SPECTRAL-ENERGY EMISSION CHARACTERISTIC
OF PHOSPHOR P7

WAVELENGTH-ANGSTROMS

RELATIVE RADIANT ENERGY

RANGE
AVERAGE

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
PERSISTENCE CHARACTERISTIC
OF PHOSPHOR P7

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

SCREEN BRIGHTNESS—MILLIFOOT—LAMBERTS

TIME AFTER EXCITATION IS REMOVED—SECONDS

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
BUILDUP CHARACTERISTICS OF PHOSPHOR P7

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

<table>
<thead>
<tr>
<th>LOCUS</th>
<th>SCREEN MICROAMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>150</td>
</tr>
<tr>
<td>B</td>
<td>75</td>
</tr>
<tr>
<td>C</td>
<td>37</td>
</tr>
</tbody>
</table>

EXCITATION PULSE

RELATIVE SCREEN BRIGHTNESS PERCENT OF SATURATION VALUE

1 2 3 4 5 6 7 8 9 10 11 12 13 15

3rd 5th 7th 9th 11th 13th 15th

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 №1 OF CATHODE-RAY TUBE AT 1-SECOND INTERVALS FOR EACH OF THE LOCI UNDER THE INDICATED CONDITIONS.
BRIGHTNESS: MEASURED JUST BEFORE EACH EXCITATION PULSE.

<table>
<thead>
<tr>
<th>LOCUS</th>
<th>FINAL HIGH-VOLTAGE-ELECTRODE VOLTS</th>
<th>SCREEN MICROAMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4000</td>
<td>150</td>
</tr>
<tr>
<td>B</td>
<td>4000</td>
<td>75</td>
</tr>
<tr>
<td>C</td>
<td>2500</td>
<td>75</td>
</tr>
<tr>
<td>D</td>
<td>2500</td>
<td>37</td>
</tr>
<tr>
<td>E</td>
<td>1500</td>
<td>37</td>
</tr>
</tbody>
</table>

SCREEN BRIGHTNESS—FOOT-LAMBERTS

1st 5th 9th 13th 17th 21st
EXCITATION PULSE

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-6805R5
PERSISTENCE CHARACTERISTICS OF PHOSPHOR P7

EXCITATION LEVEL (SATURATION)

SCANNING AREA (CM): 7x7
SCANNING PERIOD (SEC): 1/60
NUMBER OF LINES: 260 APPROX.

<table>
<thead>
<tr>
<th>CURVE</th>
<th>FINAL HIGH-VOLTAGE-ELECTRODE VOLTS</th>
<th>SCREEN MICROAMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4000</td>
<td>150</td>
</tr>
<tr>
<td>*</td>
<td>4000</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>2500</td>
<td>75</td>
</tr>
<tr>
<td>**</td>
<td>2500</td>
<td>37</td>
</tr>
<tr>
<td>3</td>
<td>1500</td>
<td>37</td>
</tr>
</tbody>
</table>

*CURVE FOR THESE CONDITIONS WOULD BE MIDWAY BETWEEN CURVES 1 & 2

**CURVE FOR THESE CONDITIONS WOULD BE MIDWAY BETWEEN CURVES 2 & 3
SPECTRAL-ENERGY EMISSION CHARACTERISTIC
OF PHOSPHOR № 11

WAVELENGTH - ANGSTROMS

RELATIVE RADIANT ENERGY

3000  4000  5000  6000  7000  8000

APRIL 9, 1948
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6748
PERSISTENCE CHARACTERISTICS OF PHOSPHOR NO. 11

\[ n_{\text{max}} = 0.5 \text{ TO } 2 \]
WHERE \( n \) = SLOPE

CURVE A: \( 2 \mu A/CM^2, \frac{1}{60} \text{ SEC. PULSE} \)
B: \( 20 \mu A/CM^2, \text{ SINGLE-LINE SCAN} \)
C: \( 50 \mu A/CM^2, \text{ SINGLE-LINE SCAN} \)
PERSISTENCE CHARACTERISTIC OF PHOSPHOR P12

The curve is essentially independent of tube operating values.
Spectral Energy Emission Characteristic of Phosphor P14
ANODE VOLTS: 4000 - 6000
SCREEN MICROAMP: 150
SCANNING AREA (CM): 7 x 7
SCANNING PERIOD (SEC): 1/60
NUMBER OF LINES: 260 APPROX.
EXCITATION: 2-SECOND DURATION

PERSISTENCE CHARACTERISTIC
OF PHOSPHOR P14

Subdivisions are 2, 4, 6, 8
$\text{SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR PI5}$

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>COLOR</th>
<th>I.C.I. COORDINATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>VISIBLE</td>
<td>GREEN</td>
<td>0.246 0.439</td>
</tr>
<tr>
<td>ULTRAVIOLET</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$\text{WAVELENGTH-ANGSTROMS}$

$\text{RELATIVE RADIANT ENERGY}$
PERSISTENCE CHARACTERISTIC OF PHOSPHOR PI5

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>EACH ESSENTIALLY INDEPENDENT OF TUBE OPERATING VALUES.</th>
</tr>
</thead>
<tbody>
<tr>
<td>VISIBLE</td>
<td>SHOWN BY CURVE.</td>
</tr>
<tr>
<td>ULTRAVIOLET</td>
<td>DECAYS TO APPROXIMATELY 10% OF MAXIMUM IN NOT MORE THAN 0.05 MICROSECOND.</td>
</tr>
</tbody>
</table>

SPOT: SHARPLY FOCUSED.

RELATIVE BRIGHTNESS

TIME AFTER EXCITATION IS REMOVED — MICROSECONDS
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR PI6

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>COLOR</th>
<th>I.C.I. COORDINATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>VISIBLE</td>
<td>VIOLET</td>
<td>X: 0.175</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Y: 0.003</td>
</tr>
<tr>
<td>NEAR ULTRAVIOLET</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

WAVELENGTH—ANGSTROMS

RELATIVE RADIANT ENERGY
PERSISTENCE CHARACTERISTIC OF PHOSPHOR P16

CURVE IS ESSENTIALLY INDEPENDENT OF TUBE OPERATING VALUES.
SPOT: SHARPLY FOCUSED.
Phosphor P20

Persistence Characteristic

**Curves:**
- **Curve A:** $2 \mu A/CM^2$, 1/80 SEC. PULSE
- **Curve B:** $20 \mu A/CM^2$, SINGLE-LINE SCAN
- **Curve C:** $50 \mu A/CM^2$, SINGLE-LINE SCAN

**Characteristics:**
- $n_{max} = 0.5$ TO 2
- $n = \text{slope}$

**Graph Details:**
- **Axes:**
  - X-axis: Time after excitation is removed (milliseconds)
  - Y-axis: Relative brightness - per cent of maximum

**Data:**
- **92CM-6806R2**

**Publisher:**
- **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).

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>COLOR DESCRIPT</th>
<th>JEDEC DESIGNATION</th>
<th>CIE COORDINATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLUE</td>
<td>PURPLISH-BLUE</td>
<td>0.146</td>
<td>0.052</td>
</tr>
<tr>
<td>GREEN</td>
<td>YELLOWISH-GREEN</td>
<td>0.218</td>
<td>0.712</td>
</tr>
<tr>
<td>RED</td>
<td>REDDISH-ORANGE</td>
<td>0.674</td>
<td>0.326</td>
</tr>
</tbody>
</table>

*JEDEC COLOR CLASSIFICATION CORRESPONDING TO CIE COORDINATE VALUES.
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.
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).

<table>
<thead>
<tr>
<th>COMPONENT COLOR</th>
<th>C.I.E. COORDINATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLUE</td>
<td>X 0.155 Y 0.061</td>
</tr>
<tr>
<td>GREEN</td>
<td>X 0.265 Y 0.585</td>
</tr>
<tr>
<td>RED</td>
<td>X 0.639 Y 0.342</td>
</tr>
</tbody>
</table>

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

GROUP PHOSPHOR P22
5-61
The persistence of the group phosphorescence is medium short. Persistence of the component phosphors is such that after excitation is removed, brightness decays to a level not exceeding 10 percent of the initial value in:

- 22 microseconds (Approx.) . . . . . . Blue phosphor
- 60 microseconds (Approx.) . . . . . . Green phosphor
- 60 microseconds (Approx.) . . . . . . Red phosphor
Group Phosphor P22
Rare-Earth (Red), Sulfide (Blue & Green) Type

Spectral-Energy Emission Characteristic

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).

<table>
<thead>
<tr>
<th>COMPONENT COLOR</th>
<th>C.I.E. COORDINATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED</td>
<td>X = 0.676, Y = 0.324</td>
</tr>
<tr>
<td>BLUE</td>
<td>X = 0.155, Y = 0.061</td>
</tr>
<tr>
<td>GREEN</td>
<td>X = 0.290, Y = 0.590</td>
</tr>
</tbody>
</table>

PEAKS IN THIS AREA HAVE BEEN REDUCED BY A FACTOR OF 5.
Group Phosphor P22
Rare-Earth (Red), Sulfide (Blue & Green) Type

PERSISTENCE CHARACTERISTIC

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

- 22 microseconds (Approx.) ......... Blue phosphor
- 60 microseconds (Approx.) ......... Green phosphor
- 1 millisecond (Approx.) ............ Red phosphor
**Group Phosphor P22**

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

Spectral-Energy Emission Characteristic

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)**

<table>
<thead>
<tr>
<th>COMPONENT COLOR</th>
<th>C.I.E. COORDINATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED</td>
<td>X: 0.660, Y: 0.340</td>
</tr>
<tr>
<td>BLUE</td>
<td>X: 0.152, Y: 0.063</td>
</tr>
<tr>
<td>GREEN</td>
<td>X: 0.300, Y: 0.600</td>
</tr>
</tbody>
</table>

**Graph**

- **PEAKS AT 405**
- **PEAKS AT 175**

**Graph Details**

- **Relative Radiant Energy**
- **Wavelength - Angstroms**

**Graph Legend**

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

<table>
<thead>
<tr>
<th>COLOR</th>
<th>I.C.I. COORDINATES</th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>GREEN</td>
<td></td>
<td>0.245</td>
<td>0.441</td>
</tr>
</tbody>
</table>

WAVELENGTH—ANGSTROMS

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
PERSISTENCE CHARACTERISTIC OF PHOSPHOR P24

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

RELATIVE BRIGHNESS

TIME AFTER EXCITATION IS REMOVED — MICROSECONDS

ELECTRON TUBE DIVISION

92CM-8205R2
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

SCREEN DIAGONAL
15 MIN.

OVERALL LENGTH
7.686 ± .025

SCREEN HEIGHT
9.500 MIN.

NECK LENGTH
66°

BASE

CAVITY CAP
JEDEC No. J-21
- 2.250 ± .250

SCREEN WIDTH
12.062 MIN.

DIMENSIONS IN INCHES

See data for specific tube type.

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

OUTLINES 2
CRT
4-65
FOR PICTURE TUBES UTILIZING BULB J125 A AND PROTECTIVE WINDOW (FP125 A)

SCREEN DIAGONAL 14.875 MIN.
SCREEN HEIGHT 10.250 MIN.
SCREEN WIDTH 12.938 MIN.

Overall Length
6.312 ± .166
Neck Length
11.094 ± .125
Base
1.500 ± .125

Cavity Cap
JEDEC No. JI-21

Reference Line
Determined by Gauge
JEDEC No. G-126

Dimensions in Inches

13.703 ± .125
25.88 R.
102°
L125 ± .043
- .025 Dia.

* See data for specific tube type.

