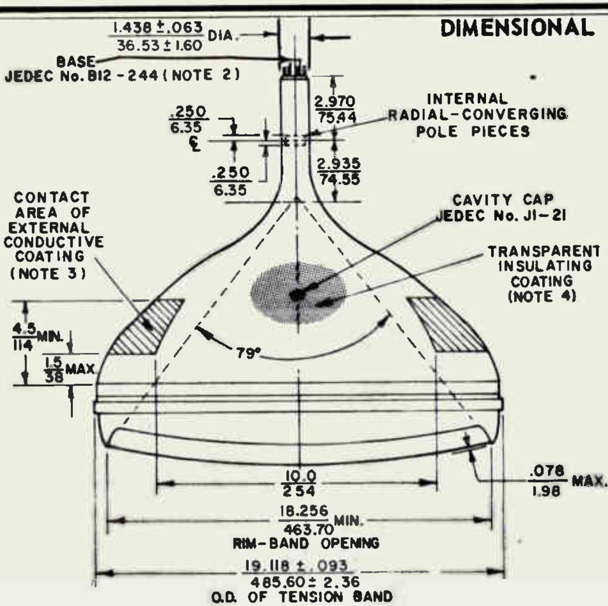
Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge JEDEC No.G162 and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C' of the gauge with the glass funnel.

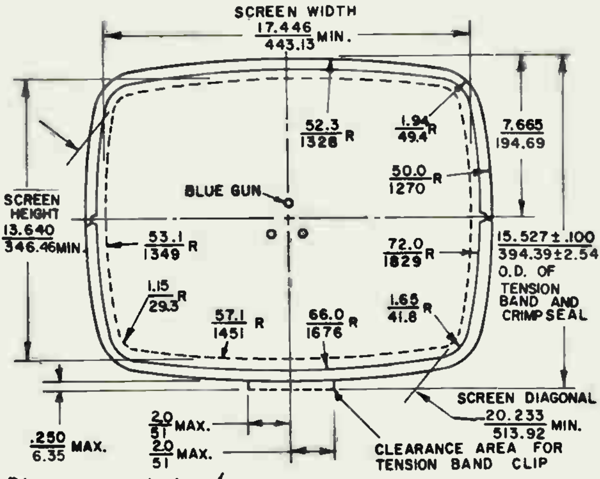
Note 2: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.

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.

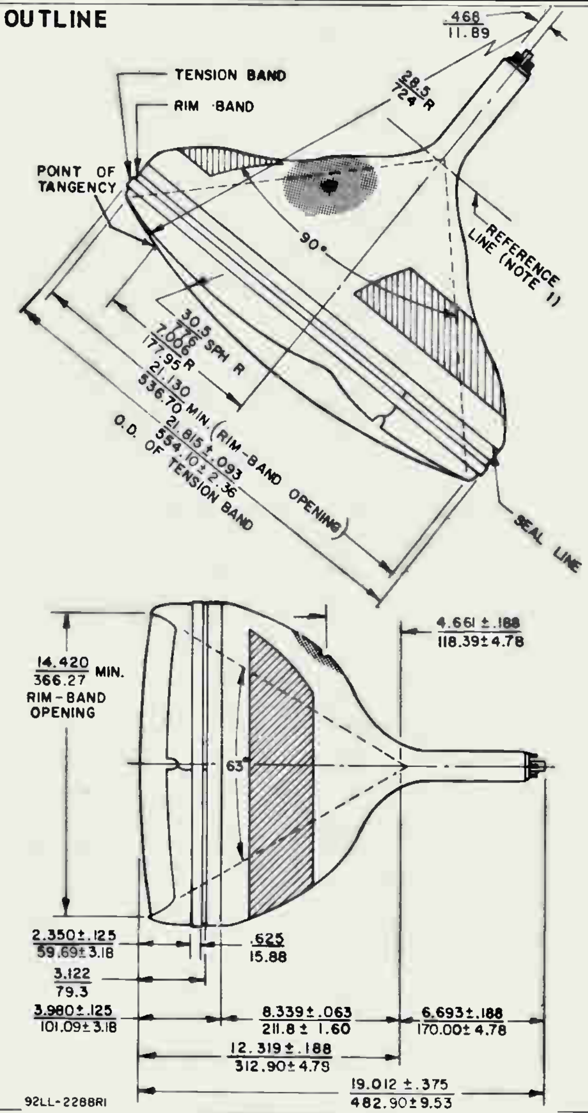
DIMENSIONAL





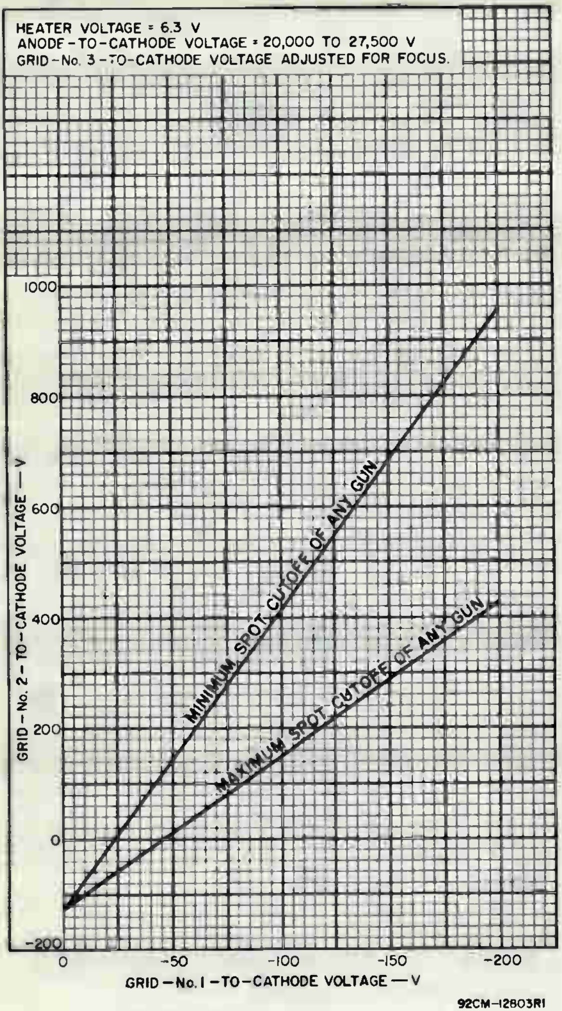
Dimensions in Inches/mm

OUTLINE



.468 / 11.89
TENSION BAND
RIM BAND
28.5 / 724 R
POINT OF TANGENCY
90°
REFERENCE LINE (NOTE 1)
30.5 / 776 SPH R
7.006 / 177.95 R
21.130 / 536.70 MIN. (RIM-BAND OPENING)
21.815 ±.093 / 554.10±2.36
O.D. OF TENSION BAND
SEAL LINE
4.661 ±.188 / 118.39±4.78
14.420 / 366.27 MIN.
RIM-BAND OPENING
63°
2.350±.125 / 59.69±3.18
.625 / 15.88
3.122 / 79.3
3.980±.125 / 101.09±3.18
8.339±.063 / 211.8± 1.60
6.693±.188 / 170.00±4.78
12.319±.188 / 312.90±4.78
19.012 ±.375 / 482.90±9.53
92LL-2288R1

CUTOFF DESIGN CHART



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.

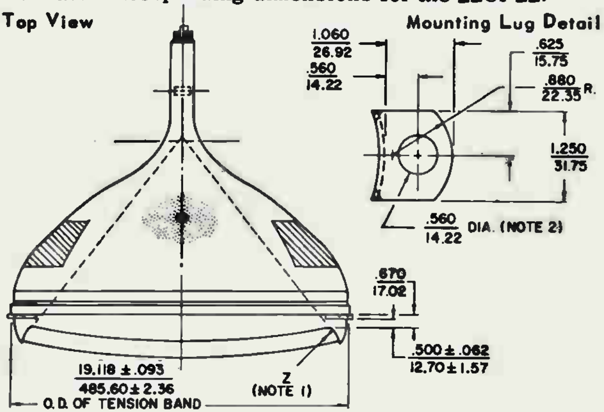
MECHANICAL

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)

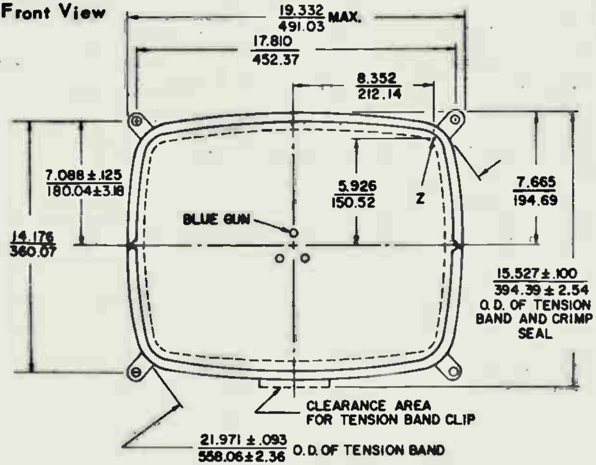
DIMENSIONAL OUTLINE

Dimensions shown are only those which are different from the corresponding dimensions for the 22UP22.

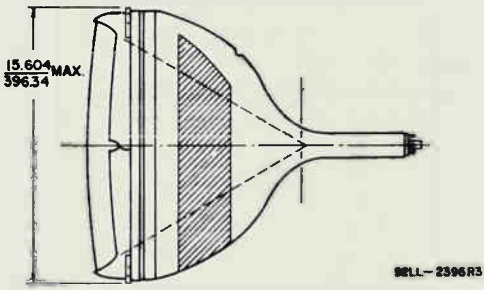


DIMENSIONAL OUTLINE (Cont'd)

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 .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.

23AHP4

Picture Tube

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 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		92°
Horizontal		80°
Vertical		65°
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
	1700 min.	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:

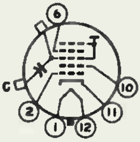
Tube Dimensions:	
Overall length	18" ± 3/8"
Greatest width	20-1/2" + 1/16" − 1/8"
Greatest height	16-1/2" ± 1/8"
Diagonal	23-25/64" + 3/32" − 1/8"
Neck length	5-1/2" ± 3/16"
Curvature of faceplate (Radii):	
Center	50"
Edge	36-3/4"
Screen Dimensions (Minimum):	
Greatest width	19-1/4"
Greatest height	15-1/8"
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 6-Pin (JEDEC Group 4, 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[▲] 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_{c_5k}) of	*18000*	*volts*
and grid-No.2 voltage (E_{c_2k}) 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

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 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 (Ec_5g_1) of	*18000*	*volts*
and grid-No.2-to-grid-No.1 voltage (Ec_2g_1) 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 face. Maximum field strength of adjustable centering magnet equals:

$$\sqrt{\frac{E_{c_5k} \text{ or } E_{c_5g_1} \text{ (volts)}}{16000 \text{ (volts)}}} \times 10 \text{ gausses}$$

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.

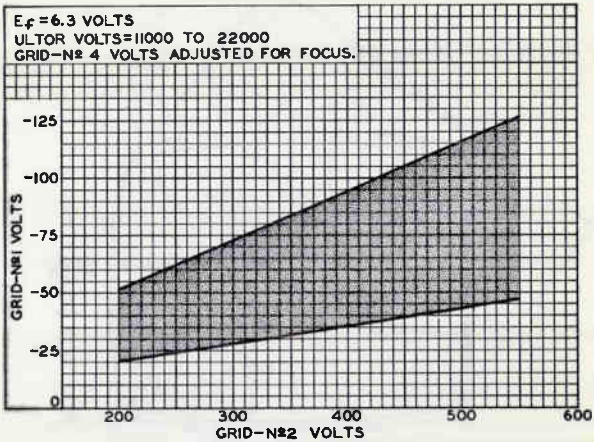
♠ See *Raster-Cutoff-Range Chart for Cathode-Drive Service*.

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 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



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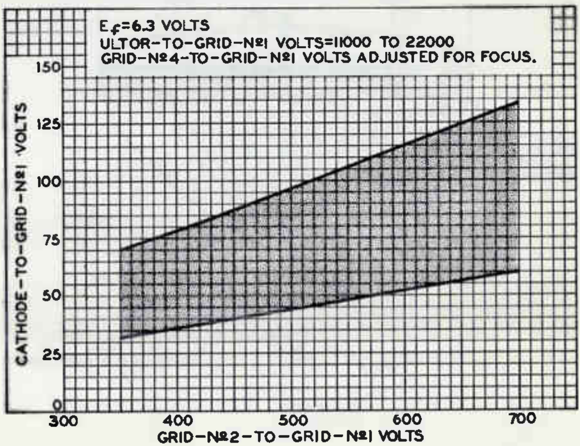
Cathode-Drive Service



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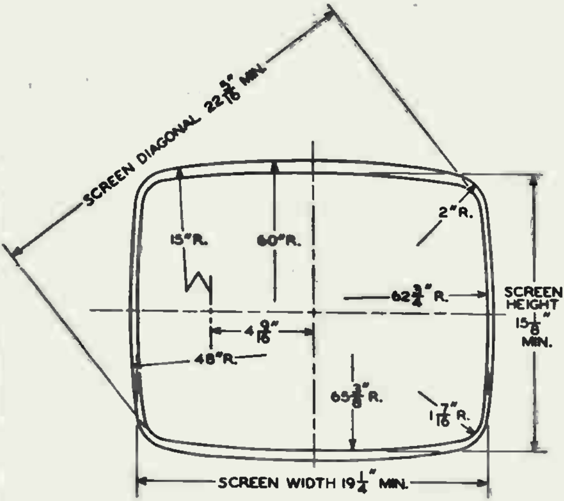
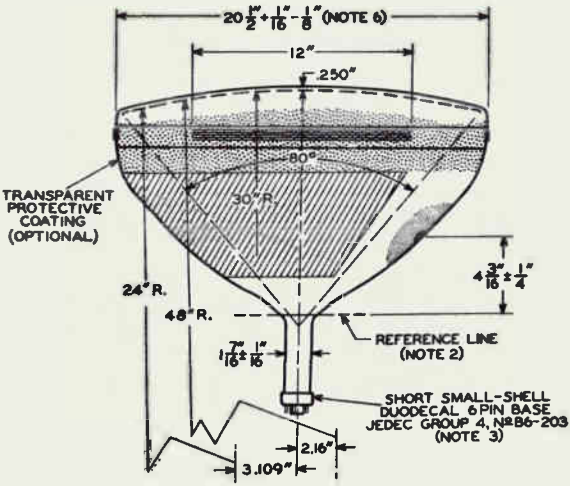
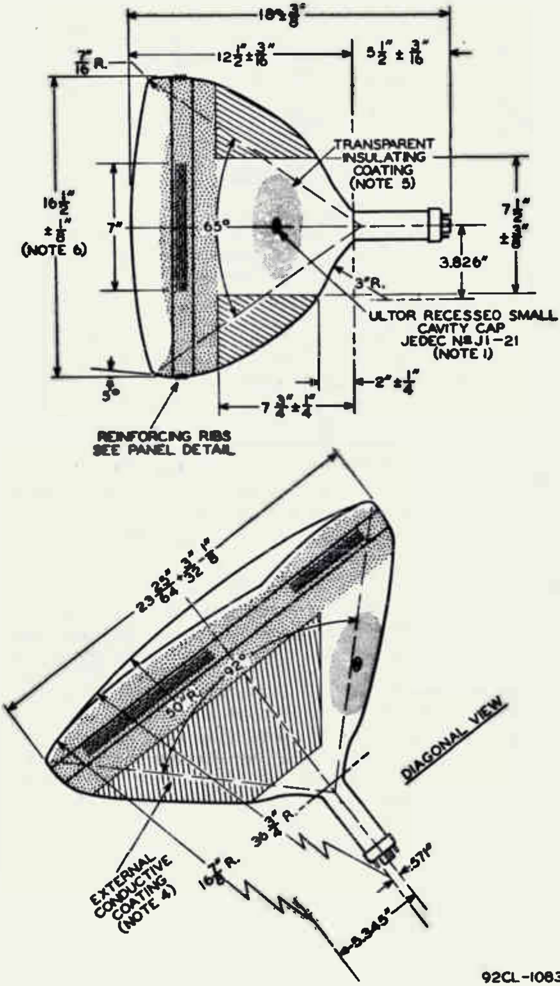
23AHP4



SCREEN DIAGONAL 22 5/16" MIN.
2" R.
15" R.
60" R.
62 3/4" R.
SCREEN HEIGHT 15 1/8" MIN.
4 9/16"
48" R.
65 3/8" R.
1 7/16" R.
SCREEN WIDTH 19 1/4" MIN.



20 1/2" + 1/16" − 1/8" (NOTE 6)
12"
.250"
80°
30" R.
TRANSPARENT PROTECTIVE COATING (OPTIONAL)
4 3/16" ± 1/4"
24" R.
48" R.
REFERENCE LINE (NOTE 2)
1 7/16" ± 1/16"
SHORT SMALL-SHELL DUODECAL 6 PIN BASE JEDEC GROUP 4, № B6-203 (NOTE 3)
2.16"
3.109"



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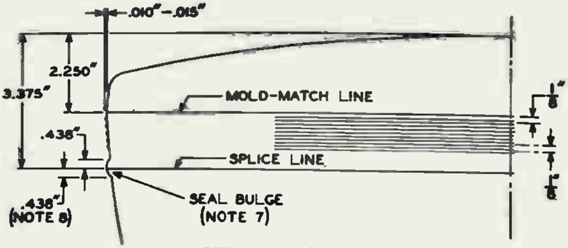


DETAIL OF PANEL

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 ±30°. 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.

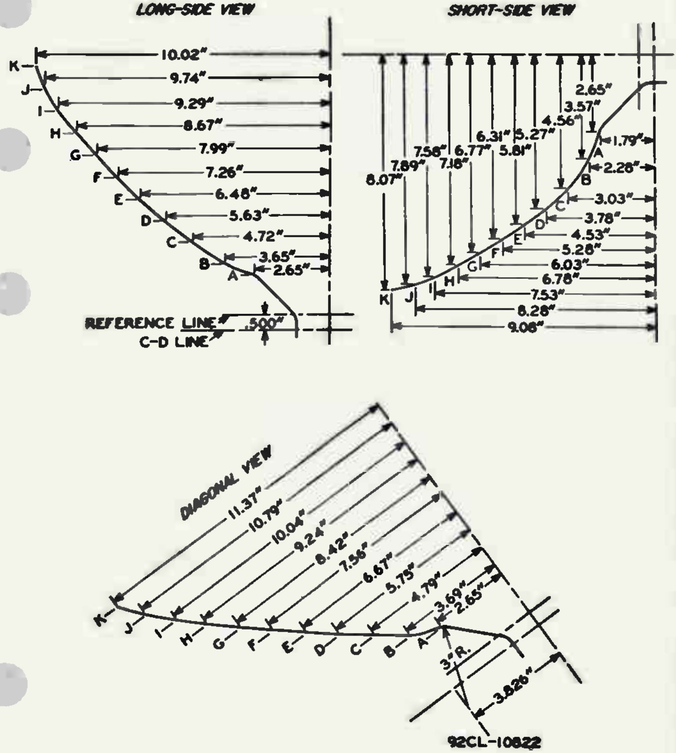
NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

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 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 electrodes.	5	pF
Grid No.1 to all other electrodes.	6	pF
External conductive coating to anode	2500 max	pF
	1700 min	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

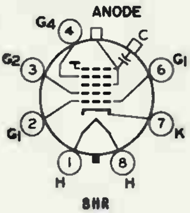
For Additional Information on Coatings and Dimensions
See *Picture-Tube Dimensional-Outlines* and *Bulb J187E* sheets at front of this section

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



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

Picture Tube

RECTANGULAR GLASS TYPE — **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS — **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 . . . . 17" ± 3/8"
- Neck length. 4-1/2" ± 3/16"

23BDP4

Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE | ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS | 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

Picture Tube

LOW-VOLTAGE ELECTROSTATIC FOCUS
BI-PANEL TYPE
NO ION-TRAP MAGNET REQUIRED

LOW-GRID-No.2 VOLTAGE
CATHODE-DRIVE TYPE
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. pf / 1700 min. 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 . . . . P4—Sulfide Type, Aluminized
(For Curves, see front of this Section)
Faceplate and Protective Panel . . . . .Filterglass
Light transmission (Approx.) 40%

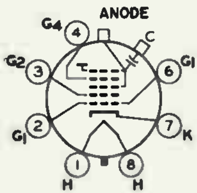
Mechanical:

Weight (Approx.) . . . . 33 lbs
Overall Length . . . . 15.188" ± .375"
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 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 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



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
	12000 min.	volts
Grid-No.4 (Focusing) Voltage:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
Grid-No.2 Voltage	70 max.	volts
	40 min.	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.	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 Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	16000 max.	volts
Grid-No.4 Voltage	0 to 400	volts
Grid-No.2 Voltage	50	volts
Cathode Voltage for visual extinction of focused raster	32 to 50	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

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

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 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; 1700 min. μμf}
Electron Gun . . . . .Type Requiring No Ion-Trap Magnet

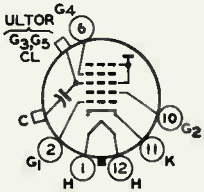
Optical:

Faceplate. .Filterglass
  Light transmission (Approx.) 78%
Phosphor (For curves, see front of this Section) .P4—Sulfide Type, Aluminized

Mechanical:

Operating Position . . . . .Any
Weight (Approx.) . . . . 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 *Picture-Tube Dimensional-Outlines* and *Bulb J187 C/F* 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

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

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
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 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
	1700 min.	μμf
Electron Gun	Type Requiring No Ion-Trap Magnet	

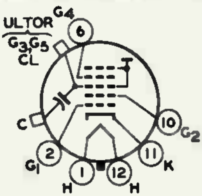
Optical:

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.) . . . . 35 lbs
Overall Length . . . . 18-7/16" ± 7/16"
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 *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

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
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.	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-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

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 **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS **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 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

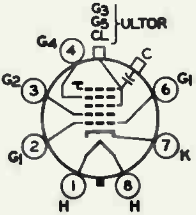
Optical:

Faceplate 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

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

ULTOR VOLTAGE	23000 max.	volts
	12000 min.	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

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 — 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 ± 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*
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"
In plane of horizontal deflection	39-3/4"	26-1/2"

23CP4

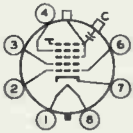
	Radius at center	Radius at edge
In plane of vertical deflection.	36-3/4"	18-1/2"

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 (JEDEC No.J1-21)
Bulb. . . . . J187 Fitted with Protective Panel FP198
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▲ 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 ($E_{c_5}k$) between 12000● and 20000 volts and grid-No.2 voltage ($E_{c_2}k$) between 200 and 500 volts

Grid-No.4 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.4 Current.	−25 to +25	μa
Grid-No.2 Current.	−15 to +15	μa
Field Strength of Adjustable Centering Magnet♦	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor voltage of	*18000*	*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	−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

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	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 ($E_{c_5 g_1}$) between 12000● and 20000 volts and grid-No.2-to-grid-No.1 voltage ($E_{c_2 g_1}$) between 225 and 640 volts

Grid-No.4-to-Grid-No.1 Voltage for focus★.	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 voltage	
Grid-No.4 Current	-25 to +25	μa
Grid-No.2 Current	-15 to +15	μa
Field Strength of Adjustable Centering Magnet♦	0 to 8	gausses

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 signel veries the grid-No.1 potential with respect to cathode.

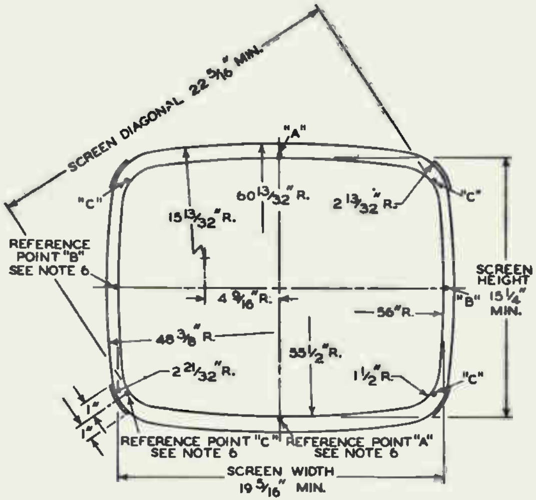
● This value is a working design-center minimum. The equivalent *absolute minimum* ultor (or ultor-to-grid-No.1) voltage is 11,000 volts below which the serviceability of the 23CP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor (or ultor-to-grid-No.1) voltege is never less than 11,000 volts.

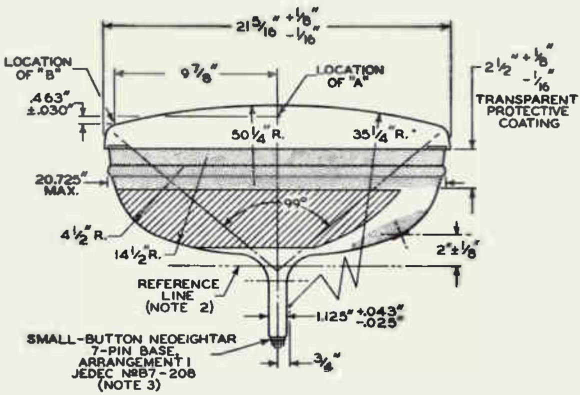
★ The grid-No.4 (or grid-No.4-to-grid-No.1) voltage required for optimum focus of any individual tube may have a value anywhere between 0 and 400 volts; is independent of ultor current; and will remain essentially constant for values of ultor (or ultor-to-grid-No.1) voltage, or grid-No.2 (or grid-No.2-to-grid-No.1) voltage, within design ranges shown for these items.

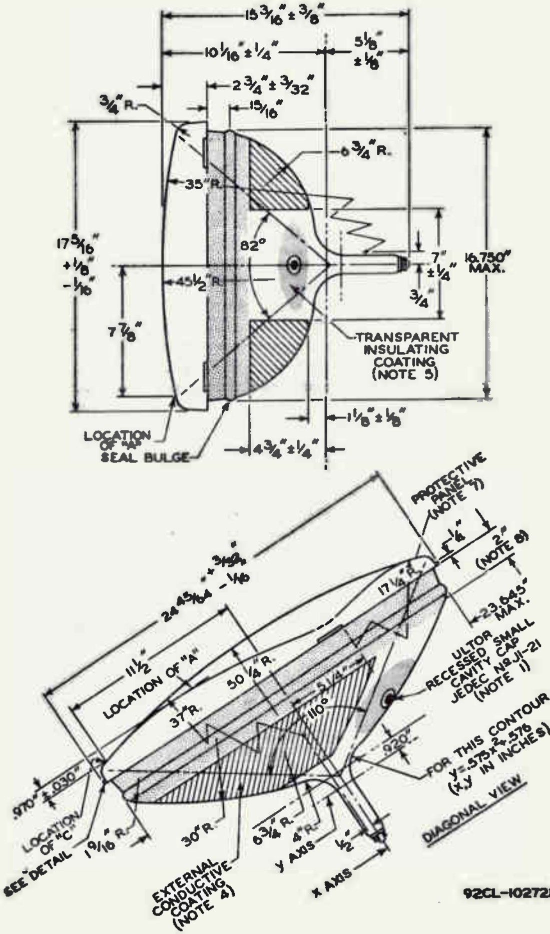
♦ Distance from *Reference Line* for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 3/8-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic 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.

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section


SCREEN DIAGONAL 22 5/16" MIN.
"A"
"C"
60 13/32" R.
2 13/32" R.
15 13/32" R.
REFERENCE POINT "B" SEE NOTE 6
SCREEN HEIGHT 15 1/4" MIN.
4 9/16" R.
"B"
56" R.
48 3/8" R.
55 1/2" R.
2 21/32" R.
1 1/2" R.
1"
1"
REFERENCE POINT "C" SEE NOTE 6
REFERENCE POINT "A" SEE NOTE 6
SCREEN WIDTH 19 5/16" MIN.


21 5/16" +1/8" -1/16"
LOCATION OF "B"
9 7/8"
LOCATION OF "A"
2 1/2" +1/8" -1/16"
.463" ±.030"
TRANSPARENT PROTECTIVE COATING
50 1/4" R.
35 1/4" R.
20.725" MAX.
90°
4 1/2" R.
14 1/2" R.
2" ± 1/8"
REFERENCE LINE (NOTE 2)
1.125" +.043" -.025"
SMALL-BUTTON NEOEIGHTAR 7-PIN BASE, ARRANGEMENT 1 JEDEC №B7-208 (NOTE 3)
3/4"



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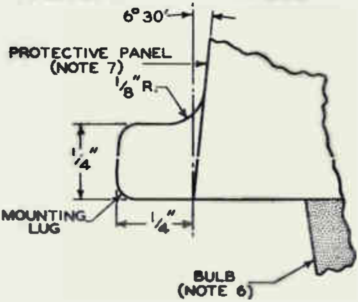
DETAIL OF MOUNTING LUG



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 ± 30°. 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.

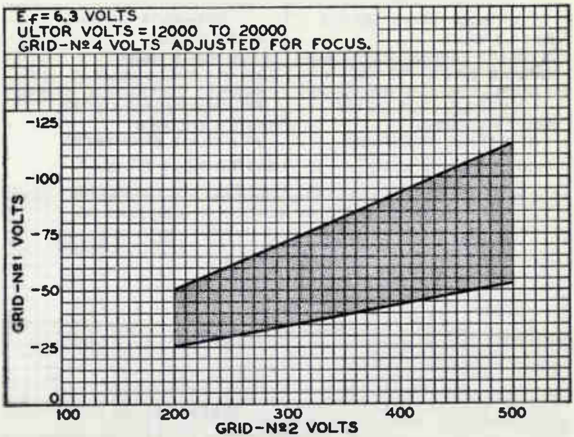
NOTE 6: REFERENCE POINTS A, B, AND C ARE PROVIDED FOR USE IN DESIGN OF A MASK CONTOURED FOR CLOSE FIT TO THE PROTECTIVE PANEL.

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



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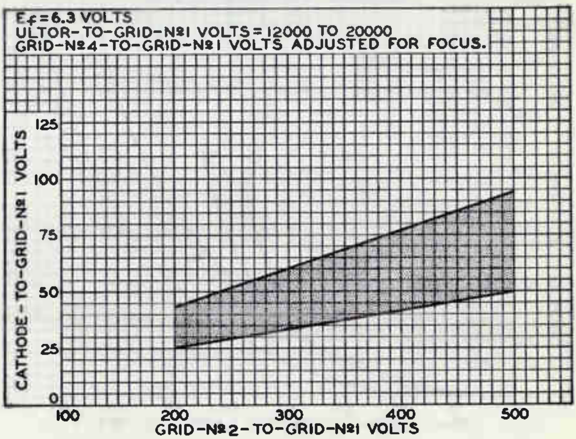
Cathode-Drive Service



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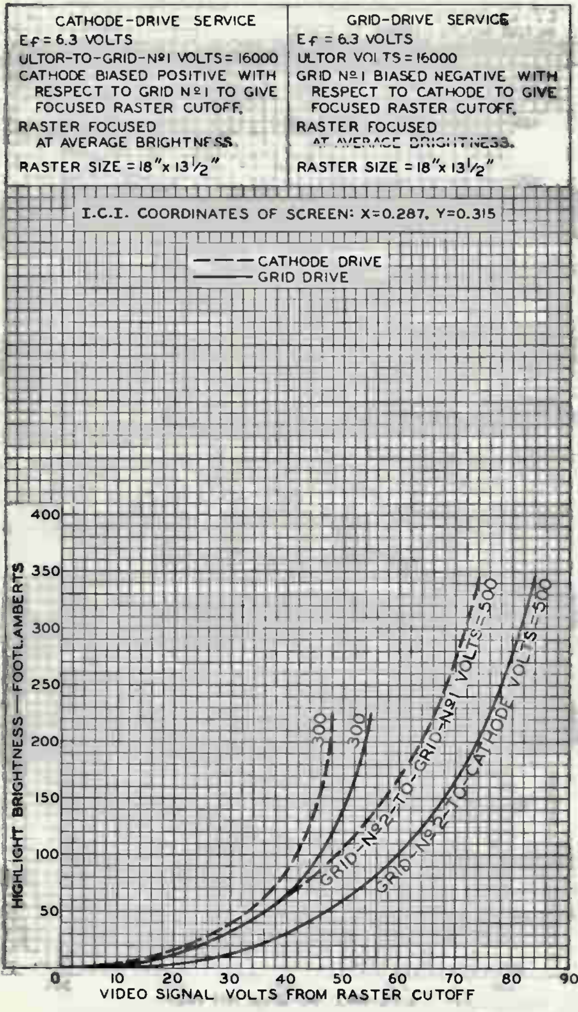
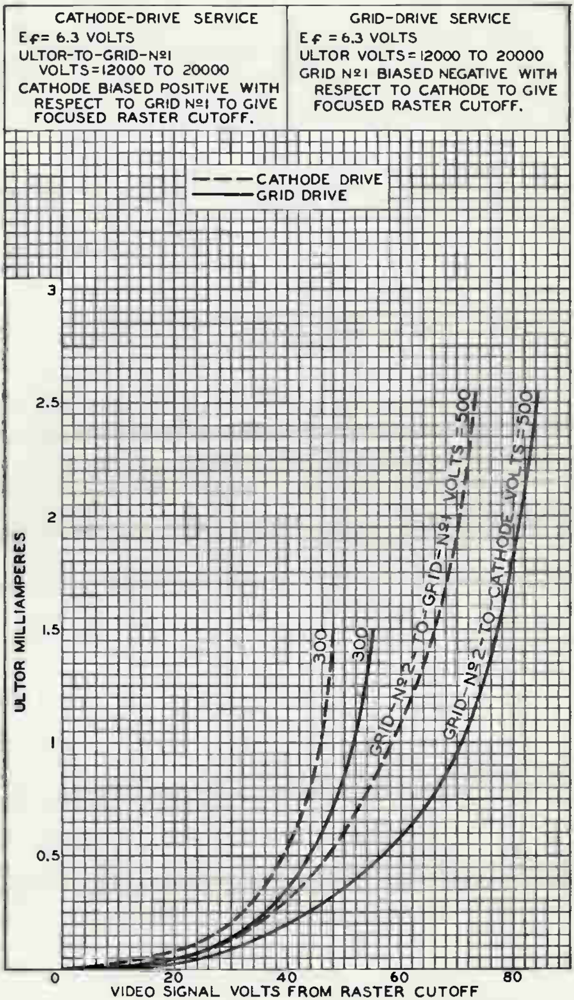
AVERAGE DRIVE CHARACTERISTICS



92CM-10318

AVERAGE DRIVE CHARACTERISTICS



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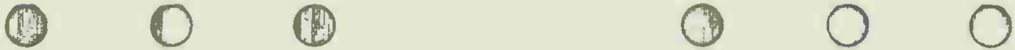


Picture Tube

LOW-VOLTAGE ELECTROSTATIC FOCUS

NO ION-TRAP MAGNET REQUIRED — 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	2500 max.	pf
	1700 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	

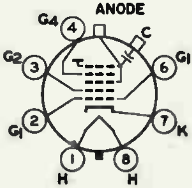
Optical:

Phosphor . . . . P4—Sulfide Type, Aluminized
(For Curves, see front of this Section)
Faceplate and Protective Window . . . . Filterglass
Light transmission (Approx.) 78%

Mechanical:

Weight (Approx.) . . . . 24 lbs
Overall Length . . . . 13.781" ± .281"
Neck Length . . . . 4.375" ± .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 J187B* 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



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	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 Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	14000	volts
Grid-No.4 Voltage	0 to 400	volts
Grid-No.2 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

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
94° MAGNETIC DEFLECTION

Low-Grid-No.2-Voltage Type
for Cathode-Drive Operation

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. pf / 1700 min. 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.). 78%

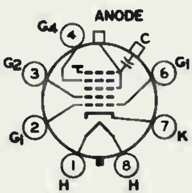
Mechanical:

Weight (Approx.). . . . . 27 lbs
Overall Length. . . . . 17-5/64" ± 5/16"
Neck Length . . . . 5" ± 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, Dimensions, and Deflection Angles:
See *Picture-Tube Dimensional-Outlines and Bulb J187 B1* 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 - 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	23000 max.	volts
	10000 min.	volts
GRID-No.4 VOLTAGE:		
Positive value.	1100 max.	volts
Negative value.	550 max.	volts
GRID-No.2 VOLTAGE	70 max.	volts
	40 min.	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.	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 & 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

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.

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.	pf
	2000 min.	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.) 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:

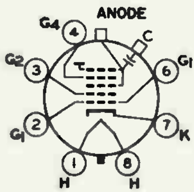
See Picture-Tube *Dimensional-Outlines* and *Bulb J187 E* at front on this section

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

Base . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208) or (JEDEC No. B7-237)

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



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	1250 max.	volts
Negative value	400 max.	volts
Grid-No.2 Voltage	250 max.	volts
Grid-No.2 to Cathode Voltage	100 max. / 40 min.	volts / 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. / 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	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

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front on 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)

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	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to anode[a]	2500 max.	pf
	1700 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

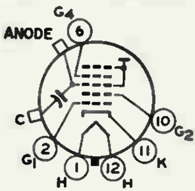
Optical:

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 . . . . 18.000" ± .375"
Neck Length . . . . 5.500" ± .188"
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 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	25000 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.	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	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

[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 +800 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

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] . 2500 max. pf / 1700 min. 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.). 42%

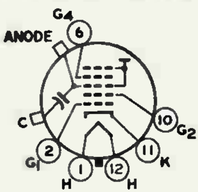
Mechanical:

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 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 grid No.1

Anode Voltage	25000 max.	volts
	11000 min.	volts
Grid-No.4 Voltage:		
Positive value	1250 max.	volts
Negative value	400 max.	volts
Grid-No.2 Voltage	70 max.	volts
	40 min.	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.	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	50	volts
Cathode Voltage for visual extinction of focused raster	36 to 54	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 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 μμf
  Cathode to all other electrodes. . . . 5 μμf
  External conductive coating to ultor . . {2500 max. μμf; 1700 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*
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):

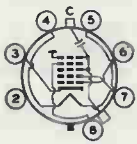
	Radius at center	*Radius at edge*
In plane of diagonal deflection	39-1/2"	31-1/2"

	Radius at center	*Radius at edge*
In plane of horizontal deflection . . .	39-3/4"	28-1/2"
In plane of vertical deflection.	38-3/4"	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 ($E_{c_5 g_1}$) between 12000● and 20000 volts and grid-No. 2-to-grid No. 1 voltage ($E_{c_2 g_1}$) 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 ($E_{k_{g1}}$) 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 $E_{k_{g1}}$ except video drive is a negative voltage	
Grid-No. 4 Current	-25 to +25	μa
Grid-No. 2 Current	-15 to +15	μa
Field Strength of Adjustable Centering Magnet♦	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

▲ 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.

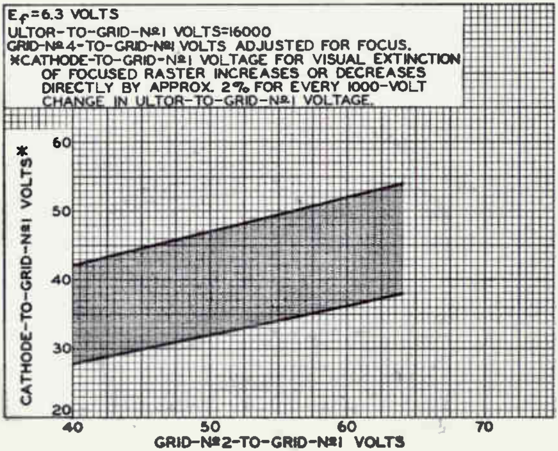
● This value is a working design-center minimum. The equivalent *absolute minimum* ultor-to-grid-No. 1 voltage is 11,000 volts below which the serviceability of the 23EP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable 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.

♦ 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



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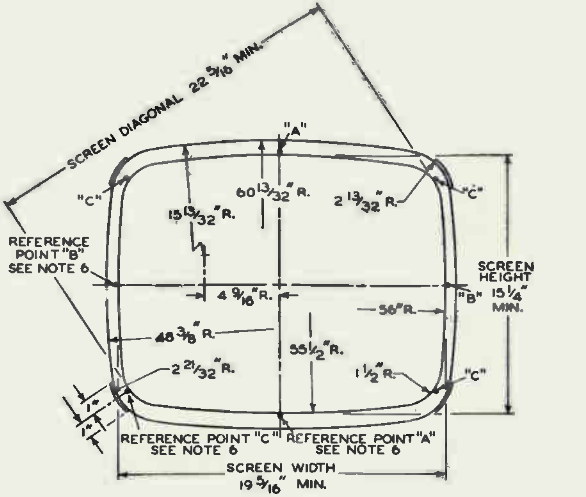
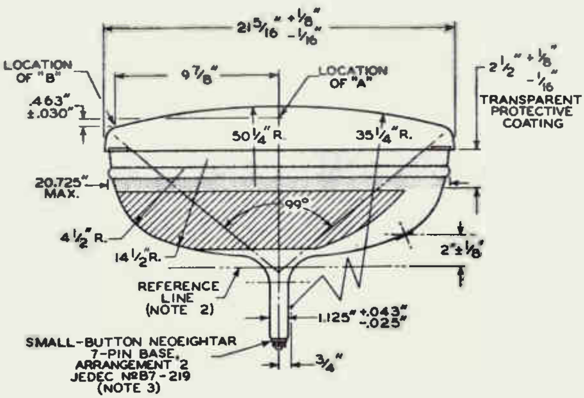
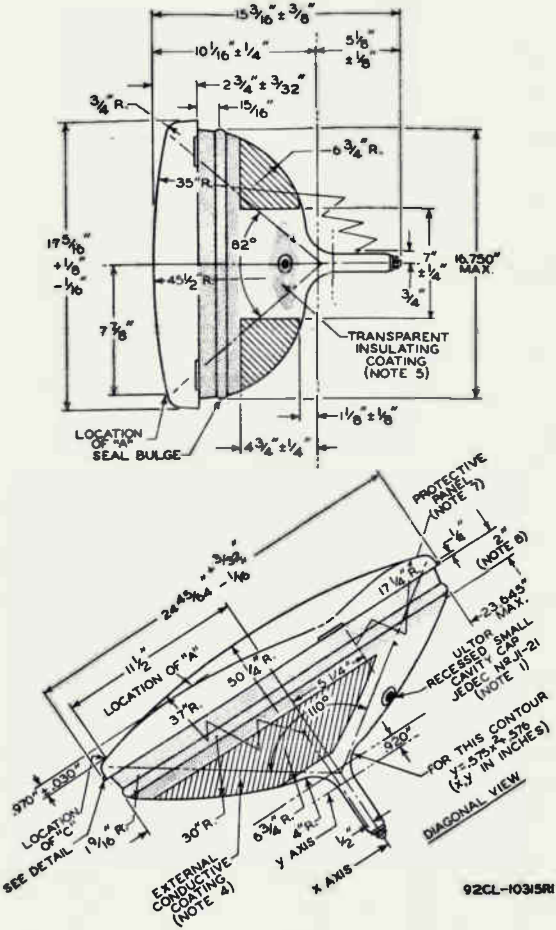

SCREEN DIAGONAL 22 5/16" MIN.
"A"
"C"
60 13/32" R.
2 13/32" R.
15 13/32" R.
REFERENCE POINT "B" SEE NOTE 6
SCREEN HEIGHT 15 1/4" MIN.
"B"
4 9/16" R.
56" R.
48 3/8" R.
55 1/2" R.
2 21/32" R.
1 1/2" R.
1"
1"
REFERENCE POINT "C" SEE NOTE 6
REFERENCE POINT "A" SEE NOTE 6
SCREEN WIDTH 19 5/16" MIN.