CRT OUTLINES 2
RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.
FOR PICTURE TUBE UTILIZING BULB J125 B

DIMENSIONS IN INCHES

* See data for specific tube type.
BULB J125 C2

OVERALL LENGTH

NECK LENGTH

BASE

CAVITY CAP
JEDEC No.JI-21

REFERENCES LINE
DETERMINED BY GAUGE
JEDEC No. G-128

DIMENSIONS IN INCHES

* See data for specific tube type.
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

SCREEN DIAGONAL 15.750 MIN.
SCREEN HEIGHT 16.688 MIN.
SCREEN WIDTH 14.750 MIN.
OVERALL LENGTH 7.125 ± .125
NECK LENGTH 12.750 ± .25
BASE CAVITY CAP JEDEC No. JI-21 1.812 ± .125
SCREEN HEIGHT 12.750 MIN.
SCREEN WIDTH 14.750 MIN.
OVERALL LENGTH 7.125 ± .125
NECK LENGTH 12.750 ± .25
BASE CAVITY CAP JEDEC No. JI-21 1.812 ± .125
REFERENCE LINE DETERMINED BY GAUGE JEDEC No. G-126

DIMENSIONS IN INCHES

* See data for specific tube type.
FOR PICTURE TUBES UTILIZING BULB J132-1/2 C/D

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.
65°
17/16 ± 1/16 DIA.
**Bulb J132-1/2 C/D**

**OVERALL LENGTH**

\[ 9\frac{1}{2} \pm \frac{1}{8} \]

**NECK LENGTH**

\[ 12\frac{3}{4} \pm \frac{1}{8} \]

**BASE**

\[ 68^\circ \]

**CAVITY CAP**

*JEDEC No. J1-21*

\[ 3\frac{13}{16} \pm \frac{1}{4} \]

**REFERENCE LINE**

*DETERMINED BY GAUGE*

*JEDEC No. G-116*

**ALL DIMENSIONS IN INCHES**

*See data for specific tube type.*
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
15 3/16 MIN.

SCREEN HEIGHT
11 1/8 MIN.

SCREEN WIDTH
14 3/16 MIN.

27 R.

65°

1 7/16 ± 1/16 DIA.

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
BULB J133 B/D

OVERALL LENGTH

11 11/16 ± 1/8

NECK LENGTH

4 5/8 ± 1/4

CAVITY CAP

JEDEC No. J1-21

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No. S-110

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
$\frac{3}{16}$ MIN.

SCREEN WIDTH
$14\frac{1}{4}$ MIN.

SCREEN HEIGHT
$10\frac{3}{4}$ MIN.

$15\frac{25}{64} + \frac{1}{8}$

$65^{\circ}$

$7 + \frac{1}{16}$ DIA.

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
BULB J133 C/E

OVERALL LENGTH*

NECK LENGTH*

11 + 1/16

BASE*

CAVITY CAP
JEDEC No. J1-21

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
15 2/16 MIN.

SCREEN HEIGHT
11 1/8 MIN.

SCREEN WIDTH
14 5/16 MIN.

15 25/64 ± 1/8

27 R.

65°

17/16 ± 1/16 DIA.

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
BULB J133 F/G

OVERALL LENGTH

NECK LENGTH

BASE

CAVITY CAP
JEDEC No. J1-21

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No. G-116

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.
FOR PICTURE TUBES UTILIZING BULB J149 B

OVERALL LENGTH

13.344" - 9.750 ± .125

NECK LENGTH

3.000 ± .250

BASE

67°

CAVITY CAP

JEDEC No. J1-21

SCREEN DIAGONAL

17.562 MIN.

SCREEN WIDTH

15.125 MIN.

SCREEN HEIGHT

12.000 MIN.

1.25"

92GL-11604R

REFERENCE LINE

DETERMINED BY GAUGE

JEDEC No. G-116

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.

CRT OUTLINES II
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.
OVERALL LENGTH: 14 1/4 - 3/16
NECK LENGTH: 14 13/16 + 1/16

CAVITY CAP
JEDEC No.J1-21

BASE

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No.G-110

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

For Picture Tubes Utilizing

Screen Diagonal
19 1/2 Min.

Screen Height
13 5/8 Min.

Screen Width
17 3/8 Min.

10 11/16 ± 1/8

40 R.

66°

17/16 ± 1/16 Dia.
BULB J165 Z

OVERALL LENGTH*

14 15/16 ± 3/16

NECK LENGTH*

BASE*

CAVITY CAP
JEDEC No. J1-21

7 3/16 ± 1/4

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No. 6-110

ALL DIMENSIONS IN INCHES

*See data for specific tube type.

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

3-62
FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL 20 1/16 MIN.

SCREEN HEIGHT 13 1/6 MIN.

SCREEN WIDTH 19 5/8 MIN.

20 1/4 ± 1/8

35 R.

65°

1 7/16 ± 1/16 DIA.
**BULB J170 A/C**

**OVERALL LENGTH**

15\(\frac{17}{32}\) ± 3\(\frac{3}{16}\)

**NECK LENGTH**

7\(\frac{5}{32}\) ± \(\frac{1}{4}\)

**CAVITY CAP**

JEDEC No. J1-21

**BASE**

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No. G-110

**ALL DIMENSIONS IN INCHES**

* See data for specific tube type.

---

**RADIO CORPORATION OF AMERICA**

Electron Tube Division
Harrison, N. J.

CRT OUTLINES 15
3-62
BULB J170 B/D

OVERALL LENGTH:
16 17/32
15 9/16
+ 1/8
32 - 16

NECK LENGTH:
7 5/32
2 1/8
32 - 4

BASE:
50°

CAVITY CAP
JEDEC No. J1-21

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No. G-110

92CL-11566

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
20\(\frac{1}{4}\) MIN.

SCREEN HEIGHT
15\(\frac{1}{16}\) MIN.

SCREEN WIDTH
19\(\frac{1}{16}\) MIN.

20\(\frac{1}{4}\) ± \(\frac{1}{8}\)

33 R.

67°

17\(\frac{1}{16}\) ± \(\frac{1}{16}\) DIA.

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
OVERALL LENGTH* 17\(\frac{3}{32}\) ± \(\frac{3}{16}\)

NECK LENGTH* 15\(\frac{17}{32}\) ± \(\frac{3}{16}\)

BASE*

CAVITY CAP
JEDEC No. Ji-21

17 \(\frac{3}{32}\) ± \(\frac{1}{8}\)

16 \(\frac{3}{32}\) ± \(\frac{1}{8}\)

15 \(\frac{3}{8}\)

7 \(\frac{5}{32}\) ± \(\frac{1}{4}\)

53°

21 \(\frac{3}{8}\) ± \(\frac{1}{8}\)

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No. 9-110

92CL-11607

ALL DIMENSIONS IN INCHES

*See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
20 1/4 MIN.

SCREEN HEIGHT
15 1/16 MIN.

SCREEN WIDTH
19 1/16 MIN.

20 1/4 + 1/8

33 R.

85°

7/16 + 1/16 DIA.
Bulb J171 D/E

OVERALL LENGTH

12 \( \frac{1}{2} + \frac{3}{16} \)

NECK LENGTH

BASE

CAVITY CAP
JEDEC No.JI-21

16 \( \frac{3}{8} \) + \( \frac{1}{8} \)

NECK LENGTH

4 \( \frac{1}{8} \) + \( \frac{1}{4} \)

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No.G-118

92CL—11599

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
20 $\frac{1}{4}$ MIN.

SCREEN HEIGHT
15 $\frac{1}{16}$ MIN.

SCREEN WIDTH
19 $\frac{1}{16}$ MIN.

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
BULB J171 G/K

OVERALL LENGTH*

9 1/4 ± 3/16

NECK LENGTH*

16 3/8

± 1/8

CAVITY CAP
JEDEC No. J1-21

92CL-11593

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
1 20\text{\text{-}2} MIN.

SCREEN WIDTH
19 \frac{1}{16} MIN.

SCREEN HEIGHT
15 \frac{1}{16} MIN.

20 \frac{1}{4} \pm \frac{1}{8}

33 R.

105^\circ

1 \frac{1}{8} \pm \frac{1}{32} DIA.

RADIO CORPORATION OF AMERICA
Electron Tube Division  Harrison, N. J.
BULB J171 H/J

OVERALL LENGTH

NECK LENGTH

CAVITY CAP

JEDEC No. J1-21

DIMENSIONS IN INCHES

*See data for specific tube type.
FOR PICTURE TUBES UTILIZING BULB J167A AND PROTECTIVE PANEL FP198

DIMENSIONS IN INCHES

* See data for specific tube type.
FOR PICTURE TUBES UTILIZING BULB J187 B

SCREEN DIAGONAL 22.32 MIN.
SCREEN WIDTH 19.250 MIN.
SCREEN HEIGHT 15.125 MIN.
OVERALL LENGTH 9.406 ± 0.156
NECK LENGTH 11.500 ± 0.100
BASE 8 ± 0.1
CAVITY CAP JEDEC No. J-21
JEDEC No. J1-13
2.000 ± 0.200
-0.125

SCREEN MOUTH 19.250 MK

20.800 ± 0.125
1125 ± 0.043
DIAL

DIMENSIONS IN INCHES

* See data for specific tube type.
FOR PICTURE TUBES UTILIZING BULB J187 C/F

SCREEN DIAGONAL
22 5/16 MIN.

SCREEN HEIGHT
15 7/8 MIN.

SCREEN WIDTH
19 1/4 MIN.

20 1/2 + 1/8

80°

1 7/16 + 1/16 DIA.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.
BULB J187 C/F

OVERALL LENGTH

12 1/2

NECK LENGTH

4 3/16

BASE

CAVITY CAP

JEDEC No. J1—21

ALL DIMENSIONS IN INCHES

* See data for specific tube type.

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

CRT OUTLINES 23 3-62
FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
22 \frac{7}{16} \text{ MIN.}

SCREEN WIDTH
19 \frac{5}{16} \text{ MIN.}

SCREEN HEIGHT
15 \frac{1}{4} \text{ MIN.}

21 \frac{5}{16} \pm \frac{1}{8}

50 \frac{1}{4} \text{ R.}

35 \frac{1}{2} \text{ R.}

61^\circ

\frac{2}{3}

1 \frac{7}{16} \pm \frac{1}{16} \text{ DIA.}

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
BULB J187 D/G AND PROTECTIVE PANEL

OVERALL LENGTH:
12 13/16 + 1/4

NECK LENGTH:
2 3/4 ± 3/32

CABINET CAP
JEDEC No. J1-21

DIMENSIONS IN INCHES

*See data for specific tube type.
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 H1

DIMENSIONS IN INCHES

*See data for specific tube type.
FOR PICTURE TUBES UTILIZING BULB JT67 J

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.
Dimensional Outline

Bulb J187 L

FOR PICTURE TUBES UTILIZING BULB J187 L

DIMENSIONS IN INCHES

*See data for specific tube type.
FOR PICTURE TUBES UTILIZING BULB J187M

MINIMUM SCREEN
DIAGONAL 22.312
GREATEST WIDTH 19.250
GREATEST HEIGHT 15.125

RIM-BAND OPENING 19.900 MIN.

OVERALL LENGTH* 12.080 ±.188
NECK LENGTH 3.768 ±.250
BASE* 58°
CAVITY CAP
JEDEC No. J1-21

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No. G-126
92LM-1477

DIMENSIONS IN INCHES

* See data for specific tube type.
FOR PICTURE TUBES UTILIZING BULB J192 A/B

SCREEN DIAGONAL
22.608 MIN.

SCREEN WIDTH
21.438 MIN.

SCREEN DIAGONAL
22.608 ± .125

SCREEN HEIGHT
16.675 MIN.

SCREEN HEIGHT
18.438 ± .125

OVERALL LENGTH
13.625 ± .188

NECK LENGTH
.68

BASE

CAVITY CAP
JEDEC
No. J1-21

13.625 ± .188

5.250 ± .250

DIMENSIONS IN INCHES

* See data for specific tube type.
FOR PICTURE TUBES UTILIZING BULB J192 C/D

SCREEN DIAGONAL
22.912 MIN.

SCREEN HEIGHT
16.875 MIN.

OVERALL LENGTH
10.438 ± .188

NECK LENGTH
18.500 ± .125

GAVITY CAP
JEDEC
No. J1-21

BASE

SCREEN WIDTH
21.438 MIN.

NECK LENGTH
16.875 MIN.

2.000 ± .125

RADIO CORPORATION OF AMERICA

Electronic Components and Devices
Harrison, N. J.

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

SCREEN DIAGONAL
\[ 19 \frac{1}{8} \text{ MIN.} \]

SCREEN HEIGHT
\[ 13 \frac{11}{16} \text{ MIN.} \]

SCREEN WIDTH
\[ 18 \frac{1}{8} \text{ MIN.} \]

ULTOR LIP-TERMINAL

METAL SHELL

33 R.

66°

19\[\frac{33}{32}\] ± \[\frac{1}{8}\]

7 ± \[\frac{1}{16}\]

RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.
Bulb MJ166 A

OVERALL LENGTH*

NECK LENGTH*

BASE

OVERALL LENGTH*

NECK LENGTH*

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC NO.6-110

92CL - 11590

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
25 1/8 MIN.

SCREEN WIDTH
23 7/16 MIN.