21 5/16" +1/8" -1/16"
LOCATION OF "B"
9 7/8"
LOCATION OF "A"
2 1/2" +1/8" -1/16"
TRANSPARENT PROTECTIVE COATING
.463" ±.030"
50 1/4" R.
35 1/4" R.
20.725" MAX.
99°
4 1/2" R.
14 1/2" R.
2"±1/8"
REFERENCE LINE (NOTE 2)
1.125" +.043" -.025"
SMALL-BUTTON NEOEIGHTAR 7-PIN BASE, ARRANGEMENT 2 JEDEC Nº B7-219 (NOTE 3)
3/4"



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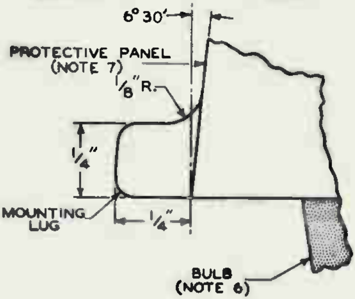
DETAIL OF MOUNTING LUG



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 8 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 30°. ULTOR TERMINAL IS ON SAME SIDE AS PIN 8.

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.

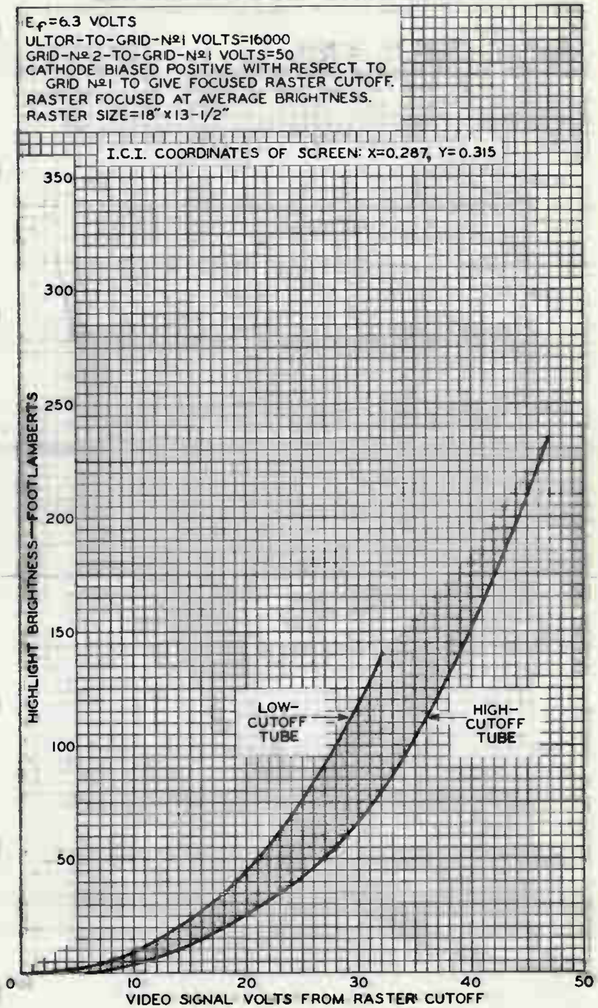
NOTE 6: REFERENCE POINTS A, B, AND C ARE PROVIDED FOR USE IN DESIGN OF A MASK CONTOURED FOR CLOSE FIT TO THE PROTECTIVE PANEL.

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



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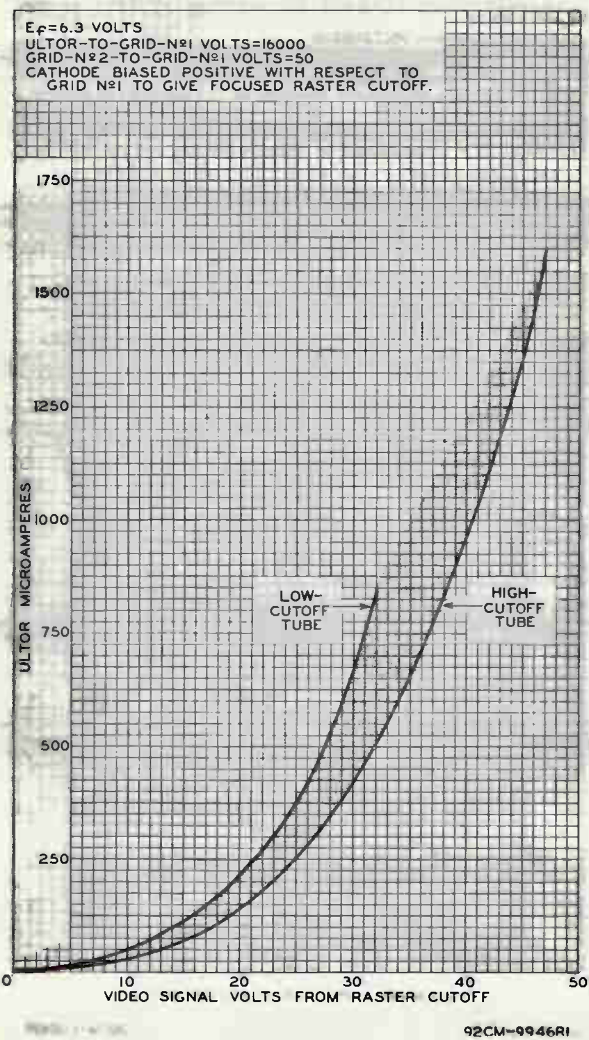
CATHODE-DRIVE CHARACTERISTICS



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

For curves, see front of this section

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

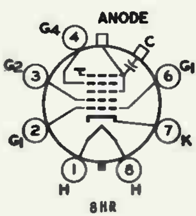
See *Picture-Tube Dimensional-Outlines* and *Bulb J187L* sheets at front of this section

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



←Indicates a change.

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	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.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 and video-signal-voltage adjusted to give a 200-microampere anode current.

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

114° MAGNETIC DEFLECTION — LOW GRID-No.2 VOLTAGE

The 23ERP4 is the same as the 23EQP4 except for the following items:

ELECTRICAL

Heater Current at 6.3 V. . . . . **600 ± 30 mA**

MECHANICAL

External Conductive Coating

Type (See CRT OUTLINES 1 at front of this section) . . **Regular-Band**

Contact area for grounding . . . . **Near Reference Line**

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 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.	pf
	1700 min.	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

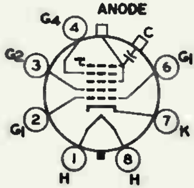
Optical:

Phosphor (For curves, see front of this Section) . .P4—Sulfide Type. Aluminized
Faceplate. . . . . .Filterglass
Light Transmission at center (Approx.) 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 and Dimensions:
See *Picture-Tube Dimensional-Outlines* and *Bulb J187 K* 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



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	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	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	300	volts
Cathode Voltage 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 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

PAN-O-PLY TYPE WITH MOUNTING LUGS

94° MAGNETIC DEFLECTION — LOW-GRID-No.2 VOLTAGE

LOW-VOLTAGE ELECTROSTATIC FOCUS — 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	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.)	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]

Type . . . . Regular-Band

Contact area for grounding. . . . . .Near Reference Line

For Additional Information on Coatings and Dimensions

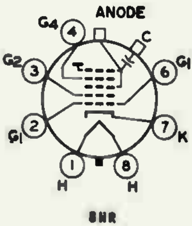
See *Picture-Tube Dimensional-Outlines* and *Bulb J187M* sheets at front of this section

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



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 value	1250 max	V
Negative value	400 max	V
Grid-No.2 Voltage	20 min—70 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 ≤ 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	50	V
Cathode Voltage	34 to 52	V
For visual extinction of focused raster		

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 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

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

The 23FBP4 is the same as the 23ENP4 except for the following item:

Optical:

Surface of Protective Panel. . . . . Treated to reduce specular reflection

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

The 23FMP4 is the same as the 23ETP4 except for the following item:

Electrical:

Heater Current at 6.3 volts. . . . . 450 ± 20 ma

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

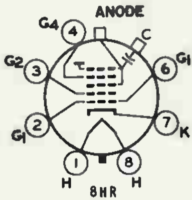
Phosphor	P4—Sulfide Type, Aluminized
For curves, see front of this section	
Faceplate.	Filterglass
Light transmission at center (Approx.)	42 %

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 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 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

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

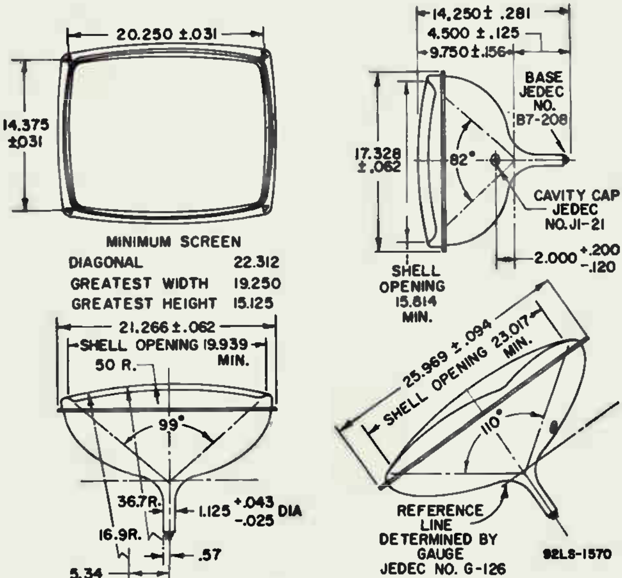
Anode Voltage	16000	V
Grid-No.4 Voltage	0 to 400	V
Grid-No.2 Voltage	50	V
Cathode Voltage	32 to 50	V
For visual extinction of focused raster		
Field Strength.	0 to 10	G
Of required adjustable centering magnet		

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance.	1.5 max	MΩ

[a] Includes implosion protection hardware.

DIMENSIONAL OUTLINE
(Bulb J187 K)



DIMENSIONS IN INCHES

Picture Tube

FILLED-RIM TYPE **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[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

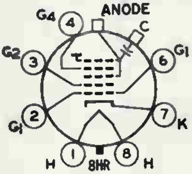
Phosphor . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate . . . . Filterglass
Light transmission at center (Approx.). 42%

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 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	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

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	

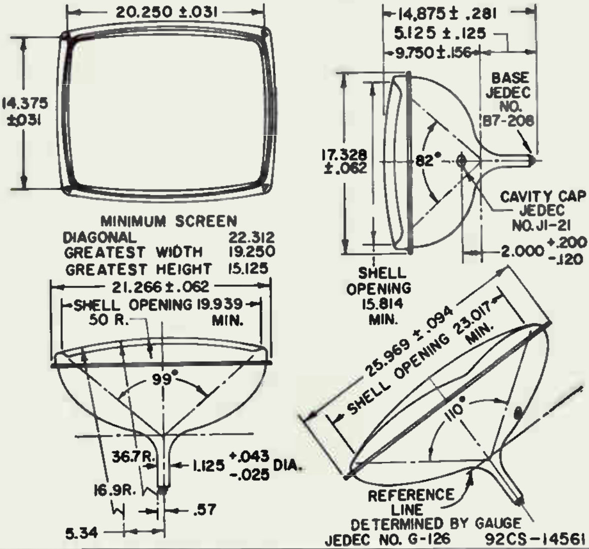
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance.	1.5 max MΩ

● Includes implosion protection hardware.

DIMENSIONAL OUTLINE
(Bulb J187 K)

DIMENSIONS IN INCHES



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

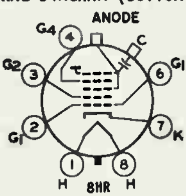
Phosphor . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate . . . . Filterglass
Light transmission at center (Approx.). 42%

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 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	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

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

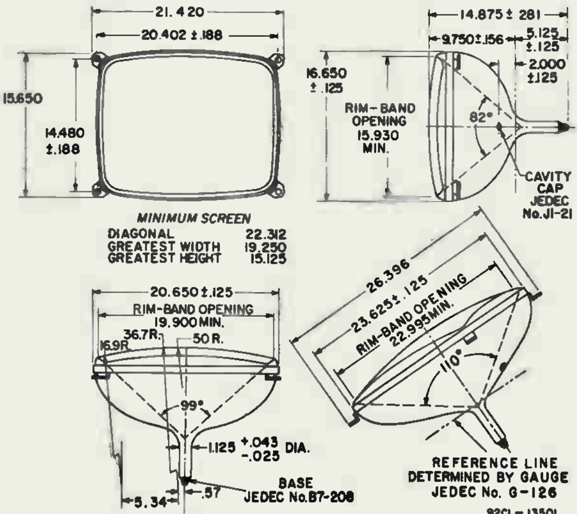
Grid-No.1 Circuit Resistance.	1.5 max	MΩ

[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 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 J187K WITH MOUNTING LUGS



DIMENSIONS IN INCHES

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 area for grounding . . . . . . Near Reference Line

Picture Tube

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE	ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS	114° MAGNETIC DEFLECTION
LOW GRID-No.2 VOLTAGE	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 . . {2500 max. pf / 1700 min. 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

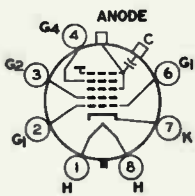
Optical:

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" ± .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 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



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
	11000 min.	volts
Grid-No. 4 (Focusing) Voltage:		
Positive value	1250 max.	volts
Negative value	400 max.	volts
Grid-No. 2 Voltage	70 max.	volts
	40 min.	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.	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 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	34 to 52	volts

Maximum Circuit Value:

Grid-No. 1 Circuit Resistance	1.5 max.	megohms

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 — 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.	pf
	1700 min.	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	

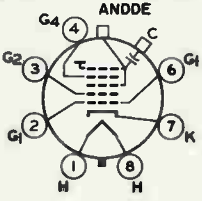
Optical:

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

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

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

ANODE VOLTAGE	23500 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	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. / 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	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

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
110° MAGNETIC DEFLECTION

LOW-VOLTAGE ELECTROSTATIC FOCUS
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. .	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

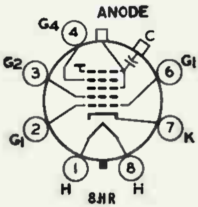
Phosphor. . . . . .P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate . . . . Filterglass
Light transmission at center (approx.). 42%

MECHANICAL

Weight (Approx.). . . . . 28 lb
Overall Length. . . . . 14.250 ± .281 in
Neck Length . . . . 4.500 ± .125 in
Projected Area of Screen. . . . . 282 sq in
External Conductive Coating[a]
Type. . . . . .Regular-Band
Contact area for grounding. . . . . Near Reference Line
For Additional Information on Coatings Dimensions
See *Picture-Tube Dimensional-Outlines* and *Bulb J187K* 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



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	40 min—70 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 ≤ 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	
Grid-No.4 Voltage	0 to 400	V
Grid-No.2 Voltage	50	V
Cathode Voltage	34 to 52	V
For visual extinction of focused raster		

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ

* Includes implosion protection hardware.

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 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-Band

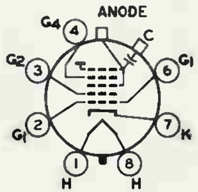
Contact area for grounding. . . . . . . Near Reference Line

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



8HR

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

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

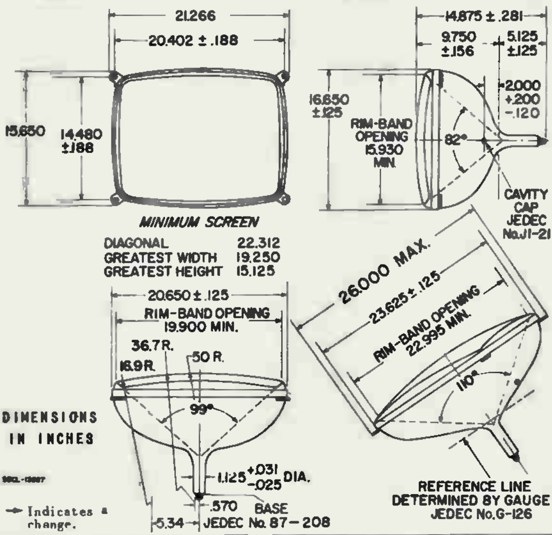
Grid-No.1 Circuit Resistance.	1.5 max	MΩ

[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 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

DIMENSIONAL OUTLINE (Bulb J187 K With Mounting Lugs)



DIMENSIONS IN INCHES

→ Indicates a change.

Picture Tube

PAN-O-PLY TYPE — **LOW-GRID-No.2 VOLTAGE**
LOW-VOLTAGE ELECTROSTATIC FOCUS — **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. . 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 curves, see front of this section
Faceplate . . . . Filterglass
Light transmission at center (approx.). 42%

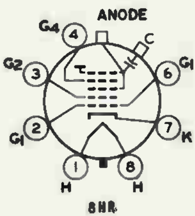
MECHANICAL

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]
- Type. . . . . Regular-Band
- Contact area for grounding. . . . . Near Reference Line

For Additional Information on Coatings and Dimensions
See *Picture-Tube Dimensional-Outlines* and *Bulb J187K* 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



← Indicates a change.

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 For visual extinction of focused raster	22 to 45	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] 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 13.5-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

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[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.) . . . . 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

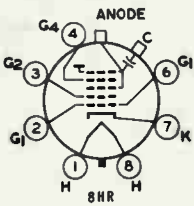
Contact area for grounding. . . . . .Near Reference Line

Cap. . . . . Recessed Small Cavity (JEDEC no.J1-21)

Base . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.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 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		
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 ≤ 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		

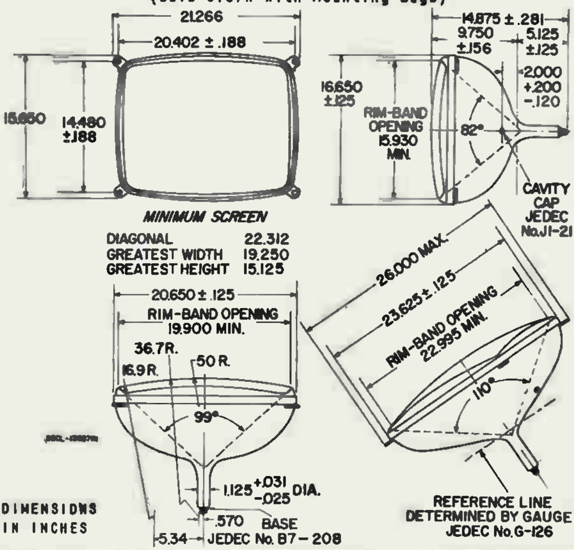
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ

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 J187K with Mounting Lugs)



DIMENSIONS IN INCHES

Picture Tube

PAN-O-PLY TYPE

110° MAGNETIC DEFLECTION   LOW-VOLTAGE ELECTROSTATIC FOCUS

The 23HXP4 is the same as the 23ETP4 except for the faceplate which is treated to reduce specular reflections and the following items:

ELECTRICAL

Heater Current at 6.3 V. . . . . 450 ± 20 mA

MECHANICAL

External Conductive Coating

Type . . . . .Special

Contact area for grounding . . . . .Near Reference Line

Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE	ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS	110° MAGNETIC DEFLECTION
LOW-GRID-NO.2 VOLTAGE	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.	pf
	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

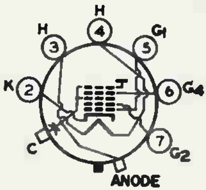
Optical:

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

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	1100 max.	volts
Negative value	550 max.	volts
GRID-No.2 VOLTAGE	70 max.	volts
	44 min.	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.	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 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

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.	μμf
	1700 min.	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.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▲ 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 (Ec_5k) between 11000 and 22000 volts and grid-No.2 voltage (Ec_2k) between 220 and 550 volts

Grid-No.4 Voltage for focus●	0 to 400	volts
Grid-No.1 Voltage (Ec_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 Ec_1k except video drive is a positive voltage	

Grid-No.4 Current.	-25 to +25	µa
Grid-No.2 Current.	-15 to +15	µa
Field Strength of Adjustable Centering Magnet*.	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor voltage of	*18000*	*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
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

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.	volts
	11000 max.	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.	volts
	350 min.	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.	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-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

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 voltage	
Grid-No.4 Current	−25 to +25	μa
Grid-No.2 Current	−15 to +15	μa
Field Strength of Adjustable Centering Magnet*	0 to 8	gausses

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.

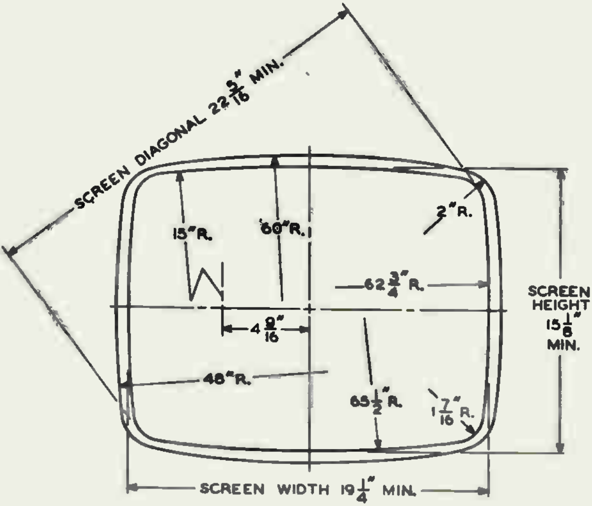
* Distance from *Reference-Line* for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 3/8-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the the center of the tube face.

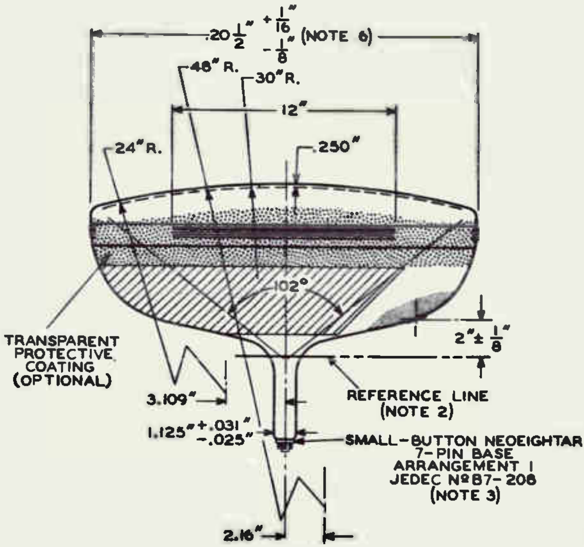
♦ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

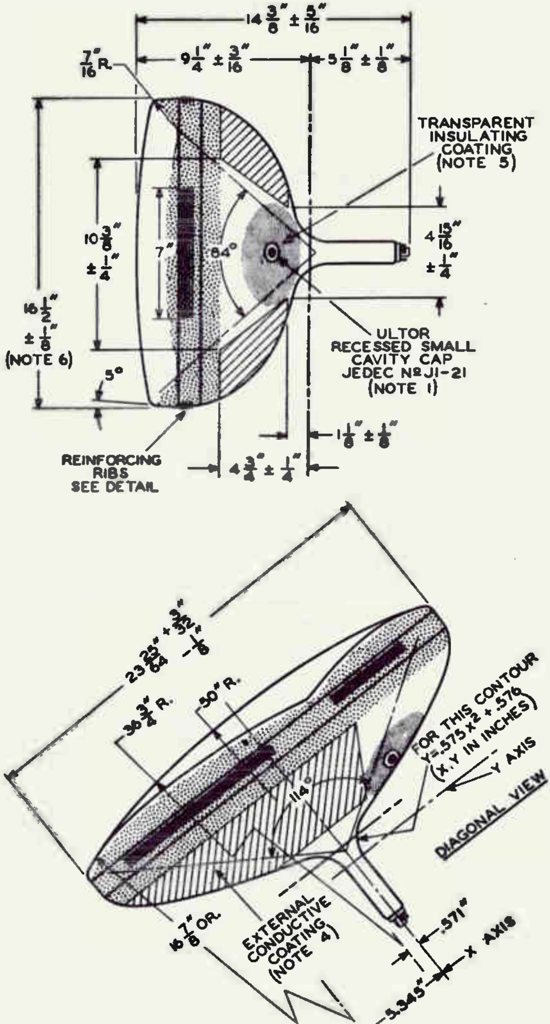
OPERATING CONSIDERATIONS

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.


SCREEN DIAGONAL 22 5/16" MIN.
15" R.
60" R.
2" R.
62 3/4" R.
4 9/16"
48" R.
65 1/2" R.
1 7/16" R.
SCREEN HEIGHT 15 1/8" MIN.
SCREEN WIDTH 19 1/4" MIN.


20 1/2" +1/16" -1/8" (NOTE 6)
48" R.
30" R.
12"
24" R.
.250"
102°
2" ± 1/8"
TRANSPARENT PROTECTIVE COATING (OPTIONAL)
3.109"
REFERENCE LINE (NOTE 2)
1.125" +.031" -.025"
SMALL-BUTTON NEOEIGHTAR 7-PIN BASE ARRANGEMENT 1 JEDEC Nº B7-208 (NOTE 3)
2.16"



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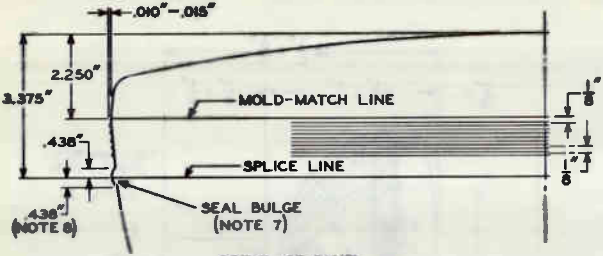


DETAIL OF PANEL

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 ± 30°. 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.

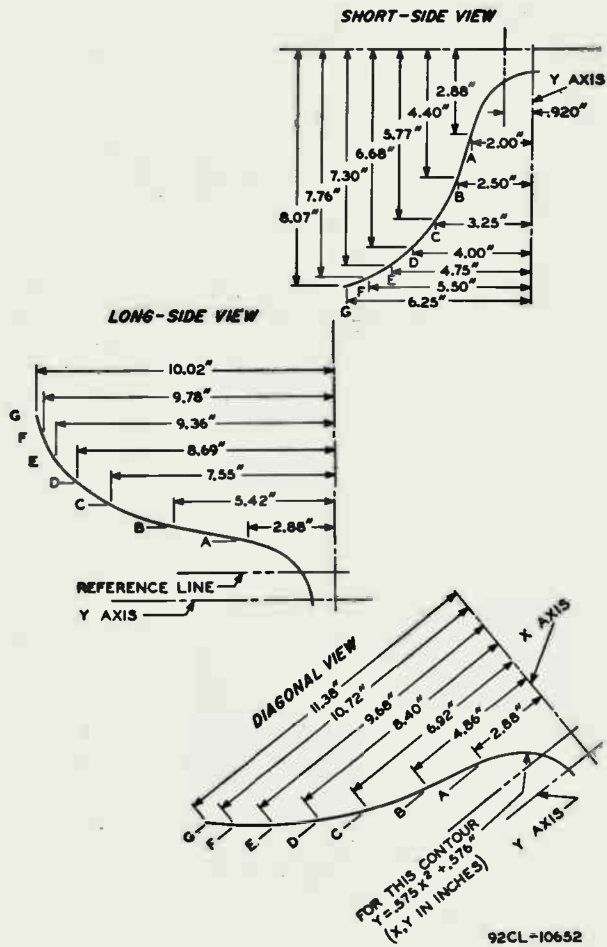
NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

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.

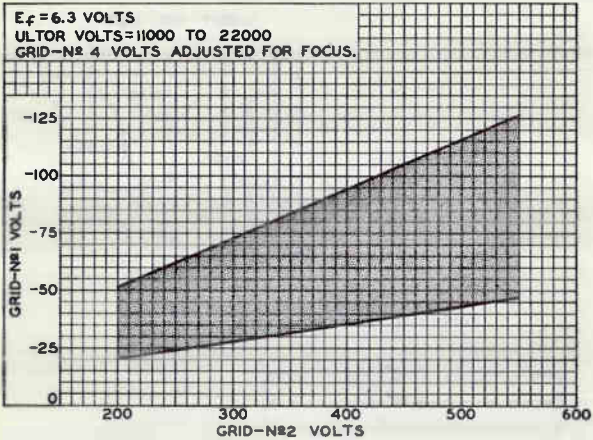
BULB-CONTOUR DIMENSIONS



NOTE: PLANES A THRU 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.

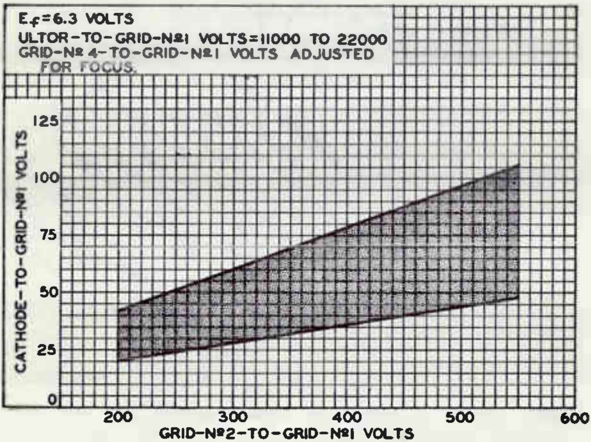
RASTER-CUTOFF-RANGE CHARTS

Grid-Drive Service



92CS-10620R1

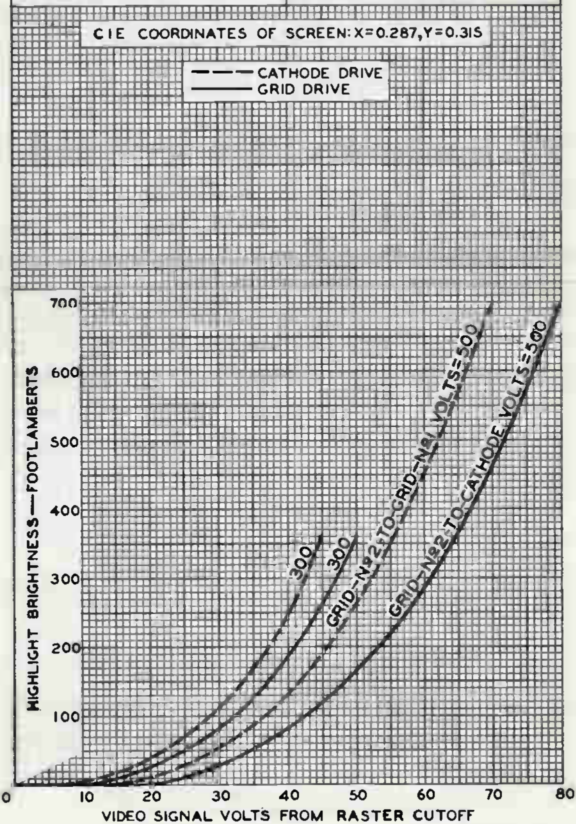
Cathode-Drive Service



92CS-10621R1

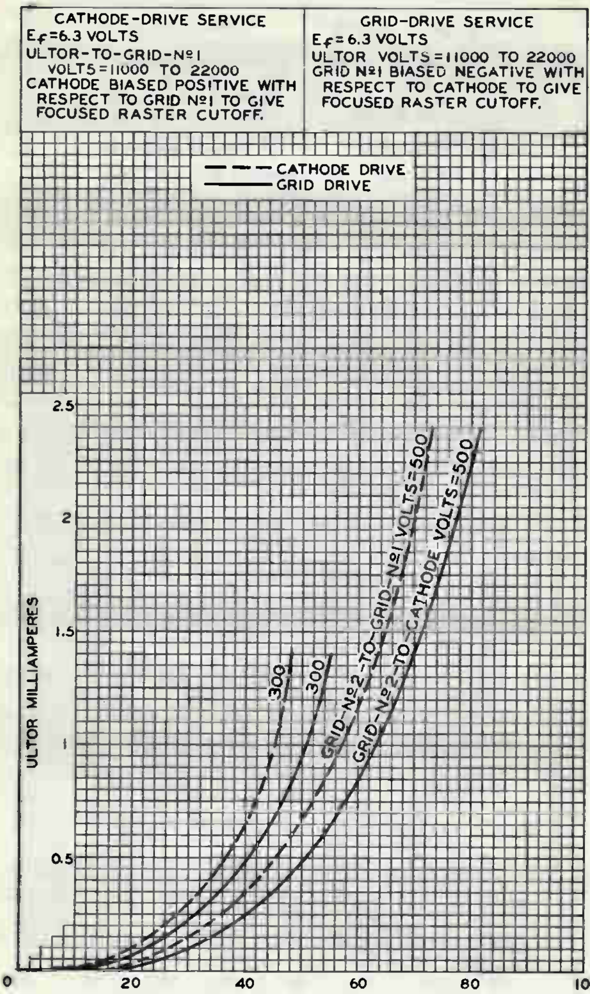
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS	E_f = 6.3 VOLTS
ULTOR-TO-GRID-№1 VOLTS = 16000	ULTOR VOLTS = 16000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID №1 TO GIVE FOCUSED RASTER CUTOFF.	GRID №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" x 13½"	RASTER SIZE = 18" x 13½"



92CM-10625

AVERAGE DRIVE CHARACTERISTICS



92CM-10618

Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE — **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS — **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	$\mu\mu$f
Cathode to all other electrodes	5	$\mu\mu$f
External conductive coating to ultor. .	2500 max.	$\mu\mu$f
	2000 min.	$\mu\mu$f

Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

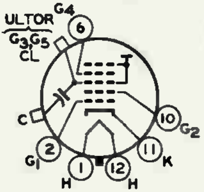
Optical:

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

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

ULTOR VOLTAGE	22000 max.	volts
	12000 min.	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

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

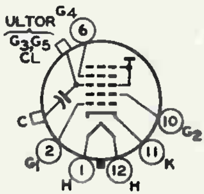
Optical:

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

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

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

RCA

24AHP4

24AHP4
PICTURE TUBE

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE FOCUS — 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 $\mu\mu f$
Cathode to all other electrodes	5 $\mu\mu f$
External conductive coating to ultor	2500 max. $\mu\mu f$ / 2000 min. $\mu\mu f$
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 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater

Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

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

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. / 12000● min.	volts / volts
GRID-No.4 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_{c_5k}) between 12000 and 20000 volts and grid-No.2 voltage (E_{c_2k}) between 200 and 500 volts

Grid-No.4 Voltage for Focus§	-50 to +350	volts
Grid-No.1 Voltage ($E_{c_1}k$) 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 $E_{c_1}k$ except video drive is a positive voltage	
Grid-No.4 Current	-25 to +25	μa
Grid-No.2 Current	-15 to +15	μa
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.

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

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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

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 (Ec_5g_1) between 12000 and 20000 volts and grid-No.2-to-grid-No.1 voltage (Ec_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.

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

RCA

24AHP4

PICTURE TUBE

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 voltage		
Grid-No.4 Current.	-25 to +25		μa
Grid-No.2 Current.	-15 to +15		μa
Field Strength of Adjustable Centering Magnet* .	0 to 8		gausses

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 +350	-50 to +350	volts
Cathode-to-Grid-No.1 Voltage for Visual Extinction of Focused Raster	28 to 60	36 to 78	volts
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.

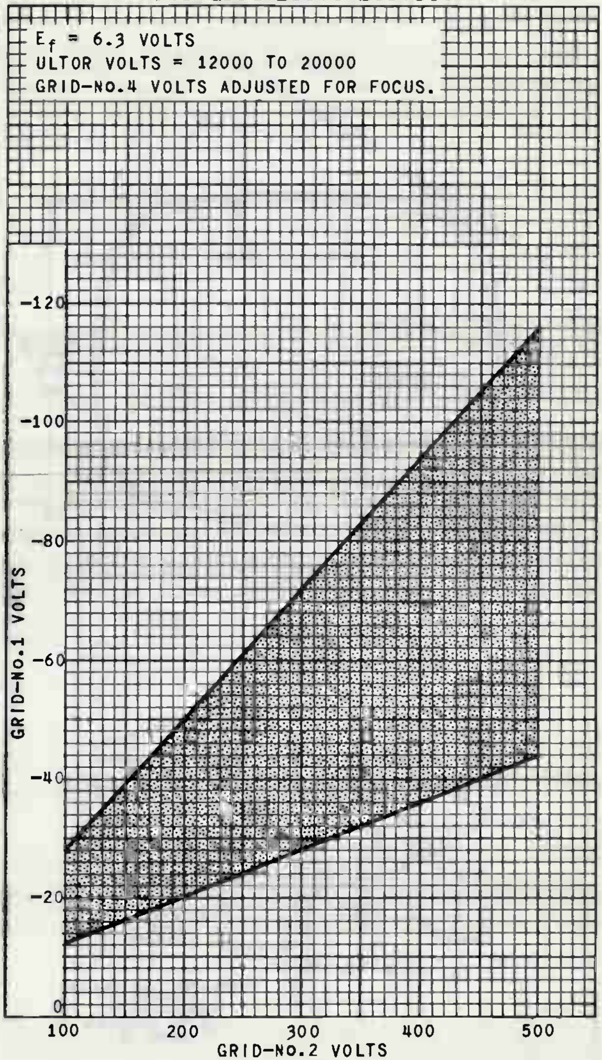
For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

24AHP4

24AHP4

RASTER-CUTOFF-RANGE CHART

For Grid-Drive Service



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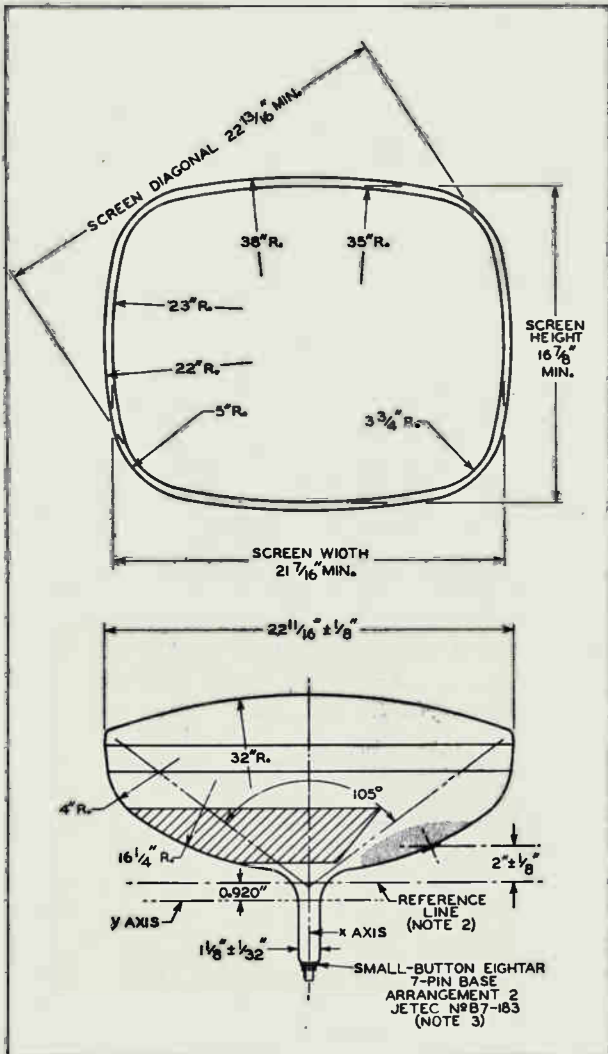
24AHP4

PICTURE TUBE



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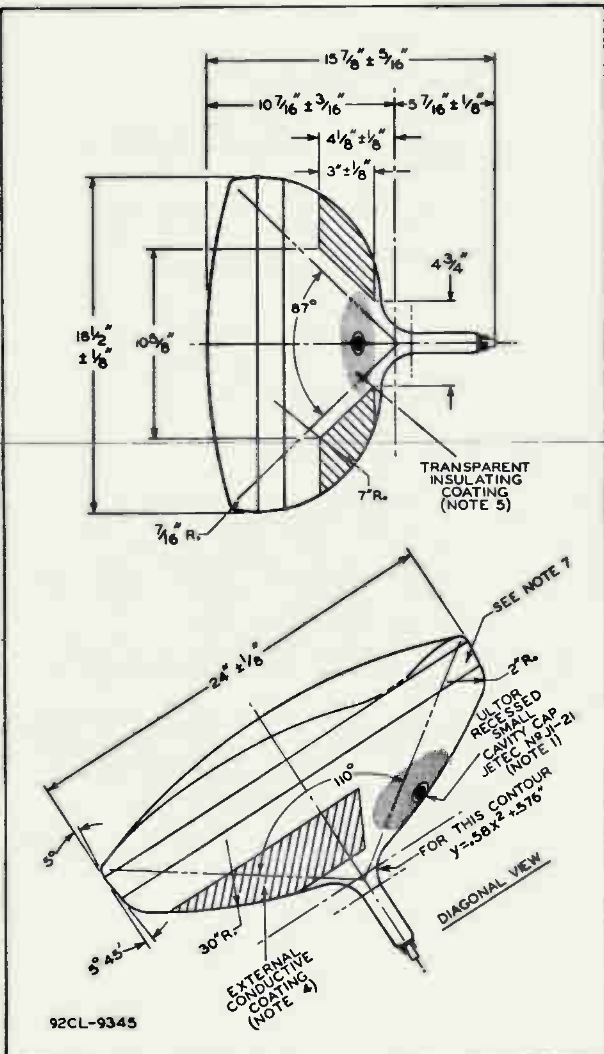
PICTURE TUBE



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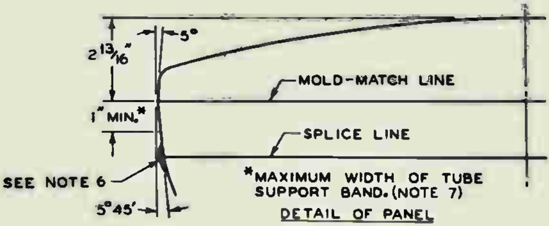
24AHP4

24AHP4

PICTURE TUBE



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 ± 30°. 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 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.

NOTE 7: UNDISTURBED AREA BETWEEN MOLD-MATCH LINE AND SPLICE LINE IS 1" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF TUBE SUPPORT BAND.