SCREEN HEIGHT
16 1/8 MIN.

ULTOR LIP - TERMINAL

METAL SHELL

RADIO CORPORATION OF AMERICA
Electron Tube Division  Harrison, N. J.
BULB MJ214 A

OVERALL LENGTH

NECK LENGTH

BASE

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
REFERENCE-LINE GAUGE
JETEC No. 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 NO. 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

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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-9145RI

9-58.
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-9145R1
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**

**DATA**

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

**Direct Interelectrode Capacitances (Approx.):**
- Grid No.1 to all other electrodes: 6.5 μf
- Deflecting electrode DJ1 to deflecting electrode DJ2: 1.7 μf
- Deflecting electrode DJ3 to deflecting electrode DJ4: 0.6 μf
- DJ1 to all other electrodes: 5 μf
- DJ2 to all other electrodes: 5 μf
- DJ3 to all other electrodes: 3.8 μf
- DJ4 to all other electrodes: 3.8 μf

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

**Focusing Method:** Electrostatic
**Deflection Method:** Electrostatic
- **Maximum Overall Length:** 4-1/16" + 1/16"
- **Maximum Diameter:** 1-1/4" ± 1/16"
- **Minimum Useful Screen Diameter:** 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 Designation:**
- Pin 1 - Heater
- Pin 2 - Heater
- Pin 3 - Grid No.1
- Pin 4 - Cathode
- Pin 5 - Grid No.3
- Pin 6 - Deflecting Electrode DJ4
- Pin 7 - Deflecting Electrode DJ3
- Pin 8 - Ultor (Grid No.2, Grid No.4, Collector)
- Pin 9 - Deflecting Electrode DJ2
- Pin 10 - Deflecting Electrode DJ1
- Pin 11 - Internal Connection—Do Not Use

DJ1 and DJ4 are nearer the screen
DJ3 and DJ4 are nearer the base
With DJ2 positive with respect to DJ1, the spot is deflected toward the midpoint between pins 6 and 7. With DJ3 positive with respect to DJ4, the spot is deflected toward the midpoint between pins 9 and 10.

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

Maximum Ratings, Design-Center Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR VOLTAGE</td>
<td>1500 max. volts</td>
</tr>
<tr>
<td>GRID-No.3 VOLTAGE</td>
<td>1200 max. volts</td>
</tr>
<tr>
<td>GRID-No.1 VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max. volts</td>
</tr>
<tr>
<td>PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFLECTING ELECTRODE</td>
<td>600 max. volts</td>
</tr>
<tr>
<td>PEAK HEATER-CATHODE VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode.</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode.</td>
<td>125 max. volts</td>
</tr>
</tbody>
</table>

Equipment Design Ranges:

For any ultor voltage ($E_{Cu}$) between recommended minimum* and 250 volts

<table>
<thead>
<tr>
<th>Component</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.3 Voltage for Focus</td>
<td>10% to 30% of $E_{Cu}$</td>
</tr>
<tr>
<td>Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot</td>
<td>-1.4% to -4.2% of $E_{Cu}$</td>
</tr>
<tr>
<td>Grid-No.3 Current for Any Operating Condition</td>
<td>-15 to +16</td>
</tr>
</tbody>
</table>

Deflection Factors:

<table>
<thead>
<tr>
<th>Factor</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>DJ1 &amp; DJ2</td>
<td>210 to 310 v dc/in./kv of $E_{Cu}$</td>
</tr>
<tr>
<td>DJ3 &amp; DJ4</td>
<td>240 to 350 v dc/in./kv of $E_{Cu}$</td>
</tr>
</tbody>
</table>

Examples of Use of Design Ranges:

For ultor voltage of 500 to 1000 volts

<table>
<thead>
<tr>
<th>Component</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.3 Voltage for Focus</td>
<td>50 to 150 100 to 300 volts</td>
</tr>
</tbody>
</table>

* Brilliance and definition decrease with decreasing ultor voltage. Recommended minimum for the IEPI 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.
OSCILLOGRAPH TUBE

For ultimate voltage of 500 to 1000 volts:

Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot: -7 to -21 volts

Deflection Factors:
DJ1 & DJ2: 105 to 155 volts per 210 to 310 volts dc/in.
DJ3 & DJ4: 120 to 175 volts per 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 a 2.5-mm radius concentric with the center of the tube face.

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

1\(\frac{1}{16}\)" MIN.
SCREEN DIA.

1\(\frac{1}{4}\)" ± 1\(\frac{1}{16}\)"

3\(\frac{3}{8}\)"
± 1/8"

4\(\frac{1}{16}\)" MAX.

TENTATIVE DATA 2

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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 T21FOB
F1: 1-ampere fuse

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

$E_g = 6.3 \text{ VOLTS}$

GRID-Nº 3 VOLTS ADJUSTED FOR FOCUS

<table>
<thead>
<tr>
<th>CURVE</th>
<th>ULTOR VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1000</td>
</tr>
<tr>
<td>B</td>
<td>1000</td>
</tr>
<tr>
<td>C</td>
<td>500</td>
</tr>
<tr>
<td>D</td>
<td>500</td>
</tr>
</tbody>
</table>

---

RELATIVE LINE BRIGHTNESS

ULTOR MICROAMPERES

RELATIVE LINE BRIGHTNESS—PER CENT OF MAXIMUM

ULTOR MICROAMPERES

GRID-Nº1 VOLTS

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
MAXIMUM ULTOR-CURRENT REQUIREMENTS
FROM POWER SUPPLY

$E_C = 6.3$ VOLTS
GRID-N°3 VOLTS ADJUSTED FOR FOCUS

MAX. ULTOR CURRENT FOR ANY TUBE AT ZERO GRID-N°1 VOLTAGE

ULTOR VOLTS
ULTOR MICROAMPERES

TUBE DIVISION
RAIDO CORPORATION OF AMERICA, MABERZ, NEW JERSEY

92CM-89939
The IEP2 is the same as the IEP1 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 IEP2 at an ultor voltage less than 750 volts is not recommended.

**AVERAGE CHARACTERISTICS**

\[
E_f = 6.3 \text{ VOLTS} \\
\text{GRID-NO.3 VOLTS ADJUSTED FOR SHARP FOCUS AT CENTER OF RASTER.} \\
\text{GRID-NO.1 VOLTS ADJUSTED TO GIVE INDICATED BRIGHTNESS VALUE ON A 2CM x 2CM, 25-LINE RASTER.} \\
* \text{LINE WIDTH MEASURED BETWEEN POINTS WHERE BRIGHTNESS WAS APPROX. } \frac{1}{2} \text{ THAT AT CENTER OF LINE.}
\]
AVERAGE CHARACTERISTICS

$E_f = 6.3 \text{ VOLTS}$
ULTOR VOLTS = 1000
GRID-No. 3 VOLTS ADJUSTED FOR FOCUS.
The IEP11 is the same as the IEP1 except for the following items:

**General:**
- Phosphor (For Curves, see front of this Section)
- Fluorescence
- Phosphorescence
- Persistence

In general, operation of the IEP11 at an Ultra voltage less than 750 volts is not recommended.

**AVERAGE CHARACTERISTICS**

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

Grid - N x 3 Volts Adjusted for Focus.
Ultor Volts = 1000
Eg = 6.3 Volts
HIGH-VACUUM CATHODE-RAY TUBE
Supersedes Type 2AP1

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

Direct Interelectrode Capacitances (Approx.):
- Grid No.1 to All Other Electrodes: 8.0 μf
- Cathode to All Other Electrodes: 5.5 μf
- DJ1 to DJ2: 0.6 μf
- DJ3 to DJ4: 1.1 μf
- DJ1 to All Other Electrodes: 8.5 μf
- DJ3 to All Other Electrodes: 9.0 μf
- DJ1 to All Other Electrodes except DJ2: 8.0 μf
- DJ2 to All Other Electrodes except DJ1: 4.6 μf
- DJ3 to All Other Electrodes except DJ4: 7.5 μf
- DJ4 to All Other Electrodes except DJ3: 6.0 μf

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

Focus 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 DJ1
Pin 4—Anode No.1
Pin 5—No Connection
Pin 6—Deflecting Electrode DJ3
Pin 7—Anode No.2, Grid No.2
Pin 8—Deflecting Electrode DJ2
Pin 9—Deflecting Electrode DJ3
Pin 10—Grid No.1
Pin 11—Heater

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

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

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

The angle between the trace produced by DJ3 and DJ4 and the trace produced by DJ1 and DJ2 is 90° ± 4°.
HIGH-VACUUM CATHODE-RAY TUBE

Maximum Ratings, Absolute Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANODE—No. 2 &amp; GRID—No. 2</td>
<td>1100 max. volts</td>
</tr>
<tr>
<td>ANODE—No. 1 Voltage</td>
<td>550 max. volts</td>
</tr>
<tr>
<td>GRID—No. 1 (CONTROL ELECTRODE)</td>
<td></td>
</tr>
<tr>
<td>VOLTAGE</td>
<td></td>
</tr>
<tr>
<td>Negative Value</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>Positive Value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>PEAK VOLTAGE BETWEEN ANODE NO.2 AND ANY DEFLECTING ELECTRODE</td>
<td>660 max. volts</td>
</tr>
<tr>
<td>PEAK HEATER-CATHODE VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>10 max. volts</td>
</tr>
</tbody>
</table>

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 +10 125 250 volts

Deflection Sensitivity:

- DJ1 and DJ2 0.220 0.110 mm/v dc
- DJ3 and DJ4 0.260 0.130 mm/v dc

Deflection Factor:**

- DJ1 and DJ2 115 220 v dc/in.
- DJ3 and DJ4 98 196 v dc/in.

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

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

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

> See curve for average values.

Spot Position:

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

Maximum Circuit Values:

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

![Diagram of a typical oscillograph circuit](image)

- **C1**: 0.1 μF
- **C2**: 0.05 μF Blocking Capacitor
- **R1, R2**: 0.5 Megohm
- **R3**: 3.0 Megohms
- **C3, C4, C5, C6**: 0.05-μF Blocking Capacitor
- **R4**: 1.0-Megohm Potentiometer
- **R5**: 0.5 Megohm
- **R6**: 0.5-Megohm Potentiometer
- **R7, R8**: Dual 5-Megohm Potentiometer
- **R9**: 0.5 Megohm
- **R10**: Dual 5-Megohm Potentiometer
- **R11, R12, R13, R14**: 2 Megohms

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

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

**JULY 1, 1945**

**RCA VICTOR DIVISION**

**RADIO CORPORATION OF AMERICA, MARIEN, NEW JERSEY**
Screen radius: 7/8" min. 

Small shell magnal 11-pin base

© of bulb will not deviate more than 2° in any direction from perpendicular erected at center of bottom of base.
Heater, for Unipotential Cathode:
Voltage: 6.3 ac or dc volts
Current: 0.6 amp

Direct Interelectrode Capacitances (Approx.):
Grid No. 1 to All Other Electrodes: 8 µf
DJ₁ to DJ₂: 2 µf
DJ₃ to DJ₄: 2 µf
DJ₅ to All Other Electrodes: 11 µf
DJ₂ to All Other Electrodes: 8 µf
DJ₃ to All Other Electrodes: 7 µf
DJ₄ to All Other Electrodes: 8 µf

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 DJ₁
Pin 7 - Deflecting Electrode DJ₂
Pin 8 - Anode No. 2, Grid No. 2
Pin 9 - Deflecting Electrode DJ₂
Pin 10 - Deflecting Electrode DJ₁
Pin 11 - Internal Connection—Do Not Use
Pin 12 - Heater

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

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° ± 30°.

Indicates a change.
Maximum Ratings, Design-Center Values:

ANODE-No. 2 VOLTAGE. ........................................ 2500 max. volts
ANODE-No. 1 VOLTAGE ............................................ 1000 max. volts
GRID-No. 1 VOLTAGE:
  Negative bias value. ........................................... 200 max. volts
  Positive bias value. ........................................... 0 max. volts
  Positive peak value. ........................................... 2 max. volts
PEAK VOLTAGE BETWEEN ANODE No. 2 AND
ANY DEFLECTING ELECTRODE. .................................. 500 max. volts
PEAK HEATER-CATHODE VOLTAGE:
  Heater negative with respect to cathode. .................. 125 max. volts
  Heater positive with respect to cathode. .................. 125 max. volts

Equipment Design Ranges:
For any anode-No. 2 voltage (E_b2) between 500 and 2500 volts
Anode-No. 1 Voltage .............................................. 15% to 28% of E_b2
Max. Grid-No. 1 Voltage for Visual Cutoff. .................. 6.75% of E_b2
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. .................................................. a

Examples of Use of Design Ranges:
For anode-No. 2 voltage of 2000 volts
Anode-No. 1 Voltage .............................................. 150 - 280
Max. Grid-No. 1 Voltage for Visual Cutoff. .................. -67.5 -135
Deflection Factors:
DJ1 & DJ2. .................................................. 115 - 155
DJ3 & DJ4. .................................................. 74 - 100

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.