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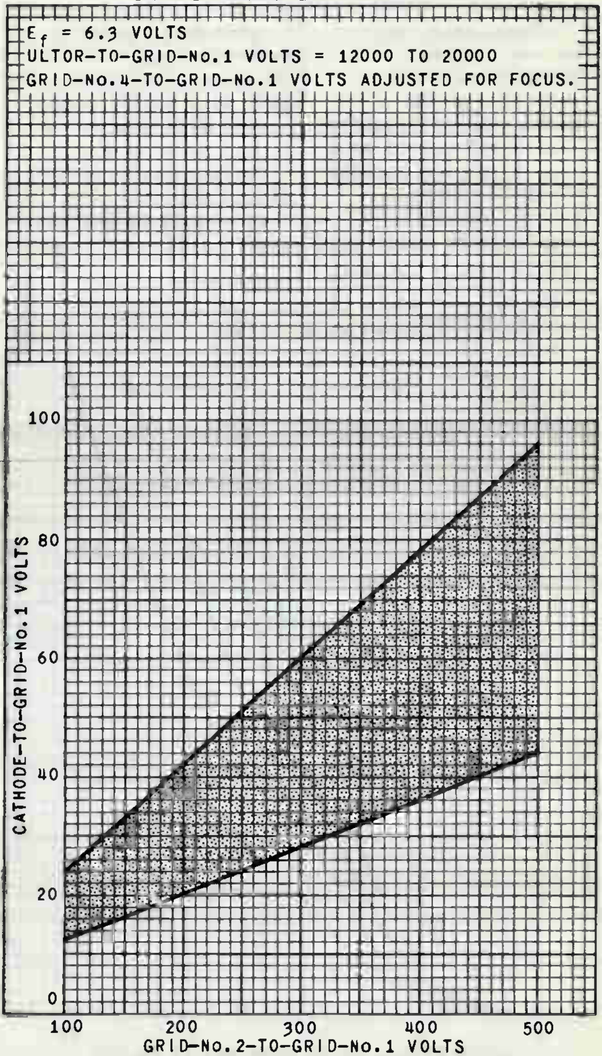
24AHP4

RASTER-CUTOFF-RANGE CHART
For Cathode-Drive Service



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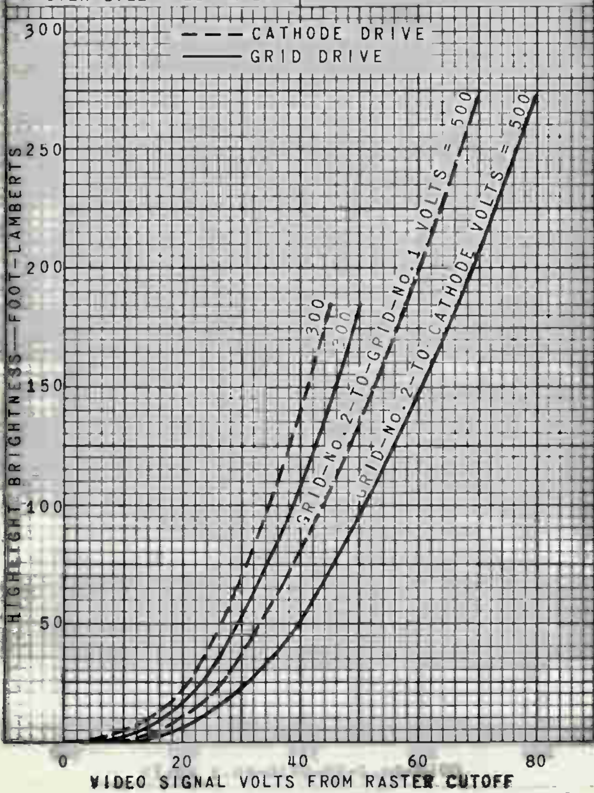
24AHP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-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"	E_f = 6.3 VOLTS ULTOR VOLTS = 16000 GRID No.1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF. RASTER FOCUSED AT AVERAGE BRIGHTNESS. RASTER SIZE = 21" x 16"



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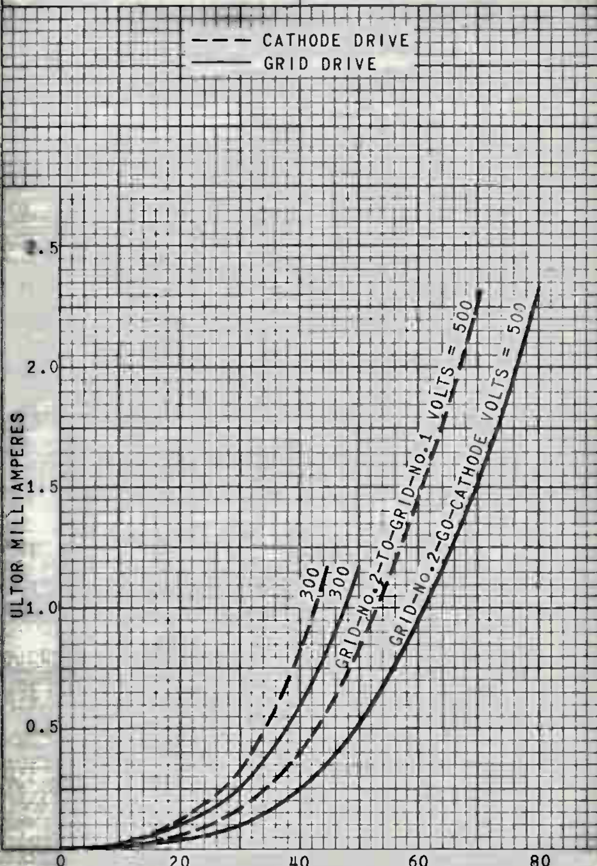
24AHP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-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.	E_f = 6.3 VOLTS ULTOR VOLTS = 12000 TO 20000 GRID No.1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.



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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 μμf
- Cathode to all other electrodes . . . . 5 μμf
- External conductive coating to ultor . . . {2500 max. μμf / 1700 min. μμf}

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)

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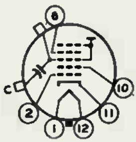
24AUP4
PICTURE TUBE

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

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_{c_5k}) between 12000 and 20000 volts and grid-No.2 voltage (E_{c_2k}) between 200 and 500 volts

Grid-No.4 Voltage for focus§	-75 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.4 Current.	-25 to +25	μa

▲,●,§: 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:

With ultor voltage of	*18000*	*volts*
and grid-No.2 voltage of	*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

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§.	-75 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*	

▲,●,§,†,■: See next page.

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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	µa
Grid-No.2 Current	-15 to +15	µa
Field Strength of Adjustable Centering Magnet†	0 to 8	gausses

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	*300*	*volts*
Grid-No.4-to-Grid-No.1 Voltage for focus	-75 to +400	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

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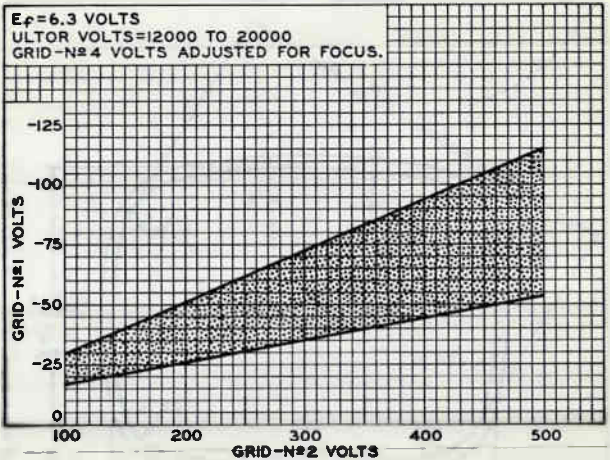
24AUP4

RASTER-CUTOFF-RANGE CHARTS

GRID-DRIVE SERVICE



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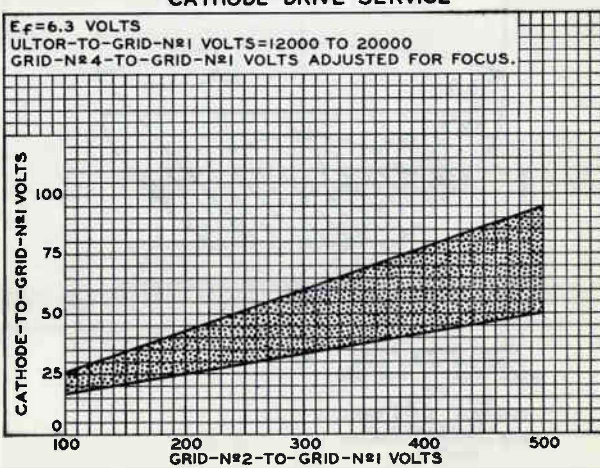
CATHODE-DRIVE SERVICE



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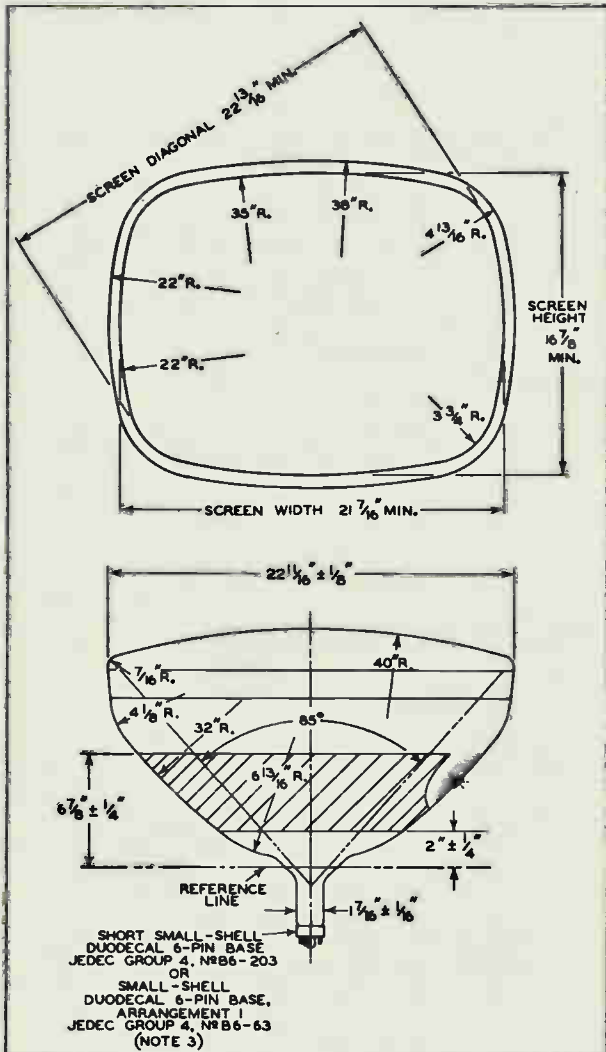
24AUP4

PICTURE TUBE



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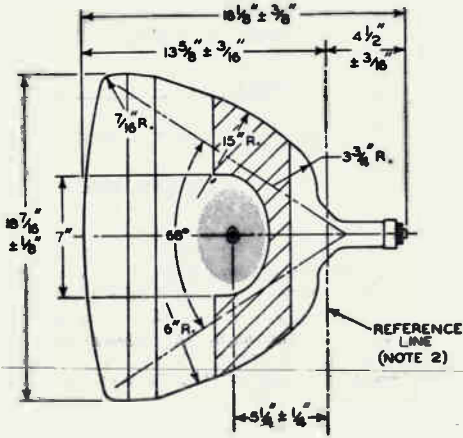
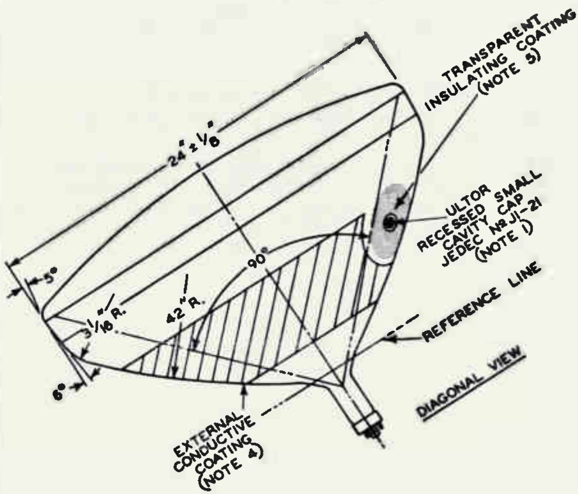
24AUP4

24AUP4
PICTURE TUBE





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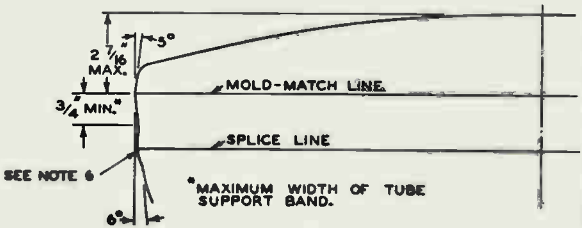
24AUP4

PICTURE TUBE



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 ± 30°. 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.

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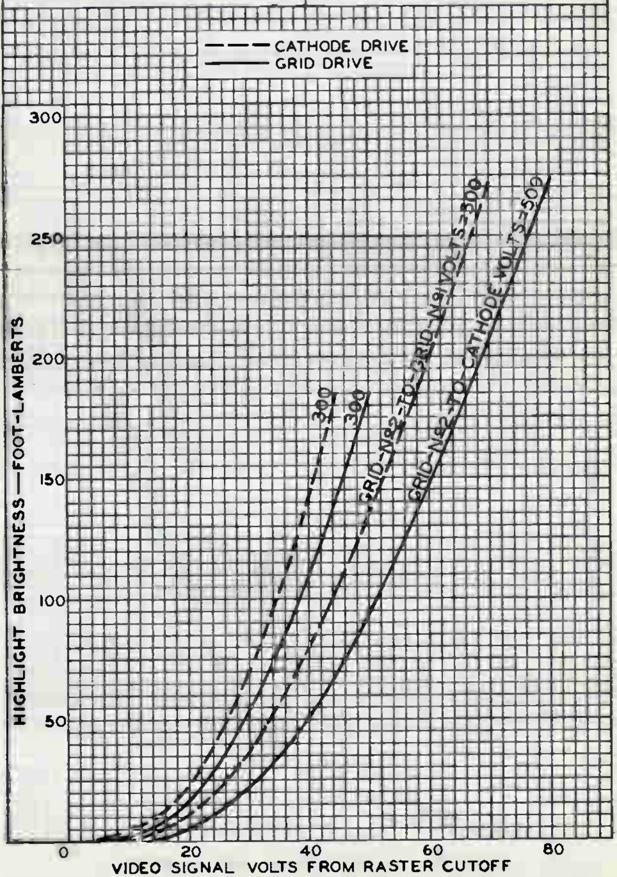
24AUP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS	E_f = 6.3 VOLTS
ULTOR-TO-GRID-Nº1 VOLTS = 16000	ULTOR VOLTS = 16000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID Nº1 TO GIVE FOCUSED RASTER CUTOFF.	GRID Nº1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.
RASTER FOCUSED AT AVERAGE BRIGHTNESS.	RASTER FOCUSED AT AVERAGE BRIGHTNESS.
RASTER SIZE = 21" x 16"	RASTER SIZE = 21" x 16"



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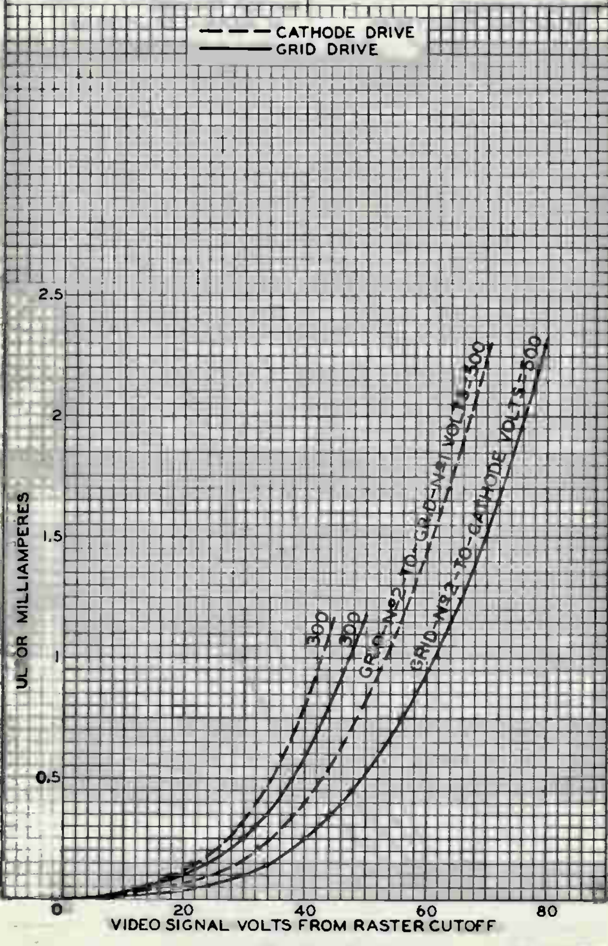
24AUP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f=6.3 VOLTS ULTOR-TO-GRID-Nº1 VOLTS = 12000 TO 20000 CATHODE BIASED POSITIVE WITH RESPECT TO GRID Nº1 TO GIVE FOCUSED RASTER CUTOFF.	E_f= 6.3 VOLTS ULTOR VOLTS = 12000 TO 20000 GRID Nº1 BIASED NEGATIVE, WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.



24BEP4

Picture Tube

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 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.	pf
	1700 min.	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

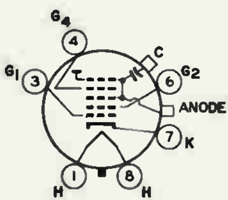
Optical:

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

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

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 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.)	75%
Phosphor (For curves, see front of this section). .	P4—Sulfide Type, Aluminized

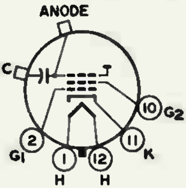
Mechanical:

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-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.	22000 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	*16000*	*volts*
and grid-No.2 voltage of	*300*	*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

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

Color Picture Tube

Perma-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] . . .	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.)	0.029 in (0.74 mm)

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. 20,000 min.	V V
Total Anode Current, Long-Term Average	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):		
Under operating conditions[a]	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 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			µA
Grid-No.2 Current	−5 to +5			µA
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* 34	*Blue* 32	*Green* 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[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. MΩ

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. 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 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.

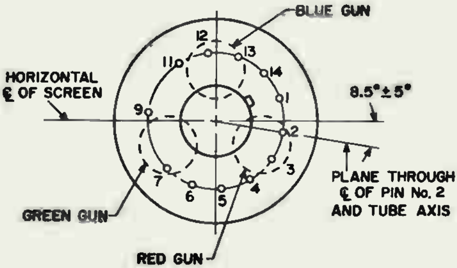
X-RADIATION WARNING

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.

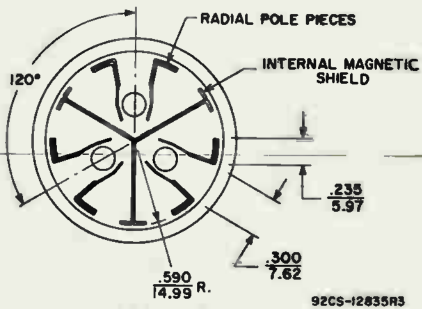
BASE SPECIFICATION – JEDEC No. 14BE

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



LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



NOTES FOR DIMENSIONAL OUTLINE

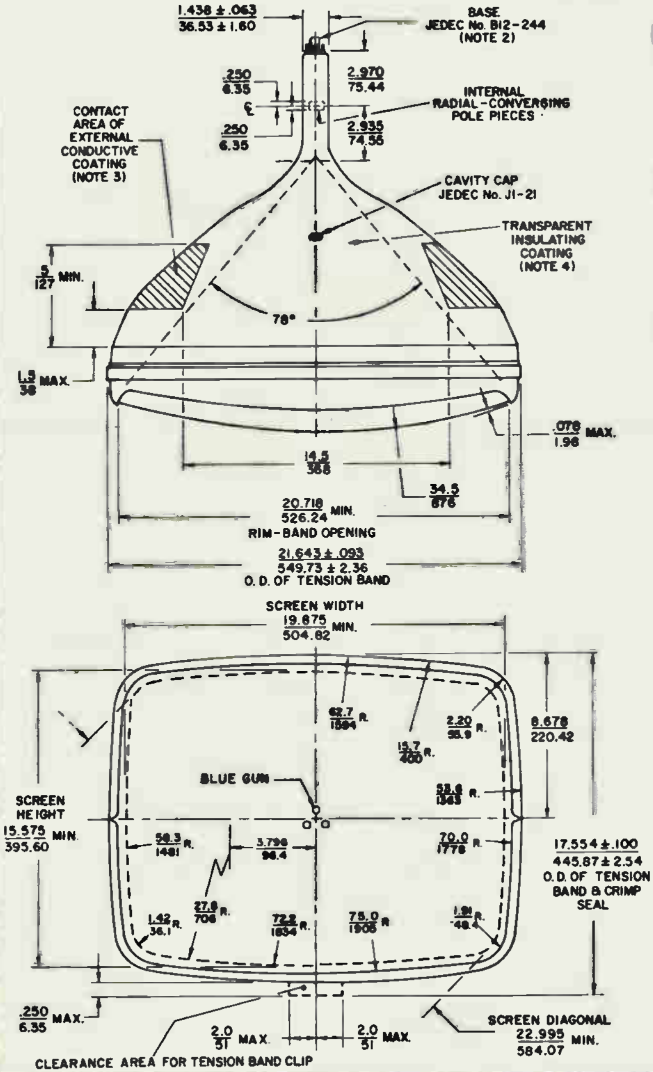
Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge JEDEC No. G162 and with tube seated in guage, the reference line is determined by the intersection on the plane C-C' of the gauge with the glass funnel.

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.

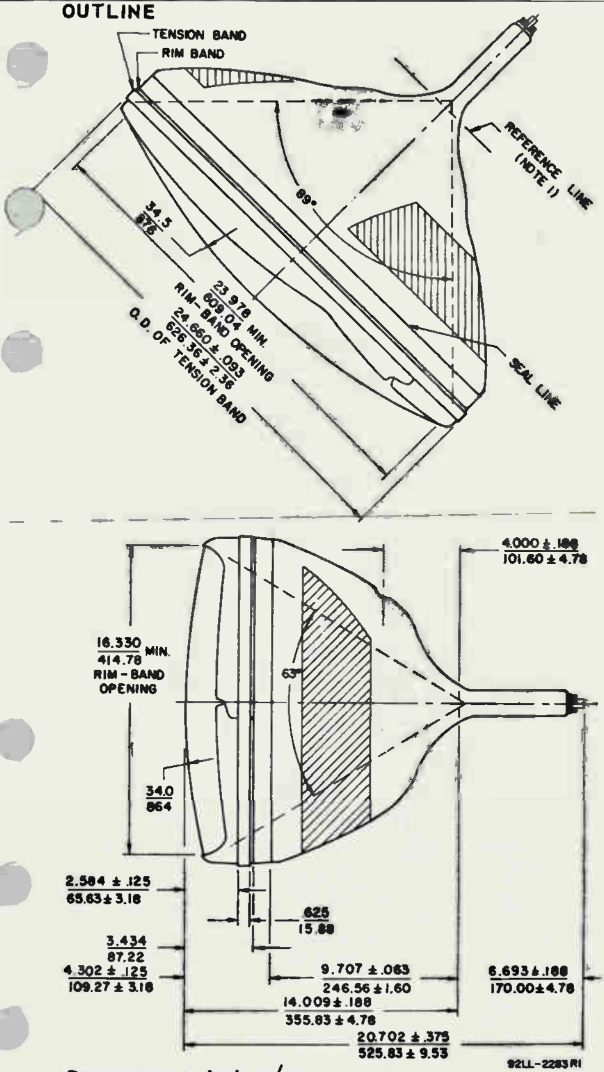
Note 4: To clean this area, wipe only with soft, dry, lintless cloth.

DIMENSIONAL



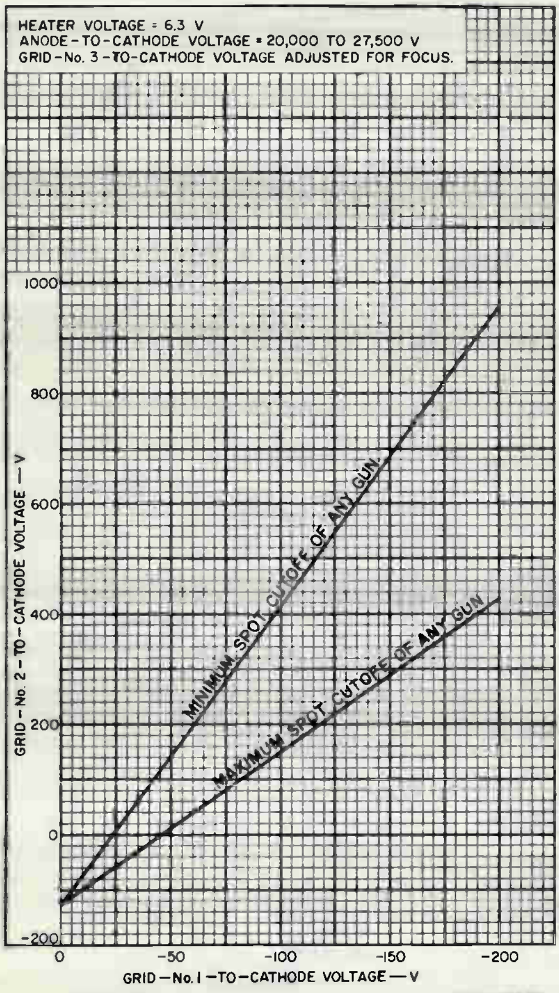
25AJP22

OUTLINE



Dimensions in Inches/mm

CUTOFF DESIGN CHART



Color Picture Tube

Hi-Lite Matrix Screen — **Perma-Chrome**
90° Rectangular — **High-Resolution Gun**
New Green Phosphor — **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	2500 max. pF; 2000 min. pF

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)

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.	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):		
Under operating conditions[c]	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:[c]

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 µA

Grid-No.2 Current . . . . -5 to +5 µA

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 supplied 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 . . . . ± 0.45 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

High-Voltage Circuits:

Grid-No.3 circuit resistance . . . . 7.5 max. MΩ

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. 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 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. 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.

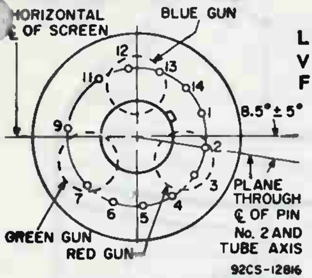
[e] Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

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.

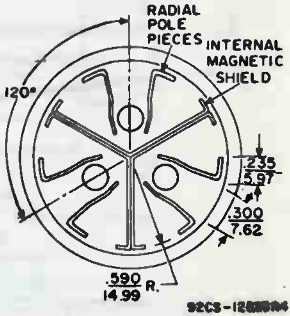
BASE SPECIFICATION – JEDEC No. 14BE

Pin 1: Heater
Pin 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

BOTTOM VIEW OF BASE



LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



NOTES FOR DIMENSIONAL OUTLINE

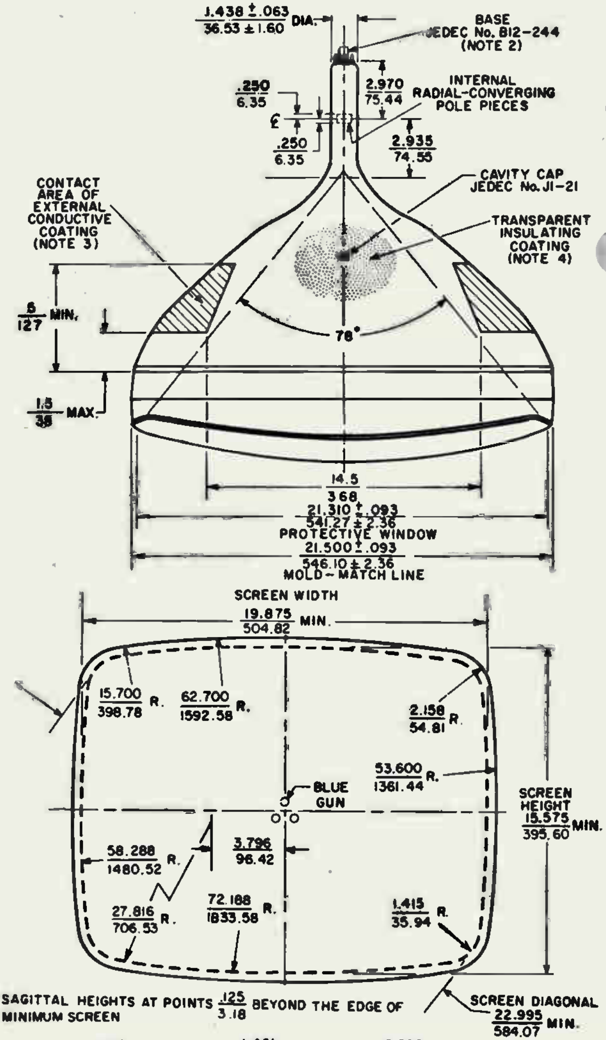
Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge (JEDEC No.G162) and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C′ of the gauge with the glass funnel.

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.

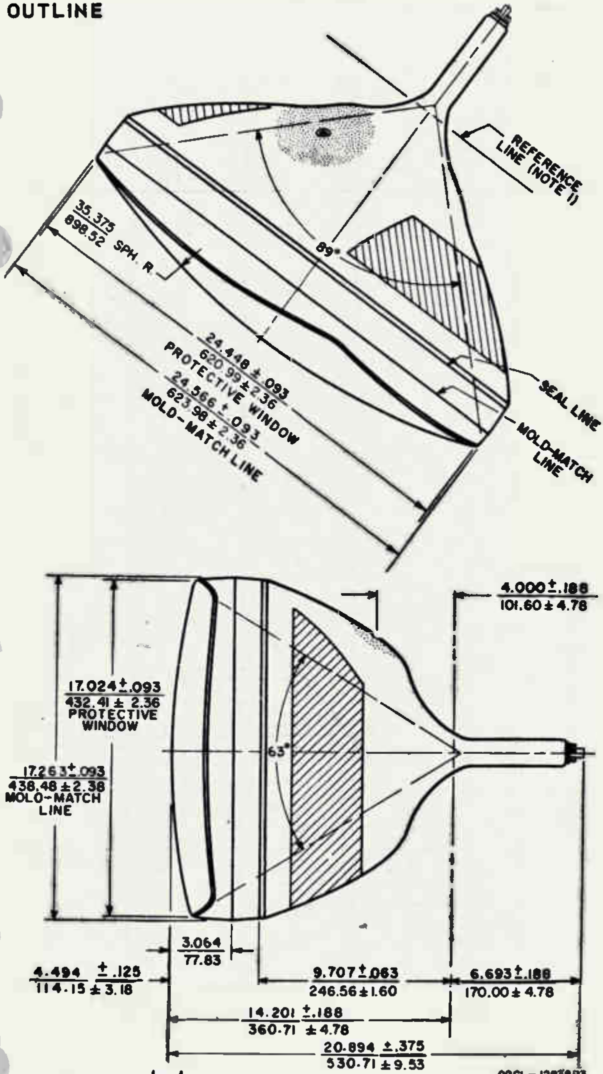
DIMENSIONAL



SAGITTAL HEIGHTS AT POINTS $\frac{.125}{3.18}$ BEYOND THE EDGE OF MINIMUM SCREEN

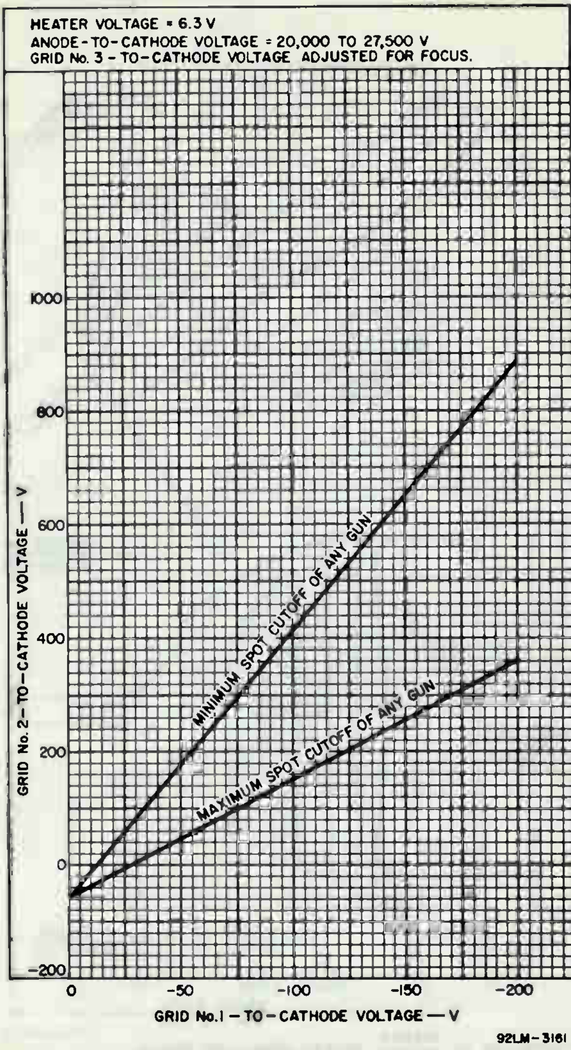
DIAGONAL	$\frac{1.964}{49.89}$	WIDTH	$\frac{1.461}{37.11}$	HEIGHT	$\frac{0.896}{22.76}$

OUTLINE



Dimensions in $\frac{\text{inches}}{\text{mm}}$ unless otherwise shown

CUTOFF DESIGN CHART



Color Picture Tube

Hi-Lite Matrix Screen | **Permo-Chrome**
90° Rectangular | **High-Resolution Gun**
New Green Phosphor | **Unity Current Ratios**

Integral Implosion Protection – Bonded Type

The 25BDP22 is the same as the 25BCP22 except for:

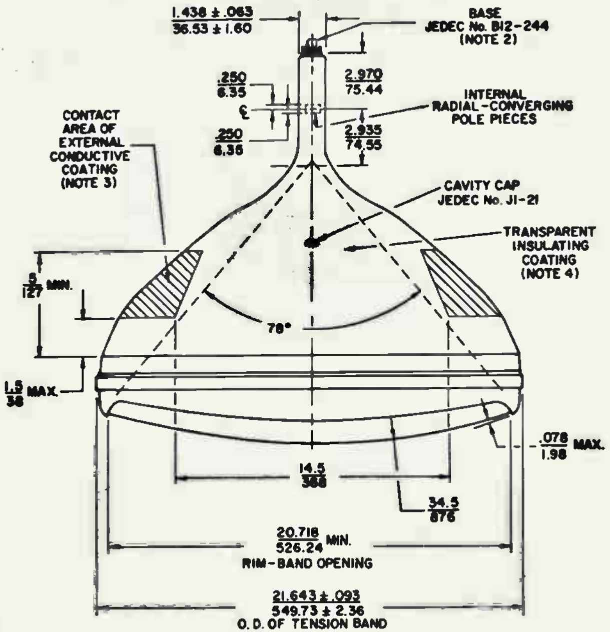
OPTICAL

Faceplate .... Filterglass
  Light transmission at center (Approx.) 69%
  Surface ....Polished

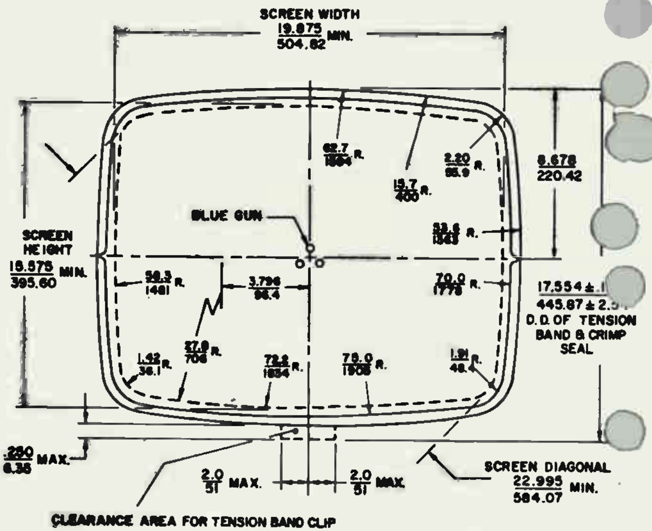
MECHANICAL

Weight (Approx.).................... 38 lb (17.4 kg)

DIMENSIONAL OUTLINE (Top View)



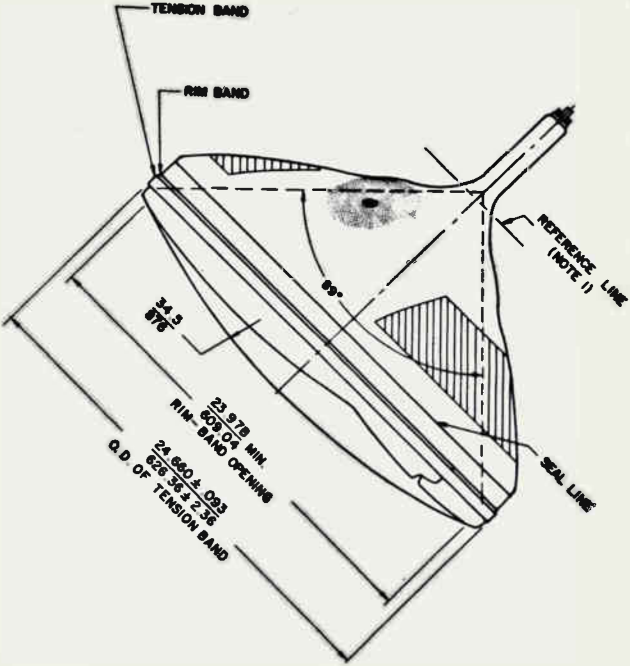
DIMENSIONAL OUTLINE (Front View)



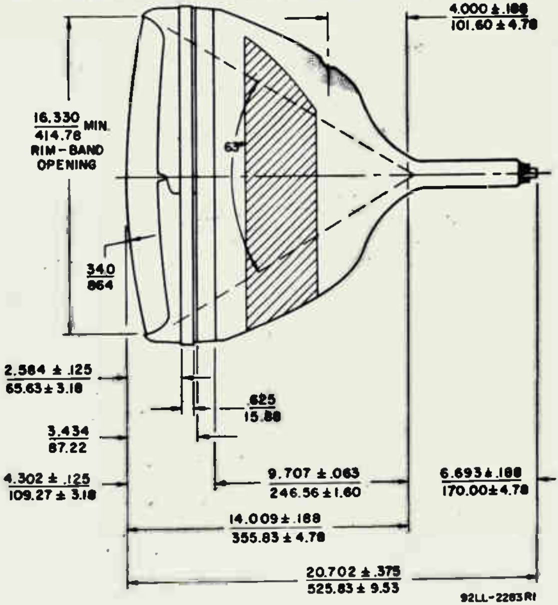
SAGITTAL HEIGHTS AT POINTS $\frac{.125}{3.18}$ BEYOND THE EDGE OF MINIMUM SCREEN

DIAGONAL	$\frac{2.063}{52.40}$
WIDTH	$\frac{1.524}{38.71}$
HEIGHT	$\frac{0.950}{24.13}$

DIMENSIONAL OUTLINE (Right Oblique View)



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

Color Picture Tube

RECTANGULAR TUBE — 90° MAGNETIC DEFLECTION

ALUMINIZED TRICOLOR PHOSPHOR-DOT *Hi-Lite* SCREEN
(Utilizing a Rare-Earth Red-Emitting Phosphor)

INTEGRAL FILTERGLASS PROTECTIVE WINDOW
(Treated to Minimize Specular Reflection)

MAGNETIC CONVERGENCE — ELECTROSTATIC-FOCUS GUNS

For Use in Color-TV Receivers

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 volts*	800	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:		
Grid No.1 of any gun to all other electrodes	6	pf
All cathodes to all other electrodes	15	pf
Grid No.3 to all other electrodes	6.5	pf
External conductive coating to anode	2500 max.	pf
	2000 min.	pf

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) (See accompanying *Curve*)	P22 — Rare-Earth (Red), Sulphide (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.)	0.029"

Mechanical:

Tube Dimensions:

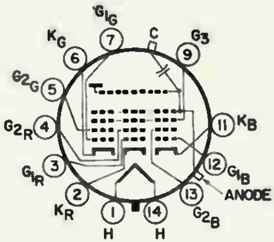
Overall length	20.924" ± .375"
Neck length	6.693" ± .188"
Diagonal	24.566" ± .093
Greatest width	21.500" ± .093"
Greatest height	17.263" ± .093"

Minimum Screen Dimensions (Projected):

Diagonal	22.995"
Greatest width	19.875"
Greatest height	15.575"
Area	295 sq. in.

Weight (Approx.) . . . . 42 lbs.
Operating Position . . . . Anode Cap Contact on Top
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Pin Position Alignment . .Pin 12 Align Approx. with Anode Cap
Base . . . . .Small-Button Diheptar 12-Pin (JEDEC No.B12-244)
Basing Designation for BOTTOM VIEW 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, 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.	volts
	20,000 min.	volts
Total Anode Current, Long-Term Average	1000 max.	μa
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

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Heater Voltage (AC or DC):		
Under operating conditions[a]	6.9 max.	volts
	5.7 min.	volts
Under standby conditions[b]	5.5 max.	volts
Peak Heater-Cathode Voltage (Each gun):		
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:

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltage 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 accompanying *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	μa
Grid-No.2 Current.	-5 to +5	μa

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 Supplied by Each Gun (Average):	42	25	33	%

	Red to Blue			Red to Green		
Ratios of	*Min.*	*Typ.*	*Max.*	*Min.*	*Typ.*	*Max.*
Cathode Currents . .	1.0	1.7	2.0	1.0	1.3	1.8

Displacements, Measured at Center of Screen:		
Raster centering displacement:		
Vertical	-0.45 to +0.45	inch
Horizontal	-0.47 to +0.47	inch
Lateral convergence displacement of blue beam with respect to converged red and green beams	-0.25 to +0.25	inch
Radial convergence displacement excluding effects of dynamic convergence (Each beam).	-0.37 to +0.37	inch
Maximum Required Correction for Register[c] (Including Effect of Earth's Magnetic Field when Using Recommended Components) as Measured at Center of the Screen in any Direction	0.005	inch

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	volts
Grid-No.3 Voltage.	4200 to 5000	volts
Grid-No.2 Voltage when circuit design utilizes grid-No.1 voltage of −150 volts for visual extinction of focused spot	285 to 685	volts
Grid-No.1 Voltage for visual extinction of focused spot when circuit design utilizes grid-No.2 voltage of 400 volts.	−95 to −190	volts
Heater Voltage:		
Under operating conditions[a].	6.3	volts
Under standby conditions	5.0	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.

Grid-No.3 circuit resistance . . . . 7.5 max. megohms

Low-Voltage Circuits

Effective grid-No.1-to-cathode-circuit resistance (each gun). . . . . 0.75 max. megohm

The low voltage circuits should be analyzed by assuming the color picture tube heater is connected directly to the receiver chassis ground. Under these conditions the grid-No.2-to-heater circuit, grid-No.1-to-heater circuit, and the cathode to-heater circuits of all other tubes operating from the same heater winding as the color picture tube 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. Such current limitation will prevent heater burnout in case of a momentary internal arc within the color picture tube.

[a] For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts.

[b] 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.

[c] Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

[d] The relative intensities of the narrow-emission bands of the red phosphor are dependent on the resolution of the measuring device.

GENERAL CONSIDERATIONS

X-Radiation Warning. Because the 25AP22A is designed to be operated at anode voltages as high as 27.5 kilovolts (design-maximum value), shielding of the 25AP22A for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

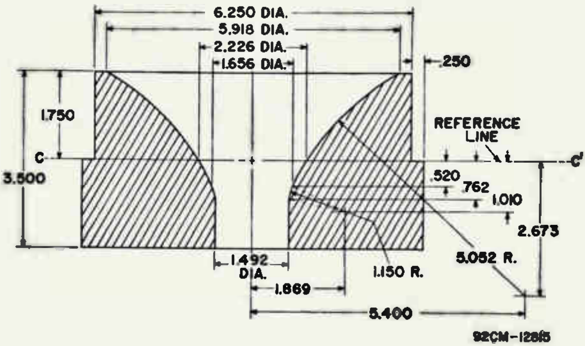
Orientation. The 25AP22A must be operated with tube axis in a horizontal position and with the blue gun uppermost (i.e., anode cap on top). This is the operating position for which the beam-displacement and register correction values shown in the data apply.

The *deflecting yoke* should not be used for supporting the picture tube because it should be centered on the neck and be free to move along the neck for a distance of approximately 1/2 inch 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 in order to prevent overheating and possible damage to the tube.

Misregister Compensation. Proper operation of the 25AP22A 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.

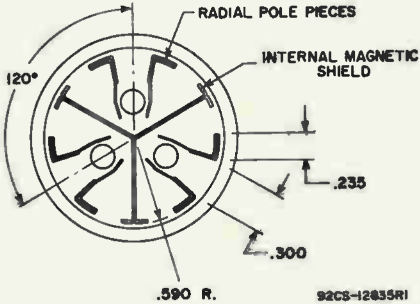
REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE



DIMENSIONS IN INCHES

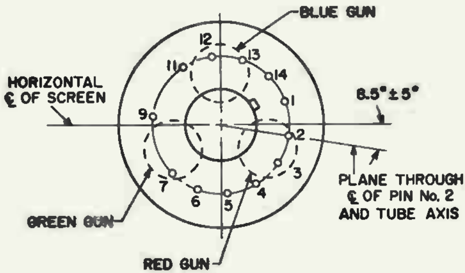
Reference line is determined by plane C-C' when gauge is seated.

LOCATION OF RADIAL-CONVERGING POLE PIECES
VIEWED FROM SCREEN END OF GUNS



DIMENSIONS IN INCHES

BASE
BOTTOM VIEW



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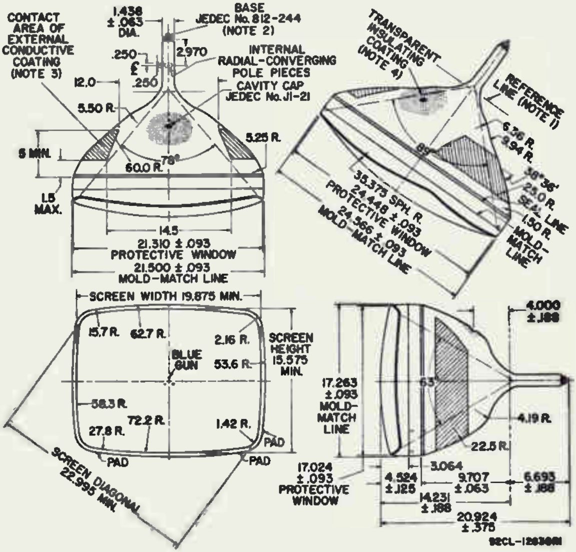
DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

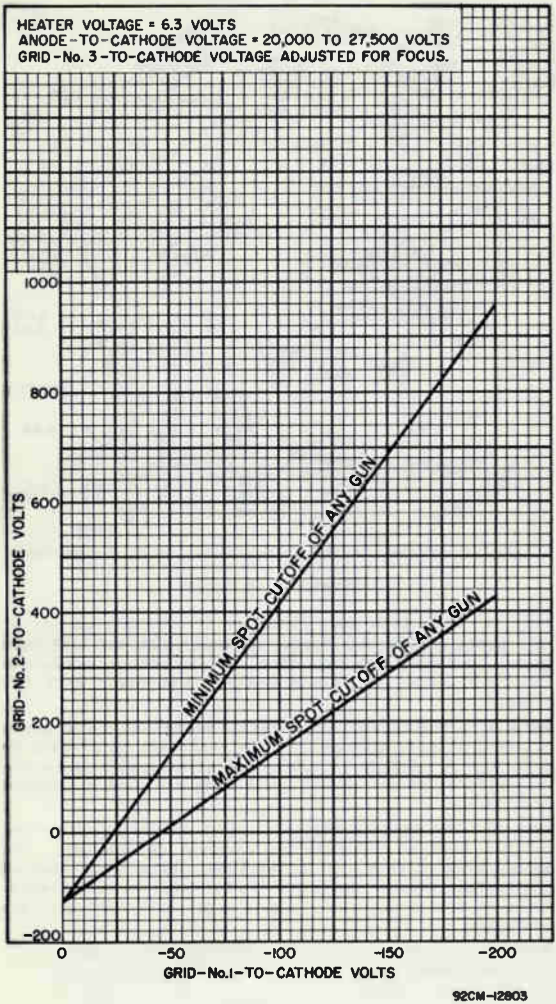
Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C' of the gauge with the glass funnel.

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 circle concentric with bulb axis and have a diameter of 2 inches.

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.

Cutoff Design Chart



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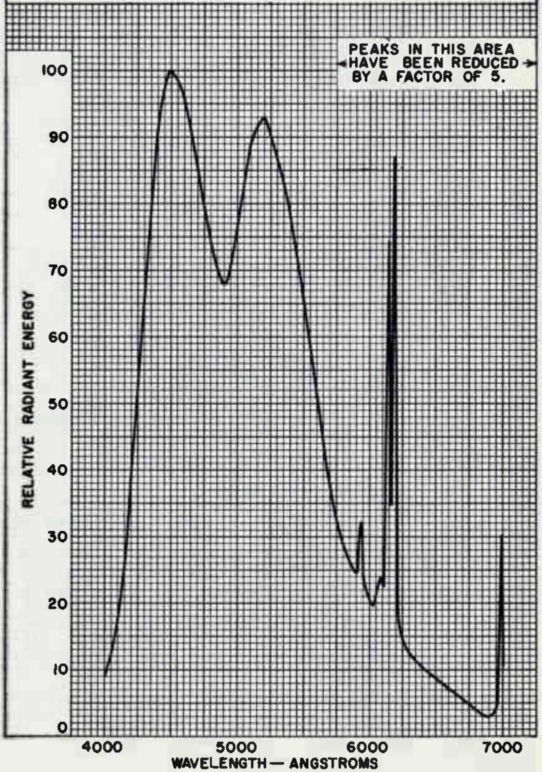
Spectral-Energy Emission Characteristic of Group Phosphor P22—Rare-Earth (Red), Sulfide (Blue & Green) Type[d]

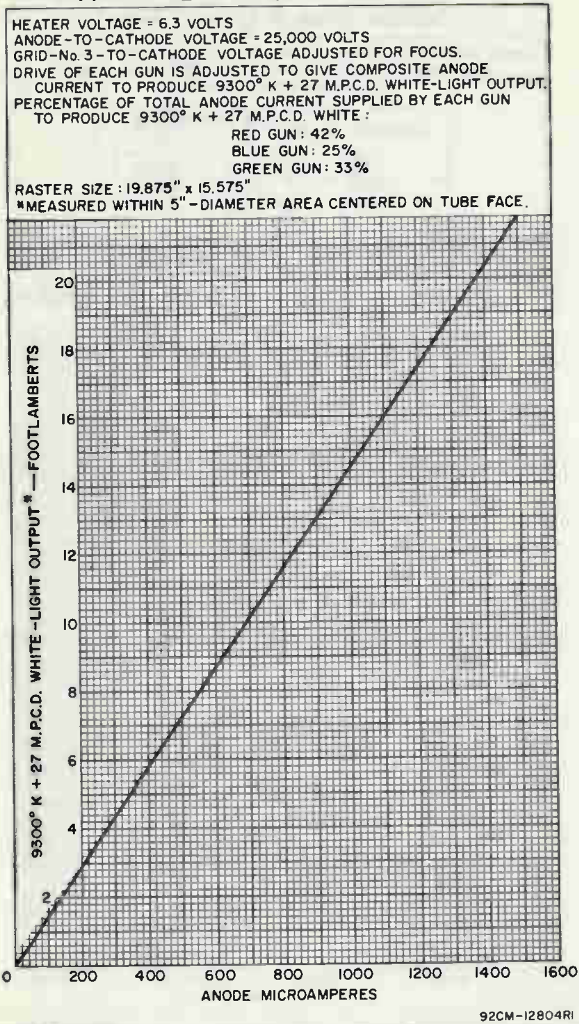
SIMULTANEOUS EXCITATION OF RED PHOSPHOR, BLUE PHOSPHOR, AND GREEN PHOSPHOR TO PRODUCE 9300° K + 27 M.P.C.D. WHITE (X = 0.281, Y = 0.311).

COMPONENT COLOR	C.I.E. COORDINATES	
	X	Y
RED	0.676	0.324
BLUE	0.155	0.061
GREEN	0.290	0.590



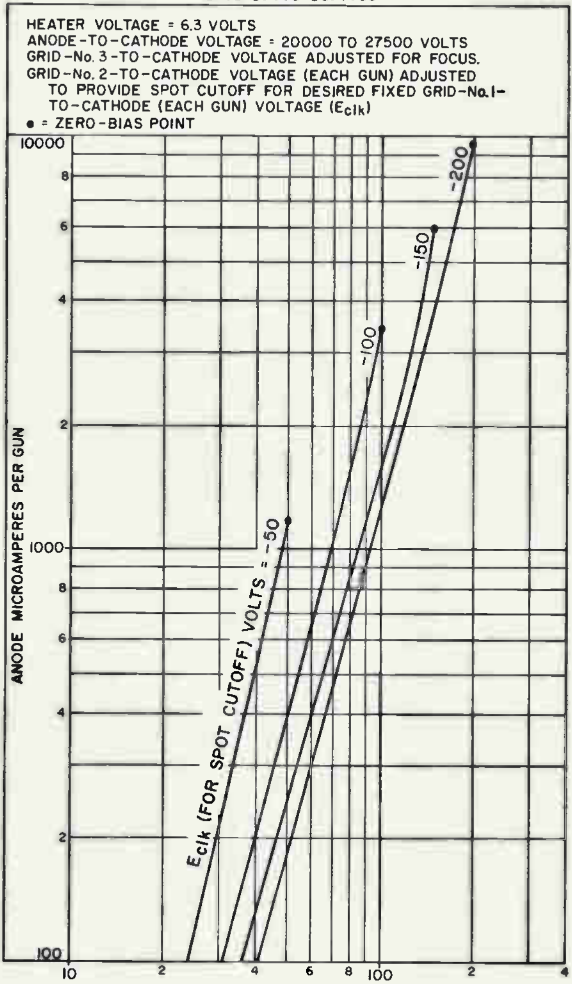
92CM-13088R1

Typical Light-Output Characteristic



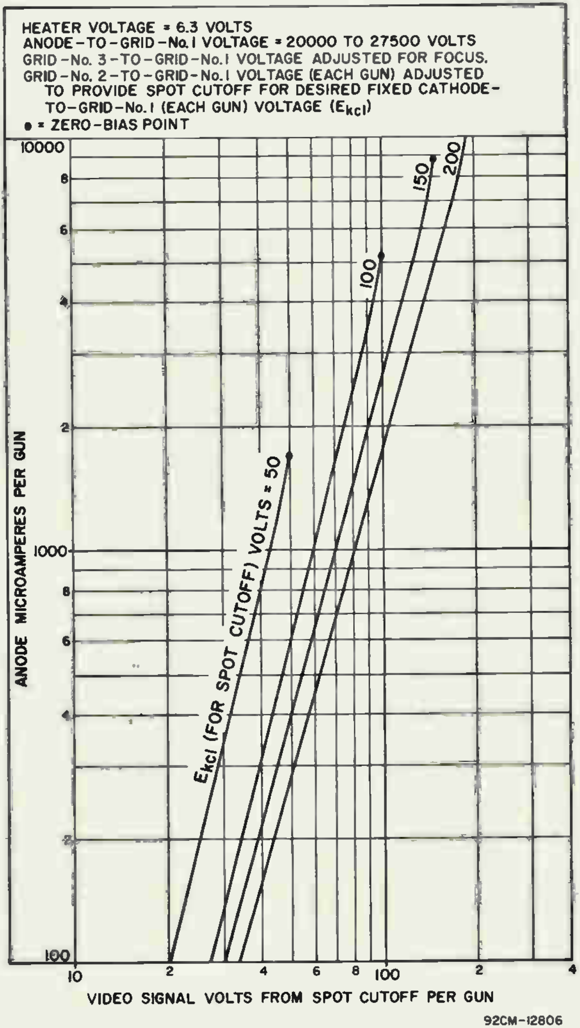
Typical Drive Characteristics

Grid-Drive Service



Typical Drive Characteristics

Cathode-Drive Service



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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%

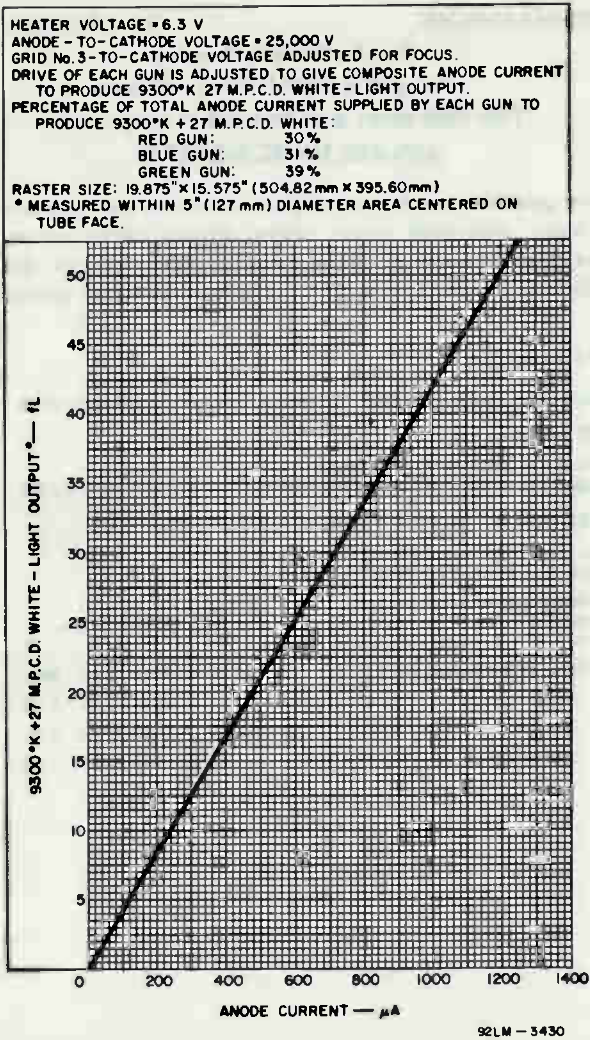
EQUIPMENT DESIGN RANGES

To Product White of 9300° K + 27 M.P.C.D.
(CIE Coordinates x = 0.281, y = 0.311):

	Red	Blue	Green	
Percentage of total anode current supplied by each gun (average)	30	31	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

TYPICAL LIGHT-OUTPUT CHARACTERISTIC



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):

	Red	Blue	Green	
Percentage of total anode current supplied by each gun (average)	30	31	39	%

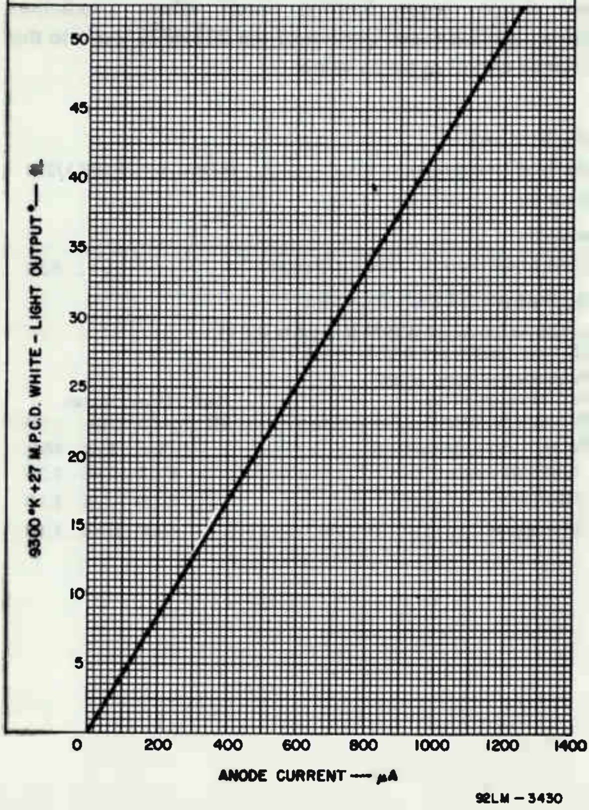
Ratio of cathode currents:	Min	Typ	Max
Red/blue	0.75	0.95	1.25
Red/green	0.60	0.75	1.10
Blue/green	0.60	0.80	1.10

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" × 15.575" (504.82 mm × 395.60 mm)
* MEASURED WITHIN 5" (127 mm) DIAMETER AREA CENTERED ON TUBE FACE.



25VABP22

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

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. / 20 min.	kV / 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. / 5.7 min.	V / 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 Undeflected 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)	±15 µA
Grid-No.2 Current	±5 µA
Grid-No.1 Current	±5 µA

	Illum.D	Color	
To Produce White Light of	6550°K + 7 M.P.C.D.	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)

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 μA .... 54 fL / 185 Nit

Limiting Circuit Values:

High-Voltage Circuits:
Grid-No.3 circuit resistance .... 7.5 max. MΩ

Low-Voltage Circuits:
Effective grid-No.1-to-cathode-circuit resistance (each gun)............... 0.75 max. MΩ

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 .... 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 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 cirucit 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

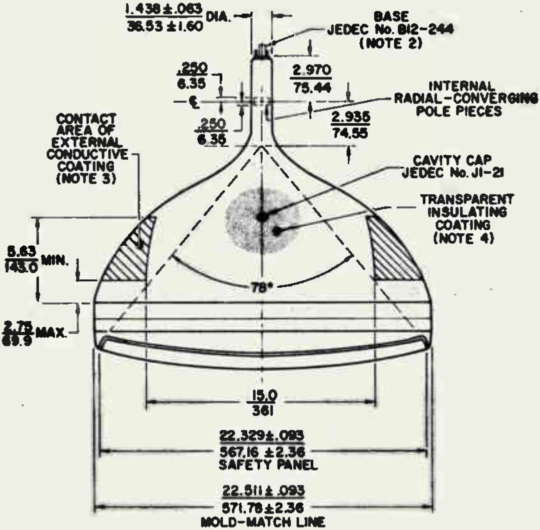
Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge (JEDEC No.G162) and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C′ of the gauge with the glass funnel.

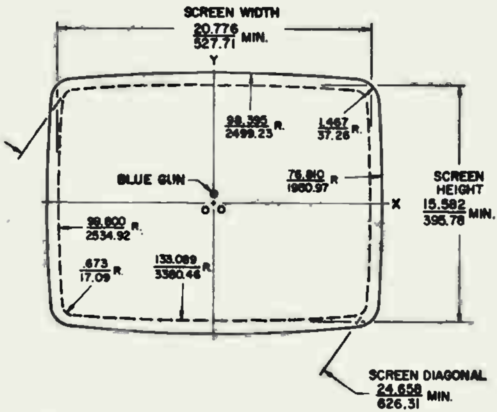
Note 2: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.

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.

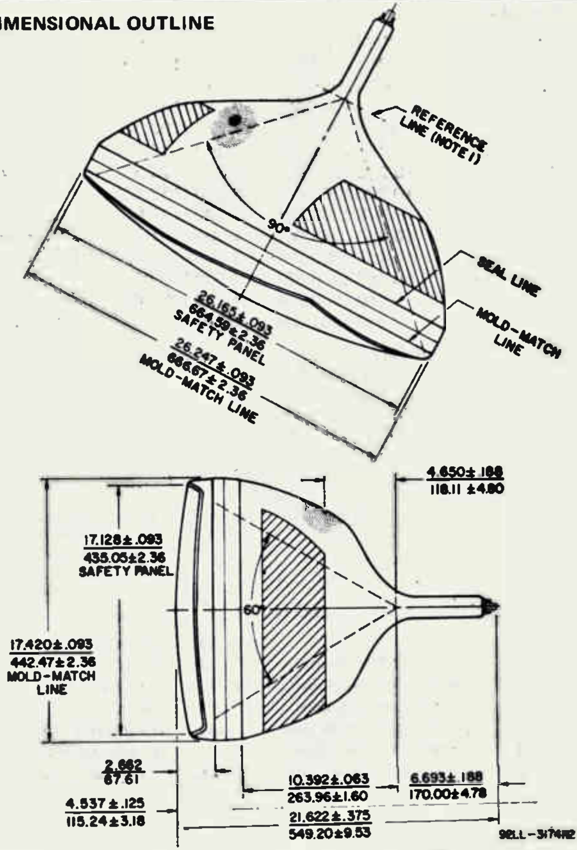
DIMENSIONAL OUTLINE





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.

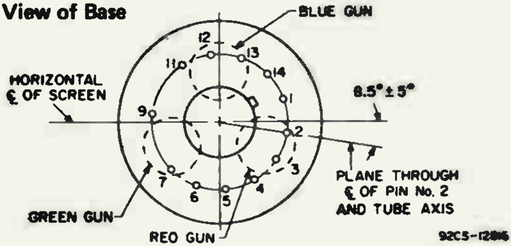
Station No.	Coordinates X in (mm)	Coordinates Y in (mm)	Sagittal Height in (mm)
1 (Minor)	0 (0)	7.916 (201.07)	.680 (17.27)
2	1.000 (25.40)	7.912 (200.96)	.692 (17.58)
3	2.000 (50.80)	7.901 (200.69)	.730 (18.54)
4	3.000 (76.20)	7.882 (220.20)	.791 (20.09)
5	4.000 (101.60)	7.856 (199.54)	.877 (22.28)
6	5.000 (127.00)	7.822 (198.68)	.987 (25.07)

(continued on next page.)

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)

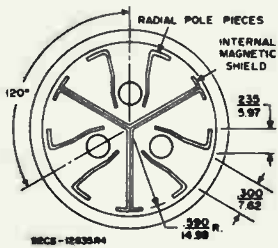
Bottom View of Base



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

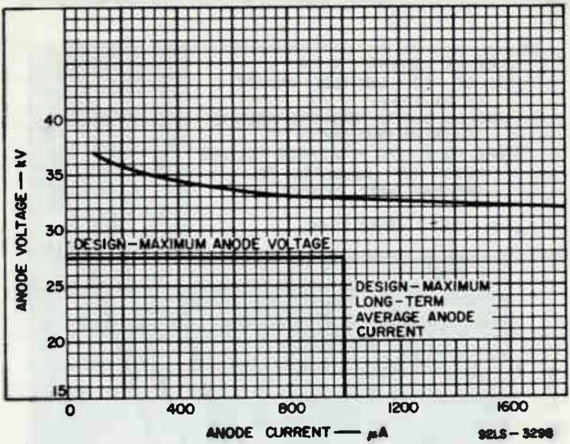


Figure 1

X-RADIATION LIMIT CURVE AT A CONSTANT ANODE CURRENT OF 300 µA (X-RADIATION AT A CONSTANT ANODE VOLTAGE VARIES LINEARLY WITH ANODE CURRENT)

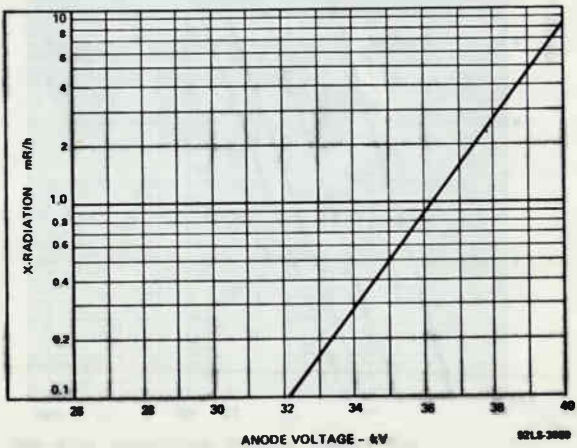
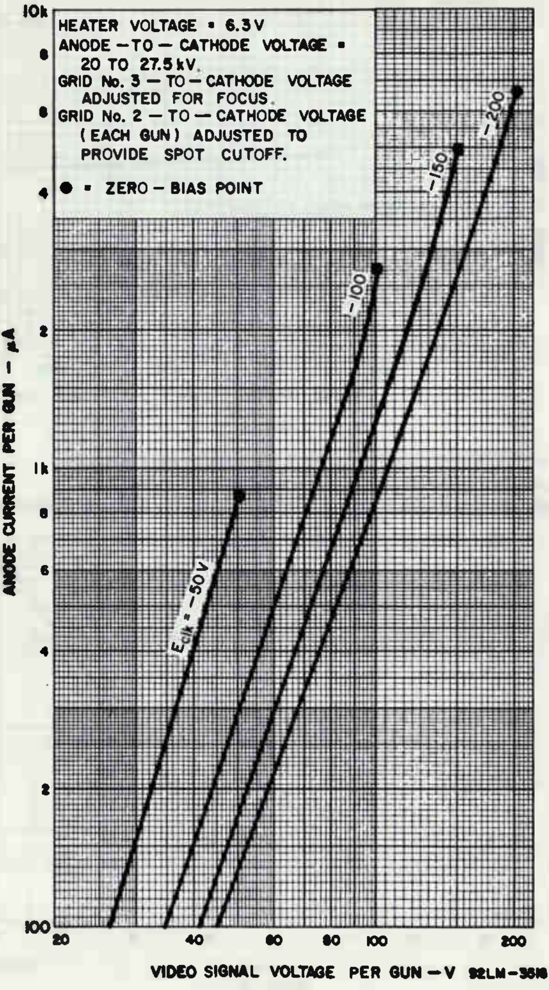
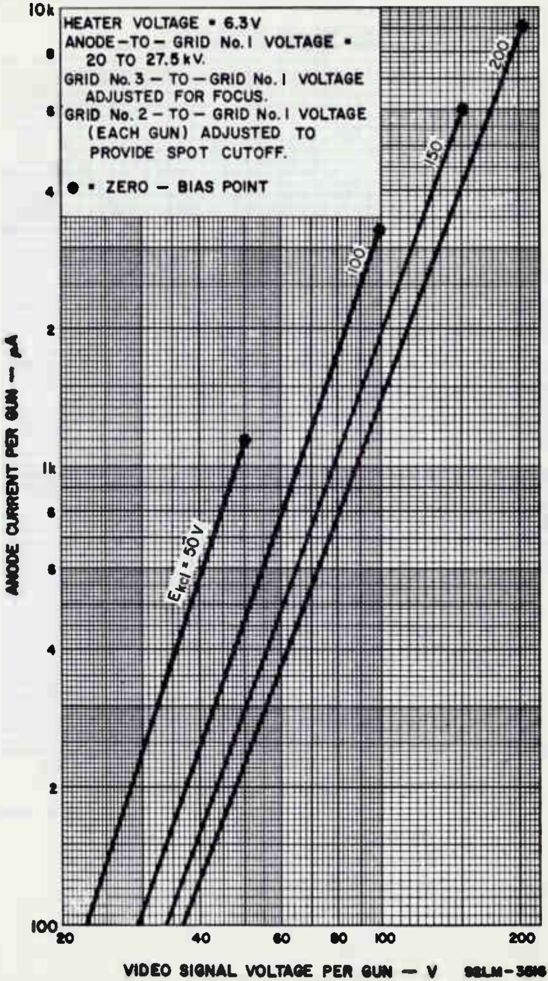


Figure 2

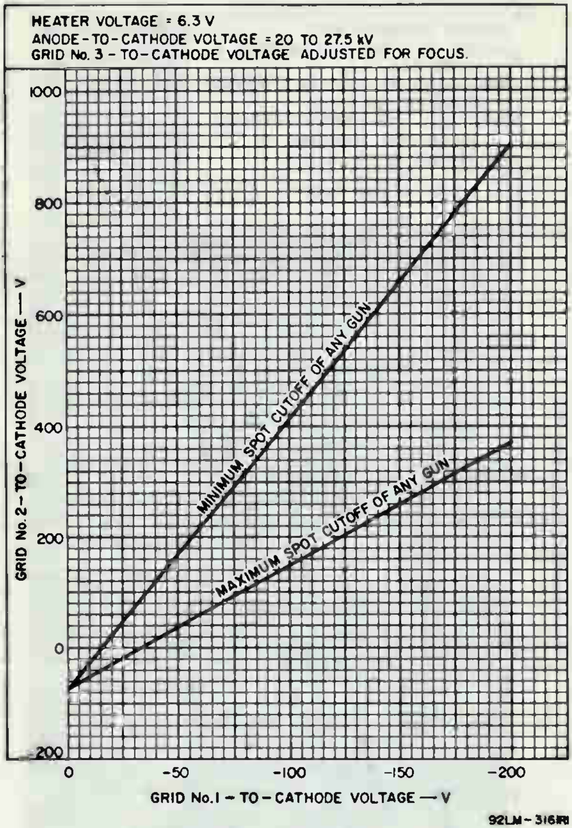
TYPICAL DRIVE CHARACTERISTICS, GRID-DRIVE SERVICE



TYPICAL DRIVE CHARACTERISTICS,
CATHODE-DRIVE SERVICE



CUTOFF DESIGN CHART



IMPORTANT: Refer to sheet **Safety Precautions for Color Picture Tubes** at front of this section.

Figure 3

25BP22A

Color Picture Tube

RECTANGULAR TUBE — **90° MAGNETIC DEFLECTION**
ALUMINIZED TRICOLOR PHOSPHOR-DOT *Hi-Lite* SCREEN
(Utilizing a Rare-Earth Red-Emitting Phosphor)
MAGNETIC CONVERGENCE — **3 ELECTROSTATIC-FOCUS GUNS**

For Use in Color-TV Receivers

The 25BP22A is the same as the 25AP22A except for the following items:

Optical:

Faceplate. . . . . .Filterglass
Light transmission (Approx.) 69%
Faceplate does not have an integral protective window.[a]

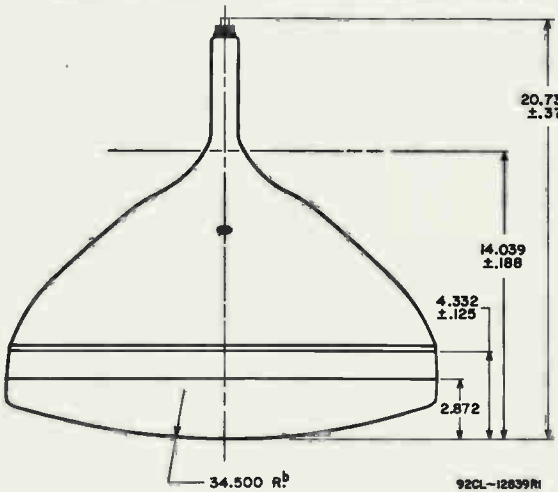
Mechanical:

Tube Dimensions:
Overall length . . . . 20.732" ± .375"
Weight (Approx.) . . . . 37 lbs

[a] It is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of the 25BP22A 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

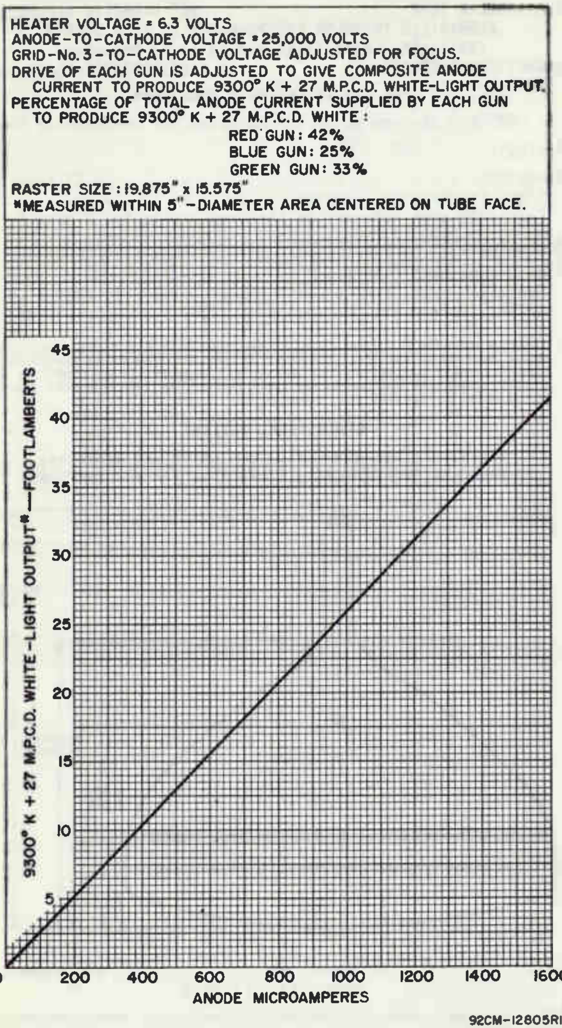
Dimensions shown are only those which are different from the corresponding dimensions for the 25AP22A



DIMENSIONS IN INCHES

[b] Short side has a radius of 34.000" R. In diagonal view, radius = 34.500" R.

Typical Light-Output Characteristic



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 toward tube axis		
Heater, of Each Gun		
Series connected within tube with each of the other two heaters		
Current at 6.3 volts[a]	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.3 to all other electrodes	6.5	pF
External conductive coating to anode	2500 max	pF
	2000 min	pF

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)

MECHANICAL

Tube Dimensions

Overall length	20.924 ± .375 in (531.5 ± 9.5 mm)
Neck length	6.693 ± .188 in (170.0 ± 4.8 mm)
Diagonal	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)

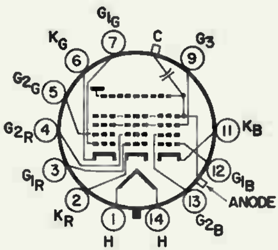
Minimum Screen Dimensions (Projected)

Diagonal	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.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, Grid No.5, Screen, Collector)
C – External Conductive Coating



14BE

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 20,000 min	V V
Total Anode Current, Long-Term Average	1000 max	μA
Grid-No.3 (Focusing Electrode) Voltage	6000 max	V
Peak Grid-No.2 Voltage, Including Video Signal Voltage	1000 max	V

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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 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 *Cutoff Design Chart*
For visual extinction of 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 µA

Grid-No.2 Current . . . . . . −5 to +5 µA

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)

Maximum Required Correction for Register[c] (Including Effect of Earth's Magnetic Field when Using Recommended Components)		
Measured 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		
Under operating conditions[a]	6.3	V
Under standby conditions.	5.0	V

LIMITING CIRCUIT VALUES

High-Voltage Circuits

Grid-No.3 Circuit Resistance.	7.5 max	MΩ

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	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.

[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" (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 25XP22 is designed to be operated at anode voltages as high as 27.5 kilovolts (design-maximum value), shielding of the 25XP22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

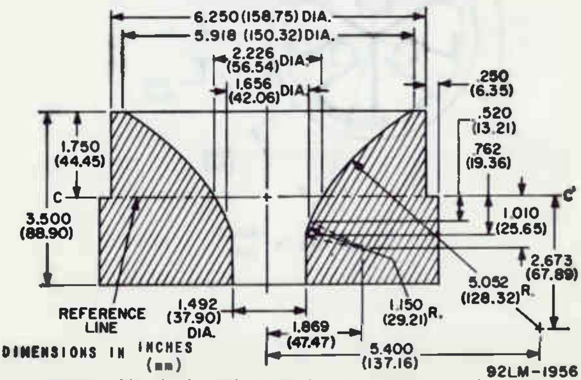
Orientation. The 25XP22 must be operated with tube axis in a horizontal position and with the blue gun uppermost (i.e., the anode contact button on top).

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.

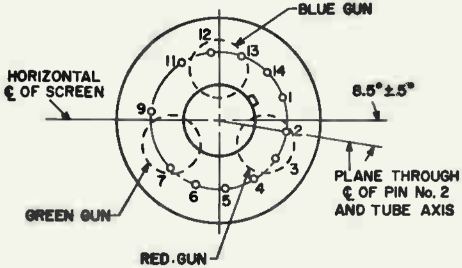
Misregister Compensation. Proper operation of the 25XP22 requires compensation for the effects of extraneous magnetic fields, the earth's magnetic field, and other causes which may produce misregister. Compensation for these effects may be accomplished by the use of a purifying magnet.

REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE JEDEC No. G102

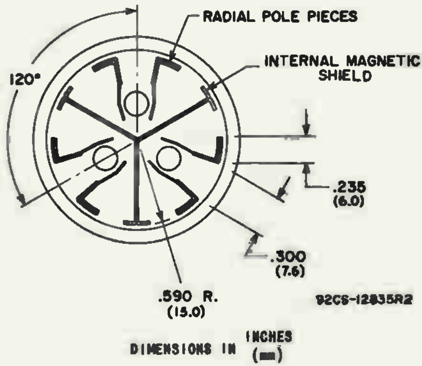


Reference Line is determined by plane C-C' when gauge is seated.

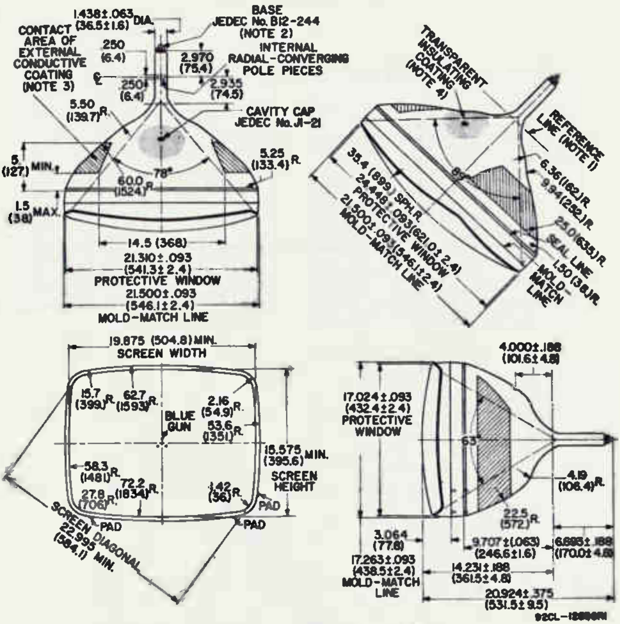
BOTTOM VIEW OF BASE



LOCATION OF RADIAL-CONVERGING POLE PIECES
VIEWED FROM SCREEN END OF GUNS



DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES (mm)

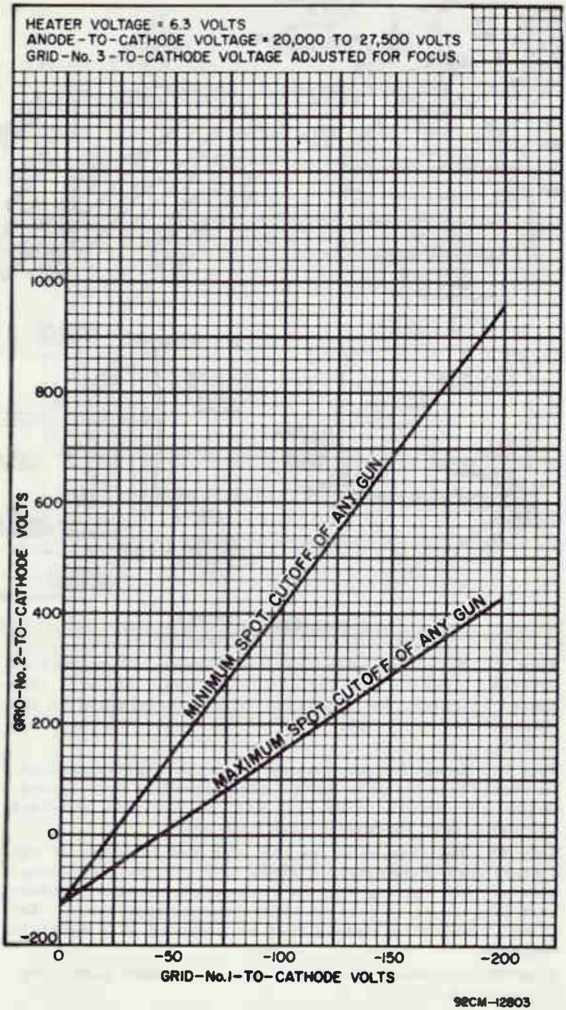
Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge and with tube seated in gauge, the reference line is determined by the intersection on the plane C-C' of the gauge with the glass funnel.

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.

Cutoff Design Chart



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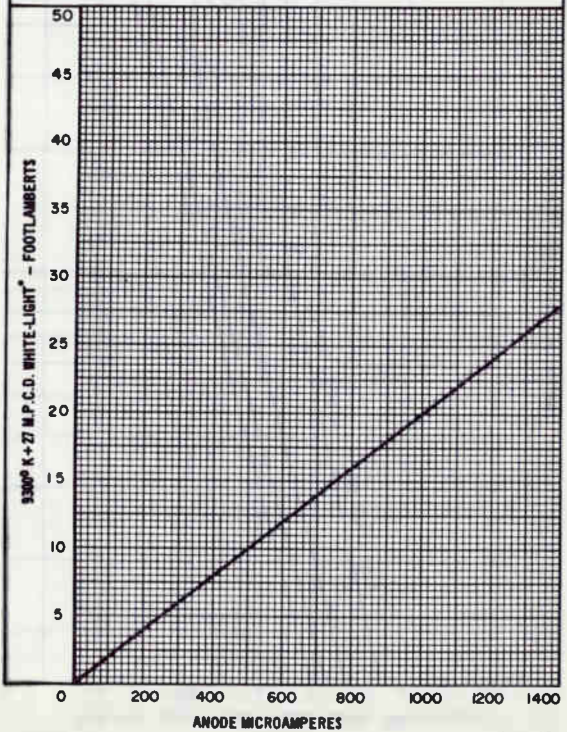
Typical Light-Output Characteristic

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%

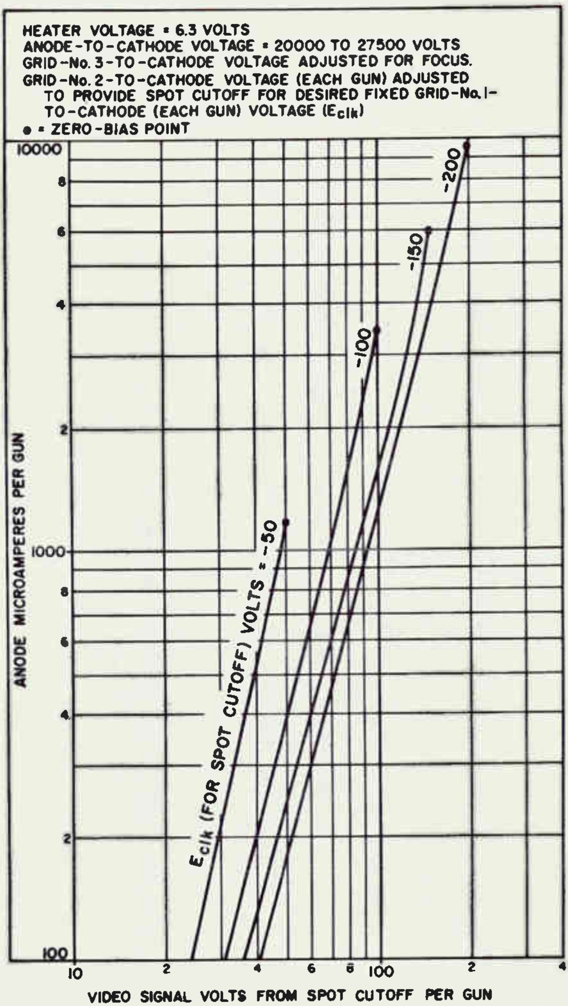
RASTER SIZE: 19.875" X 15.575" (504.8 mm X 395.6 mm)
*MEASURED WITHIN 5" – DIAMETER AREA CENTERED ON TUBE FACE.