SEPT. 1, 1950 TUBE DEPARTMENT DATA
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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.

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

9269-6689
E_f = 6.3 VOLTS
ANODE-Nº1 VOLTS ADJUSTED FOR FOCUS

MAX. ANODE-Nº 2 CURRENT FOR ANY TUBE AT ZERO GRID-Nº 1 VOLTAGE

AUGUST 14, 1950
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
E = 6.3 VOLTS
ANODE - N° 2 VOLTS = 1000
ANODE - N° 1 VOLTS ADJUSTED FOR FOCUS
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.
General:

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

Direct Interelectrode Capacitances:
Grid No.1 to All Other Electrodes: 7 μf
Pattern Electrode to Grid No.4: 5 μf

Pattern:
Type: See Illustration on next page
Dimensions (Approx.): 2-5/16" x 3-1/16"
Calibration: Up to 500 lines
Focusing Method: Electrostatic
Deflection Method: Magnetic
Maximum Solid Deflection Angle: 40°
Overall Length: 12-7/16" + 1/4" - 7/16"
Greatest Diameter of Bulb: 5-1/16" max.
Caps (Two): Recessed Small Ball
Mounting Position: Any
Base: Long-Shell Medium 6-Pin

Basing Designation for BOTTOM VIEW: 6BV
Pin 1-Heater
Pin 2-Grid No.2
Pin 3-Grid No.3
Pin 4-Grid No.1
Pin 5-Cathode

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 at Focus: 0.5 μamp Grid-No.4 Current: 300 approx. volts
Grid-No.2 Voltage: 1000 volts
Grid-No.1 Voltage for Visual Cutoff: -50 approx. volts
Internal Resistance between Grid No.4 and Pattern Electrode: Greater than 1 meg.

Grid-No.4 Current: 0.5 μamp

JUNE 20, 1946
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 + 80% and - 80% of this value.

With full scanning.

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

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

NOTE 6: BB' INDICATES PLANE THROUGH TUBE AXIS AND GRID-NO.4 TERMINAL.
3API-A
OSCILLOGRAPHS TUBE

GENERAL DATA
except for those on the phosphor as indicated below.

MAXIMUM RATINGS, TYPICAL OPERATION, OUTLINE,

and

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

for the 3API-A

are the same as those for Type 908-A.

Phosphor (For Curves, see front of this Section)........ No.1
Fluorescence...........................................Green
Persistence.............................................Medium
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 \( \mu \text{f} \)
- Cathode to all other electrodes .... 4.3 \( \mu \text{f} \)
- Deflecting electrode DJ\(_1\) to deflecting electrode DJ\(_2\) .... 5.2 \( \mu \text{f} \)
- Deflecting electrode DJ\(_3\) to deflecting electrode DJ\(_4\) .... 7 \( \mu \text{f} \)
- DJ\(_1\) to all other electrodes .... 10.1 \( \mu \text{f} \)
- DJ\(_2\) to all other electrodes .... 7.5 \( \mu \text{f} \)
- DJ\(_3\) to all other electrodes .... 8.1 \( \mu \text{f} \)
- DJ\(_4\) to all other electrodes .... 9.2 \( \mu \text{f} \)

**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

---

**Diagram:**

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

**Note:**
- DJ\(_1\) and DJ\(_3\) are nearer the screen
- DJ\(_3\) and DJ\(_4\) are nearer the base
Maximum and Minimum Ratings, Design-Center Values:

ULTOR VOLTAGE: \[ 2750 \text{ max. volts} \]
ULTOR INPUT (AVERAGE): \[ 500 \text{ min. volts} \]
GRID-No.3 VOLTAGE: \[ 1100 \text{ max. volts} \]

GRID-No.1 VOLTAGE:
- Negative-bias value: \[ 200 \text{ max. volts} \]
- Positive-bias value: \[ 0 \text{ max. volts} \]
- Positive-peak value: \[ 2 \text{ max. volts} \]

PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFLECTING ELECTRODE: \[ 550 \text{ max. volts} \]

Equipment Design Ranges:

For any ultor voltage \( (E_{c4}) \) between 500 and 1750 volts:

Grid-No.3 Voltage
- for focus: \[ 16.5\% \text{ to } 31\% \text{ of } E_{c4} \] volts

Negative Grid-No.1 Voltage for visual extinction of undeflected spot: \[ 2.8\% \text{ to } 6.7\% \text{ of } E_{c4} \] volts

Grid-No.3 Current for any operating condition: \[ -15 \text{ to } +10 \] mA

Deflection Factors:
- \( DJ_1 \) & \( DJ_2 \): \[ 73 \text{ to } 99 \text{ v dc/in./kv of } E_{c4} \]
- \( DJ_3 \) & \( DJ_4 \): \[ 26 \text{ to } 35 \text{ v dc/in./kv of } E_{c4} \]
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 .... \mu f
Cathode to All Other Electrodes ........... 8.0 .... \mu f
DJ1 to DJ2 ............. 2.0 .... \mu f
DJ3 to DJ4 ............. 2.0 .... \mu f
DJ1 to All Other Electrodes ........... 8.0 .... \mu f
DJ3 to All Other Electrodes ........... 6.0 .... \mu f
DJ1 to All Other Electrodes except DJ2 ... 6.0 .... \mu f
DJ2 to All Other Electrodes except DJ1 ... 5.0 .... \mu f
DJ3 to All Other Electrodes except DJ4 ... 4.0 .... \mu f
DJ4 to All Other Electrodes except DJ3 ... 6.0 .... \mu f

Phosphor (For Curves, see front of this Section) ........ No. 1
Fluorescence ........ Green
Persistence ........ Medium
Focusing Method ........ Electrostatic
Deflection Method ........ Electrostatic
Overall Length ........ 10" ± 1/4"
Greatest Diameter of Bulb ........ 3" ± 1/16"
Minimum Useful Screen Diameter ........ 2-3/4"
Mounting Position ........ Any
Base ........ Medium Shell Diheptal 12-Pin
Basing Designation for BOTTOM VIEW ........ 14C

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid No. 1
Pin 4 - Internal Con.
Pin 5 - Anode No. 1
Pin 7 - Deflecting Electrode DJ3
Pin 8 - Deflecting Electrode DJ4
Pin 9 - Anode No. 2
Pin 10 - Deflecting Electrode DJ2
Pin 11 - Deflecting Electrode DJ1
Pin 12 - No Conn.
Pin 14 - Heater

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

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

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

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

Maximum Ratings, Absolute Values:

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

JULY 1, 1945
RCA VICTOR DIVISION
BROADCAST CORPORATION OF AMERICA, HARRISON, NEW JERSEY
### HIGH-VACUUM CATHODE-RAY TUBE

(continued from preceding page)

<table>
<thead>
<tr>
<th>GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative Value:</td>
</tr>
<tr>
<td>Positive Value:</td>
</tr>
</tbody>
</table>

**PEAK VOLTAGE BETWEEN ANODE NO.2 AND ANY DEFLECTING ELECTRODE**: 550 max. volts

**PEAK HEATER-CATHODE VOLTAGE**: 125 max. volts

**HEATER CATHODE VOLTAGE**:
- Heater negative with respect to cathode: 10 max. volts
- Heater positive with respect to cathode: 200 max. volts

### Typical Operation:

**Anode-No.2 & Grid-No.2 Voltage**: 1500 2000 ... volts

**Anode No.1 Voltage for Focus at 75% of Grid-No.1 Voltage for Cutoff**: 430 575 ... volts

**Grid-No.1 Volt. for Visual Cutoff**: -45 -60 ... volts

**Max. Anode-No.1 Current Range Between -50 and +10 µamp.**

**Deflection Sensitivity:**
- DJ1 and DJ2: 0.169 0.127 mm/v dc
- DJ3 and DJ4: 0.229 0.172 mm/v dc

**Deflection Factor:**
- DJ1 and DJ2: 150 200 v dc/in.
- DJ3 and DJ4: 111 148 v dc/in.

- Brilliance and definition decrease with decreasing anode-No.2 voltage.
- Individual tubes may require between +20% and -30% of the values shown with grid-No.1 voltages between zero and cutoff.

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

**See curve for average values.**

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

### Spot Position:

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

### Maximum Circuit Values:

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

**Impedance of Any Deflecting-Electrode Circuit at Heater-Supply Frequency**: 1.0 max. megohms

**Resistance in Any Deflecting-Electrode Circuit**: 5.0 max. megohms

**It is recommended that all deflecting-electrode-circuit resistances be approximately equal.**
HIGH-VACUUM CATHODE-RAY TUBE

TYPICAL OSCILLOGRAPH CIRCUIT

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 directly to amplifier output. In this service, it is preferable usually to remove deflecting-electrode resistors to minimize loading effect on amplifier. In order to minimize spot defocusing, it is essential that anode No. 2 be returned to a point in the amplifier system which will give the lowest possible potential difference between anode No. 2 and the deflecting electrodes.

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

JULY 1, 1945

DATA 2
HIGH-VACUUM CATHODE-RAY TUBE

MEDIUM SHELL DIHEPTAL 12-PIN BASE

$\%$ OF BULB WILL NOT DEViate MORE THAN $2^\circ$
IN ANY DIRECTION FROM PERPENDICULAR
ERECTED AT CENTER OF BOTTOM OF BASE

JULY 1, 1945
RCA VICTOR DIVISION
DATA 2

BENDO CORPORATION OF AMERICA, MASONIC, NEW JERSEY
$E_F = 6.3$ Volts

Anode No. 1 Volts Adjusted to Give Focus

<table>
<thead>
<tr>
<th>CURVE</th>
<th>ELECTRODE CURRENT</th>
<th>ANODE No. 2 &amp; GRID No. 2 VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ANODE No. 1</td>
<td>2000</td>
</tr>
<tr>
<td>B</td>
<td>ANODE No. 1</td>
<td>1500</td>
</tr>
<tr>
<td>C</td>
<td>ANODE No. 2 &amp; GRID No. 2</td>
<td>2000</td>
</tr>
<tr>
<td>D</td>
<td>ANODE No. 2 &amp; GRID No. 2</td>
<td>1500</td>
</tr>
</tbody>
</table>

Grid No. 1 Volts

Grid No. 2 & Grid No. 2 Microamperes

Grid No. 1 Volts

Andre No. 2 & Grid No. 2 Microamperes

Apr. 16, 1945

RCA Victor Division
Radio Corporation of America, Harrison, New Jersey

92CM-6412R1
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 f
  Cathode to All Other Electrodes. ....... 8 \mu f
  DJ1 to DJ2 ......... 2.5 \mu f
  DJ3 to DJ4 ......... 2 \mu f
  DJ1 to All Other Electrodes. .......... 8 \mu f
  DJ2 to All Other Electrodes .......... 7 \mu f
  DJ3 to All Other Electrodes .......... 7 \mu f
  DJ4 to All Other Electrodes .......... 8 \mu f

Phosphor (For Curves, see front of this Section). .... P1
  Fluorescence and Phosphorescence .... Green
  Persistence of Phosphorescence ....... Medium

Focusing Method. .... Electrostatic
Deflection Method. .... Electrostatic
Overall Length .... 10" \pm 1/4"
Greatest Diameter of Bulb. .... 3" \pm 1/16"
Minimum Useful Screen Diameter .... 2-3/4"
Mounting Position. .... Any
  Cap. .... Recessed Small Ball (JETEC No.J1-22)
Base .... Medium-Shell Diheptal 12-Pin (JETEC No.B12-37)
Basing Designation for BOTTOM VIEW .... 14J1

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid No.1
Pin 4 - Internal Connection-Do Not Use
Pin 5 - Anode No.1
Pin 7 - Deflecting Electrode DJ3
Pin 8 - Deflecting Electrode DJ4
Pin 9 - Anode No.2, Grid No.2
Pin 10 - Deflecting Electrode DJ2
Pin 11 - Deflecting Electrode DJ1
Pin 12 - No Connection
Pin 14 - Heater Cap - Anode No.3

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

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

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

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

AUG. 1, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Maximum Ratings, Design-Center Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Maximum Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ANODE-No.3 VOLTAGE</strong></td>
<td>4000 max. volts</td>
</tr>
<tr>
<td><strong>ANODE-No.2 VOLTAGE</strong></td>
<td>2000 max. volts</td>
</tr>
<tr>
<td><strong>RATIO OF ANODE-No.3 VOLTAGE TO ANODE-No.2 VOLTAGE</strong></td>
<td>2.3 : 1 max.</td>
</tr>
<tr>
<td><strong>ANODE-No.1 VOLTAGE</strong></td>
<td>1000 max. volts</td>
</tr>
<tr>
<td><strong>GRID-No.1 VOLTAGE:</strong></td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max. volts</td>
</tr>
<tr>
<td><strong>PEAK VOLTAGE BETWEEN ANODE No.2 AND ANY DEFLECTING ELECTRODE</strong></td>
<td>500 max. volts</td>
</tr>
<tr>
<td><strong>PEAK HEATER-CATHODE VOLTAGE:</strong></td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>125 max. volts</td>
</tr>
</tbody>
</table>

Equipment Design Ranges:

For any anode-No.3 voltage (Eb3) between 2000 and 4000 volts and any anode-No.2 voltage (Eb2) between 1500 and 2000 volts

**Anode-No.1 Voltage:** 20% to 34.5% of Eb2 volts

**Grid-No.1 Voltage:** 1.5% to 4.5% of Eb2 volts

**Anode-No.1 Current for any Operating Condition:** -50 to +10 µamp

Deflection Factors:

\[
\text{When } Eb_3 = 2 \times Eb_2
\]

<table>
<thead>
<tr>
<th>Electrode</th>
<th>Voltage Range</th>
<th>dc/in./kv of Eb2</th>
</tr>
</thead>
<tbody>
<tr>
<td>DJ1 &amp; DJ2</td>
<td>85 to 115</td>
<td></td>
</tr>
<tr>
<td>DJ3 &amp; DJ4</td>
<td>62.5 to 85</td>
<td></td>
</tr>
</tbody>
</table>

\[
\text{When } Eb_3 = Eb_2
\]

<table>
<thead>
<tr>
<th>Electrode</th>
<th>Voltage Range</th>
<th>dc/in./kv of Eb2</th>
</tr>
</thead>
<tbody>
<tr>
<td>DJ1 &amp; DJ2</td>
<td>68 to 92</td>
<td></td>
</tr>
<tr>
<td>DJ3 &amp; DJ4</td>
<td>50 to 68</td>
<td></td>
</tr>
</tbody>
</table>

**Spot Position:**

- Anode No.2 and grid No.2, which are connected together within tube, and referred to herein as anode No.2.
- At or near this rating, the effective resistance of the anode supply should be adequate to limit the anode-No.2 input power to 6 watts.
- It is recommended that anode-No.3 voltage be not less than 3000 volts for high-speed transients.

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

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

See next page.
Examples of Use of Design Ranges:

For anode-No. 3

<table>
<thead>
<tr>
<th>Voltage of</th>
<th>2000</th>
<th>3000</th>
<th>4000</th>
</tr>
</thead>
</table>

and anode-No. 2

<table>
<thead>
<tr>
<th>Voltage of</th>
<th>2000</th>
<th>1500</th>
<th>2000</th>
</tr>
</thead>
</table>

Anode-No.1 Volt. 400 to 690 300 to 515 400 to 690 volts
Grid-No.1 Volt. 25 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.
SCREEN RADIUS
1 3/8" MIN.

1 3/8" + 1/8"

ANODE NO. 3
RECESSED
SMALL BALL
CAP

12 7/16" R.

8" R.

2" ± 1/16"

3 7/8"

10"

9 7/16"

± 1/8"

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

92CM-6583

AUG. 1, 1951
TUBE DEPARTMENT
BIBCO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
CE-6583
### Average Characteristics

**Eₚ = 6.3 Volts**

Anode-№ 1 Volts Adjusted to Give Focus

<table>
<thead>
<tr>
<th>Curve</th>
<th>Electrode Current</th>
<th>Anode-№2 Volts</th>
<th>Anode-№3 Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Anode №1</td>
<td>2000</td>
<td>4000</td>
</tr>
<tr>
<td>B</td>
<td>Anode №1</td>
<td>1500</td>
<td>3000</td>
</tr>
<tr>
<td>C</td>
<td>Anode №2</td>
<td>2000</td>
<td>4000</td>
</tr>
<tr>
<td>D</td>
<td>Anode №2</td>
<td>1500</td>
<td>3000</td>
</tr>
<tr>
<td>E</td>
<td>Anode №3</td>
<td>2000</td>
<td>4000</td>
</tr>
<tr>
<td>F</td>
<td>Anode №3</td>
<td>1500</td>
<td>3000</td>
</tr>
</tbody>
</table>

![Graph showing grid voltage and anode current characteristics](image)
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 DJ1 and DJ2.

**THE SPECTRAL-ENERGY EMISSION CHARACTERISTIC, BUILDUP CHARACTERISTICS, and PERSISTENCE CHARACTERISTICS of the P7 Phosphor are shown at the front of this Section.**
3KPI
OSCILOGRAPH TUBE

ELECTROSTATIC FOCUS

ELECTROSTATIC DEFLECTION

DATA

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

Direct Interelectrode Capacitances (Approx.):
Grid No. 1 to all other electrodes .......... 8 μf
Deflecting electrode DJ1 to
deflecting electrode DJ2 .......... 2.5 μf
Deflecting electrode DJ3 to
deflecting electrode DJ4 .......... 2.5 μf
DJ1 to all other electrodes ....... 11 μf
DJ2 to all other electrodes ....... 8 μf
DJ3 to all other electrodes ....... 7 μf
DJ4 to all other electrodes ....... 8 μf

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

Focusing Method .......... Electrostatic
Deflection Method .......... Electrostatic
Overall Length .......... 11-1/2" ± 1/4"
Greatest Diameter of Bulb .......... 3" ± 1/16"
Minimum Useful Screen Diameter .......... 2-3/4"

Weight (Approx.) .......... 9 oz
Mounting Position .......... Any
Gulb .......... Medium-Shell Magnal

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

Basing Designation for BOTTOM VIEW .......... 1.1M

Pin 1 - Heater
Pin 2 - Grid No. 1
Pin 3 - Cathode
Pin 4 - Grid No. 3
Pin 5 - Deflecting Electrode DJ3
Pin 6 - Deflecting Electrode DJ4
Pin 7 - Ultor (Grid No. 2, Grid No. 4, Collector)
Pin 8 - Deflecting Electrode DJ2
Pin 9 - Deflecting Electrode DJ4
Pin 10 - Internal Connection-Do Not Use
Pin 11 - Heater

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

Indicates a change.
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 1 may vary from the trace produced by DJ3 and DJ4 by ±10° (measured about the tube axis).

The angle between DJ1 - DJ2 trace and DJ3 - DJ4 trace is 90° ±10°.

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ULTOR VOLTAGE</strong></td>
<td>2500 max. volts</td>
</tr>
<tr>
<td><strong>ULTOR INPUT (AVERAGE)</strong></td>
<td>6 max. watts</td>
</tr>
<tr>
<td><strong>GRID-No.3 VOLTAGE</strong></td>
<td>1000 max. volts</td>
</tr>
<tr>
<td><strong>GRID-No.1 VOLTAGE:</strong></td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max. volts</td>
</tr>
<tr>
<td><strong>PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFLECTING ELECTRODE.</strong></td>
<td>500 max. volts</td>
</tr>
<tr>
<td><strong>PEAKHEATER-CATHODE VOLTAGE:</strong></td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>125 max. volts</td>
</tr>
</tbody>
</table>

**Equipment Design Ranges:**

For any ultor voltage \( (E_{d4}) \) between recommended minimum and 2500 volts

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.3 Voltage for Focus</td>
<td>16% to 30% of ( E_{d4} ) volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot</td>
<td>1.9% to 4.5% of ( E_{d4} ) volts</td>
</tr>
<tr>
<td>Grid-No.3 Current for Any Operating Condition</td>
<td>-15 to +10 μamp</td>
</tr>
</tbody>
</table>

**Deflection Factors:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DJ1 &amp; DJ2</td>
<td>50 to 68 v dc/in./kv of ( E_{d4} )</td>
</tr>
<tr>
<td>DJ3 &amp; DJ4</td>
<td>38 to 52 v dc/in./kv of ( E_{d4} )</td>
</tr>
</tbody>
</table>

**Examples of Use of Design Ranges:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.3 Voltage for Focus</td>
<td>160 to 300 320 to 600 volts</td>
</tr>
</tbody>
</table>

- Brilliance and definition decrease with decreasing ultor voltage. Recommended minimum for the 3KPI 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.
### OSCILLOGRAPH TUBE

**For voltage of**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>-19 to -45</td>
<td>50 to 68</td>
<td>38 to 52</td>
<td>1.5 max. megohms</td>
<td>5 max. megohms</td>
</tr>
<tr>
<td>2000</td>
<td>-30 to -90</td>
<td>100 to 136</td>
<td>76 to 104</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

---

**Dimensions:**

- **Screen Dia.**: 3" ± 1/16" to 2 3/4" min.
- **5" Max.**
- **1 1/2" ± 1/8" L 1/8 R.**
- **8" R.**
- **1 15/6" ± 1/16"**

**MEDIUM-SHELL MAGNAL 11-PIN BASE JETEC NO. BI-66 92CM-6599RI**

- **92CM-6599RI**

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

---

**4-56 DATA 2**

### Notes:

- Indicates a change.

**TUBE DIVISION**

**RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY**
TYPICAL OSCILLOGRAPH CIRCUIT

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.

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.
E_r = 6.3 VOLTS
GRID-N°3 VOLTS ADJUSTED FOR FOCUS
GRID-N°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.
MAXIMUM ULTOR-CURRENT REQUIREMENTS FROM POWER SUPPLY

$E_f = 6.3 \text{ VOLTS}$
$\text{GRID-N}^2 \text{ VOLTS ADJUSTED FOR FOCUS}$

MAX. ULTOR CURRENT FOR ANY TUBE AT ZERO GRID-N\text{1} VOLTAGE

RECOMMENDED MAX. ULTOR CURRENT

ULTOR MILLIAMPERES

ULTOR VOLTS

TUBE DIVISION

SABO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7192R1
AVERAGE CHARACTERISTIC

$E_F = 6.3$ VOLTS
GRID-No. 3 VOLTS ADJUSTED TO FOCUS
ULTOR VOLTS = 2000
### 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.*

**DATA**

11-58

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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 ultraviolet voltage less than 1500 volts is not recommended.
The 3RPI is the same as the 3RP1-A except for the following items:

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

**Dimensions:**
- Screen Dia.: 2 3/4 in. MIN.
- 0.350 in.
- 11/16 in.
- 4 1/16 in. MAX.
- 1 2/3 in. ± 1/8 in.
- 9 1/8 in. ± 1/4 in.

**Connectors:**
- Small-SHELL DUODECAL 10-PIN BASE JETEC No. B10-75 or
- Small-SHELL DUODECAL 12-PIN BASE JETEC No. B12-43

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

**Date:**
Sept. 1, 1955

**Company:**
Radio Corporation of America, Harrison, New Jersey
The 3RP4 is the same as the 3RP3 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 ultraviolet voltage less than 1500 volts is not recommended.
### General:

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

### Direct Interelectrode Capacitances (Approx.):

<table>
<thead>
<tr>
<th>Electrode 1</th>
<th>Electrode 2</th>
<th>Capacitance (μF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid No.1</td>
<td>all other electrodes</td>
<td>8</td>
</tr>
<tr>
<td>Deflecting electrode DJ1 to</td>
<td>Deflecting electrode DJ2</td>
<td>2</td>
</tr>
<tr>
<td>Deflecting electrode DJ3 to</td>
<td>Deflecting electrode DJ4</td>
<td>2</td>
</tr>
<tr>
<td>DJ1 to all other electrodes</td>
<td>all other electrodes</td>
<td>11</td>
</tr>
<tr>
<td>DJ2 to all other electrodes</td>
<td>all other electrodes</td>
<td>8</td>
</tr>
<tr>
<td>DJ3 to all other electrodes</td>
<td>all other electrodes</td>
<td>7</td>
</tr>
<tr>
<td>DJ4 to all other electrodes</td>
<td>all other electrodes</td>
<td>8</td>
</tr>
</tbody>
</table>

### Faceplate
- Flat Clear Glass

### Phosphor
- 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
- 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

### Pins

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Connection</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Heater</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Grid No.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Cathode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Grid No.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Internal Connection-</td>
<td>Do Not Use</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Deflecting Electrode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Deflecting Electrode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Ultor</td>
<td></td>
<td>(Grid No.2, Grid No.4, Collector)</td>
</tr>
<tr>
<td>9</td>
<td>Deflecting Electrode</td>
<td></td>
<td>DJ2</td>
</tr>
<tr>
<td>10</td>
<td>Deflecting Electrode</td>
<td></td>
<td>DJ1</td>
</tr>
<tr>
<td>11</td>
<td>Internal Connection-</td>
<td>Do Not Use</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Heater</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*DJ1 and DJ2 are nearer the screen.  
**DJ3 and DJ4 are nearer the base.*
With DJ₁ positive with respect to DJ₂, the spot is deflected toward pin 4. With DJ₃ positive with respect to DJ₄, the spot is deflected toward pin 1.