92LM-1951

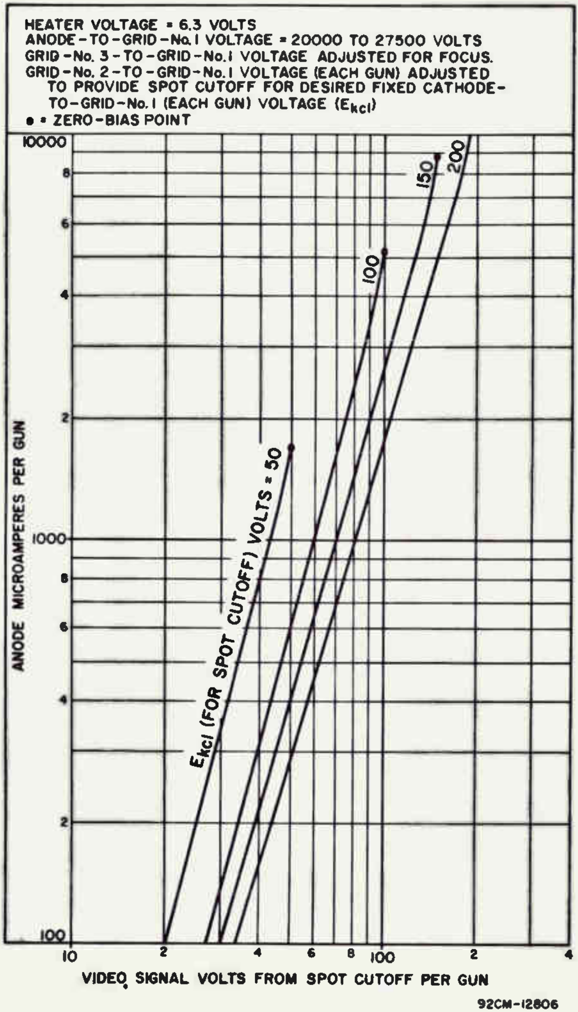
Typical Drive Characteristics

Grid-Drive Service



Typical Drive Characteristics

Cathode-Drive Service



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 25XP22 except for the following items:

OPTICAL

Faceplate. . . . . **Filterglass**
Light transmission (Approx.) **69%**
Faceplate does not have an integral protective window[a]

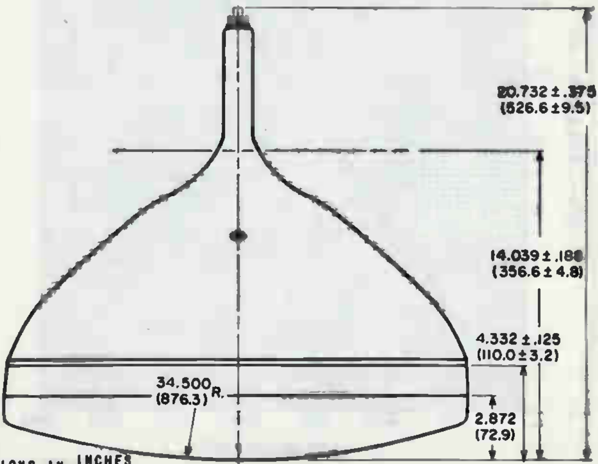
MECHANICAL

Tube Dimensions
Overall length . . . . . . **20.732 ± .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 25XP22



DIMENSIONS IN INCHES (mm)

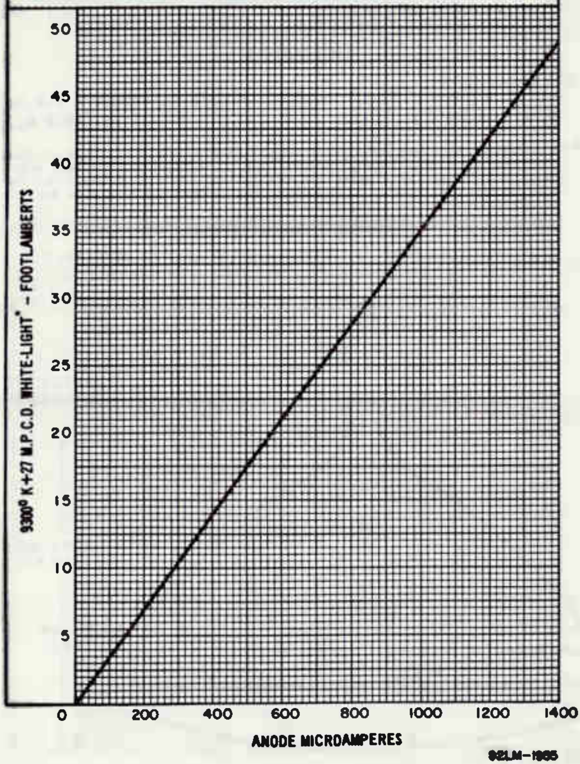
Note: In side view, spherical radius = 34.000 in (863.6 mm).

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 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.



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 . . . . μμf
- DJ_1 to All Other Electrodes . . . . 8.5 . . . . μμf
- DJ_4 to All Other Electrodes . . . . 6.0 . . . . μμf

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 . . . . 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 2 - Heater, Cathode

Pin 3 - Anode No.1

Pin 4 - Deflecting Electr. DJ_1

Pin 5 - Grid No.1

Pin 6 - Deflecting Electr. DJ_4

Pin 7 - Heater

Pin 8 - No Connection

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 is deflected toward pin 3. With DJ_3 positive with respect to DJ_4, the spot is deflected toward pin 1.

The angle between the trace produced by DJ_3 and DJ_4 and its intersection with the plane through the tube axis and pin 1 does not exceed 10°.

The angle between the trace produced by DJ_3 and DJ_4 and the trace produced by DJ_1 and DJ_2 is 90° ± 4°.

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

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

902-A

902-A

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 DJ_1 and DJ_2. Suitable test conditions are: anode-No.2 voltage, 600 volts; anode-No.1 voltage, adjusted for focus; deflecting-electrode resistors, 1 megohm each for DJ_1 and DJ_4, 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 both deflecting-electrode-circuit resistances be approximately equal.

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

Projection Kinescope

FORCED-AIR COOLED
ELECTROSTATIC FOCUS

MAGNETIC DEFLECTION
20 FT. x 15 FT. PROJECTED PICTURES

For Black-and-White Projection Systems in Theater and Closed-Circuit Television Applications

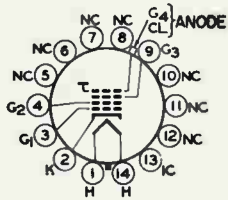
The 4486 *is the same as the* 7NP4 *except that it is supplied with a fitted high-voltage anode cable. (See Accompanying Dimension Outline).*

MECHANICAL

Cap shown for type 7NP4 does not apply for type 4486.

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 – Anode (Grid No.4, Collector)

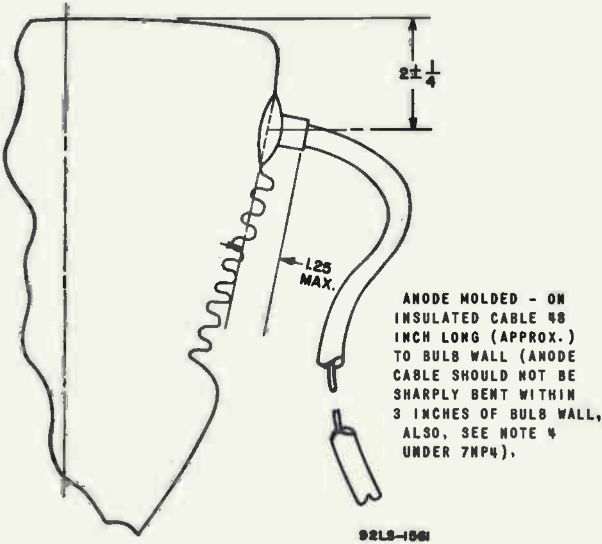


14R

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)



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

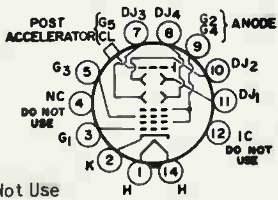
Phosphor	P31
Flourescence and phosphorescence	Green
Persistence	Medium-Short
Faceplate	Clear Glass
Shape	Curved, Circular
Minimum Useful Screen Diameter	
4490	6 in
4491	7 in

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)



14J1

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

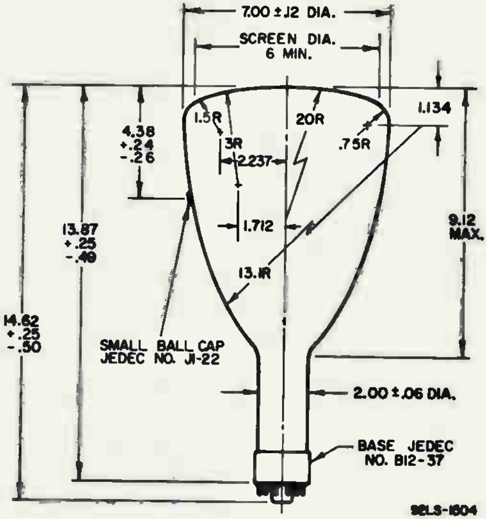
MAXIMUM CIRCUIT VALUES

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)



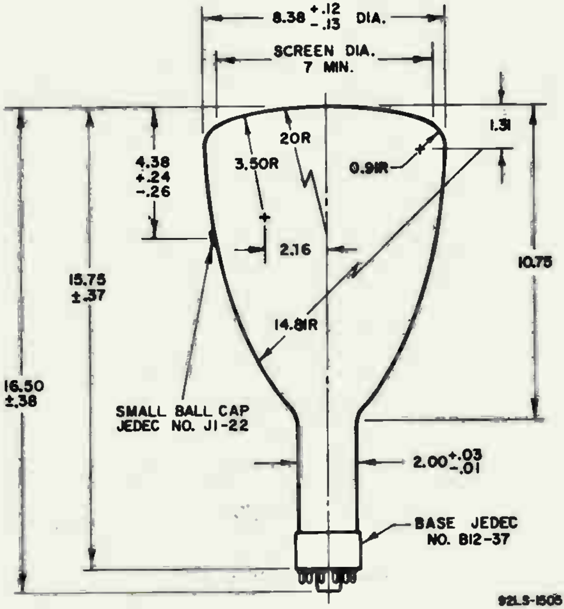
DIMENSIONS IN INCHES

℄ 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 ±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 5; likewise, with DJ3 positive with respect to DJ4, the spot will be deflected toward pin 2.

DIMENSIONAL OUTLINE (4491)



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 ±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 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
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	9.5	pF
Focusing Method	Electrostatic	
Deflection Method	Electrostatic	

OPTICAL

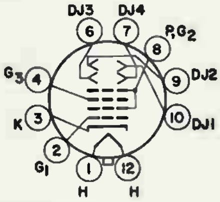
Phosphor	P1
Fluorescence and phosphorescence	Yellowish-Green
Persistence	Medium
Faceplate	Clear Glass
Shape	Flat, Circular
Minimum Useful Screen Diameter	4.56 in

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 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



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 5.7 min	V 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

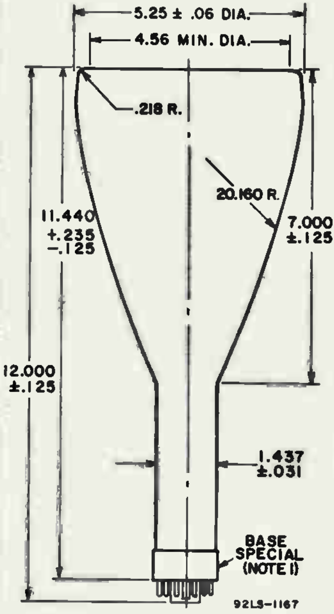
Anode Voltage	2200	V
Grid-No.3 (Focusing-Electrode) Voltage	750 to 1000	V
Grid-No.1 Voltage	-60 to -140	V
For visual cutoff of focused spot		
Deflection Factors		
DJ1 and DJ2	84 to 106	V (dc)/in
DJ3 and DJ4	67 to 83	V (dc)/in

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



DIMENSIONS IN INCHES

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.

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

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	μsec

Circuit Requirements

Maximum Grid-No.1 Circuit Resistance	1.0 MΩ
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 μA.

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 μA.

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.

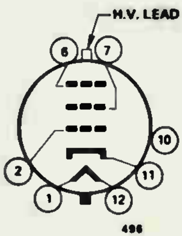
In the use of the tube it should always be remembered that high voltages may appear at normally low-potential points in the circuit because of capacitor breakdown or incorrect circuit connections, and that the tube surface maintains a static charge for some time after the power has been turned off. Therefore, 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 face-plate, 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

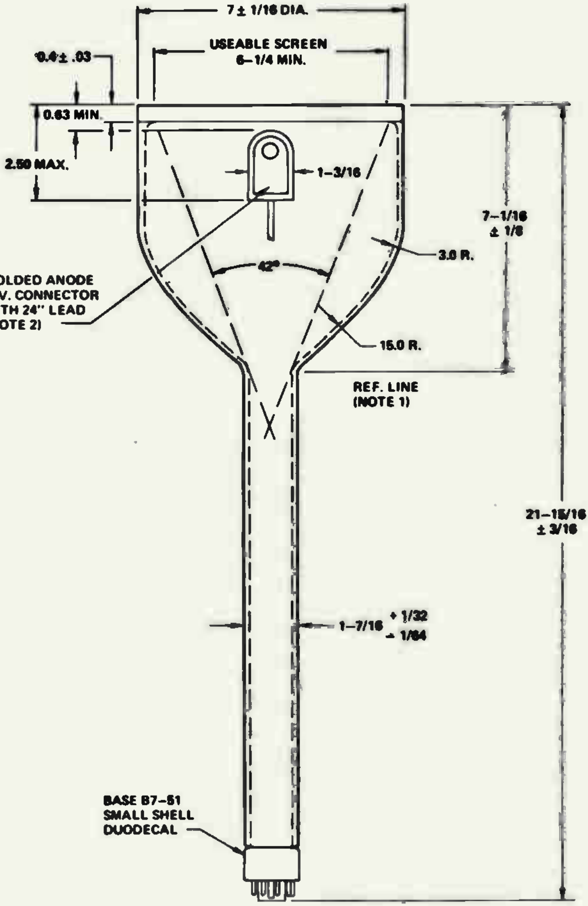
Wear "Safety" Goggles with side shields, when handling tube, to prevent possible injury from flying glass in case of tube breakage. Do not strike or scratch tube. Never subject it to more than moderate pressure when installing in or removing from equipment. Always Handle Tube with Extreme Care. Ground 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

DIMENSIONAL OUTLINE



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

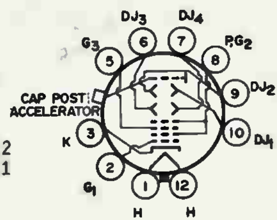
Phosphor	P7
Fluorescence	Purplish-Blue
Phosphorescence	Yellowish-Green
Persistence	Long
Faceplate	Clear Glass
Shape	Flat, Circular
Minimum Useful Screen Diameter	4.56 in

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	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	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

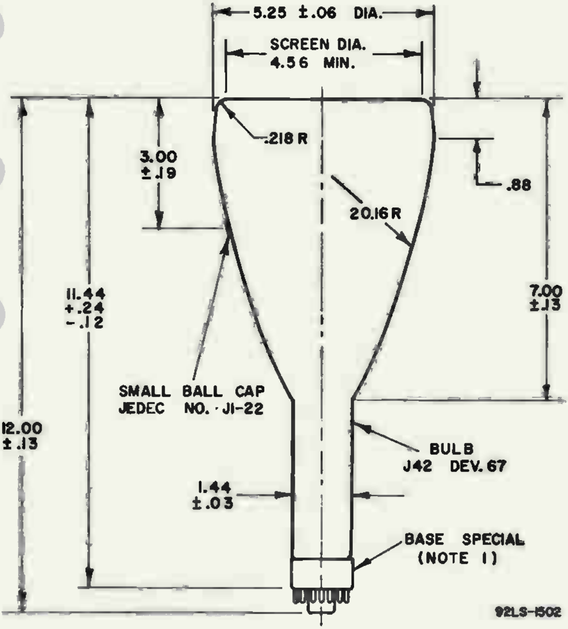
MAXIMUM CIRCUIT VALUES

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° ± 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 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

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	μA
Grid No.3 Current	10	μA
Grid No.2 Current	1.0	μA
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.

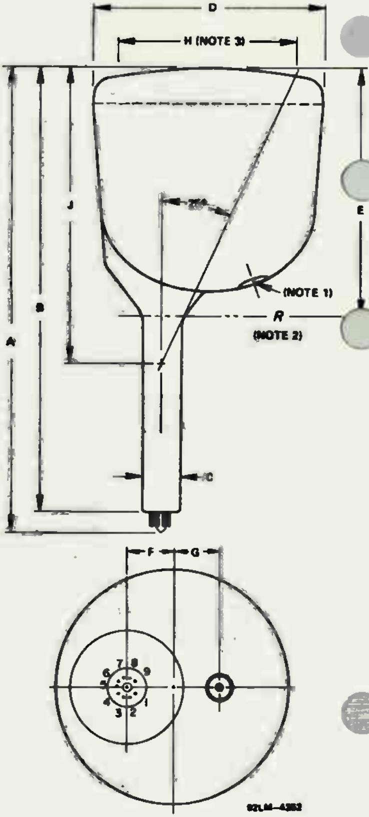
High Voltage

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.

Dimensional Outline



Note 1: Anode button J1-22.

Note 2: Reference line; ring gauge (1.000" +.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 ± .060
C	0.870 ± .030
D	4.950 ± .062
E	5.218 ± .125
F	1.000 Ref.
G	1.000 Ref.
H	4.500 Min.
J	6.250 Ref.

Photomultiplier Tubes

10-Stage, Head-On Types Having Bialkali Photocathode.

GENERAL

Spectral Response . . . . . See accompanying *Typical Spectral Response Characteristics*

Wavelength of Maximum Response . . . . 4000 ± 500 Å

Cathode, Semitransparent . . Potassium-Cesium-Antimony (Bialkali)

Type 4516

Minimum projected area . . . . 0.2 in^2 (1.26 cm^2)

Minimum diameter . . . . 0.5 in (1.27 cm)

Type 4517

Minimum projected area . . . . 1.2 in^2 (7.8 cm^2)

Minimum diameter . . . . 1.24 in (31.5 mm)

Window . . . . Corning® No.0080, or equivalent

Index of refraction at 4360 angstroms 1.523

Type 4516

Shape . . . . Plano-Concave

Type 4517

Shape . . . . Plano-Plano

Dynodes:

Substrate . . . . Copper-Beryllium

Secondary-Emitting Surface . . . . Beryllium-Oxide

Structure . . . . (4516) In-Line, Electrostatic-Focus Type
(4517) Circular-Cage, Electrostatic-Focus Type

Direct Interelectrode Capacitances (Approx.):

Type 4516

Anode to dynode No.10 . . . . 2.4 pF

Anode to all other electrodes . . . . 3.2 pF

Type 4517

Anode to dynode No.10 . . . . 4 pF

Anode to all other electrodes . . . . 7 pF

Type 4516

Maximum Overall Length
(Excluding semiflexible leads) . . . . 3.94 in (10 cm)

Maximum Diameter . . . . 0.78 in (2 cm)

Bulb T6

Base . . . . See Dimensional Outline

Magnetic Shield . . . . Millen© Part No.80801N, or equivalent

Operating Position . . . . Any

Weight (Approx.) . . . . 0.9 oz (25.5 g)

GENERAL (Cont'd)

Type 4517

Maximum Overall Length	4.57 in (116 mm)
Seated Length	3.88 in ± 0.19 in (98.6 mm ± 4.8 mm)
Maximum Diameter	1.56 in (39.6 mm)
Bulb	T12
Base	Small-Shell Duodecal 12-pin, JEDEC No.B12-43
Socket	Eby[b] No.9058, or equivalent
Magnetic Shield	Millen[c] No.80802C, or equivalent
Operating Position	Any
Weight (Approx.)	2 oz

MAXIMUM RATINGS, *Absolute-Maximum Values*

DC Supply voltage:		
Between anode and cathode	1800 max.	V
Between anode and dynode No.10		
Type 4516	300 max.	V
Type 4517	250 max.	V
Between consecutive dynodes	300 max.	V
Between dynode No.1 and cathode		
Type 4516	300 max.	V
Type 4517	400 max.	V
Average Anode Current[e]	0.5 max.	mA
Ambient-Temperature Range[f]	-100 to +85	°C

CHARACTERISTICS RANGE VALUES

Under conditions with dc supply voltage (E) across a voltage divider providing electrode voltages as shown in Table I and at a temperature of 22° C, except as noted.

With E = 1500 volts (Except as noted)

	Min.	Typical	Max.	
Anode Sensitivity:				
Radiant[g] at 4000 angstroms	–	5.6×10^4	–	A/W
Luminous[h] (2870° K)				
Type 4516	10	47	170	A/lm
Type 4517	10	47	150	A/lm

→ CHARACTERISTICS RANGE VALUES (Cont'd)

	Min.	Typical	Max.	
Current with blue light source[j] (2870°K + C.S. No.5-58)				
Type 4516	1.5×10^{-6}	7×10^{-6}	2.6×10^{-5}	A
Type 4517	1.5×10^{-5}	7×10^{-5}	2.2×10^{-4}	A
Cathode Sensitivity:				
Type 4516				
Radiant[k] at 4000 angstroms	–	0.071	–	A/W
Luminous[m] (2870°K) . .	5.3×10^{-5}	6×10^{-5}	–	A/lm
Current with blue light source[n] (2870° K + C.S. No.5-58)	8×10^{-9}	9×10^{-9}	–	A
Quantum Efficiency at 4000 angstroms	–	22	–	%
Type 4517				
Radiant[k] at 4000 angstroms	–	0.079	–	A/W
Luminous[m] (2870°K) . .	–	6.7×10^{-5}	–	A/lm
Current with blue light source[n] (2870° K + C.S. No.5-58)	8×10^{-10}	1×10^{-9}	–	A
Quantum Efficiency at 4000 angstroms	–	24	–	%
Type 4516				
Current Amplification . .	–	8×10^{5}	–	
Anode Dark Current at 7 A/lm[p]	–	2×10^{-10}	6×10^{-10}	A
Equivalent Anode Dark Current Input at 7 A/lm	–	2.9×10^{-11} [p]	8.6×10^{-11} [p]	lm
	–	2.4×10^{-14} [q]	7.2×10^{-14} [q]	W
Equivalent Noise Input[r] . .	–	4.1×10^{-13}	–	lm
	–	3.5×10^{-16} [s]	–	W
Dark Pulse Summation:[t]				
1 to 32 photoelectrons . (See *Typical Dark-Pulse Spectrum*)	–	250	–	cps
Pulse Height Resolution[u].	–	8.5	–	%
Anode-Pulse Rise Time[v,w] at 1800 V	–	1.7×10^{-9}	–	s
Electron Transit Time[v,x] at 1800 V	–	1.8×10^{-8}	–	s

→ Indicates a change or addition.

CHARACTERISTIC RANGE VALUES (Cont'd)

Type 4517	Min.	Typical	Max.	
➡ Current Amplification . .	–	7×10^5	–	
Anode Dark Current at ➡ 7 A/lm[p]	–	2×10^{-10}	7×10^{-10}	A
Equivalent Anode Dark Current Input at ➡ 7 A/lm	–	2.9×10^{-11}[p]	1×10^{-10}[p]	lm
	–	2.4×10^{-13}[q]	8.4×10^{-12}[q]	W
➡ Equivalent Noise Input[r] . .	–	3.9×10^{-13}	–	lm
	–	3.3×10^{-16}[s]	–	W
Dark Pulse Summation:[t]				
1 to 32 photoelectrons . (See *Typical Dark-Pulse Spectrum*)	–	250	–	cps
Pulse Height Resolution[u].	–	8.5	–	%
Anode-Pulse Rise Time[v,w] at 1800 V	–	2.1×10^{-9}	–	s
Electron Transit Time[v,x] at 1800 V	–	2.4×10^{-8}	–	s

Typical Potential Distribution	Type 4516	Type 4517
Between:	8.25% of Supply Voltage (E) Multiplied by:	8.13% of Supply Voltage (E) Multiplied by:
Cathode and Dynode No.1	1.2	1.7
Dynode No.1 and Dynode No.2	1.2	1.3
Dynode No.2 and Dynode No.3	1.7	1.3
Dynode No.3 and Dynode No.4	1.0	1.0
Dynode No.4 and Dynode No.5	1.0	1.0
Dynode No.5 and Dynode No.6	1.0	1.0
Dynode No.6 and Dynode No.7	1.0	1.0
Dynode No.7 and Dynode No.8	1.0	1.0
Dynode No.8 and Dynode No.9	1.0	1.0
Dynode No.9 and Dynode No.10	1.0	1.0
Dynode No.10 and Anode	1.0	1.0
Anode and Cathode	12.1	12.3

a Made by Corning Glass Works, Corning, NY 14830.

b Made by Hugh H. Eby Company, 4701 Germantown Avenue, Philadelphia, PA 19144.

c Made by James Millen Manufacturing Company, 150 Exchange Street, Malden, MA 02148.

e Averaged over any interval of 30 seconds maximum.

f Tube operation at room temperature or below is recommended.

g This value is calculated from the typical anode luminous sensitivity rating using a conversion factor of 1190 lumens per watt.

h These values are calculated as shown below:

$$\text{Luminous Sensitivity (A/lm)} = \frac{\text{Anode Current (with blue light source) (A)}}{0.15 \times \text{Light Flux of } 1 \times 10^{-5} \text{ (lm)}}$$

The value of 0.15 is the average value of the ratio of the anode current measured under the conditions specified in footnote (j) to the anode current measured under the same conditions but with the blue filter removed.

j Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning C.S. No.5-58, polished to 1/2 stock thickness – Manufactured by the Corning Glass Works, Corning, NY 14830) from a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux incident on the filter is 1×10^{-5} lumen.

k This value is calculated from the typical cathode luminous sensitivity rating using a conversion factor of 1190 lumens per watt.

m This value is calculated as shown below:

$$\text{Cathode Luminous Sensitivity (A/lm)} = \frac{\text{Cathode Current (with blue light source) (A)}}{0.15 \times \text{Light Flux of } 1 \times 10^{-4}}$$

The value of 0.15 is the average value of the ratio of the cathode current measured under the conditions specified in footnote (n) to the cathode current measured under the same conditions but with the blue filter removed.

n Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning C.S. No.5-58, polished to 1/2 stock thickness – Manufactured by the Corning Glass Works, Corning, NY 14830) from a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux incident on the filter is 1×10^{-4} lumen and 200 volts are applied between cathode and all other electrodes connected as anode.

p Light incident on the cathode is transmitted through a blue filter (Corning C.S. No.5-58, polished to 1/2 stock thickness). The light flux incident on the filter is 10 microlumens. The supply voltage (E) is adjusted to obtain an anode current of 10 microamperes. Sensitivity of the tube under these conditions is approximately equivalent to 7 amperes per lumen. Dark current is measured with no light incident on the tube.

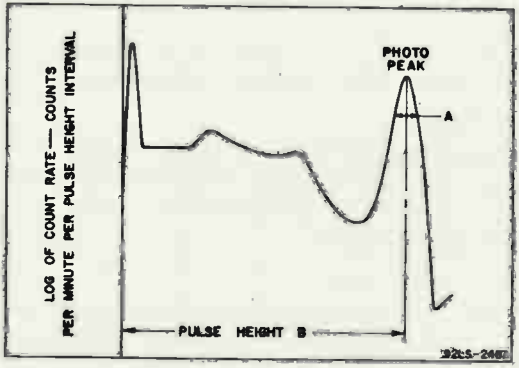
q At 4000 angstroms. These values are calculated from the EADCI values in lumens using a conversion factor of 1190 lumens per watt.

r Under the following conditions: External shield connected to cathode, an equivalent bandwidth of 1 Hz, tungsten light source at a color temperature of 2870° K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The "on" period of the pulse is equal to the "off" period.

s At 4000 angstroms. This value is calculated from the ENI value in lumens using a conversion factor of 1190 lumens per watt.

t Measured with the tube in complete darkness. The pulse height for the single photoelectron equivalent is determined by using a light source operated at a low color temperature to assure the high probability of single photoelectron emission from the photocathode of the tube. The intensity of the light source is adjusted for approximately 10^4 photons per second. This light is removed before the dark pulse summation is measured.

u The 662 keV photon from an isotope of cesium having an atomic mass of 137 (Cs^{137}) and a cylindrical 1-1/2" x 1-1/2" thallium-activated sodium-iodide scintillator [NaI (Tl) -type 6D6] are used. This scintillator is manufactured by the Harshaw Chemical Corporation, 1945 East 97 Street, Cleveland 6, OH 44106, and is rated by the manufacturer as having a resolution capability of 8.5%. The Cs^{137} source is in direct contact with the metal end of the scintillator. The faceplate end of the crystal is coupled to the tube by a coupling fluid such as Dow Corning Corp., Type DC200 (viscosity of 60,000 centistokes) — Manufactured by the Dow Corning Corp., Midland, MI 48640, or equivalent. Pulse height resolution in per cent is defined as 100 times the ratio of the width of the photopeak at half the maximum count rate in the photopeak height (A) to the pulse height at maximum photopeak count rate (B).



v Under conditions with dc supply voltage (E) across a voltage divider providing 1/6 of (E) between cathode and dynode No.1; 1/12 of (E) for each succeeding dynode stage; and 1/12 of (E) between dynode No.10 and anode.

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

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

OPERATING CONSIDERATIONS

SHIELDING

Electrostatic shielding of the 4516 and 4517 is ordinarily required. When a shield is used, it must be connected to the cathode terminal.

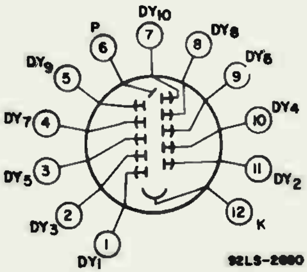
Magnetic shielding of the 4516 and 4517 is ordinarily required. See accompanying curves for the effect of variation in magnetic field intensity on the anode current for a tube with no magnetic shielding.

OPERATING VOLTAGES

In general, the operating potential between anode and cathode should not be less than 500 volts. The suggested voltage distribution shown in Table I is a typical, average distribution for obtaining a good compromise between output current and time and energy resolution. However, it may be necessary to individually adjust these distribution voltages by as much as ±15% to obtain optimum current amplification, pulse-height resolution, or time resolution.

LEAD CONNECTIONS (4516)

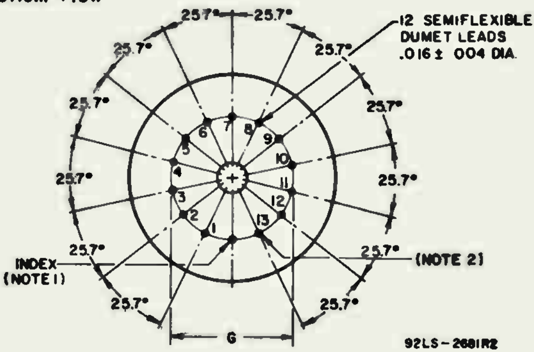
Bottom View



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

LEAD ORIENTATION (4516)

Bottom View



Note 1: Lead No.14 is cut off within 0.04 inch of the glass button for indexing.

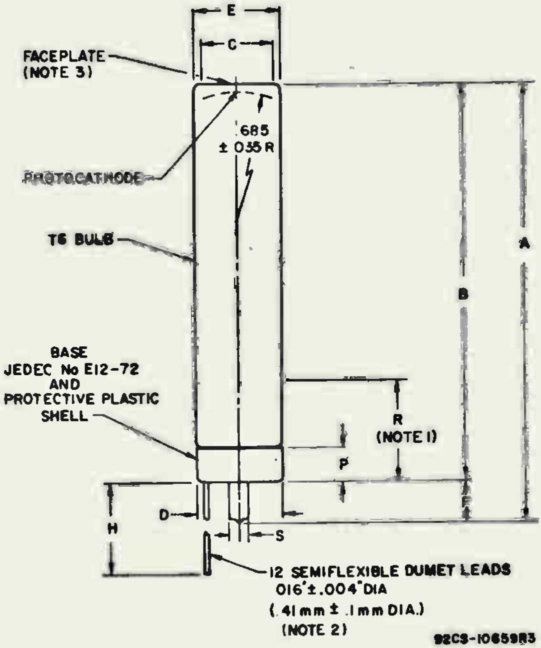
Note 2: Lead No.13 is cut off within 0.04 inch of the glass button.

OUTLINE DIMENSIONS(4516)

Dimensions	Inches	mm
A	3.94 max.	100.0 max.
B	3.50 $^{+.06}_{-.12}$	88.9 $^{+1.5}_{-3}$
C	.5 min. dia.	12.7 min. dia.
D	.78 max. dia.	19.8 max. dia.
E	.755 max. dia.	19.18 max. dia.
F	.38 max.	9.7 max.
G	.47 ± .01 dia.	11.9 ± .25 dia.
H	.75 min.	19.0 min.
P	.30 max.	7.6 max.
R	1.0 max.	25 max.
S	.17 max.	4.3 max.

The dimensions in millimeters are derived from the basic inch dimensions (1 inch = 25.4 mm)

DIMENSIONAL OUTLINE (4516)

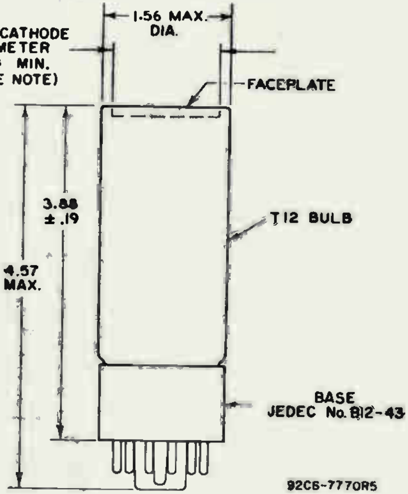


Note 1: Within this length, maximum diameter of tube is 0.78".

Note 2: The semiflexible leads of the tube may be soldered or welded into the associated circuit. If desired, the leads may be trimmed to within 1/4 inch of the protective shell. Care must be exercised when making such connections to prevent tube destruction due to thermal stress of the glass-metal seals. A heat sink placed in contact with the semiflexible leads between the point being soldered, or welded, and the protective shell is recommended. Excessive bending of the leads is to be avoided.

Note 3: Deviation from flatness will not exceed 0.006" from peak to valley.

DIMENSIONAL OUTLINE (4517)



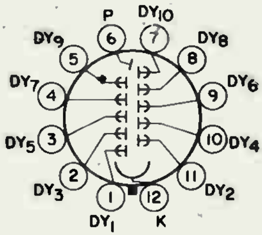
Note: Deviation from flatness will not exceed 0.010" from peak to valley.

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

PIN CONNECTIONS (4517)

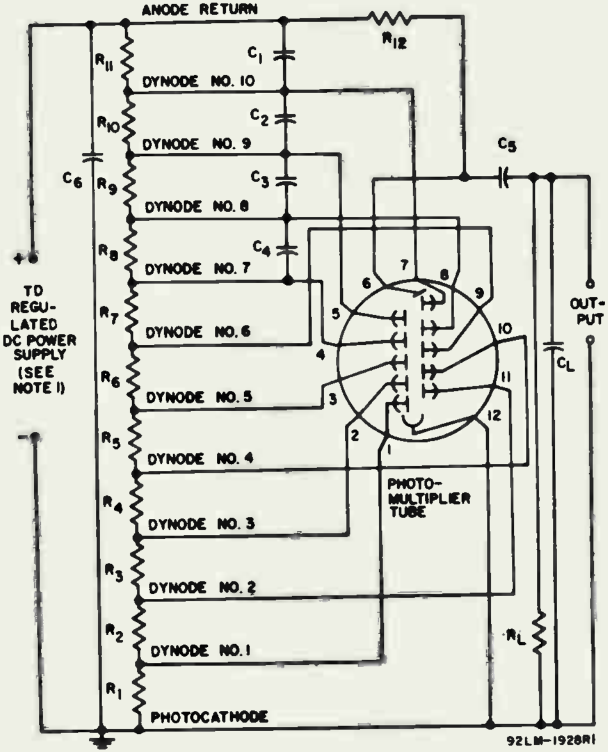
Bottom View

DIRECTION OF LIGHT: INTO END OF BULB



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

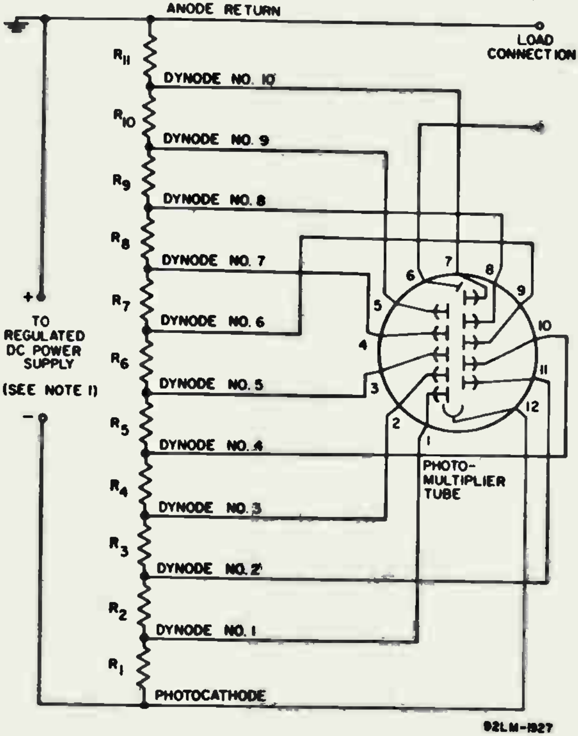
TYPICAL VOLTAGE-DIVIDER ARRANGEMENT FOR USE IN SCINTILLATION-COUNTING APPLICATIONS (4516, 4517)



C_1: 0.05 μF, 500 volts
C_2: 0.02 μF, 500 volts
C_3: 0.01 μF, 500 volts
C_4: 0.005 μF, 500 volts
C_5 and C_6: 0.005 μF, 3000 V
R_1 and R_2: 560,000 ohms, 1/2 watt
R_3: 820,000 ohms, 1/2 watt
R_4 through R_{11}: 470,000 ohms, 1/2 watt
R_{12}: 1 megohm, 1/2 watt
R_{13}: 100,000 ohms, 1/2 watt

Note 1: Adjustable between approximately 500 and 1800 V dc.
Note 2: Capacitors C_1 through C_6 should be connected at tube socket for optimum high-frequency performance.
Note 3: Component values are dependent upon nature of application and output signal desired.
Note 4: The value of the load elements, R_L and C_L, depend on the application:
$R_L C_L$ = 10 microseconds for most applications

TYPICAL VOLTAGE-DIVIDER ARRANGEMEN WHICH PERMITS DIRECT COUPLING TO THE ANODE (4516, 4517)

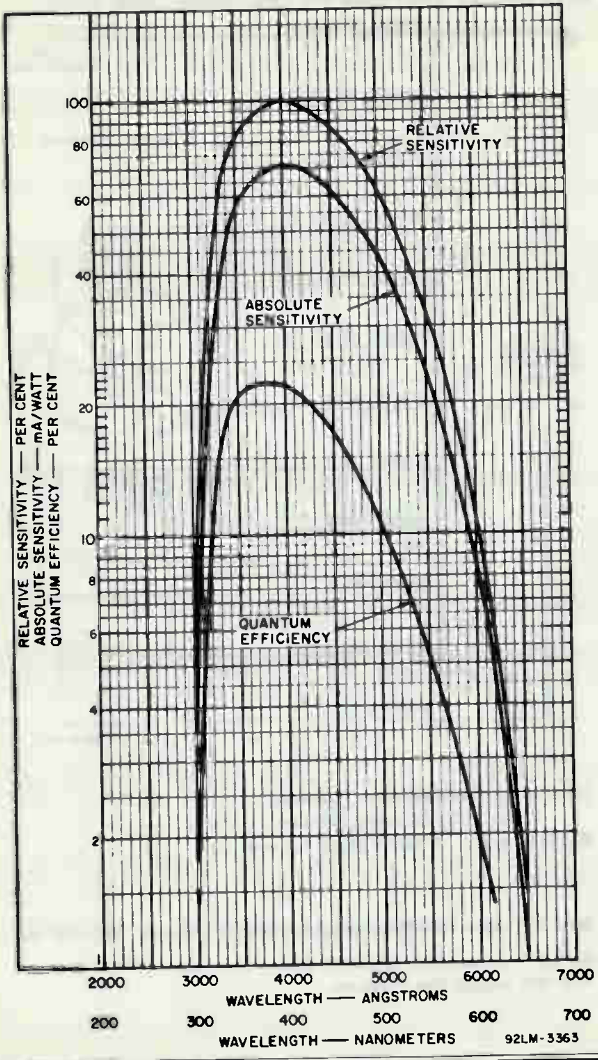


R_1 and R_2: 560,000 ohms, 1/2 watt
R_3: 820,000 ohms, 1/2 watt
R_4 through R_{11}: 470,000 ohms, 1/2 watt

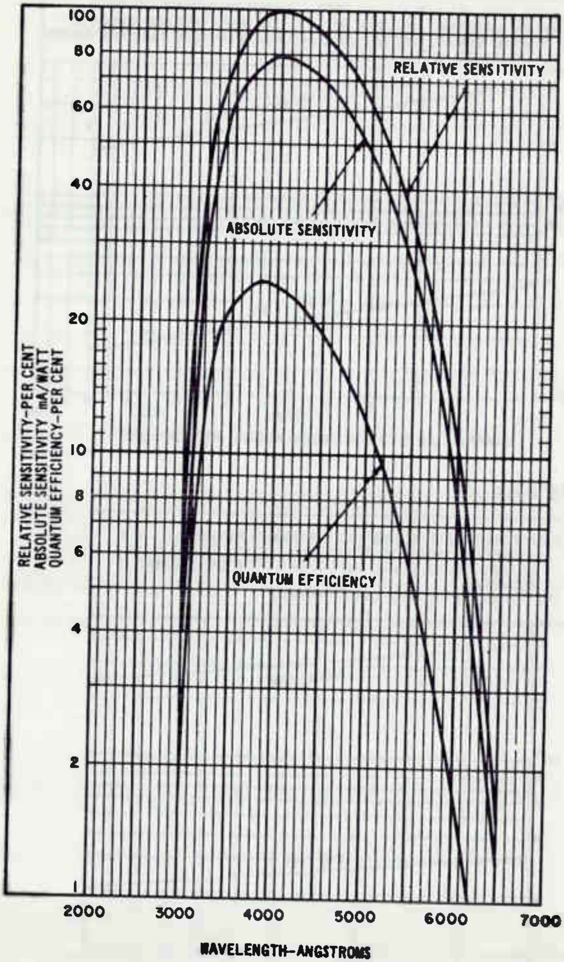
Note 1: Adjustable between approximately 500 and 1800 volts dc.

Note 2: Component values are dependent upon nature of application and output signal desired.

TYPICAL SPECTRAL RESPONSE CHARACTERISTICS (4516)

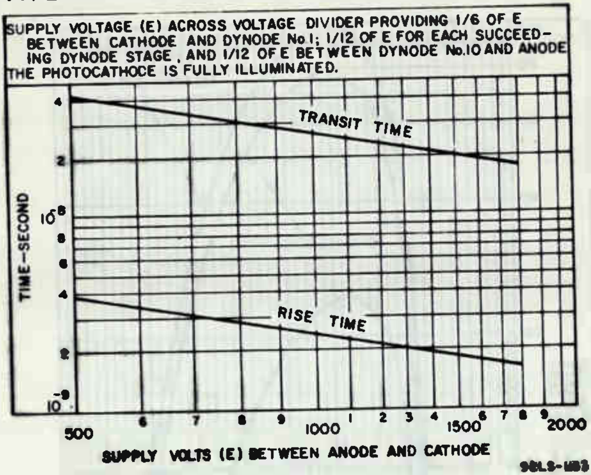


TYPICAL PHOTOCATHODE SPECTRAL RESPONSE CHARACTERISTICS (4517)

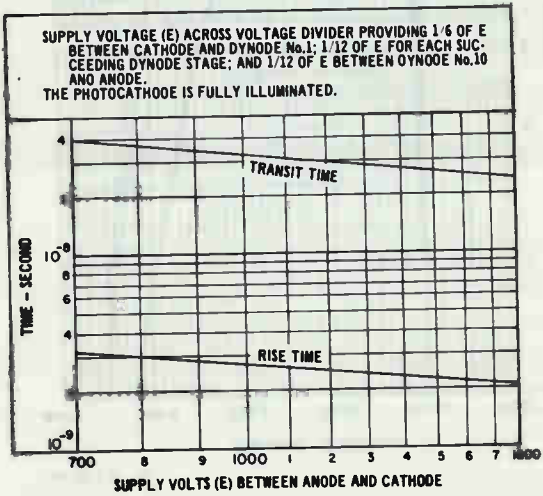


TYPICAL TIME-RESOLUTION CHARACTERISTICS

TYPE 4516



TYPE 4517

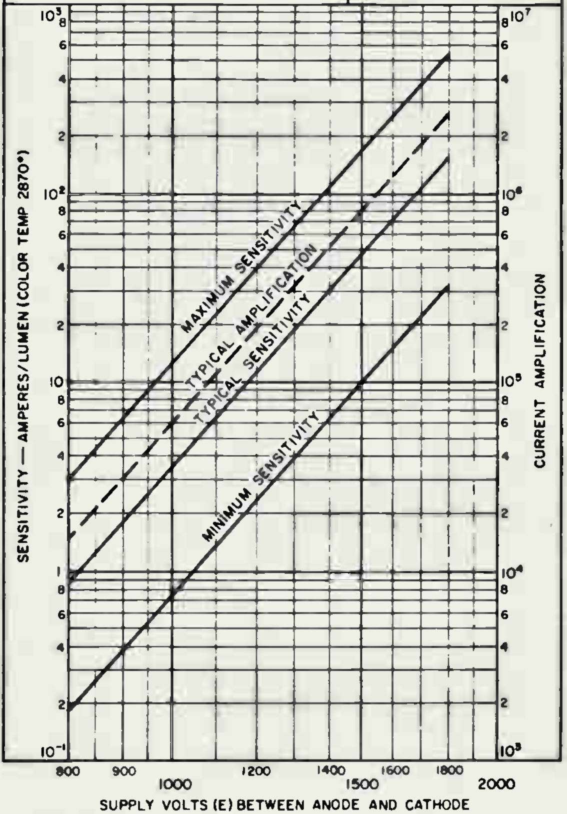


SENSITIVITY AND CURRENT AMPLIFICATION CHARACTERISTICS

TYPE 4516

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

BETWEEN	8.25% OF E MULTIPLIED BY
CATHODE AND DYNODE No. 1	1.2
DYNODE No. 1 AND DYNODE No. 2	1.2
DYNODE No. 2 AND DYNODE No. 3	1.7
EACH SUCCEEDING DYNODE STAGE	1.0
ANODE AND CATHODE	12.1



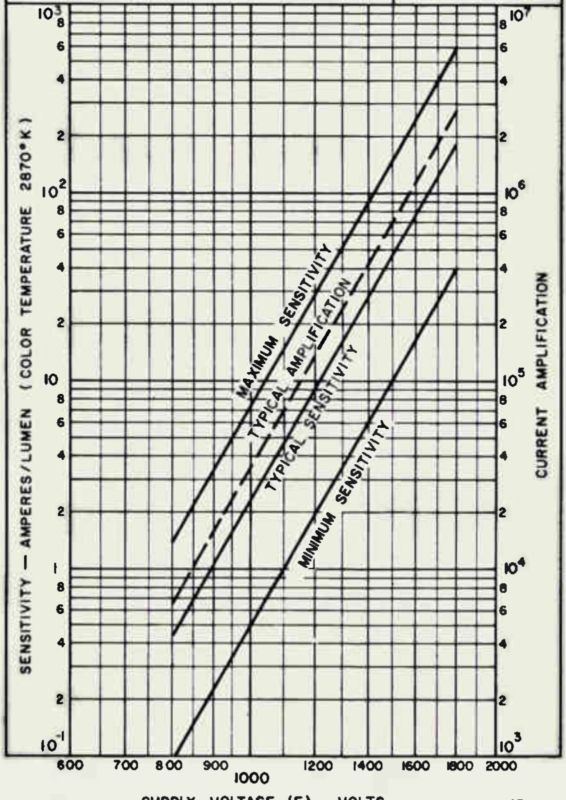
92LM-1939R1

TYPICAL SENSITIVITY AND CURRENT AMPLIFICATION CHARACTERISTICS

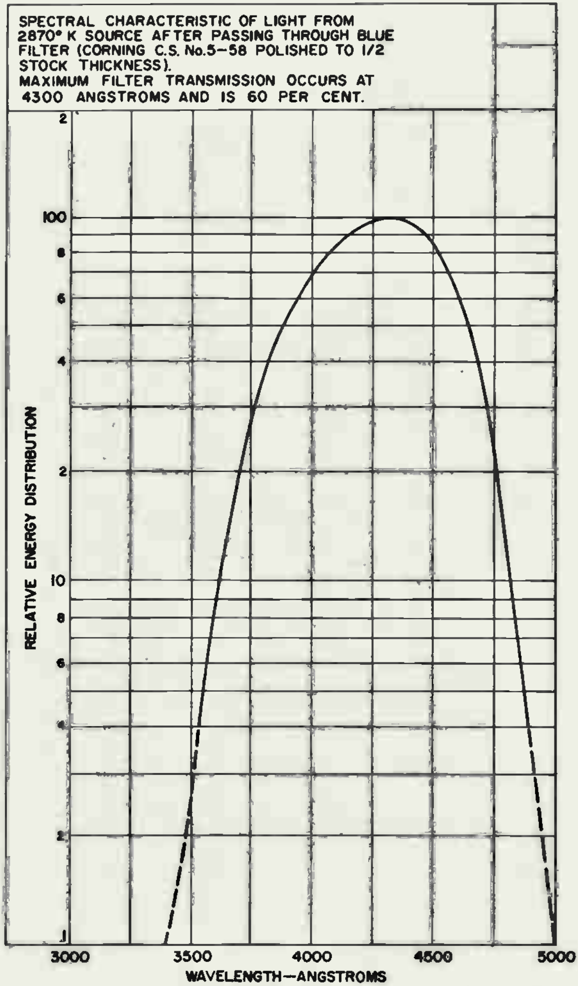
TYPE 4517

THE SUPPLY VOLTAGE (E) IS ACROSS A VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS.

BETWEEN:	8.13 % OF (E) MULTIPLIED BY
CATHODE AND DYNODE No. 1	1.7
DYNODE No. 1 AND DYNODE No. 2	1.3
DYNODE No. 2 AND DYNODE No. 3	1.3
EACH SUCCEEDING DYNODE-STAGE	1.0
ANODE AND CATHODE	12.3



SPECTRAL ENERGY DISTRIBUTION OF 2870°K LIGHT SOURCE AFTER PASSING THROUGH INDICATED FILTER



92CM-11081R1

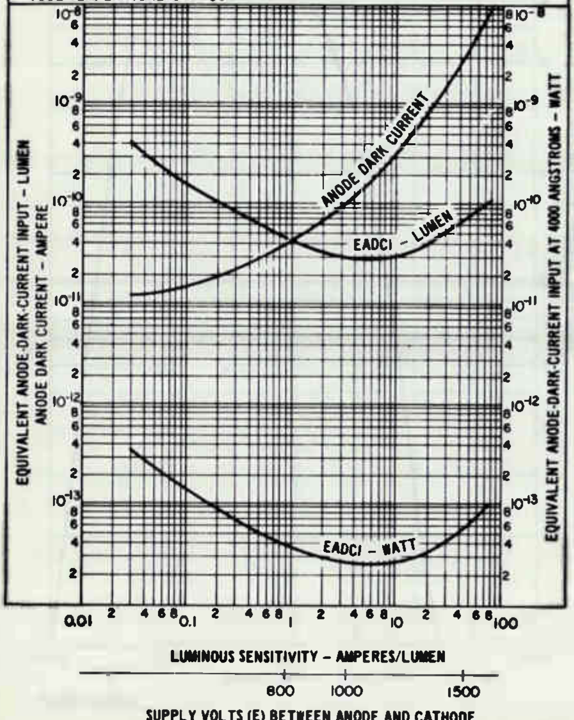
TYPICAL ANODE DARK CURRENT AND EADCI CHARACTERISTICS

TYPE 4516

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

BETWEEN	8.25% OF E MULTIPLIED BY
CATHODE AND DYNODE No. 1	1.2
DYNODE No. 1 AND DYNODE No. 2	1.2
DYNODE No. 2 AND DYNODE No. 3	1.7
EACH SUCCEEDING DYNODE-STAGE	1.0
ANODE AND CATHODE	12.1

TUBE TEMPERATURE IS 22° C.



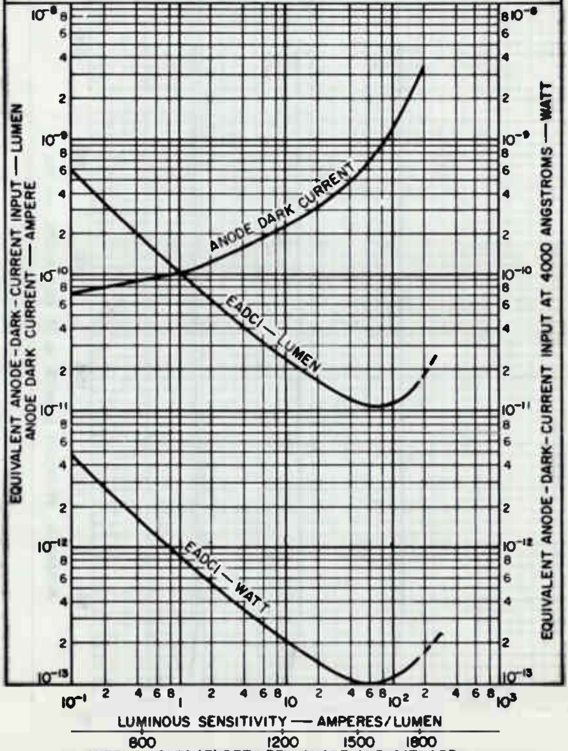
TYPICAL DARK CURRENT AND EADCI CHARACTERISTICS

TYPE 4517

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

BETWEEN	8.13 % OF E MULTIPLIED BY
CATHODE AND DYNODE No. 1	1.7
DYNODE No. 1 AND DYNODE No. 2	1.3
DYNODE No. 2 AND DYNODE No. 3	1.3
EACH SUCCEEDING DYNODE STAGE	1.0
ANODE AND CATHODE	12.3

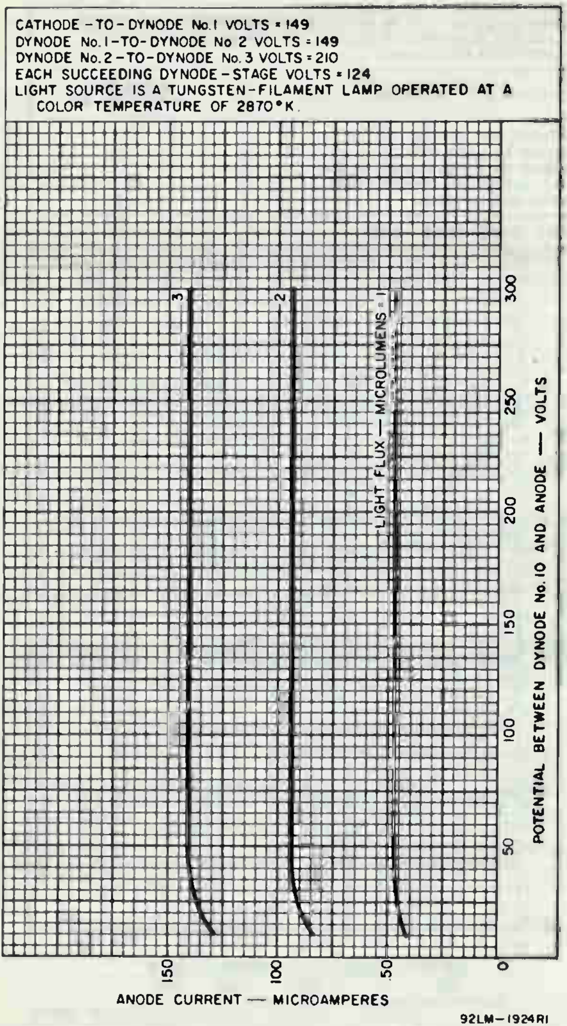
TUBE TEMPERATURE = 22°C



92LM-1954R2

TYPICAL ANODE CHARACTERISTICS

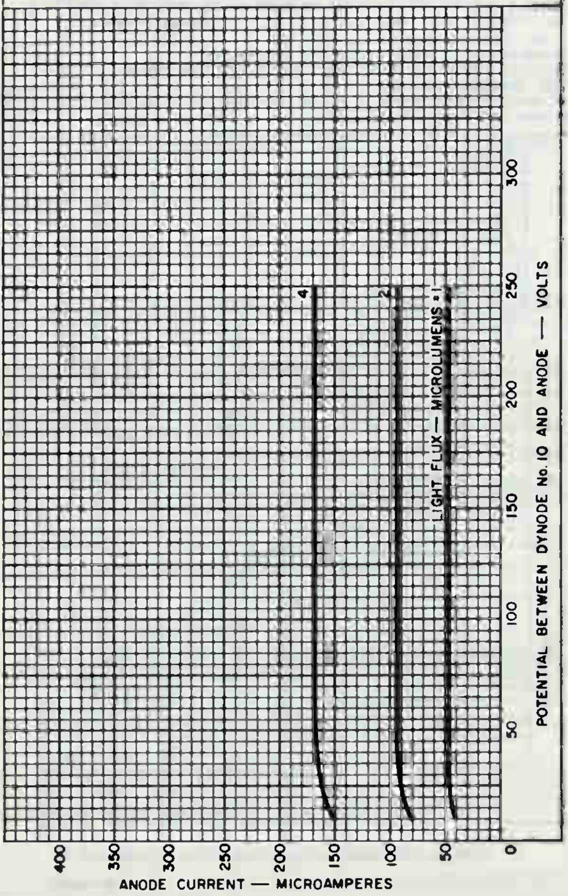
TYPE 4516



TYPICAL ANODE CHARACTERISTICS

TYPE 4517

CATHODE-TO-DYNODE No.1 VOLTS = 208
DYNODE No.1-TO-DYNODE No.2 VOLTS = 158
DYNODE No.2-TO-DYNODE No.3 VOLTS = 158
EACH SUCCEEDING DYNODE-STAGE VOLTS = 122
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870°K.

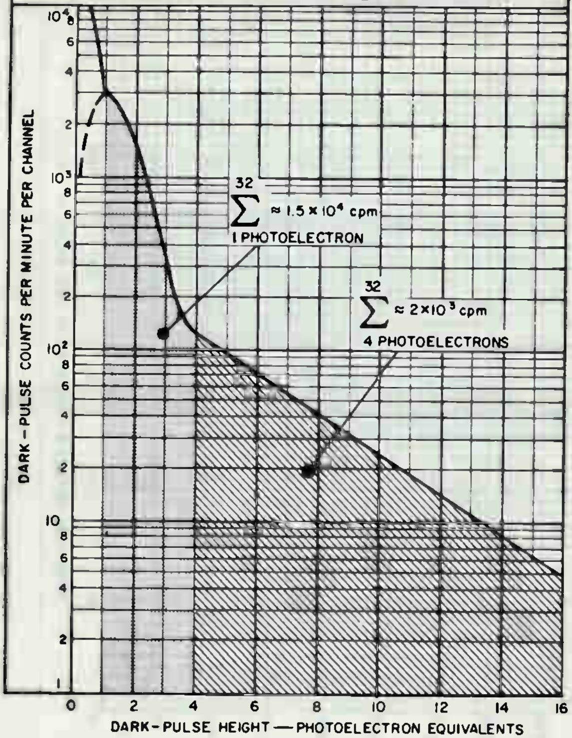


92LM-1953R2

TYPICAL DARK-PULSE SPECTRUM

	4516	4517
CATHODE-TO-DYNODE No. 1 VOLTS	149	208
DYNODE No. 1-TO-DYNODE No. 2 VOLTS	149	158
DYNODE No. 2-TO-DYNODE No. 3 VOLTS	210	158
EACH SUCCEEDING DYNODE-STAGE VOLTS	124	122
ANODE-TO-CATHODE VOLTS	1500	1500

DASHED PORTION INDICATES LOCATION OF SINGLE PHOTOELECTRON PEAK. THIS PORTION OF CURVE IS NORMALIZED TO COINCIDE WITH SINGLE PHOTOELECTRON PEAK OF DARK PULSE SPECTRUM AND IS OBTAINED WITH PHOTOCATHODE FULLY ILLUMINATED BY A TUNGSTEN-FILAMENT LAMP OPERATED AT A LOW COLOR TEMPERATURE. DARK PULSES ARE SUBTRACTED.
SOLID-LINE PORTION INDICATES DARK-PULSE SPECTRUM.
TUBE TEMPERATURE = 22°C
ONE PHOTOELECTRON PULSE HEIGHT = 4 COUNTING CHANNELS.
INTEGRATING TIME CONSTANT = 30 μ SEC (R_L = 300 kΩ C = 100 pF).

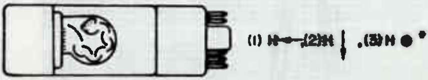


92LM-1940R2

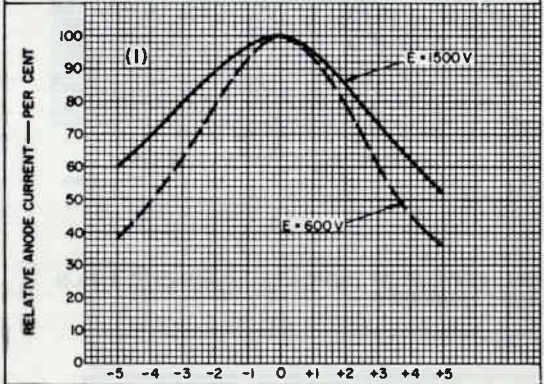
TYPICAL EFFECT OF INDICATED MAGNETIC FIELD ON ANODE CURRENT

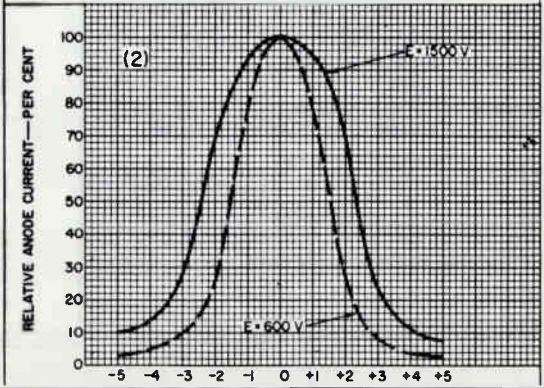
TYPE 4516

SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER PROVIDING 1/6 OF E BETWEEN CATHODE AND DYNODE No.1; 1/12 OF E FOR EACH SUCCEEDING DYNODE STAGE; AND 1/12 OF E BETWEEN DYNODE No.10 AND ANODE.
PHOTOCATHODE IS FULLY ILLUMINATED.



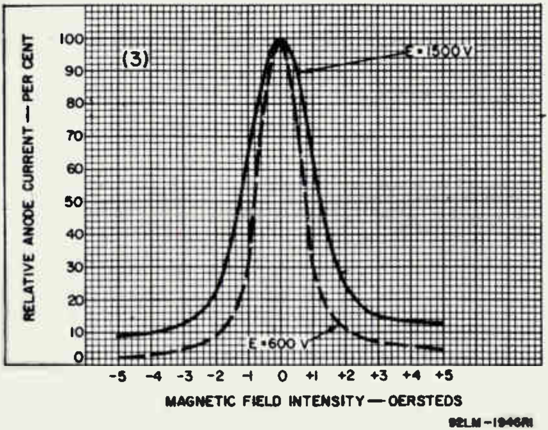
POSITIVE VALUES OF MAGNETIC FIELD INTENSITY (H) ARE FOR LINES OF FLUX IN INDICATED DIRECTION.
*POSITIVE VALUES OF MAGNETIC FIELD INTENSITY (H) ARE FOR LINES OF FLUX OUT OF PAPER.





TYPICAL EFFECT OF INDICATED MAGNETIC FIELD ON ANODE CURRENT

TYPE 4516 (Cont'd)

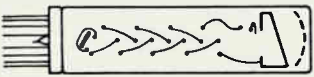


TYPICAL EFFECT OF INDICATED MAGNETIC FIELD ON ANODE CURRENT

TYPE 4517

SUPPLY VOLTAGE E IS ACROSS A VOLTAGE DIVIDER PROVIDING 1/6 OF E BETWEEN CATHODE AND DYNODE-No.1; 1/12 OF E FOR EACH SUCCEEDING DYNODE-STAGE; AND 1/12 OF E BETWEEN DYNODE-No.10 AND ANODE.

PHOTOCATHODE IS FULLY ILLUMINATED.
TUBE IS ORIENTED IN MAGNETIC FIELD AS SHOWN BELOW:

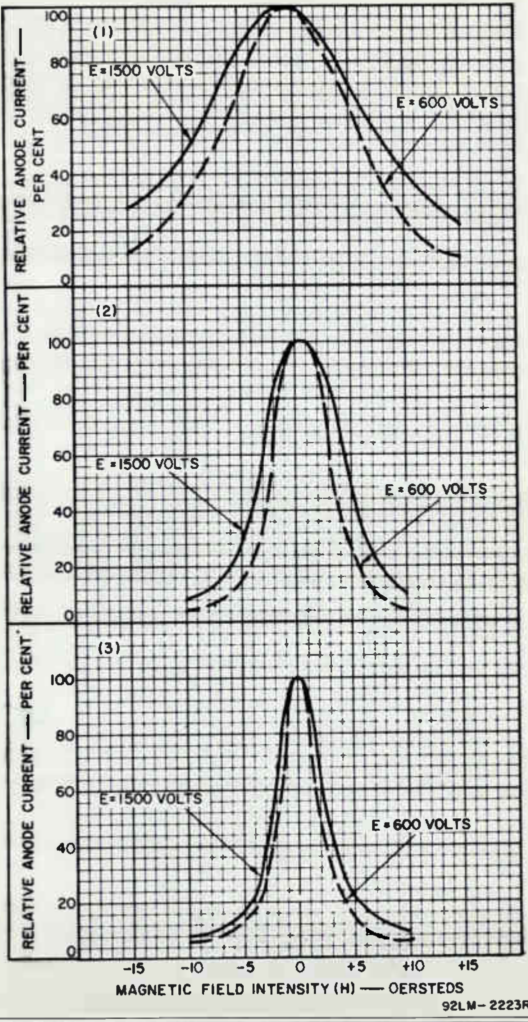


POSITIVE VALUE OF H IN DIRECTION SHOWN:
(1) →, (2) ↓, (3) ● *

* DIRECTION (3) IS OUT OF PAPER

TYPICAL EFFECT OF INDICATED MAGNETIC FIELD ON ANODE CURRENT

TYPE 4517 (Cont'd)



Display-Storage Tube

Single Writing Gun
Single Viewing Gun
High Display Uniformity

High Luminance
High Resolution
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	6.0		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	MΩ
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[r]	10			s
Undeflected Spot Position			Note s	
Screen Current[p]		300	750	μA
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° C is reached. Following one hour storage at +86° 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

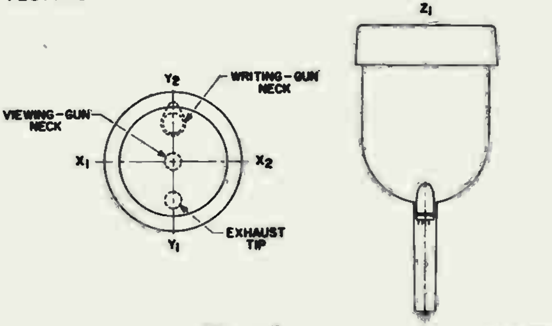


Figure 1

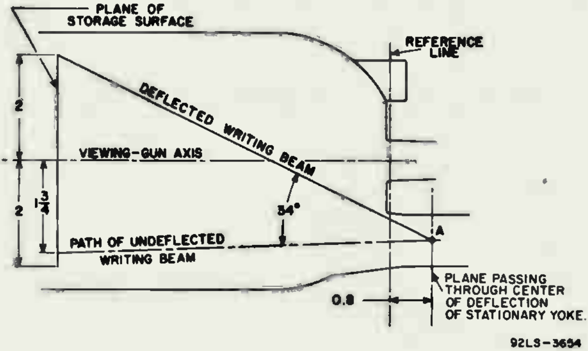
OPERATING CONSIDERATIONS

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 wirting 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



CAUTION

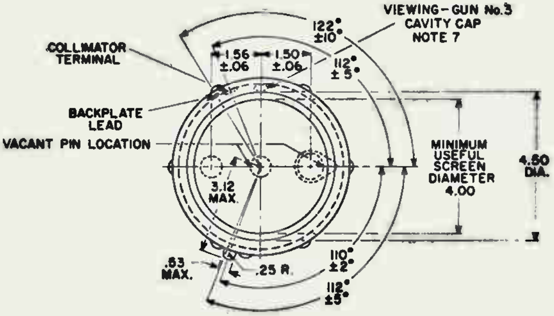
To prevent possible damage to the tube, allow the viewing-gun beam current to reach normal operating value before turning on the writing-gun beam current, and keep the viewing beam on till the writing beam is turned off.

PRECAUTIONS

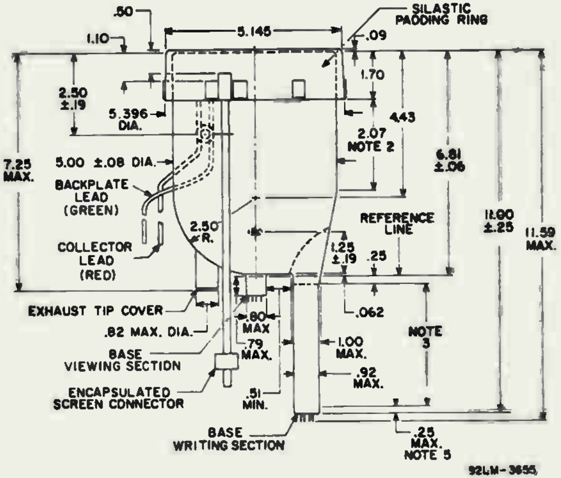
The following operating precautions must be followed to protect the 4547 from inadvertent damage –

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" ±0.015".

Note 2: Within this length, bulb diameter is 5.00" ±0.08".

Note 3: Within this length, neck diameter is 0.920" maximum.

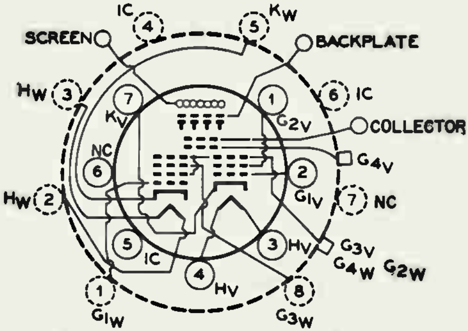
Note 4: Aircraft-Marine Products, Inc., type LGH Part No.832692, or equivalent. This part mates with Aircraft-Marine Products, Inc., Part No. AMP 833589, Ceramic Terminal, or Equivalent.

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



Small-Button Miniature 7-Pin Base

VIEWING SECTION

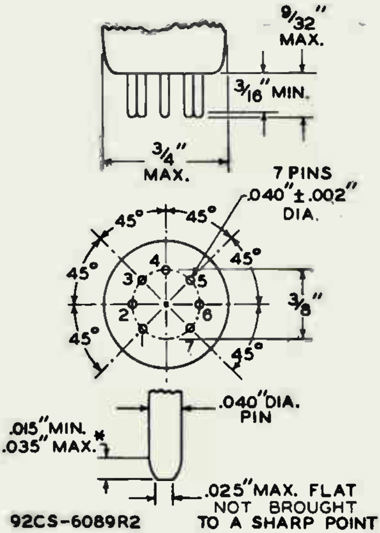
Pin 1: Grid No.2
Pin 2: Grid No.1
Pin 3: Heater
Pin 4: Heater
Pin 5: Internal Connection —Do Not Use
Pin 6: No Connection
Pin 7: Cathode
Flexible Lead (Large): Screen 8.38" ± 0.20" long
Flexible Lead (Green): Backplate 10.00" ± 0.50" long
Flexible Lead (Red): Collector 10.0 ± 0.5" long
Recessed Cavity 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



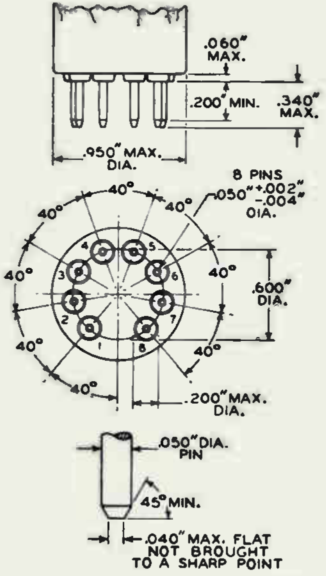
*This dimension around the periphery of any individual pin may vary within the limits shown.

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" ± 0.0005" so located on a 0.3750" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.1434" ± 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" ± 0.0005" so located on a 0.6000" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.2052" ± 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. / 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 μA
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 *Cutoff Design Chart*

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 *Typical Trace Luminance Characteristic*
Typical Center Line Width[d]	0.010 in
Spot Position	See footnote •

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max. MΩ

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.

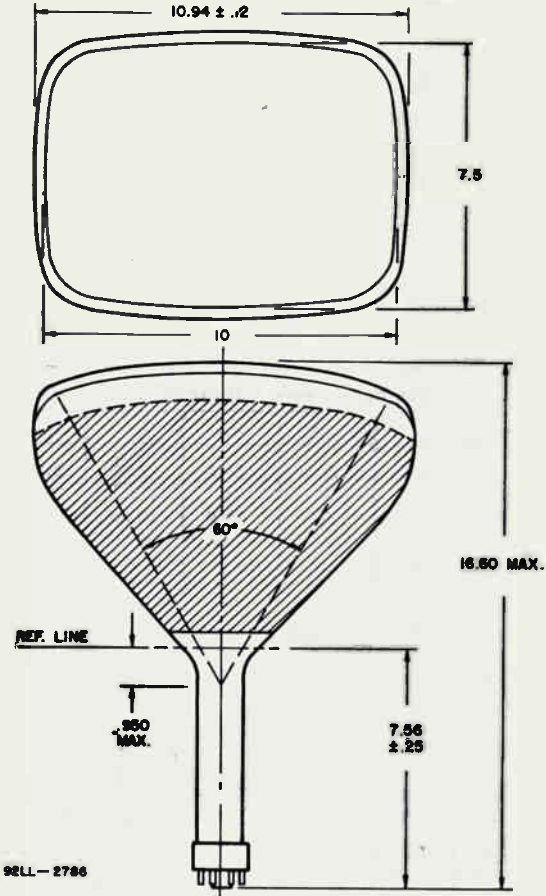
d Measured by shrinking raster technique at an anode current of 100 microamperes.

• 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

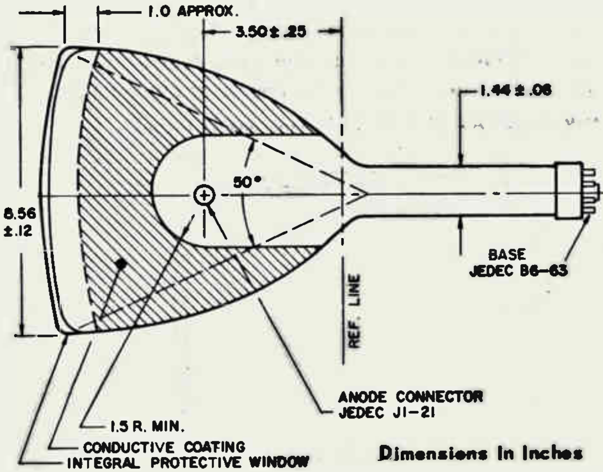
Because the 4557 is designed to be operated at anode voltages as high as 16,000 volts, shielding of the 4557 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

DIMENSIONAL OUTLINE Dimensions In Inches



See accompanying *Inch Dimension Equivalents in Millimeters*.

DIMENSIONAL OUTLINE (Top Right Side View)

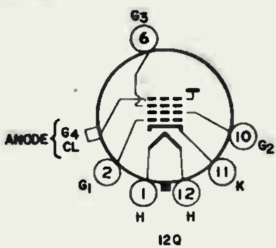


Dimensions In Inches

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		

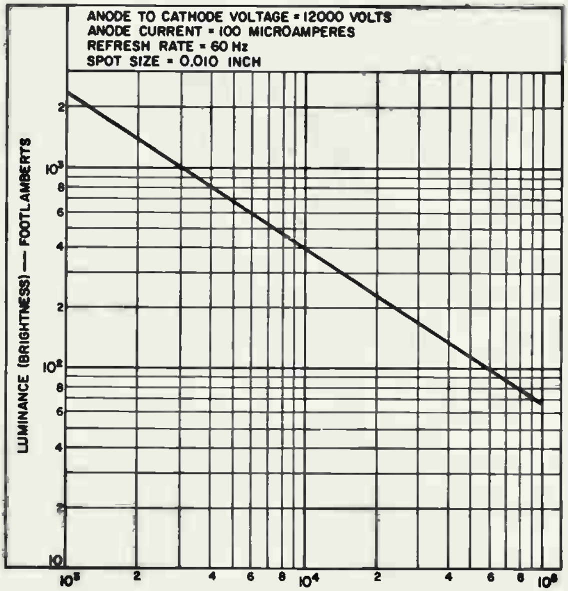
TERMINAL DIAGRAM (Bottom View)

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)

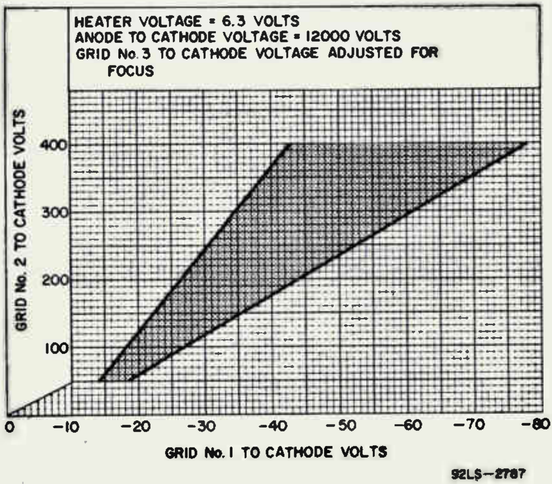


TYPICAL TRACE LUMINANCE CHARACTERISTIC

(Average brightness at center of single trace scanned at the refreshed at the indicated rate)



CUTOFF DESIGN CHART



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
Undeflected 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.

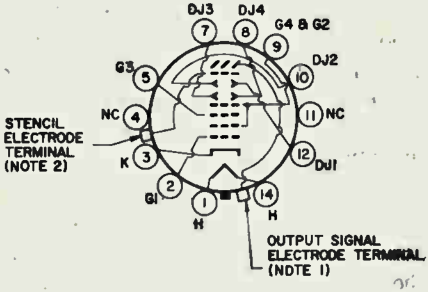
In the monoscope, electrons which pass through the stencil are collected on the output signal electrode and generate a video signal across the output load resistor. This signal is amplified and then applied to the grid of the display cathode-ray tube.

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)

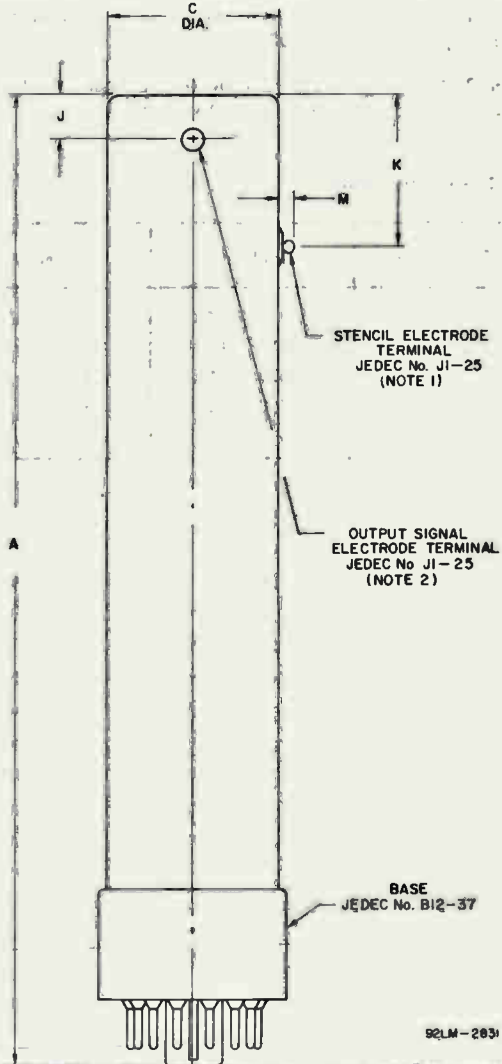


Pin No.1: Heater
Pin No.2: Grid No.1
Pin No.3: Cathode
Pin No.4: No connection
Pin No.5: Grid No.3
Pin No.7: Deflecting Electrode DJ3
Pin No.8: Deflecting Electrode DJ4
Pin No.9: Grid No.4 and Grid No.2
Pin No.10: Deflecting Electrode DJ2
Pin No.11: No connection
Pin No.12: Deflection Electrode DJ1
Pin 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 ± 10° 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 ± 10° 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 ± 10°.

Note 2: Angular orientation of the output signal electrode terminal with respect to key of base is ± 10°.

OUTLINE DIMENSIONS

Dimensions	Inches	mm
A	11.312 ± .188	287.32 ± 4.77
C	2.050 ± .050 Dia.	52.07 ± 1.27 Dia.
J	.500 ± .062	12.70 ± 1.57
K	1.750 ± .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, Aluminized:	
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

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

Typical Performance Data

	Blue	Green	Red	
Luminous Output of each Tube at an Anode Current of 1000 µA for each tube	88	1400	520	lumens
Luminance of Each Tube at an Anode Current of 1000 µA for Each Tube	680	10800	4000	fL
Luminance of Three Tubes Combined at an Anode Current of 1000 µA 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[g]			600	TV Lines
Grid-No.3 Current (Total)[h]			±15	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	20		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 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.**

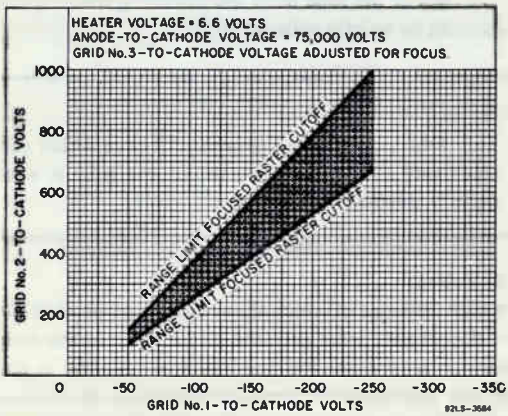
High Voltage

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 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.

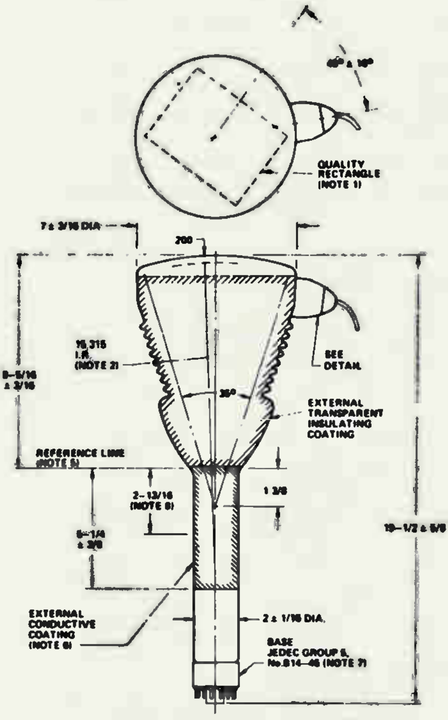
In the use of these tubes it should always be remembered that high voltages may appear at normally low-potential points in the circuit because of capacitor breakdown or incorrect circuit connections, and that the tube surface maintains a static charge for some time after the power has been turned off. 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° ± 10° 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 ± 10°. The anode terminal is on same side as Pin No.9.

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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.