The plane through the tube axis and pin 1 may vary from the trace produced by DJ₃ and DJ₄ by 10° (measured about the tube axis).

The angle between DJ₁ – DJ₂ trace and DJ₃ – DJ₄ trace is 90° ± 3°.

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR° VOLTAGE</td>
<td>2500 max. volts</td>
</tr>
<tr>
<td>ULTOR INPUT (AVERAGE)</td>
<td>6 max. watts</td>
</tr>
<tr>
<td>GRID-No.3 VOLTAGE:</td>
<td>1000 max. volts</td>
</tr>
<tr>
<td>Negative bias value.</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Positive bias value.</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive peak value.</td>
<td>2 max. volts</td>
</tr>
<tr>
<td>PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFLECTING ELECTRODE</td>
<td>500 max. volts</td>
</tr>
</tbody>
</table>

**Equipment Design Ranges:**

For any ultor voltage (E₄) between 500* and 2500 volts:

- **Grid-No.3 Voltage for Focus:** 16.5% to 31% of E₄ volts
- **Maximum Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot:** -6.75% of E₄ volts
- **Grid-No.3 Current for Any Operating Condition:** -15 to +10 µamp

**Deflection Factor:**

- DJ₁ & DJ₂: 73 to 99 v dc/in./kv of E₄
- DJ₃ & DJ₄: 52 to 70 v dc/in./kv of E₄

* 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 3RPI-A, the ultor function is performed by grid No.3, since grid No.4, grid No.2, and collector are connected together within the 3RPI-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.

** Spot Position: **

- 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.

---

**Tentative Data 1**

JULY 1, 1955

3RPI-A

OSCILLOGRAPH TUBE

Radio Corporation of America, Harrison, New Jersey
**Examples of Use of Design Ranges:**

<table>
<thead>
<tr>
<th></th>
<th>1000</th>
<th>2000</th>
<th>volts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grid-No. 3 Voltage</strong> for Focus</td>
<td>165 to 310</td>
<td>330 to 620</td>
<td>volts</td>
</tr>
<tr>
<td><strong>Maximum Grid-No. 1 Voltage for Visual Extinction of Un-deflected Focused Spot</strong></td>
<td>-67.5</td>
<td>-135</td>
<td>volts</td>
</tr>
<tr>
<td><strong>Deflection Factors:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DJ1 &amp; DJ2</td>
<td>73 to 99</td>
<td>146 to 198</td>
<td>volts dc/in.</td>
</tr>
<tr>
<td>DJ3 &amp; DJ4</td>
<td>52 to 70</td>
<td>104 to 140</td>
<td>volts dc/in.</td>
</tr>
</tbody>
</table>

**Maximum Circuit Values:**

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

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

---

**Small-SHELL Duodecal 10-Pin Base**

JETEC No. B10-75

**Small-SHELL Duodecal 12-Pin Base**

JETEC No. B12-43

**Center Line of Bulb Will Not Deviate More Than 2° in Any Direction from Perpendicular Erected at Center of Bottom of Base.**

**JULY 1, 1955**

**TUBE DIVISION**

**TENTATIVE DATA 2**

**RCA CORPORATION OF AMERICA, HARRISON, NEW JERSEY**
TYPICAL OSCILLOGRAPH CIRCUIT

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

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.

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.
3RPI-A
CHARACTERISTICS

$E_x = 6.3$ VOLTS
GRID-$N_2$ VOLTS ADJUSTED FOR FOCUS

RECOMMENDED MAX. ULTOR CURRENT

MAX. ULTOR CURRENT FOR ANY TUBE AT ZERO GRID-$N_2$ VOLTAGE

CONSTANT LINE: MACH. 1500
CONSTANT LINE: MACH. 500

ULTOR VOLTS
ULTOR MILLIAMPERES
REMARKED MAX. ULTOR CURRENT

MAR. 24, 1955
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7143RI


**DATA**

**General:**

Heater, for Unipotential Cathode:

- Voltage: 6.3 \(\pm 10\%) \text{ ac or dc volts}
- Current: 0.6 \(\pm 10\%) \text{ amp}

Direct Interelectrode Capacitances:

- Grid No.1 to all other electrodes: 4.6 to 8.7 \(\mu\text{f}\)
- Cathode to all other electrodes: 3 to 5.7 \(\mu\text{f}\)
- Deflecting electrode DJ1 to deflecting electrode DJ2: 1.7 to 3.3 \(\mu\text{f}\)
- Deflecting electrode DJ3 to deflecting electrode DJ4: 1 to 2 \(\mu\text{f}\)
- DJ1 to all other electrodes: 5.5 to 10.5 \(\mu\text{f}\)
- DJ2 to all other electrodes: 5.5 to 10.5 \(\mu\text{f}\)
- DJ3 to all other electrodes: 3.5 to 6.8 \(\mu\text{f}\)
- DJ4 to all other electrodes: 3.5 to 6.8 \(\mu\text{f}\)

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" \(\pm 1/8\"

Greatest Diameter of Bulb: 3" \(\pm 1/16\"

Minimum Useful Screen Diameter: 2-3/4"

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

- By deflecting electrodes DJ1 & DJ2: 2-1/2"
- By deflecting electrodes DJ3 & DJ4: 2-1/4"

Weight (Approx.): 1 lb

Mounting Position: Any

Bulb: J24R

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

Basing Designation for BOTTOM VIEW: 12T

**Pin 1** - Heater

**Pin 2** - Grid No.1

**Pin 3** - Cathode

**Pin 4** - Grid No.3

**Pin 5** - Deflecting Electrode DJ1

**Pin 6** - Deflecting Electrode DJ2

**Pin 7** - Deflecting Electrode DJ3

**Pin 8** - Ulfor

**Pin 9** - Deflecting Electrode DJ4

**Pin 10** - Deflecting Electrode DJ3

**Pin 12** - Heater
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 ($E_c$) between recommended minimum* and 2500 volts

Grid-No.3 Voltage for Focus: 16.5% to 31% of $E_c$

Grid-No.1 Voltage for Visual Extinction of Undelected Focused Spot: -3% to -5% of $E_c$

Grid-No.3 Current for Any Operating Condition: -15 to +10 \(\mu A\)

Deflection Factors:
- \(DJ_1\) & \(DJ_2\): 41.5 to 50.5 \(v \text{ dc/in.}/kv\) of $E_c$
- \(DJ_3\) & \(DJ_4\): 28.5 to 35 \(v \text{ dc/in.}/kv\) of $E_c$

Spot Position: **#**

Examples of Use of Design Ranges:

For ultor voltage of
- 1000 volts: 165 to 310, 247 to 465, 330 to 620
- 1500 volts: 165 to 310, 247 to 465, 330 to 620
- 2000 volts: 165 to 310, 247 to 465, 330 to 620

Deflection Factors:
- \(DJ_1\) & \(DJ_2\): 41.5 to 50.5, 62.3 to 75.8, 83 to 101 \(v \text{ dc/in.}\)
- \(DJ_3\) & \(DJ_4\): 28.5 to 35, 42.8 to 52.5, 57 to 70 \(v \text{ dc/in.}\)

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

OSCILLOGRAPH TUBE

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

SPECIAL PERFORMANCE DATA

For ultor voltage of 1500 volts

Line Width .......................... 0.026 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 DJ1 and DJ2. For line-width measurement, the high-frequency scanning is adjusted to give a raster width of 6.9 cm with the grid-No.3 voltage adjusted to give sharpest focus at center of tube face. Raster height is contracted until the individual scanning lines are just barely distinguishable. Line width is expressed as the quotient of the contracted raster height measured at the center line of the tube face divided by the number of scanning lines (49).

§ Under the following conditions: heater voltage of 6.3 volts, grid-No.3 voltage adjusted for focus, and grid-No.1 voltage adjusted to give visible raster. With 49-line raster centered with respect to the tube face and size adjusted to give mean dimensions of 1.875" in 10J2 direction and 1.688" in 30J4 direction, all points on the raster will lie within the area between the two rectangles also centered with respect to the tube face; the one, 1.920" in 10J2 direction by 1.730" in 30J4 direction; the other, 1.830" in 10J2 direction and 1.646" in 30J4 direction.

The deflection factor for either DJ4 and DJ5 electrodes or DJ3 and DJ6 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.
The plane through the tube axis and pin 3 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° ± 1°.

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 3; likewise, with DJ₃ positive with respect to DJ₄, the spot will be deflected toward pin 12.
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  
R1: Transformer, with 6.3-volt/1-ampere secondary, insulated for at least 3000 volts, such as Thordarson T26F65.  
R1: 1-ampere fuse

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

\[ EF = 6.3 \text{ volts} \]

**Ultror Volts**

Relative Line Brightness

*CONTOUR LINE WIDTH-500*
E_f = 6.3 VOLTS
GRID-N=3 VOLTS ADJUSTED FOR FOCUS.

ULTOR CURRENT.

-- FLUORESCENT-SCREEN CURRENT
(MEASURED ON SPECIAL LABORATORY TUBE).

ULTOR VOLTS = 2000

-80 -60 -40 -20 0
GRID-N=1 VOLTS

ULTOR MILLIAMPERES

FLUORESCENT-SCREEN MICROAMPERES

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, N. J.

92CM-9159
### 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.
**General:**

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

**Direct Interelectrode Capacitances (Approx.):**
- Grid No.1 to All Other Electrodes: 8 µf
- Cathode to All Other Electrodes: 5 µf
- DJ1 to DJ2: 2.5 µf
- DJ3 to DJ4: 1.3 µf
- DJ1 to All Other Electrodes: 9 µf
- DJ2 to All Other Electrodes: 9 µf
- DJ3 to All Other Electrodes: 5 µf
- DJ4 to All Other Electrodes: 6 µf

**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)

**Pin 1—Heater**
**Pin 2—Cathode**
**Pin 3—Grid No.1**
**Pin 4—No Connection—Do Not Use**
**Pin 5—Grid No.3**
**Pin 7—Deflecting Electrode DJ3**
**Pin 8—Deflecting Electrode DJ4**
**Pin 9—Ultor** (Grid No.2, Grid No.4)
**Pin 10—Deflecting Electrode DJ2**
**Pin 11—Deflecting Electrode DJ1**
**Pin 12—No. Conn.**
**Pin 14—Heater**
**Cap—Post-Ultor** (Grid No.5, Collector)

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

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

**Pin 9—Ultor**
**Pin 10—Deflecting Electrode DJ2**
**Pin 11—Deflecting Electrode DJ1**
**Pin 12—No. Conn.**
**Pin 14—Heater**
**Cap—Post-Ultor** (Grid No.5, Collector)
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 DJ1 - DJ2 trace and DJ3 - DJ4 trace is 90° ± 1.5°.