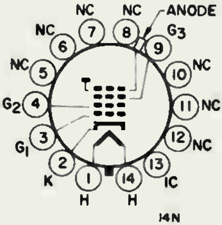
Note 7: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Socket contacts for Pins 5, 6, 7, 8, 10, 11, 12, and 13 should be removed in order to provide maximum insulation for Pin No.9.

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)



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.

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 99: 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

Graphechon 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
Undeflected 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[j,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[j,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	–	μA
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	–	μs/ 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 *Vibration Levels*

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 840706 lead assemblies manufactured by AMP Inc., Capitron 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;

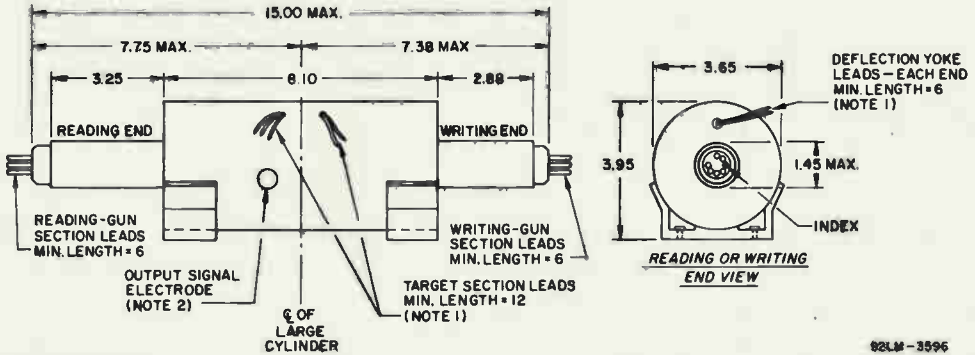
blemish amplitude, as a percentage of saturated signal amplitube. Blemishes with an amplitude of less than 10 per cent are not counted. Dark blemishes with a size of less than 1/8 per cent are not counted.

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.



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

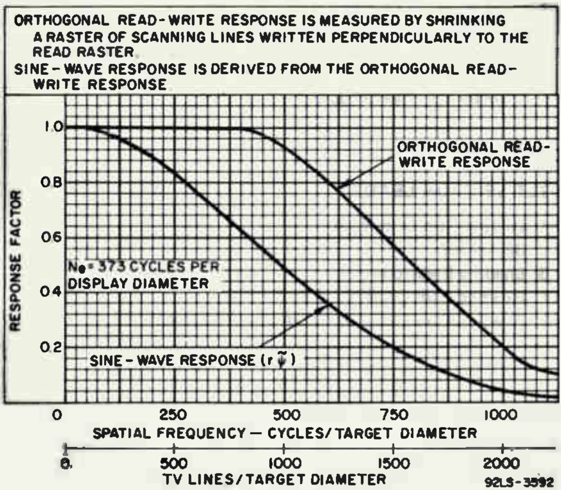
WRITING-GUN SECTION LEADS

Lead 1: Heater
Lead 2: Grid No.1
Lead 3: Grid No.3
Lead 4: Grid No.2
Lead 5: Cathode
Lead 6: Heater

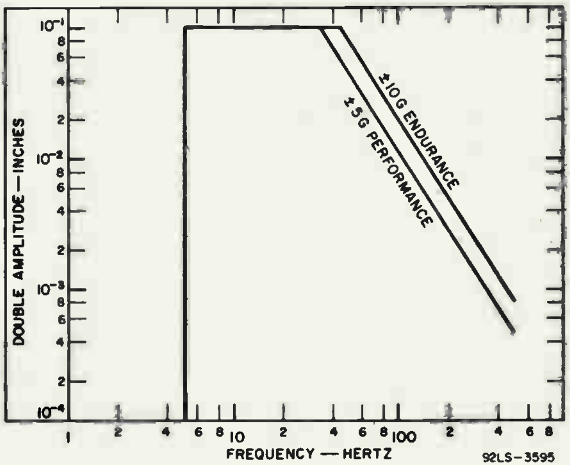
READING-GUN SECTION LEADS

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



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 μA
- High Resolution – 600 TV Lines at 300 μA
- 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 ± 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 ± 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.	μA
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	μA
Grid-No.3 Voltage for Focus at an Anode Current of 300 μA	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 μA	3000	fL
	10300	nits

Luminous Flux	250	lumens
Grid-No.3 Current (Total)[g]	±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, 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.

[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.

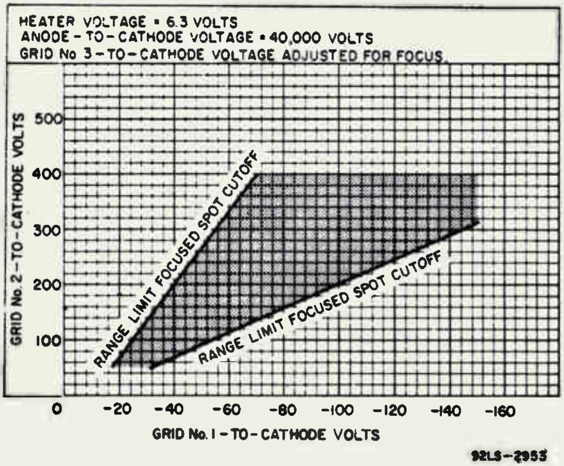
Operating Considerations

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.

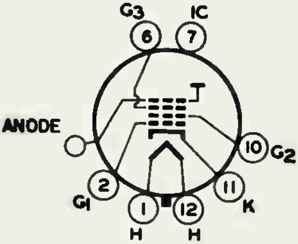
Dust Considerations. The high voltage applied to the tube increases the rate at which dust is precipitated on the surface of the tube. The rate of precipitation is further accelerated in the presence of corona. Such dust not only decreases the insulation of the bulb coating but also reduces the amount 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



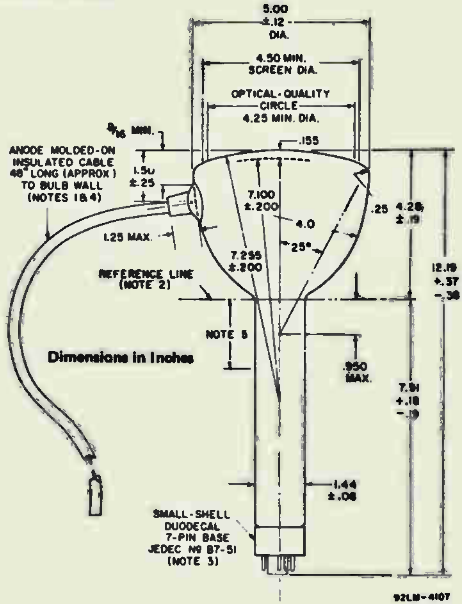
Basing Diagram, Bottom View



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 ±20°. 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.

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MULTIPLIER PHOTOTUBE

9-STAGE TYPE WITH S-4 RESPONSE

For Headlight-Control Service

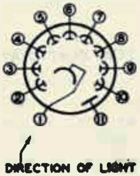
DATA

General:

Spectral Response		S-4
Wavelength of Maximum Response	4000 ± 500	angstroms
Cathode:		
Minimum projected length*		15/16"
Minimum projected width*		5-16"
Direct Interelectrode Capacitances:		
Anode to dynode No.9	4.2	μμf
Anode to all other electrodes	5.5	μμf
Maximum Overall Length (Excluding leads)		2-3/4"
Maximum Envelope Length (Excluding tip)		2-1/4"
Length from Envelope Seal to Center of Useful Cathode Area		1-1/4" ± 3/32"
Maximum Diameter		1-3/16"
Bulb		T-9
Mounting Position		Any
Weight (Approx.)		2 oz
Terminals, Flexible Lead		*See Dimensional Outline*

BOTTOM VIEW

Lead 1 – Cathode
Lead 2 – Dynode No.1
Lead 3 – Dynode No.2
Lead 4 – Dynode No.3
Lead 5 – Dynode No.4
Lead 6 – Dynode No.5



DIRECTION OF LIGHT

Lead 7 – Dynode No.6
Lead 8 – Dynode No.7
Lead 9 – Dynode No.8
Lead 10 – Dynode No.9
Lead 11 – Anode

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

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	1250 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.9 AND ANODE (DC or Peak AC)	250 max.	volts
AVERAGE ANODE CURRENT°	0.1 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

* On plane perpendicular to the indicated direction of light (*See Dimensional Outline*).

° Averaged over any interval of 30 seconds maximum.

MAY 1, 1955

TENTATIVE DATA

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MULTIPLIER PHOTOTUBE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Under conditions with supply voltage (E) across voltage divider providing 1/10 of E between cathode and dynode No.1; 1/10 of E for each succeeding dynode stage; and 1/10 of E between dynode No.9 and anode

With E = 1000 volts

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4000 angstroms	–	32500	–	µamp/µwatt
Luminous:▲				
At 0 cps	5	35	250	amp/lumen
At 100 Mc.	–	33	–	amp/lumen
Electrode Dark Current (At 25°C):				
Anode.	–	–	0.25♠	µamp
Any other electrode. . . .	–	–	0.75	µamp

▲ For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A light input of 10 microlumens is used. The load resistor has a value of 0.01 megohm.

♠ With sine-wave, 60-cycle supply voltage adjusted to give sensitivity of 7.5 amperes per lumen.

OPERATING CONSIDERATIONS

The *operating stability* of the 6472 is dependent on the magnitude of the anode current and its duration. When the 6472 is operated at high values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 6472 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum rated value of 0.1 milliampere is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 10 microamperes.

A recommended design of voltage-divider network for use with the 6472 to provide stable operation and long tube life is shown in the accompanying circuit. This design provides linear operation within the range normally required for dimming. At higher light levels, the network design limits the tube output to a safe value. The indicated design values provide dimming operation for an anode current in the range between 5 and 10 microamperes on basis of dc operation. When operation at other current values is desired, the values of the resistors can be changed proportionately.

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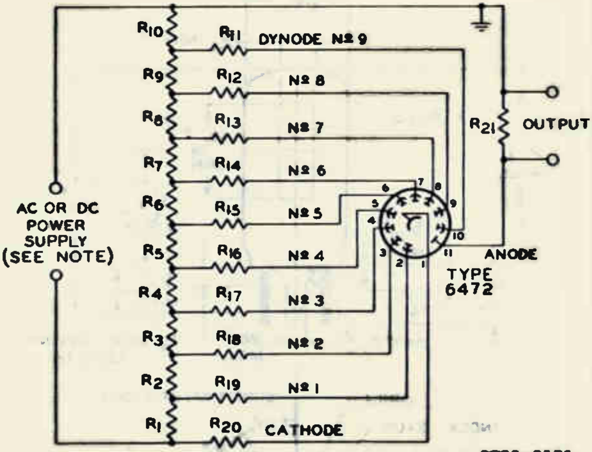
MULTIPLIER PHOTOTUBE

RECOMMENDED VOLTAGE-DIVIDER NETWORK FOR USE WITH TYPE 6472 IN HEADLIGHT-DIMMING SERVICE



92CS-8526

R1 R2 R3 R4 R5
R6 R7 R8 R9 R10: 1 megohm, 1/2 watt
R11: 2 megohms, 1/2 watt
R12: 5.1 megohms, 1/2 watt
R13 R14 R15 R16
R17 R18 R19 R20: 8.2 megohms, 1/2 watt
R21: 820,000 ohms, 1/2 watt

NOTE: Adjustable between approximately 500 and 1000 volts dc or peak ac.

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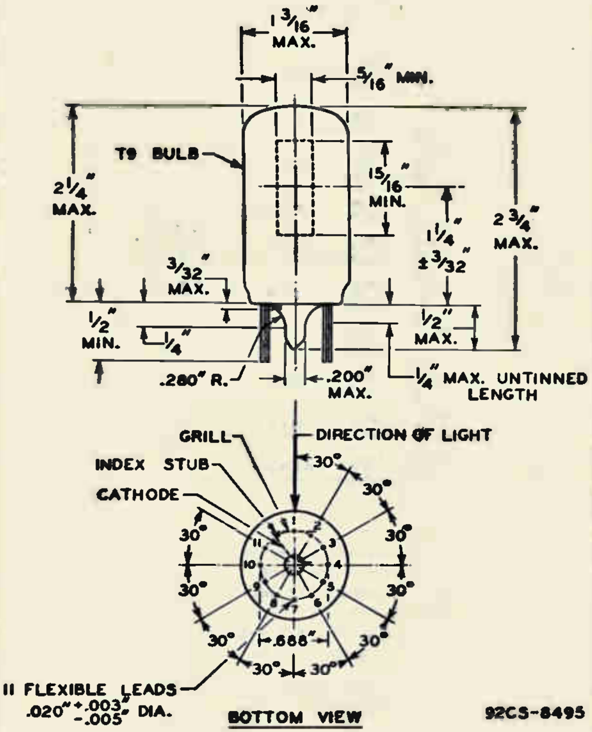
MULTIPLIER PHOTOTUBE



THE ANGULAR VARIATION BETWEEN THE PLANE THROUGH LEAD No. 1 AND TUBE AXIS AND THE PLANE PERPENDICULAR TO THE PLANE OF THE GRILL WILL NOT EXCEED 20°.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-4 Response is shown at front of this Section

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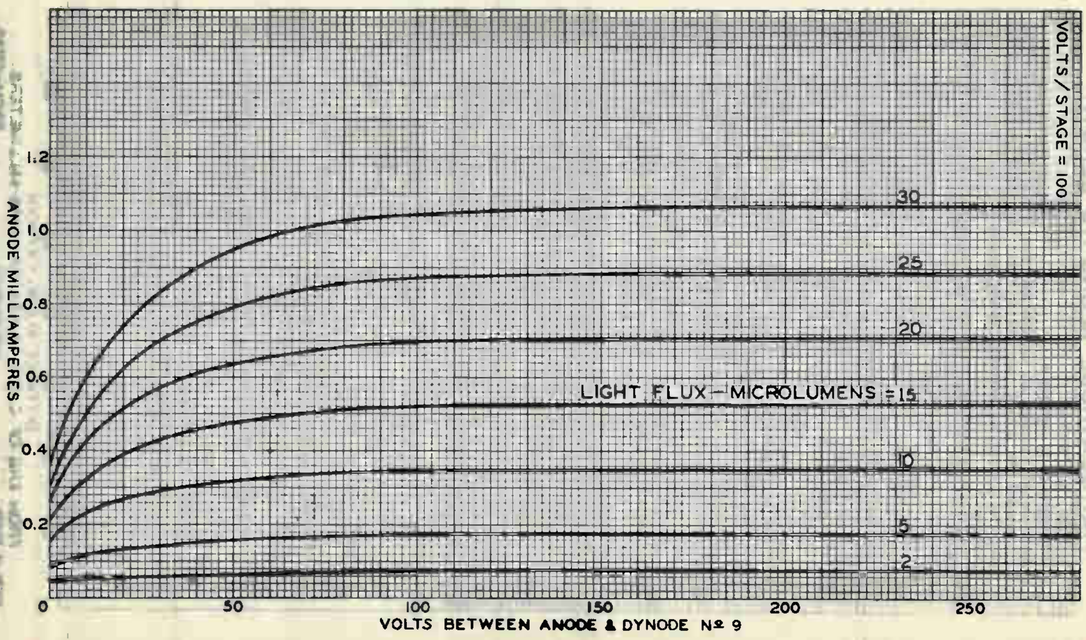
AVERAGE ANODE CHARACTERISTICS

6472



92CM-8029R1

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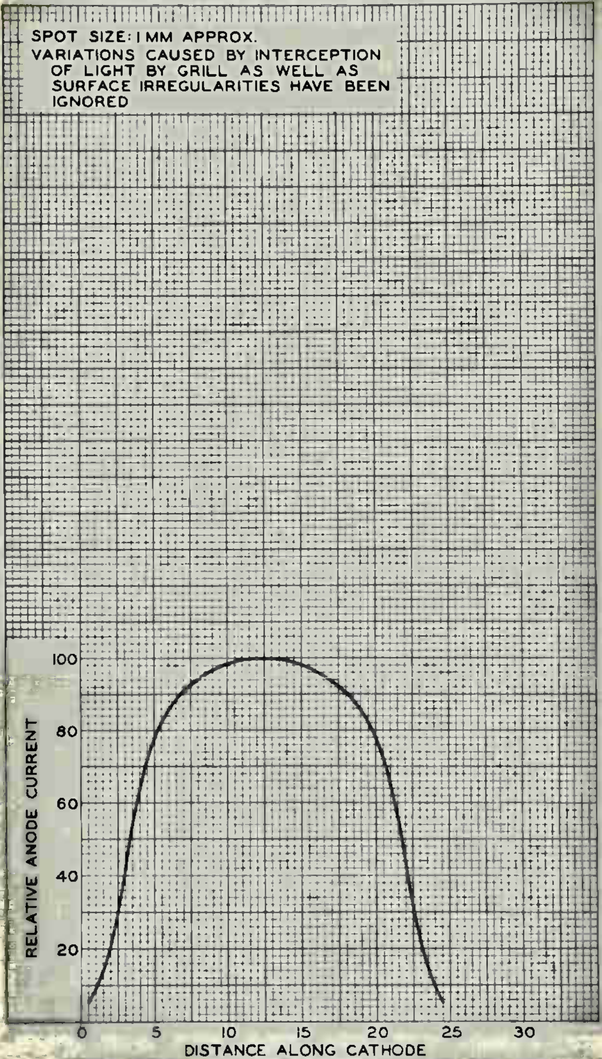
VARIATION IN SENSITIVITY OF PHOTOCATHODE ALONG ITS LENGTH



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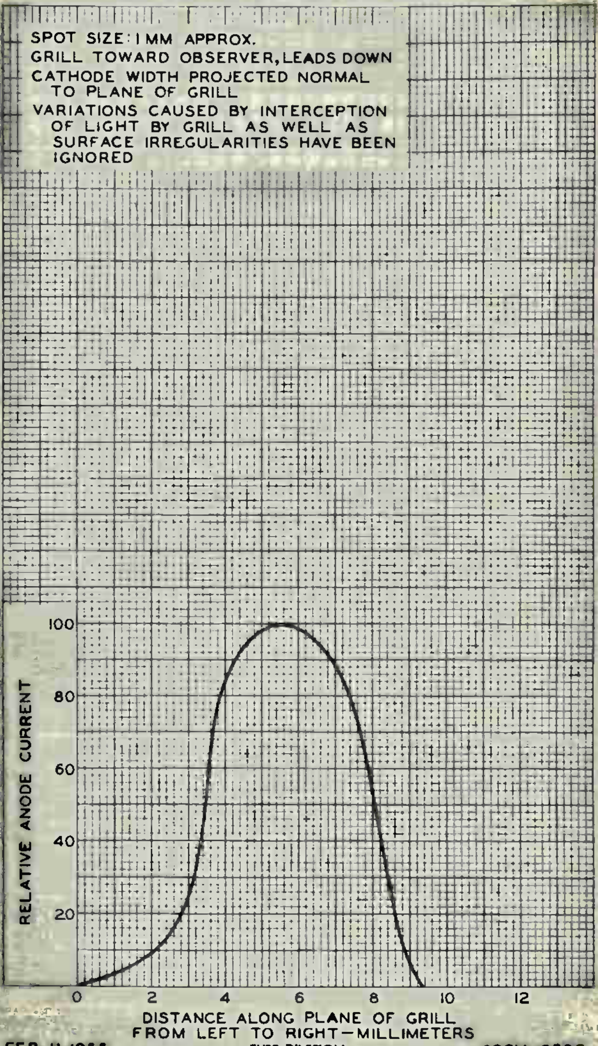
VARIATION IN SENSITIVITY OF PHOTOCATHODE ACROSS ITS PROJECTED WIDTH IN PLANE OF GRILL



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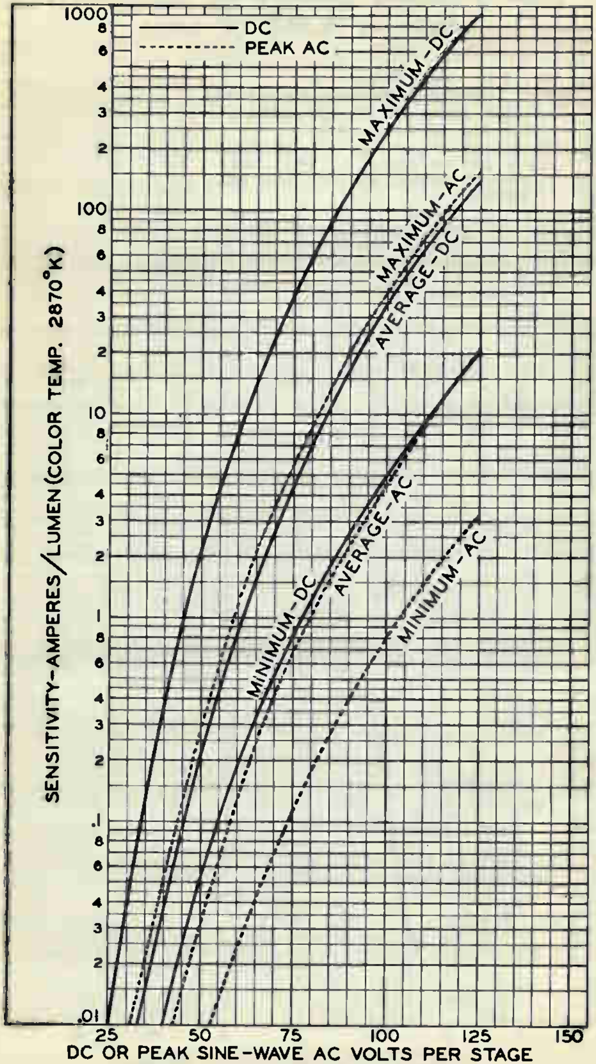
RANGE OF LUMINOUS SENSITIVITY



6499

RADECHON

CHARGE STORAGE TUBE

SINGLE-BEAM, BARRIER-GRID TYPE

NON-EQUILIBRIUM WRITING CAPACITANCE-DISCHARGE READING

DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.6	amp
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to all other electrodes	9	μμf
Deflecting electrode DJ_1 to all other electrodes	13	μμf
Deflecting electrode DJ_2 to all other electrodes	13	μμf
Deflecting electrode DJ_3 to all other electrodes	11.5	μμf
Deflecting electrode DJ_4 to all other electrodes	11.5	μμf
DJ_1 to DJ_2	3	μμf
DJ_3 to DJ_4	3	μμf
Grid No.5 to backing-electrode	800	μμf
Grid No.5 and backing-electrode to collector	4	μμf
Collector to all other electrodes & external cylindrical shield		*See Curve*

Focusing Method . . . . Electrostatic

Deflection Method . . . . Electrostatic

Overall Length . . . . 11-27/32" ± 3/8"

Greatest Diameter of Tube . . . . 3.30" ± 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)

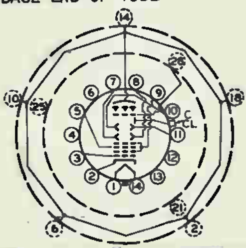
VIEW OF TWENTYNINAR-BASE END OF TUBE

Pin 2, Pin 6, Pin 10, Pin 14, Pin 18 — Multiple Connections to Backing-Electrode. Only One Need be Used

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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6499
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 2 - Cathode
Pin 3 - Grid No.1
Pin 4 - Internal Connection-Do Not Use
Pin 5 - Grid No.3
Pin 6 - No Connection
Pin 7 - Deflecting Electrode DJ_4
Pin 8 - Deflecting Electrode DJ_3
Pin 9 - Ultor (Grids No.2 & No.4)
Pin 10 - Deflecting Electrode DJ_2
Pin 11 - Deflecting Electrode DJ_1
Pin 12 - No Connection
Pin 13 - Same as Pin 4
Pin 14 - Heater
C,CL - External Conductive Coating, Collector, Internal Shield, Flange between Neck and Large Part of Tube

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_{c_4}) 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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6499

RADECHON

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_{c_4}	volts
Grid-No.1 Voltage for collector-current cutoff	-2.5% to -4.7% of E_{c_4}	volts
Collector Current for grid-No.1 volts = 0. . . .	20 to 50	µamp
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_{c_4}	
DJ_3 and DJ_4.	78 to 96 v dc/in./kv of E_{c_4}	
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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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

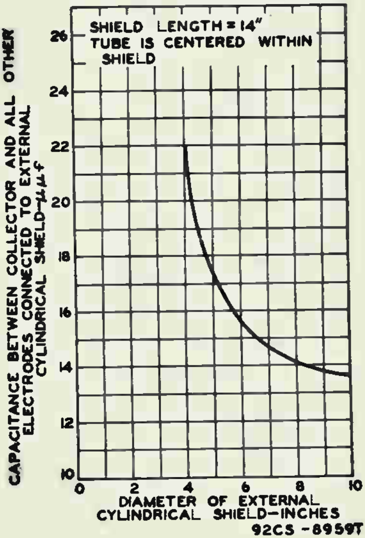
$$= 1/2\sqrt{\left(\frac{b-a}{b+a}\right)^2 + \left(\frac{d-c}{d+c}\right)^2} \times 100$$

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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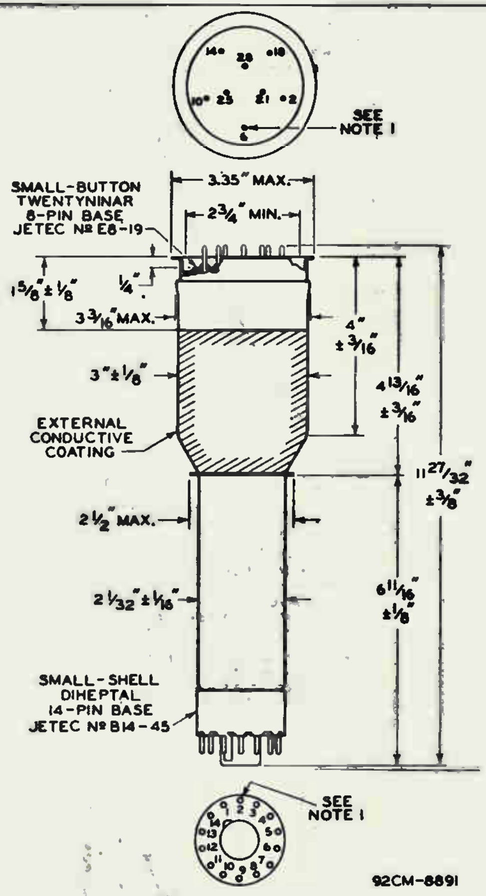

NOTE 1: THE ANGLE BETWEEN PLANE THROUGH PIN 6 OF TWENTYNINAR BASE AND TUBE AXIS, AND PLANE THROUGH PIN 2 OF DIHEPTAL BASE AND TUBE AXIS WILL NOT EXCEED 10°. THE INDICATED PINS ARE BOTH ON THE SAME SIDE OF THE TUBE.

NOTE 2: DEFLECTING ELECTRODES DJ_1 & DJ_2 ARE NEARER THE TARGET. DEFLECTING ELECTRODES DJ_3 & DJ_4 ARE NEARER THE DIHEPTAL BASE.

NOTE 3: ANGLE BETWEEN DJ_1 & DJ_2 DEFLECTION PATH AND DJ_3 & DJ_4 DEFLECTION PATH IS 90° ± 3°.

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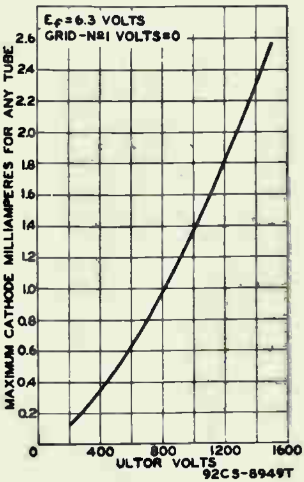
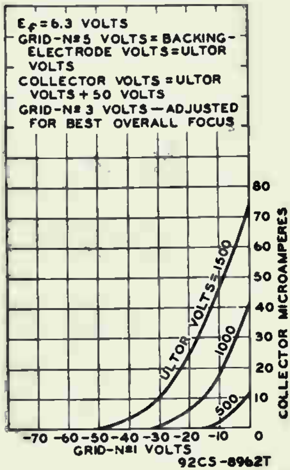
MAXIMUM CATHODE CURRENT



AVERAGE TRANSFER CHARACTERISTICS



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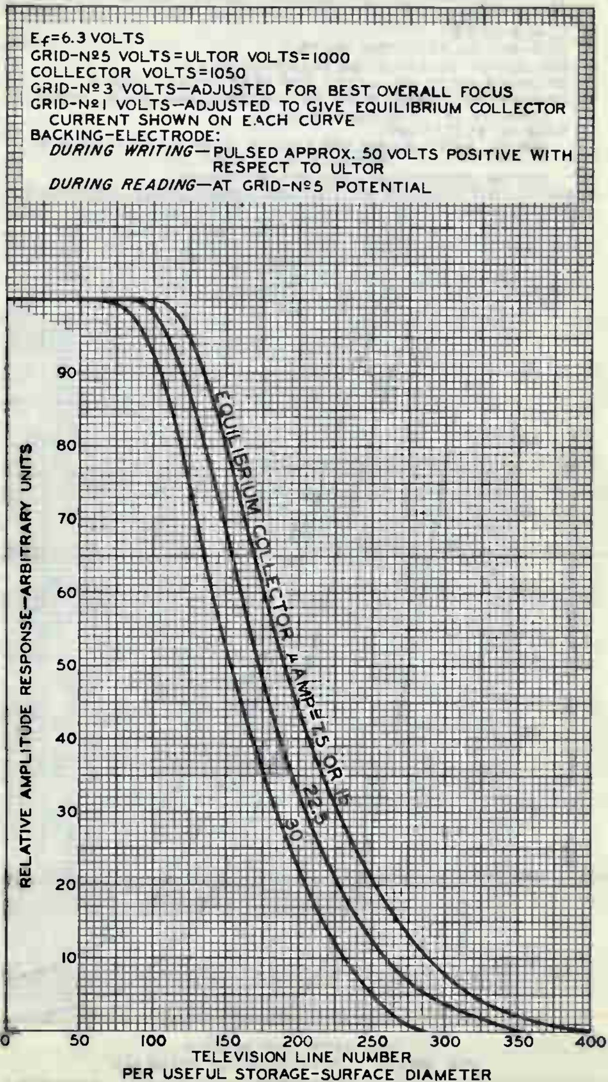
RESOLUTION CHARACTERISTICS



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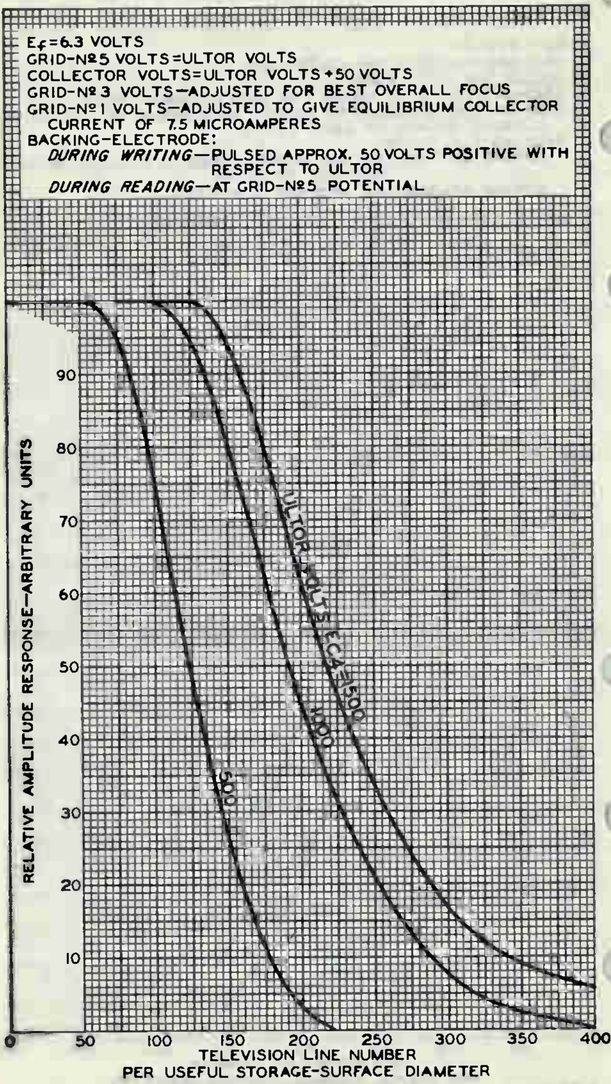
RESOLUTION CHARACTERISTICS



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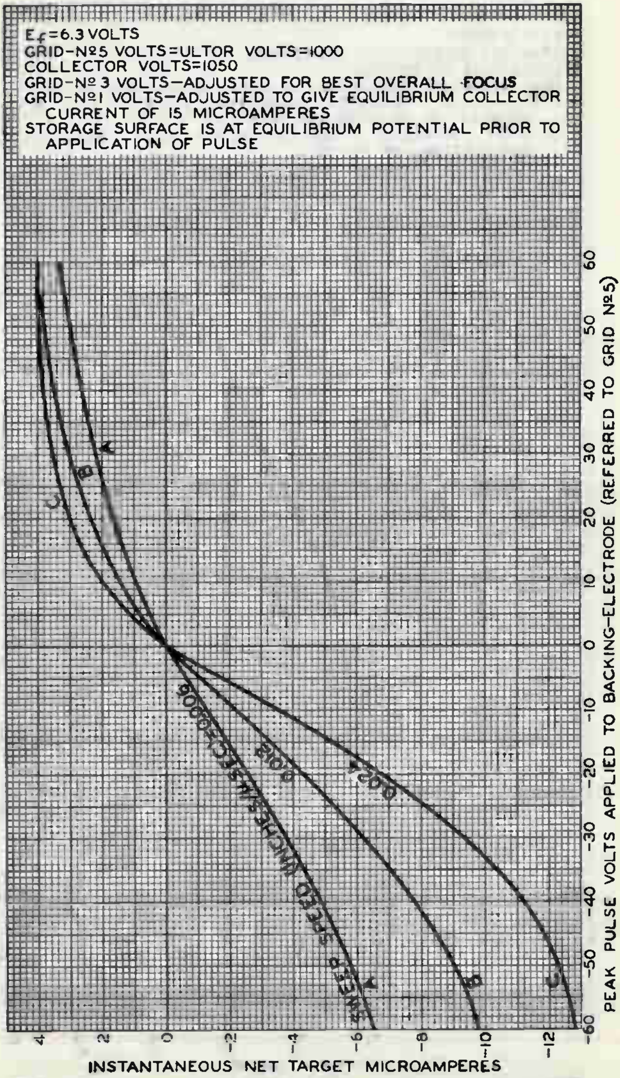
TYPICAL TARGET CHARACTERISTICS



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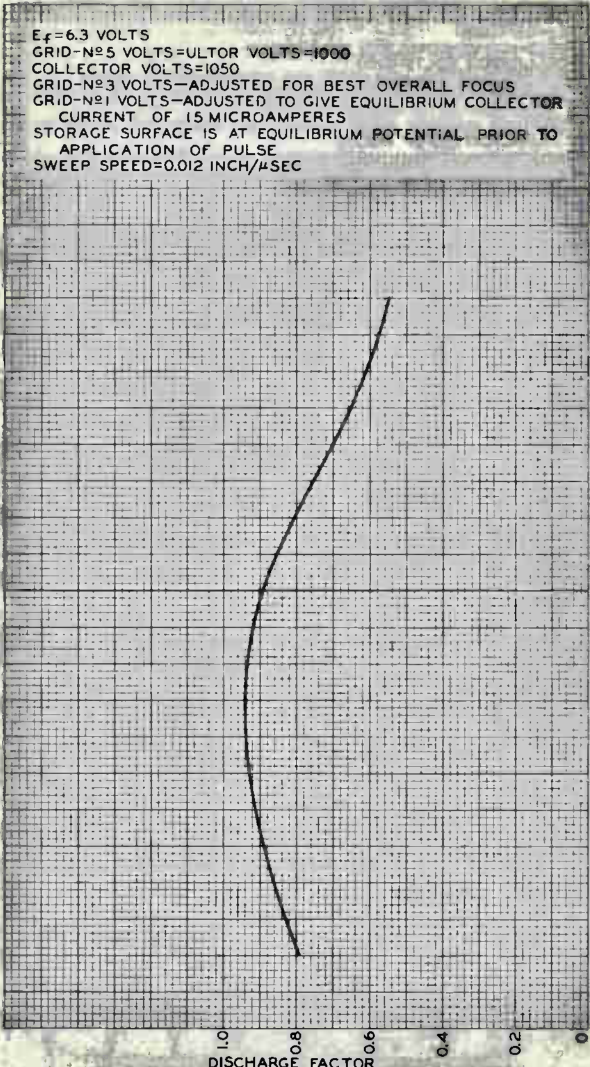
APPROXIMATE DISCHARGE-FACTOR CHARACTERISTIC



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DISPLAY STORAGE TUBE

DIRECT-VIEW TYPE
4"-DIAMETER DISPLAY
NON-EQUILIBRIUM WRITING GRID-CONTROL READING (VIEWING)

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 voltages are applied	-	30	sec
Direct Interelectrode Capacitances (Approx.):°			
Grid No. 1 to all other tube electrodes	6	18	μμf
Cathode to all other tube electrodes	4.2	6.5	μμf
Deflecting electrode DJ_1 to deflecting electrode DJ_2. . .	1.8	-	μμf
Deflecting electrode DJ_3 to deflecting electrode DJ_4. . .	1.8	-	μμf
DJ_1 to all other tube electrodes.	7.5	-	μμf
DJ_2 to all other tube electrodes.	8	-	μμf
DJ_3 to all other tube electrodes.	6	-	μμf
DJ_4 to all other tube electrodes.	7.	-	μμf
Focusing Method	Electrostatic	None	
Deflection Method	Electrostatic	None	
Deflecting-Electrode Arrangement.	*See Dimensional Outline*	-	
Phosphor.	-	High-Visual-Efficiency Type, Aluminized	
Fluorescence	-	Yellow	
Phosphorescence.	-	Yellow	

Minimum Useful Screen Diameter. . . . . 4"
Maximum Overall Length. . . . . 15-1/2"
Seated Length . . . . 14" ± 3/8"
Maximum Tube Radius . . . . 3-5/32"
Bulb-Flange Diameter. . . . . 5-1/8" ± 1/16"
Greatest Bulb Diameter. . . . . 5" ± 1/16"
Bulb Terminals:
Caps (Two). . . . . Recessed Small Cavity (JETEC No. J1-21)
Flange. . . . . *See Dimensional Outline*
Flexible cable. . . . . *See Dimensional Outline*
Ambient-Temperature Range . . . . -65° to +100 °C
Mounting Position . . . . Any
Weight (Approx.). . . . . 2 lbs
Socket. . . . . Alden Part No. 435SBA, or equivalent
Base. . . . . Small-Button Thirtyfivar 31-Pin (JETEC No. E31-36)

° Without external shield.

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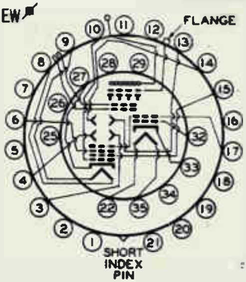
DISPLAY STORAGE TUBE

BOTTOM VIEW*



Pin 1 - No Connection
Pin 2 - Same as Pin 1
Pin 3 - Deflecting Electrode DJ_4 of Writing Gun
Pin 4 - Deflecting Electrode DJ_3 of Writing Gun
Pin 5 - Same as Pin 1
Pin 6 - Grid No.3 of Writing Gun
Pin 7 - Same as Pin 1
Pin 8 - Heater of Writing Gun
Pin 9 - Heater of Writing Gun
Pin 10 - Grid No.1 of Writing Gun
Pin 11 - Same as Pin 1
Pin 12 - Same as Pin 1
Pin 13 - Deflecting Electrode DJ_1 of Writing Gun
Pin 14 - Deflecting Electrode DJ_2 of Writing Gun
Pin 15 - Grid No.2 of Writing Gun
Pin 16 - Internal Connection-Do Not Use
Pin 17 - Grid No.4 of Writing Gun, Grid No.2 of Viewing Gun
Pin 18 - Same as Pin 1
Pin 19 - Same as Pin 1
Pin 20 - Same as Pin 16
Pin 21 - Same as Pin 1
Pin 22 - Heater of Viewing Gun
Pin 25 - Same as Pin 1
Pin 26 - Same as Pin 1
Pin 27 - Cathode of Writing Gun
Pin 28 - Same as Pin 1
Pin 29 - Same as Pin 1
Pin 32 - Grid No.1 of Viewing Gun
Pin 33 - Cathode of Viewing Gun
Pin 34 - Same as Pin 1
Pin 35 - Heater of Viewing Gun
Flexible Cable - Connection to Screen
Flange - Backing-Electrode
Recessed Cavity Cap -
Nearer Tube Face--Grid No.4 of Viewing Gun
Nearer Electron Guns--Grid No.3 of Viewing Gun

Maximum Ratings, *Absolute Values:*

	Writing Section	Viewing Section**	
SCREEN VOLTAGE	–	11000 max.	volts
PEAK BACKING-ELECTRODE VOLTAGE.	–	20 max	volts

* Pins 23 and 31 are not shown because they are trimmed to the same dimension as the short index pin and are not to be used.

**: See next page.

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DISPLAY STORAGE TUBE

	Writing Section		Viewing Section**	
	Equivalent Values			
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_{c_2}) between 500 and 2750 volts

Grid-No.4 Voltage (E_{c_4})	95% to 105% of E_{c_2}	volts
Grid-No.3 Voltage for Focus	14% to 28% of E_{c_2}	volts
Maximum Grid-No.1 Voltage for Cutoff of Undeflected Focused Spot.	−4.6% of E_{c_2}	volts
Maximum Grid-No.3 Current	−15 to +10	μamp
Maximum Cathode Current	*See Curve*	
Deflection Factors:		
DJ_1 and DJ_2	28 to 38	v dc/in./kv of E_{c_4}
DJ_3 and DJ_4	28 to 38	v dc/in./kv of E_{c_4}
Focused Beam Position	##	

Examples of Use of Design Ranges:*

With grid-No.2 voltage of	*1500*	*2500*	*volts*
Grid-No.4 Voltage (E_{c_4})	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 Undeflected Focused Spot.	−69	−115	volts
Deflection Factors when $E_{c_4} = E_{c_2}$:			
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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DISPLAY STORAGE TUBE

▲ 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% 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 ba 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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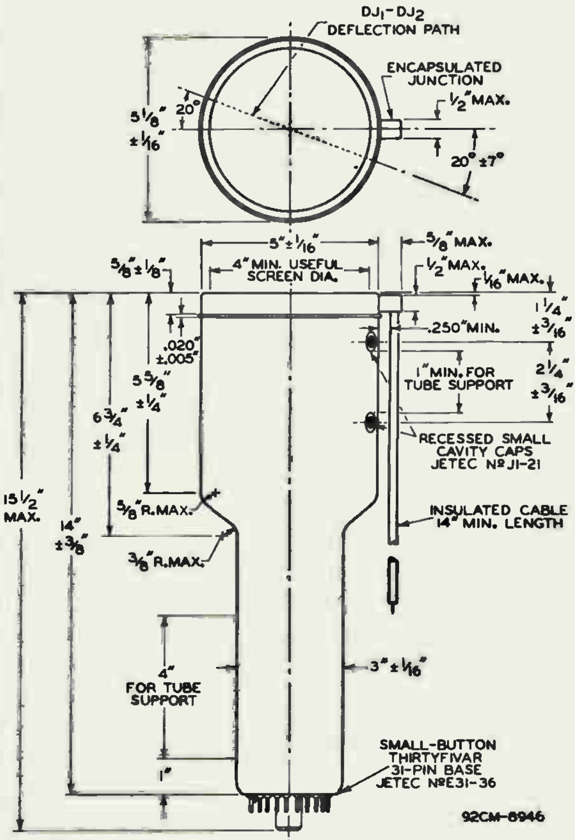
DISPLAY STORAGE TUBE



CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 3° 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 DJ_1 AND DJ_2 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 DJ_1 – DJ_2 DEFLECTION PATH AND DJ_3 – DJ_4 DEFLECTION PATH IS 90° ± 3°.