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

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>POST-ULTOR VOLTAGE</td>
<td>6000 max. volts</td>
</tr>
<tr>
<td>ULTOR VOLTAGE</td>
<td>2600 max. volts</td>
</tr>
<tr>
<td>RATIO OF POST-ULTOR VOLTAGE TO ULTOR VOLTAGE</td>
<td>2.3:1 max.</td>
</tr>
<tr>
<td>GRID-No.3 VOLTAGE</td>
<td>1000 max. volts</td>
</tr>
<tr>
<td>GRID-No.1 VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max. volts</td>
</tr>
<tr>
<td>PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFLECTING ELECTRODE</td>
<td>500 max. volts</td>
</tr>
<tr>
<td>PEAK HEATER-CATHODE VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode.</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode.</td>
<td>125 max. volts</td>
</tr>
</tbody>
</table>

**Equipment Design Ranges:**

For any post-ultor voltage \(E_{CE}\) between 2000 and 6000 volts and any ultor voltage \(E_{C4}\) between 1500 and 2600 volts:

Grid-No.3 Voltage for Focus: 20% to 34.5% of \(E_{C4}\) volts

Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot: 2.6% to 4.3% of \(E_{C4}\) volts

Grid-No.3 Current for Any Operating Condition: -15 to +10 μA

**Deflection Factors:**

- When \(E_{CE} = 2 \times E_{C4}\):
  - \(DJ_1 \& DJ_2\) 26.5 to 36 v dc/in./kv of \(E_{C4}\)
  - \(DJ_3 \& DJ_4\) 18 to 24 v dc/in./kv of \(E_{C4}\)

- When \(E_{CE} = E_{C4}\):
  - \(DJ_1 \& DJ_2\) 21.5 to 29 v dc/in./kv of \(E_{C4}\)
  - \(DJ_3 \& DJ_4\) 14.5 to 19.5 v dc/in./kv of \(E_{C4}\)

**Spot Position**

**Examples of Use of Design Ranges:**

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

---

JUNE 1, 1953  TENTATIVE DATA 1
Deflection Factors:

<table>
<thead>
<tr>
<th>DJ₁ &amp; DJ₂</th>
<th>DJ₃ &amp; DJ₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>43 to 58</td>
<td>29 to 39</td>
</tr>
<tr>
<td>40 to 54</td>
<td>27 to 36</td>
</tr>
<tr>
<td>53 to 72</td>
<td>36 to 48</td>
</tr>
<tr>
<td>v dc/in.</td>
<td>v dc/in.</td>
</tr>
</tbody>
</table>

Maximum Circuit Values:

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

The "post-ulator" in a cathode-ray tube is the electrode to which is applied a dc voltage higher than the ulator voltage for accelerating the electrons in the beam after its deflection. In the SAB-types, the post-deflection acceleration function and the collector function are both performed by grid No.5 which is conveniently referred to as "post-ulator".

The "ulator" 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 SAB-types, the ulator function is performed by grid No.4. Since grid No.4 and grid No.2 are connected together within the SAB-types, they are collectively referred to simply as "ulator" for convenience in presenting data and curves.

At or near this rating, the effective resistance of the ulator supply should be adequate to limit the ulator input power to 6 watts. It is recommended that the post-ulator voltage be not less than 3000 volts for high-speed scanning.

Recommended minimum value of ulator voltage.

The deflecting electrodes DJ₂ and DJ₄ are designed to have extra-high deflection sensitivity and consequently produce less than full-screen deflection. With post-deflection acceleration, the length of deflection may be limited to 1 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-ulator voltage of 3000 volts, ulator 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 ulator, and tube shielded from all extraneous fields, the center of the undeflected, focused spot will fall within a circle having a 12.5-inch 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.
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: 5 Megas (Five 10-Meg-Ohm, 1-Watt Resistors in Series)
R2, R3: 2 Megas, 0.5 Watt
R4: 5.5 Megas, 2 Watts
R5: 2-Megohm Potentiometer
R6: 1.5 Megas, 0.5 Watt
R7: 0.5-Megohm Potentiometer
R8, R9: 5-Megohm Potentiometer
R10, R11: Dual 5-Megohm Potentiometer
R12, R13, R14, R15: 2 Megas, 0.5 Watt
R16: 0.5 Megas, 0.5 Watt
R17: Not less than 2000 ohms per volt of positive signal
R18: 5 Megas, 0.5 Watt

When cathode is grounded, capacitors should have high voltage rating (2500 volts); when ultirot 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 ultirot be returned to a point in the amplifier system which will give the lowest possible potential difference between ultirot and the deflecting electrodes.

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

JUNE 1, 1953

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-6574R4
$E_f = 6.3$ Volts

GRID-N°3 Volts Adjusted for Focus

Post-Ultor (GRID N°5 & Collector) Volts

Greater than Ultor (Grids N°2 & N°4) Volts

GRID-N°1 Volts = 0

--- MAX. Total Current for Any Tube

--- Typical Fluorescent-Screen (Post-Ultor) Current

FEB. 3, 1953

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE CHARACTERISTICS

$E_f = 8.3$ VOLTS
GRID-N°3 VOLTS ADJUSTED FOR FOCUS

<table>
<thead>
<tr>
<th>CURVE</th>
<th>ELECTRODE CURRENT</th>
<th>ULTOR VOLTS</th>
<th>POST-ULTOR VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ULTOR</td>
<td>2000</td>
<td>4000</td>
</tr>
<tr>
<td>B</td>
<td>ULTOR</td>
<td>1500</td>
<td>3000</td>
</tr>
<tr>
<td>C</td>
<td>POST-ULTOR</td>
<td>2000</td>
<td>4000</td>
</tr>
<tr>
<td>D</td>
<td>POST-ULTOR</td>
<td>1500</td>
<td>3000</td>
</tr>
</tbody>
</table>

GRID-N°1 VOLTS
POST-ULTOR (GRID N°5 & COLLECTOR) MICROAMPERES
ULTOR (GRIDS N°2 & 4) MICROAMPERES

FEB.4, 1953 TUBE DEPARTMENT RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY 92CM-7911
5ABPI
OSCILLOGRAPH TUBE

POST-ULTOR
RECESSED
SMALL BALL
CAP
JETEC NO. JI-22

\( \frac{5}{4} \) \( \pm \frac{3}{32} \)"
SCREEN DIA.
\( 4 \frac{9}{16} \) MIN.

\( \frac{1}{4} \) R.
.875"

\( \frac{6}{4} \)"
\( \pm \frac{1}{4} \)

\( 27 \frac{13}{16} \) R.

\( \frac{10}{9} \frac{3}{32} \) MAX.

\( 18 \frac{3}{4} \)"
\( \pm \frac{3}{8} \)

MEDIUM-SHELL
DIHEPTAL
12-PIN
BASE
JETEC NO. B12-37

\( \frac{2}{2} \pm \frac{1}{16} \)

92CM-7842

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

JUNE 1, 1953
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
TYPICAL CHARACTERISTICS

$E_f = 6.3$ VOLTS

GRID - $-3$ VOLTS ADJUSTED FOR FOCUS

POST-ULTOR VOLTS = $2 \times$ ULTOR VOLTS

RELATIVE LINE BRIGHTNESS

ULTOR VOLTS

1500  1600  1700  1800  1900  2000
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

NOV. 1, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
## 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 µf
- Cathode to all other electrodes: 3.1 to 5.8 µf
- Deflecting electrode DJ1 to deflecting electrode DJ2: 1.7 to 3.1 µf
- Deflecting electrode DJ3 to deflecting electrode DJ4: 0.7 to 1.3 µf
- DJ1 to all other electrodes: 4.4 to 9.2 µf
- DJ2 to all other electrodes: 4.4 to 9.2 µf
- DJ3 to all other electrodes: 2.8 to 5.3 µf
- DJ4 to all other electrodes: 2.8 to 6.3 µf

### Faceplate, Flat:
- Clear Glass

### Phosphor (For Curves, see front of this Section):
- 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 Base:
- Medium-Shell Diheptal 12-Pin (JETEC No.B12-37)

### Basing Designation for BOTTOM VIEW:
- 14J

### Pin Designations:
- Pin 1 - Heater
- Pin 2 - Cathode
- Pin 3 - Grid No.1
- Pin 4 - No Connection - Do Not Use
- Pin 5 - Grid No.3
- Pin 6 - Deflecting Electrode DJ1
- Pin 7 - Deflecting Electrode DJ3
- Pin 8 - Deflecting Electrode DJ4
- Pin 9 - Utlor (Grid No.2, Grid No.4)
- Pin 10 - Deflecting Electrode DJ2
- Pin 11 - Deflecting Electrode DJ1
- Pin 12 - No Connection
- Pin 13 - Cap - Post - Utlor (Grid No.5, Collector)

---

**Tentative Data 1**
Maximum Ratings, Design-Center Values:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-Ultron Voltage</td>
<td>6000 max. volts</td>
</tr>
<tr>
<td>Ultron Voltage</td>
<td>2600 max. volts</td>
</tr>
<tr>
<td>Ratio of Post-Ultron Voltage to Ultron Voltage</td>
<td>2.3:1 max.</td>
</tr>
<tr>
<td>Grid-No.3 Voltage</td>
<td>1000 max. volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage:</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max. volts</td>
</tr>
<tr>
<td>Peak Voltage Between Ultron and Any Deflecting Electrode</td>
<td>500 max. volts</td>
</tr>
</tbody>
</table>

Equipment Design Ranges:

With any post-ultron voltage \( E_{c} \) between 2000* and 6000 volts and any ultron voltage \( E_{q} \) between 1500** and 2600 volts

Grid-No.3 Voltage for Focus: 20% to 34.5% of \( E_{c} \) volts

Grid-No.1 Voltage for Visual Extinction of Undelected Focused Spot: -2.25% to -3.75% of \( E_{c} \) volts

Grid-No.3 Current for Any Operating Condition: -15 to +10 \( \mu \text{amp} \)

Deflection Factors:

When \( E_{c} = 2 \times E_{q} \):
- \( DJ_{1} \) & \( DJ_{2} \): 26.7 to 33.3 \( \text{V dc/in./kv of } E_{c} \)
- \( DJ_{3} \) & \( DJ_{4} \): 20.3 to 25 \( \text{V dc/in./kv of } E_{c} \)

When \( E_{c} = E_{q} \):
- \( DJ_{1} \) & \( DJ_{2} \): 21.5 to 26.5 \( \text{V dc/in./kv of } E_{c} \)
- \( DJ_{3} \) & \( DJ_{4} \): 16 to 20 \( \text{V dc/in./kv of } E_{c} \)

Spot Position: **

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

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

Recommended minimum value of ultron voltage.

** With heater voltage of 6.3 volts, post-ultron voltage of 4000 volts, ultron 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 ultron, and the tube shielded from all extraneous fields, the center of the undelecled, focused spot will fall within a circle having an 8-mm radius concentric with the center of the tube face.

*: See next page.
Examples of Use of Design Ranges:

<table>
<thead>
<tr>
<th>Grid—No.1</th>
<th>Grid—No.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage for Focus</td>
<td>Voltage for Focus</td>
</tr>
<tr>
<td>400 to 690</td>
<td>400 to 690</td>
</tr>
<tr>
<td>300 to 515</td>
<td>300 to 515</td>
</tr>
<tr>
<td>400 to 690</td>
<td>400 to 690</td>
</tr>
</tbody>
</table>

Deflection

<table>
<thead>
<tr>
<th>DJ₁ &amp; DJ₂</th>
<th>DJ₃ &amp; DJ₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>43 to 53</td>
<td>32 to 40</td>
</tr>
<tr>
<td>40 to 50</td>
<td>30.5 to 37.5</td>
</tr>
<tr>
<td>53.4 to 66.6 v dc/in.</td>
<td>40.6 to 50 v dc/in.</td>
</tr>
</tbody>
</table>

Maximum Circuit Values:

<table>
<thead>
<tr>
<th>Grid—No.1—Circuit Resistance</th>
<th>Resistance in Any Deflecting—Electrode Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 max. megohms</td>
<td>5.0 max. megohms</td>
</tr>
</tbody>
</table>

SPECIAL PERFORMANCE DATA

<table>
<thead>
<tr>
<th>Line Width</th>
<th>Peak Grid—No.1 Drive from Spot Cutoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.030 max. inch</td>
<td>45 max. volts</td>
</tr>
</tbody>
</table>

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

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 DJ₁ and DJ₂. For line-width measurement, the high-frequency scanning is adjusted to give a raster width of 12 cm with the grid—No.3 voltage adjusted to give sharpest focus at center of tube face. Raster height is contracted until individual scanning lines are just barely distinguishable. Line width is expressed as the quotient of the contracted raster height measured at the center line of the tube face divided by the number of scanning lines (49).