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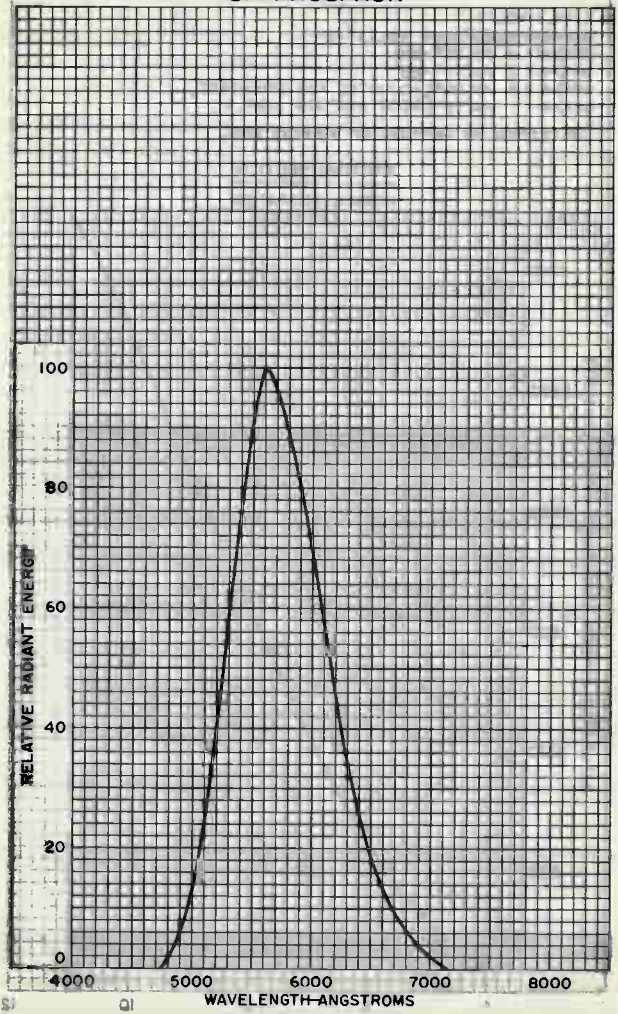
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR



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AVERAGE CHARACTERISTIC

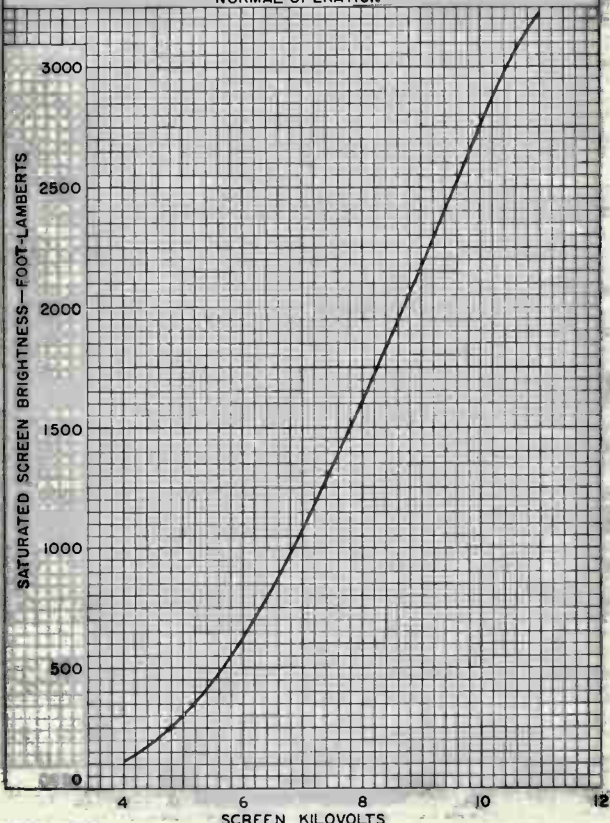
VIEWING SECTION

E_f = 6.3 VOLTS
BACKING-ELECTRODE VOLTS* = 5
GRID-No 4 VOLTS* = 210
GRID-No 2 VOLTS* = 85
GRID-No 3 VOLTS* } ADJUSTED FOR BRIGHTEST,
GRID-No 1 VOLTS* } MOST UNIFORM DISPLAY.

*REFERRED TO CATHODE OF VIEWING GUN.

WRITING SECTION

NORMAL OPERATION



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AVERAGE CHARACTERISTICS

VIEWING SECTION

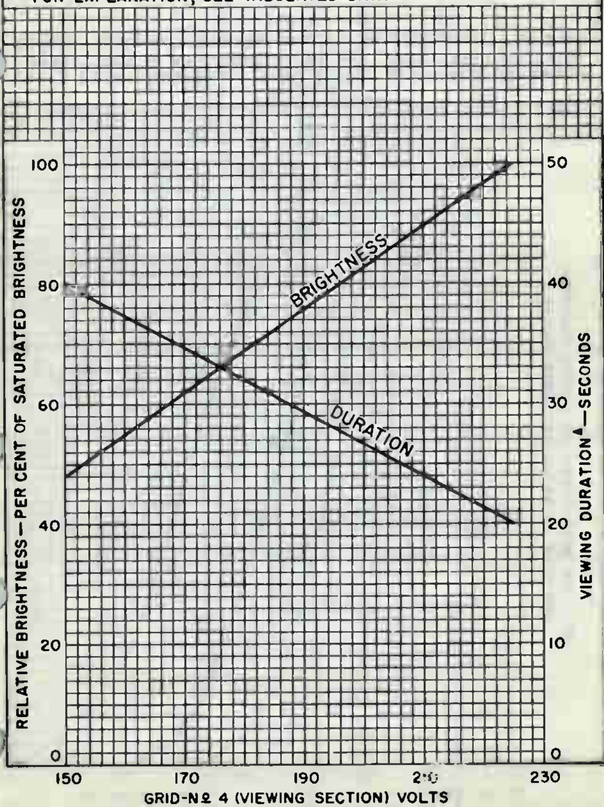
E_f = 6.3 VOLTS
SCREEN KILOVOLTS* = 5 TO 10
BACKING-ELECTRODE VOLTS* = 5
GRID-№ 2 VOLTS* = 85
GRID-№ 3 VOLTS* } ADJUSTED FOR BRIGHTEST,
GRID-№ 1 VOLTS* } MOST UNIFORM DISPLAY

*REFERRED TO CATHODE OF VIEWING GUN

WRITING SECTION

NORMAL OPERATION

▲FOR EXPLANATION, SEE TABULATED DATA



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TYPICAL ERASURE CHARACTERISTICS

VIEWING SECTION

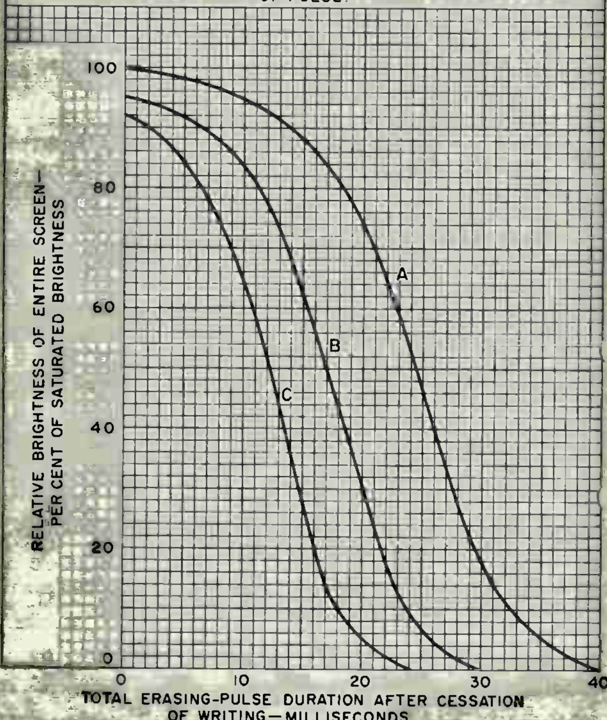
E_f = 6.3 VOLTS
GRID-No 4 VOLTS* = 210
SCREEN KILOVOLTS* = 10
GRID-No 2 VOLTS* = 85

GRID-No 3 VOLTS*, GRID-No 1 VOLTS*: ADJUSTED FOR BRIGHTEST, MOST UNIFORM DISPLAY

*REFERRED TO CATHODE OF VIEWING GUN

CURVE	BACKING-ELECTRODE VOLTS	
	DC	POSITIVE RECTANGULAR PULSE AMPLITUDE (APPROX.)
A	10	10
B	5	8
C	2	7

ERASURE IS PRODUCED BY POSITIVE RECTANGULAR PULSE APPLIED TO BACKING-ELECTRODE. INDICATED DURATION IS SUM OF DURATIONS OF NUMBER OF PULSES OR ELAPSED TIME AFTER START OF PULSE.



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CURRENT CHARACTERISTIC
FOR WRITING GUN

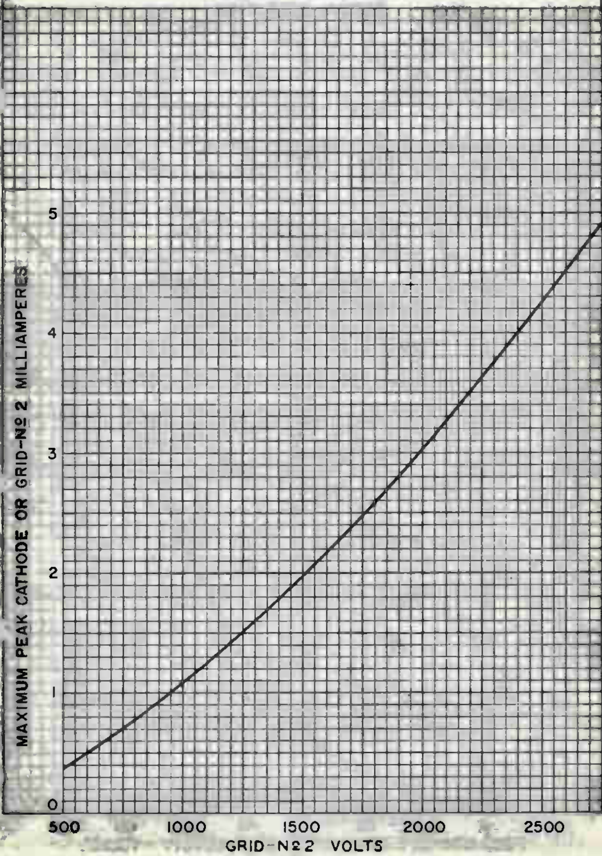
WRITING SECTION

E_f = 6.3 VOLTS
GRID-No. 4 VOLTS* = GRID-NO. 2 VOLTS
GRID-No. 3 VOLTS* = ADJUSTED FOR FOCUS
GRID-No. 1 VOLTS* = 0

*REFERRED TO CATHODE OF WRITING GUN

VIEWING SECTION

NORMAL OPERATION



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TYPICAL DRIVE CHARACTERISTIC
FOR WRITING GUN

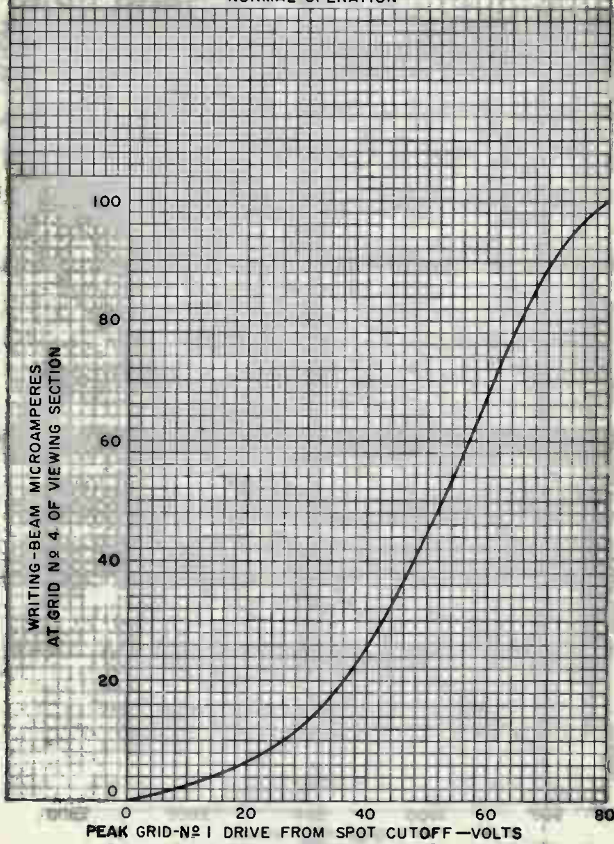
WRITING SECTION

E_f = 6.3 VOLTS
GRID-No 4 VOLTS* = 2500
GRID-No 3 VOLTS* = ADJUSTED FOR FOCUS
GRID-No 2 VOLTS* = 2500
GRID-No 1* BIASED TO SPOT CUTOFF

*REFERRED TO CATHODE OF WRITING GUN

VIEWING 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)

Screen Connector Assembly	Aircraft-Marine Products, Inc.,[a] 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	
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	
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[i]	-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
Undeflected 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., Capitron 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.

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.3 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° C is reached. Following one hour storage at +86° 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 Orthogonol Axes of 7183A Used during Environmental Tests

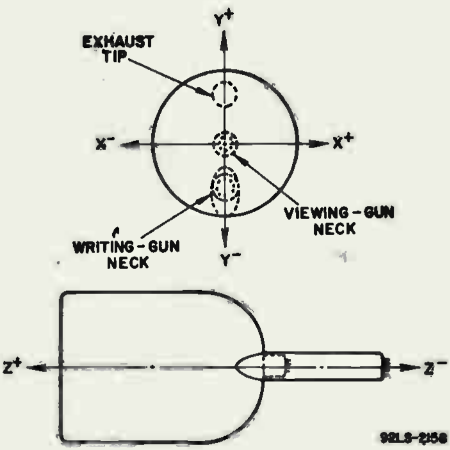
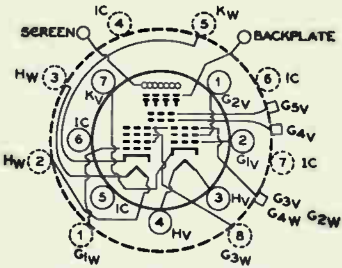


Fig.1

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
Pin 2: Grid No.1
Pin 3: Heater
Pin 4: Heater
Pin 5: Internal Connection— Do Not Use
Pin 6: Internal Connection— Do Not Use
Pin 7: Cathode
Flexible Lead (Large): Screen
Flexible Lead (Small): Backplate

Recessed Cavity Caps:
Collector (Grid No.5) — Located 1.25" from tube face; 15° from center line through writing and viewing gun necks away from screen connector.
Collimator (Grid No.4) — located 3" from tube face; 15° from center line through writing and viewing gun necks away from screen connector.
Located near viewing gun— Grid No.3 and Grids No.4 & No.2 of writing gun.

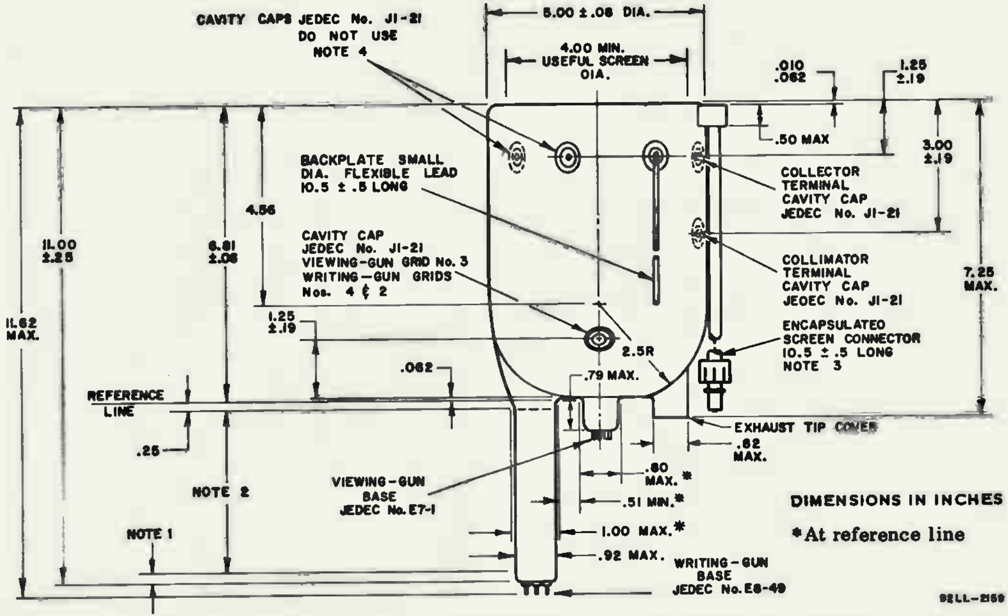
WRITING SECTION

Small-Button Neoditetrar 8-Pin Base

Pin 1: Grid No.1
Pin 2: Heater
Pin 3: Heater
Pin 4: Internal Connection— Do Not Use
Pin 5: Cathode
Pin 6: Internal Connection— Do Not Use
Pin 7: Internal Connection— Do Not Use
Pin 8: Grid No.3

Note : Grids No.4 & No.2 are connected internally to Grid No.3 of viewing gun

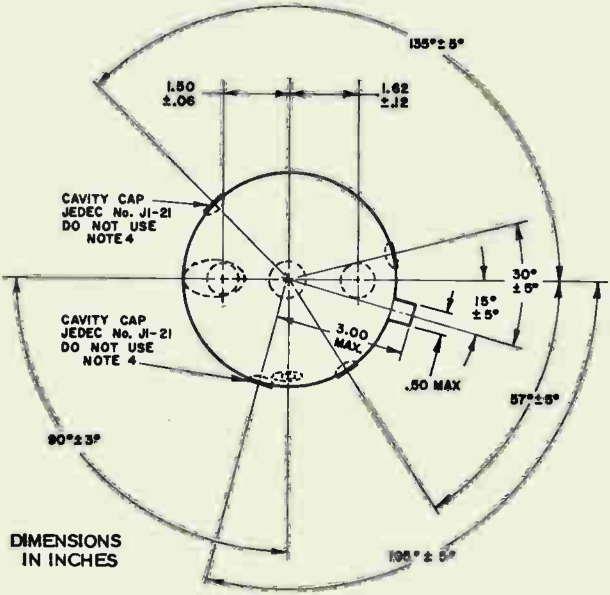
DIMENSIONAL OUTLINE (Front View)



DIMENSIONS IN INCHES

*At reference line

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

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 V	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 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 Capacitance		
Backplate to all other electrodes	110 max	pF

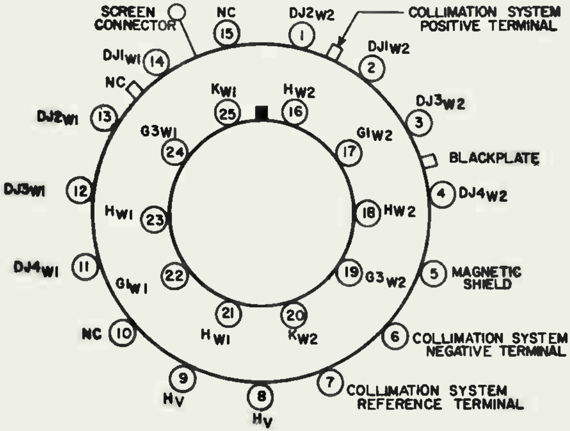
OPTICAL

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 2 – Deflecting Electrode DJ1 of Writing Gun No. 2
Pin 3 – Deflecting Electrode DJ3 of Writing Gun No. 2
Pin 4 – Deflecting Electrode DJ4 of Writing Gun No. 2
Pin 5 – Integral Magnetic Shield
Pin 6 – Collimation System Negative Terminal
Pin 7 – Collimation System Reference Terminal
Pin 8 – Heater of Viewing Gun
Pin 9 – Heater of Viewing Gun
Pin 10 – NC—No Internal Connection
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. 2
Pin 17 – Grid No. 1 of Writing Gun No. 2
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. 1
Pin 22 – Grid No. 1 of Writing Gun No. 1
Pin 23 – Heater of Writing Gun No. 1
Pin 24 – Grid No. 3 of Writing Gun No. 1
Pin 25 – Cathode of Writing Gun No. 1

Flexible Lead – Screen (Encapsulated)

Recessed Small Ball Caps –

Over Pin No. 3
NC—No Internal Connection

Over Pin No. 13
Collimation System Positive Terminal

Over Pin No. 14
Backplate

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

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			
Peak	-	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. Each gun	-600	600	V
Writing-Grid-No.3 Voltage Each gun[b]	0	2000	V
Writing-Grid-No.1 Voltage Each gun[b]	-200	(c)	V
Writing-Gun Cathode Voltage Each gun	-2800	0	V
Writing-Gun Heater-to-Cathode Voltage Each gun	-125	125	V
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 Each gun[e]	-2325 to -1975	V
Writing-Grid-No.1 Voltage Each gun	(c,f)	V
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 (Either 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
Undeflected 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.

b Voltages are shown with respect to cathode of writing gun.

c 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.

d The backplate should be maintained at 2 volts between erasing pulses when dynamic erasure is employed.

e Adjusted for the smallest, most circular spot.

f The bias-voltage value for writing-beam cutoff is between -60 and -100 volts with respect to writing-gun cathode.

g With respect to the reference terminal of the collimation system for each pair of deflecting electrodes.

h 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.

j 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.

k 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.

m 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.

n 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 "shrunken" raster.

p 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°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°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°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 1CE-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.

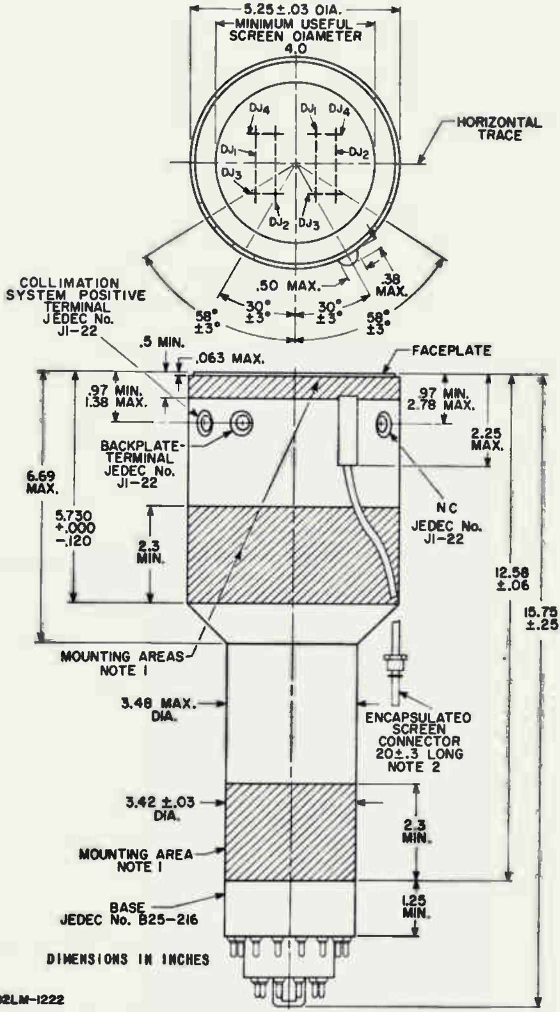
3. *Final Display Adjustments* — The dc bias and the video-signal amplitude applied to grid No.1 or cathode of the writing gun should be adjusted to set the black level and and the highlight level in the display. These adjustments depend on the scanning rate used. Resolution decreases with increasing 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 halftone 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 1CE-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.

DIMENSIONAL OUTLINE



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.

RCA

7315
DISPLAY STORAGE TUBE

DIRECT-VIEW TYPE
3.8"-DIAMETER DISPLAY

WRITING GUN:
ELECTROSTATIC DEFLECTION
ELECTROSTATIC FOCUS

VIEWING GUN:
NO DEFLECTION
NO FOCUS

DATA

General:

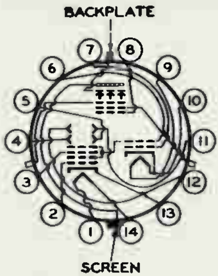
	Writing Section	Viewing Section	
Heater, for Unipotential Cathode:			
Voltage (AC or DC)	6.3	6.3	volts
Current	0.6	0.6	amp
Minimum Cathode Heating Time before other electrode voltages are applied	–	30	sec
Direct Interelectrode Capacitances (Approx.):°			
Grid No.1 to all other tube electrodes	6.5	11	μμf
Cathode to all other tube electrodes	5.5	8	μμf
Backplate to all other tube electrodes	–	116	μμf
Deflecting electrode DJ_1 to deflecting electrode DJ_2	1.9	–	μμf
Deflecting electrode DJ_3 to deflecting electrode DJ_4	2	–	μμf
DJ_1 to all other tube electrodes	6	–	μμf
DJ_2 to all other tube electrodes	7	–	μμf
DJ_3 to all other tube electrodes	5.5	–	μμf
DJ_4 to all other tube electrodes	4.8	–	μμf
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" ± 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 Diheptal 14-Pin (JEDEC Group 5, No.B14-38)

7315

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
	Equivalent Values		*Equivalent Values*		
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

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

DISPLAY STORAGE TUBE

	Writing Section		Viewing Section		
GRID-No.2 VOLTAGE	2950 max.*▲	200 max.**	2950 max.*▲	200 max.**	volts
CATHODE VOLTAGE	–	-2750 max.**	–	–	volts
GRID-No.1 VOLTAGE:					
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

RCA

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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	μa
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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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.

□ 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.

RCA

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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.

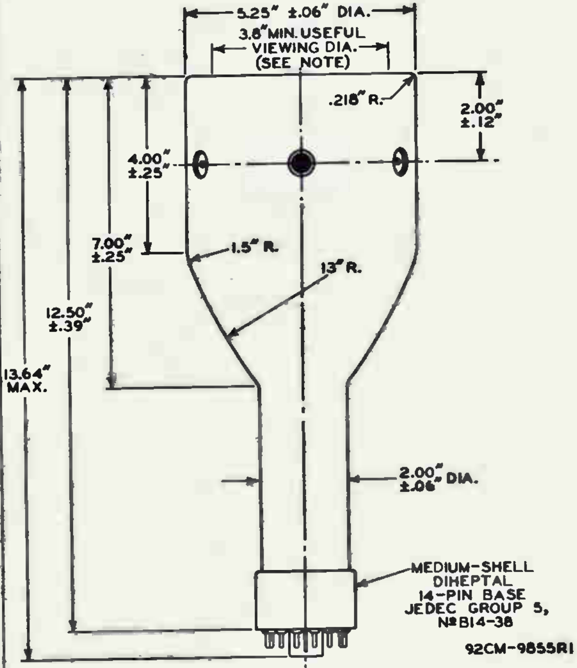
To prevent possible damage to the tube, allow the Viewing-Gun beam current to reach normal operating value before turning on the Writing-Gun beam current, and keep the viewing beam on till the writing beam is turned off.

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.

RCA

7315

DISPLAY STORAGE TUBE



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RCA

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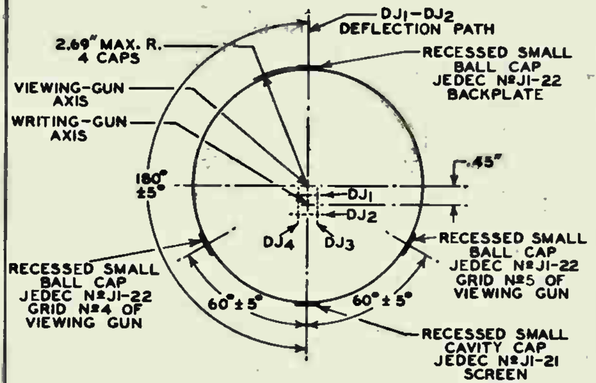
DISPLAY STORAGE TUBE

TOP VIEW



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.

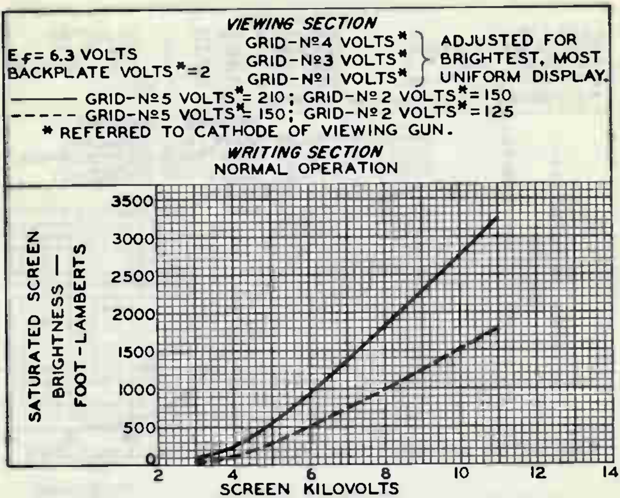
DEFLECTING ELECTRODES DJ_1 AND DJ_2 ARE NEARER THE SCREEN; DEFLECTING ELECTRODES DJ_3 AND DJ_4 ARE NEARER THE BASE. WITH DJ_1 POSITIVE WITH RESPECT TO DJ_2, THE SPOT WILL BE DEFLECTED TOWARD PIN 8; LIKEWISE, WITH DJ_3 POSITIVE WITH RESPECT TO DJ_4, THE SPOT WILL BE DEFLECTED TOWARD PIN 4.

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 $\pm 10^{\circ}$. ANGLE BETWEEN $DJ_1 - DJ_2$ DEFLECTION PATH AND $DJ_3 - DJ_4$ DEFLECTION PATH IS $90^{\circ} \pm 3^{\circ}$.

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 $\pm 10^{\circ}$.

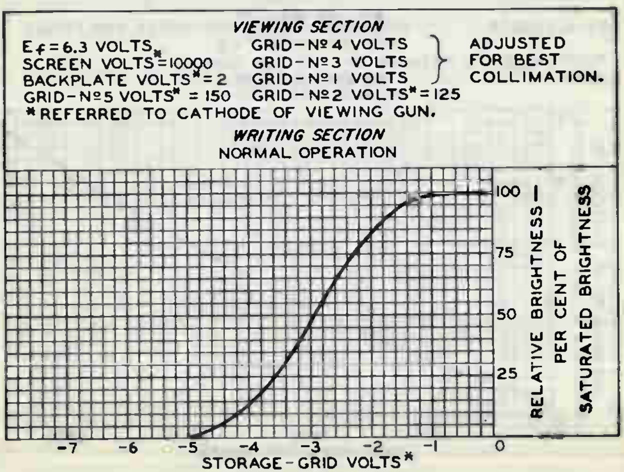
7315

TYPICAL CHARACTERISTICS



92CS-9858

TYPICAL STORAGE-GRID CHARACTERISTIC



92CS-9861

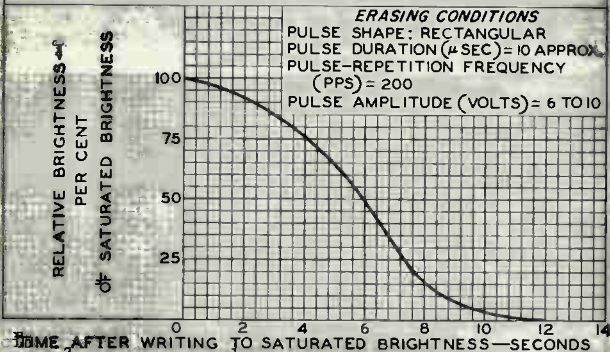
RCA

7315

TYPICAL ERASURE CHARACTERISTIC

VIEWING SECTION

Ef = 6.3 VOLTS
SCREEN VOLTS* = 10000
BACKPLATE VOLTS* = 2
GRID-№5 VOLTS* = 150
GRID-№4 VOLTS, GRID-№3 VOLTS, GRID-№1 VOLTS: ADJUSTED FOR BEST COLLIMATION
GRID-№2 VOLTS* = 125
* REFERRED TO CATHODE OF VIEWING GUN.



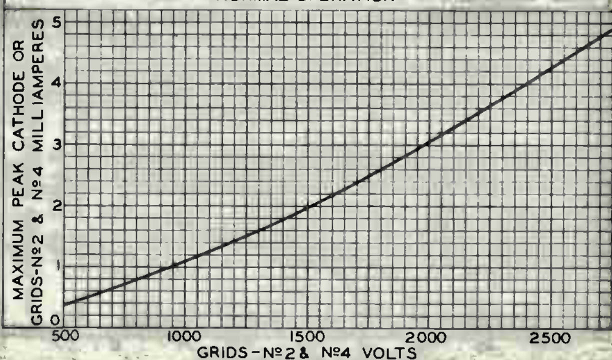
92CS-9860

WRITING-GUN-CURRENT CHARACTERISTIC

WRITING SECTION

Ef = 6.3 VOLTS
GRID-№3 VOLTS* = ADJUSTED FOR FOCUS
GRID-№1 VOLTS* = 0
*REFERRED TO CATHODE OF WRITING GUN.

VIEWING SECTION
NORMAL OPERATION



92CS-9859

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	DR2000 Series	DR2100 Series	DR2200 Series	
ELECTRICAL				
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	o
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
VIBRATION		
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

TEST	CONDITIONS	DC Segment Volts
SHOCK*		
a)	200g, 1 ms, Half-Sine Wave	2.5
b)	50g, 11 ms, Half-Sine Wave	Not Applied
VIBRATION		
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.

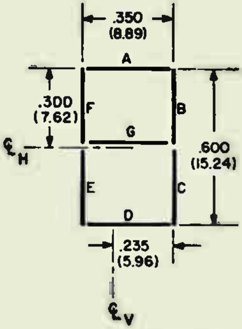
Base Pin Number And Segment Designation Chart

Display	Type	Segment Designations A–H								
		Base Pin Number								
		1	2	3	4	5	6	7	8	9
	DR2000 DR2100 DR2200	NC	COMMON	E	D	C	G	A	B	F
with decimal	DR2010 DR2110 DR2115 DR2210 DR2215	H	COMMON	E	D	C	G	A	B	F
	DR2020 DR2120 DR2220	NC	COMMON	NC	NC	NC	D	B	C	A
	DR2030	NC	COMMON	NC	NC	NC	B	NC	A	NC
	DR2130 DR2230	NC	COMMON	NC	NC	NC	NC	B	NC	A

NC = no connection – may be used as tie point.

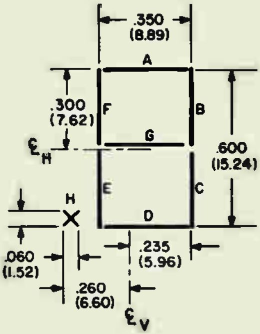
Segment Dimensions and Designations

DR2000



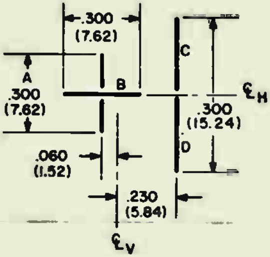
92CS-15754R1

DR2010



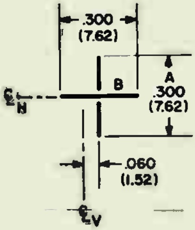
92CS-15755R1

DR2020



92CS-15756R1

DR2030



92CS-15757R1

℄$_H$ = Horizontal center line of display (bulb outline dimension F) with pin No. 3 toward viewer. Segment "G" is 0.030" above ℄$_H$.

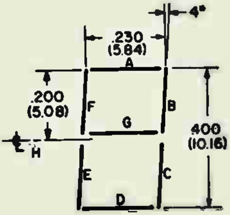
℄$_H$ = Vertical center line of device.

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.

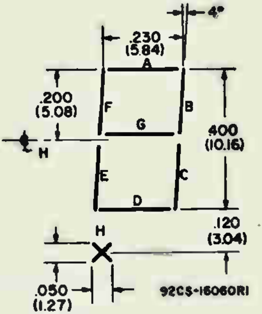
Segment Dimensions And Designations — Cont'd

DR2100
DR2200



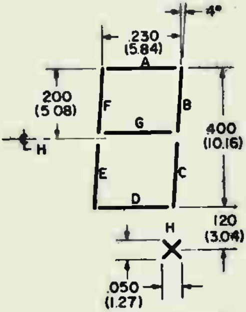
92CS-16059R1

DR2110
DR2210



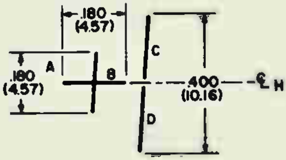
92CS-16060R1

DR2115
DR2215



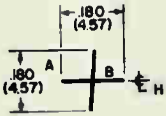
92CS-18023R1

DR2130
DR2230



92CS-16061R1

DR2120
DR2220



92CS-16062R1

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

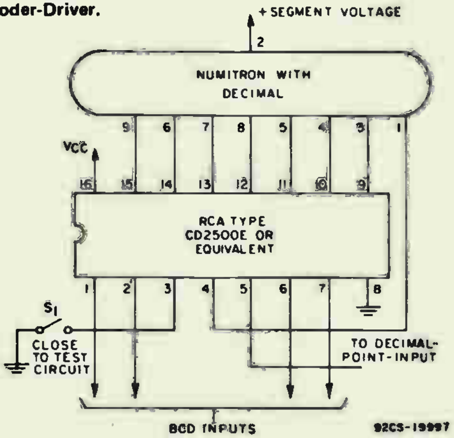
Chromafilter CF-131: Anti-Reflection Filters

Plastic Light Shield to Reduce Side Reflections

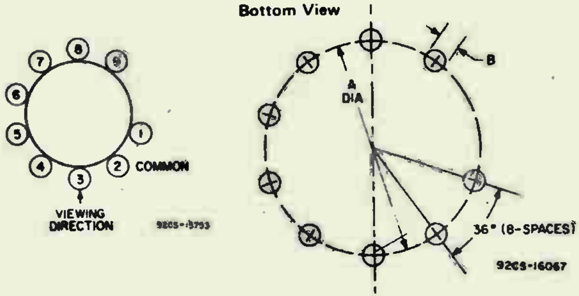
DR2100, DR2200 Series

- RCA DS3000

Basic Interconnection Circuit of NUMITRON Device and Decoder-Driver.



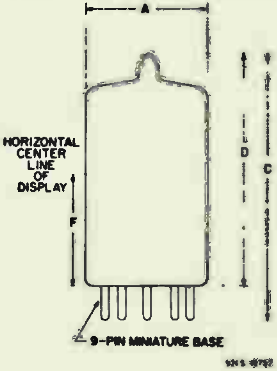
Base Diagram and Pin Circle Dimensions — All Series.



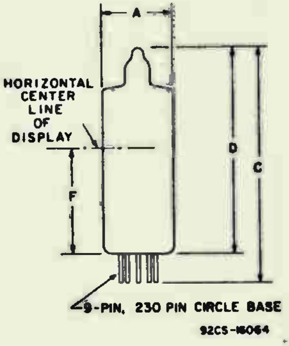
NUMITRON SERIES	DIMENSION (INCHES)		
	A	B	
	NOMINAL	MIN.	MAX.
DR2000	0.468	0.038	0.042
DR2100 and DR2200	0.230	0.018	0.022
DR2100V1 and DR2200V1	0.380	0.018	0.022

Dimensional Outlines

DR2000 Series



DR2100, DR2200 Series

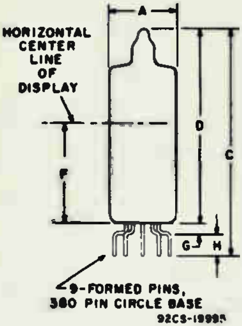


DIMENSION	DR2000 Series				DR2100 and DR2200 Series			
	INCHES		MILLIMETERS		INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
A		0.800		20.32		0.485		12.32
C		1.875		47.62		1.660		42.16
D		1.625		41.27		1.450		36.83
F	0.700	0.730	17.78	18.54	0.625	0.655	15.87	16.64

MILLIMETER DIMENSION DERIVED FROM INCH DIMENSION

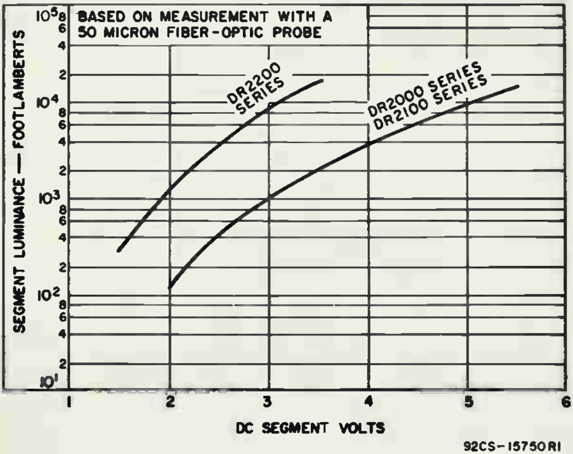
Dimensional Outlines – Cont'd

DR2100V1, DR2200V1 Series

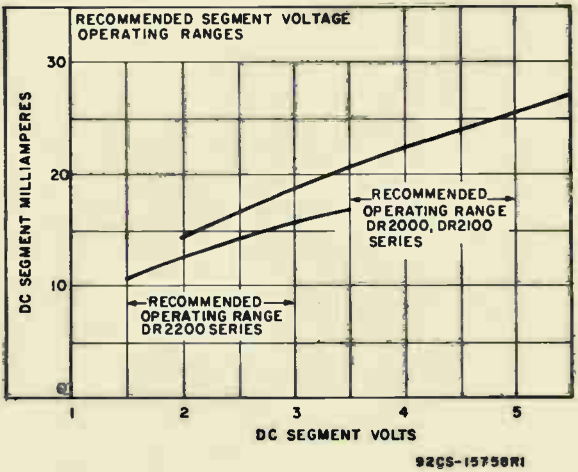


DI-MEN-SION	DR2100V1 and DR2200V1 Series			
	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A		0.485		12.32
C		1.705		43.30
D		1.450		36.83
F	0.625	0.655	15.87	16.64
G	0.060	0.090	1.52	2.28
H	0.135	0.165	3.43	4.19

Segment Luminance Characteristics



Segment Current Characteristics



Envelope Temperature Characteristics