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.
THE PLANE THROUGH TUBE AXIS AND EACH OF THE FOLLOWING ITEMS MAY VARY FROM THE TRACE PRODUCED BY DJ₁ AND DJ₂ BY THE FOLLOWING ANGULAR TOLERANCES (MEASURED ABOUT THE TUBE AXIS): PIN 5, ±10°; SIDE TERMINAL (ON SAME SIDE OF TUBE AS PIN 5), ±10°. ANGLE BETWEEN DJ₁ - DJ₂ TRACE AND DJ₃ - DJ₄ TRACE IS 90° ±10°.

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.
Average Characteristics

$E_f = 6.3$ VOLTS
GRID-Nº3 VOLTS ADJUSTED FOR FOCUS.

<table>
<thead>
<tr>
<th>CURVE</th>
<th>ELECTRODE CURRENT</th>
<th>ULTOR VOLTS</th>
<th>POST-ULTOR VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ULTOR</td>
<td>2000</td>
<td>4000</td>
</tr>
<tr>
<td>B</td>
<td>ULTOR</td>
<td>1500</td>
<td>3000</td>
</tr>
<tr>
<td>C</td>
<td>POST-ULTOR</td>
<td>2000</td>
<td>4000</td>
</tr>
<tr>
<td>D</td>
<td>POST-ULTOR</td>
<td>1500</td>
<td>3000</td>
</tr>
</tbody>
</table>

\[ \text{POST-ULTOR (GRID N°5 & COLLECTOR)} \quad \text{GRID-Nº1 VOLTS} \]

\[ \text{ULTOR (GRIDS N°2 & 4) MICROAMPERES} \quad \text{GRID-Nº1 VOLTS} \]
CHARACTERISTICS

$E_f = 6.3$ VOLTS

GRID-N°3 VOLTS ADJUSTED FOR FOCUS.

POST-ULTOR (GRID N°5 & COLLECTOR) VOLTS GREATER THAN ULTOR (GRIDS N°2 & N°4) VOLTS.

GRID-N°1 VOLTS = 0

--- MAX. TOTAL CURRENT FOR ANY TUBE.

--- TYPICAL FLUORESCENT-SCREEN (POST-ULTOR) CURRENT.
Typical Characteristics

$E_g = 6.3$ Volts

Grid-N $= 3$ Volts Adjusted for Focus.

Post-Ultron Volts = 2 x Ultron Volts
COLOR FLYING-SPOT CATHODE-RAY TUBE

**General:**
- **Heater, for Unipotential Cathode:**
  - Voltage: 6.3 ac or dc volts
  - Current: 0.6 ± 10% amp
- **Direct Inter-electrode 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
  - Green Fluorescence
  - Green Phosphorescence
  - Short Persistence
- **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" (Approx.)
- **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

**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.*
**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:

<table>
<thead>
<tr>
<th>Grid-No.3 Voltage for focus with ultor current of 200 (\mu)A</th>
<th>17% to 21.5% of (E_{c4}) volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.2 Voltage when circuit design utilizes fixed grid-No.1 voltage (E_{c1}) for visual extinction of undeflected focused spot</td>
<td>2 to 5 times (E_{c1}) volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage for visual extinction of undeflected focused spot when circuit design utilizes grid-No.2 voltage (E_{c2}) at fixed value</td>
<td>20% to 50% of (E_{c2}) volts</td>
</tr>
<tr>
<td>Maximum Grid-No.3 Current for ultor current of 200 (\mu)A</td>
<td>170 (\mu)A</td>
</tr>
<tr>
<td>Grid-No.2 Current</td>
<td>-15 to +15 (\mu)A</td>
</tr>
</tbody>
</table>

**Examples of Use of Design Ranges:**

For ultor voltage of 27000 volts:

<table>
<thead>
<tr>
<th>Grid-No.3 Voltage for focus with ultor current of 200 (\mu)A</th>
<th>4600 to 5800 volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.2 Voltage when circuit design utilizes fixed grid-No.1 voltage of -70 volts for visual extinction of undeflected focused spot</td>
<td>140 to 350 volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage for visual extinction of undeflected focused spot when circuit design utilizes grid-No.2 voltage of 200 volts</td>
<td>-40 to -100 volts</td>
</tr>
</tbody>
</table>

**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.*

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ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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.
COLOR FLYING-SPOT CATHODE-RAY TUBE


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: ½ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.
5AYP4
VIEW-FINDER KINESCOPE
METAL-BACKED SCREEN

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 μf
Cathode to all other electrodes: 5 μf
External conductive coating to ultor*: (750 max. μf)

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.88-65)

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.88-65)

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 "ultan" 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 "ultan" for convenience in presenting data and curves.

MAY 1, 1955
TUBE DIVISION
TENTATIVE DATA
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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 \(E_c\) between 5000 and 10000 volts
and grid-No. 2 voltage \(E_{c2}\) between 200 and 410 volts

Grid-No.3 Voltage for Focus with Ultor Current of
100 \(\mu\)amp .................. 9.8% to 14.1% of \(E_c\) 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 \(\mu\)amp
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 \(\mu\)amp .... 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.

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.
AVERAGE GRID-DRIVE CHARACTERISTIC

$E_F = 6.3$ VOLTS
ULTOR (GRID № 4 AND COLLECTOR) VOLTS = 10000
GRID - № 3 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS
GRID № 1 BIASED TO CUTOFF OF FOCUSED RASTER
RASTER SIZE = $3 \frac{3}{8}'' \times 2 \frac{1}{2}''$

---

FEB. 24, 1955
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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                                 J4OH1
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

RCA Electronic Components
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: 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
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 .......................... 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. MQ
Grid-No.3 Circuit Resistance (unbypassed) ....................... 0.1 MQ

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. MQ
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.
Brilliance and definition may change with decreasing anode voltage. In general, the anode voltage should not be less than 30,000 volts.

**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.*
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

TYPICAL GRID-No.3 CURRENT CHARACTERISTIC

GRID-No.3 VOLTAGE ADJUSTED FOR FOCUS AT 300 MICROAMPERES ANODE CURRENT.
GRID-No.2 VOLTAGE ADJUSTED FOR SPOT CUTOFF AT INDICATED GRID-No.1 VOLTAGE
GRID-No.1 VOLTAGE AT SPOT CUTOFF = -150 VOLTS
** ZERO BIAS POINT

ANODE CURRENT - MICROAMPERES
Typical Sine-Wave Response

5AZP4

Equivalent Passband (kHz) = 270
3" x 3" Television Raster Line Number on the Picture Frame Width.
Anode Current = 500 Microamperes
Anode Voltage = 40 Kilovolts
TYPICAL DRIVE CHARACTERISTICS
GRID-DRIVE SERVICE

- Anode-to-cathode voltage: 40,000 volts
- Grid-No. 3-to-cathode voltage adjusted for focus at 300 microamperes anode current.
- Grid-No. 2-to-cathode voltage adjusted for spot cutoff at indicated grid-No. 1 voltage.
- Zero bias point

Video signal from spot cutoff: volts

RCA Electronic Components

DATA 5 2-69
TYPICAL LUMINANCE CHARACTERISTIC

Anode Voltage = 40,000 Volts
Grid No. 3 Voltage Adjusted for Focus
At 300 Microamperes Anode Current
Raster Size: 3" x 4"
CUTOFF DESIGN CHART

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 40,000 VOLTS
GRID No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.

GRID No. 2-TO-CATHODE VOLTS

GRID No. 1-TO-CATHODE VOLTS

RANGE LIMIT FOCUSED SPOT CUTOFF

RANGE LIMIT FOCUSED SPOT CUTOFF

Electronic Components

DATA 6
HIGH-VACUUM CATHODE-RAY TUBE
Supersedes Type 5BP1

General:

Heater, for Unipotential Cathode:
Voltage: \(6.3 \pm 10\%\) ac or dc volts
Current: 0.6 amp.

Direct Interelectrode Capacitances (Approx.):
- Grid No. 1 to All Other Electrodes: 8.0 µuf
- \(DJ_1\) to \(DJ_2\): 1.3 µuf
- \(DJ_2\) to \(DJ_4\): 1.2 µuf
- \(DJ_1\) to All Other Electrodes: 9.5 µuf
- \(DJ_2\) to All Other Electrodes: 12.0 µuf
- \(DJ_1\) to All Other Electrodes except \(DJ_2\): 8.0 µuf
- \(DJ_2\) to All Other Electrodes except \(DJ_1\): 7.5 µuf
- \(DJ_3\) to All Other Electrodes except \(DJ_4\): 10.0 µuf
- \(DJ_4\) to All Other Electrodes except \(DJ_3\): 7.5 µuf

Phosphor (For Curves, see front of this Section)
- No. 1 Fluorescence: Medium
  - Persistence: Short
  - Focusing Method: Electrostatic
  - Deflection Method: Electrostatic

Greatest Diameter of Bulb: \(5-1/4'' \pm 1/16''\)
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.
- Pin 6—Deflecting Electrode \(DJ_4\)
- Pin 7—Anode No. 2
- Pin 8—Deflecting Electrode \(DJ_2\)
- Pin 9—Deflecting Electrode \(DJ_3\)
- Pin 10—Grid No. 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 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 \(100^\circ\).

The angle between the trace produced by \(DJ_3\) and \(DJ_4\) and the trace produced by \(DJ_1\) and \(DJ_2\) is \(90^\circ \pm 30^\circ\).
### Maximum Ratings, Absolute Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode—No.2 &amp; Grid—No.2</td>
<td>2200 max. volts</td>
</tr>
<tr>
<td>Anode—No.1 Voltage</td>
<td>1100 max. volts</td>
</tr>
<tr>
<td>Grid—No.2 Voltage:</td>
<td></td>
</tr>
<tr>
<td>Negative Value</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>Positive Value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Peak Voltage Between any</td>
<td>550 max. volts</td>
</tr>
<tr>
<td>Anode—No.2 and any</td>
<td></td>
</tr>
<tr>
<td>Deflecting Electrode</td>
<td></td>
</tr>
</tbody>
</table>

### 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:

<table>
<thead>
<tr>
<th>Electrode</th>
<th>Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>DJ1 and DJ2</td>
<td>0.404 0.303 mm/v dc</td>
</tr>
<tr>
<td>DJ3 and DJ4</td>
<td>0.446 0.334 mm/v dc</td>
</tr>
</tbody>
</table>

### Deflection Factor:

<table>
<thead>
<tr>
<th>Electrode</th>
<th>Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>DJ1 and DJ2</td>
<td>63 84 v dc/in</td>
</tr>
<tr>
<td>DJ3 and DJ4</td>
<td>57 76 v dc/in</td>
</tr>
</tbody>
</table>

- 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 DJ1 and DJ2. Suitable test conditions are: anode—No.2 voltage, 1500 volts; anode—No.1 voltage, adjusted for focus; deflecting-electrode resistors, 1 megohm each, connected to anode—No.2; the tube shielded from all extraneous fields. To avoid damage to the tube, grid—No.1 voltage should be near cutoff before application of anode voltages.

### Maximum Circuit Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid—No.1—Circuit Resistance</td>
<td>1.5 max. megohms</td>
</tr>
<tr>
<td>Impedance of Any Deflecting-Electrode Circuit at Heater—Supply Frequency</td>
<td>1.0 max. megohm</td>
</tr>
<tr>
<td>Resistance in Any Deflecting-Electrode Circuit</td>
<td>5.0 max. megohms</td>
</tr>
</tbody>
</table>

- It is recommended that all deflecting-electrode-circuit resistances be approximately equal.
### General:
**Heater, for Unipotential Cathode:**
- Voltage: 6.3 ac or dc volts
- Current: 0.6 amp

**Direct Interelectrode Capacitances (Approx.):**
- Grid No.1 to All Other Electrodes: 8 μf
- Cathode to All Other Electrodes: 9 μf
- DJ1 to DJ2: 2 μf
- DJ3 to DJ4: 2 μf
- DJ1 to All Other Electrodes: 9 μf
- DJ2 to All Other Electrodes: 9 μf
- DJ3 to All Other Electrodes: 7 μf
- DJ4 to All Other Electrodes: 8 μf

**Phosphor (For Curves, see front of this Section):** Green
**Fluorescence and Phosphorescence:**
**Persistence of Phosphorescence:**

**Focusing Method:** Electrostatic
**Deflection Method:** Electrostatic
**Overall Length:** 16-3/4" ± 3/16"n
**Greatest Diameter of Bulb:** 5-1/4" ± 3/32"
**Minimum Useful Screen Diameter:** 4-1/2"

**Mounting Position:** Any
**Cap Method:** Recessed Small Ball (JETEC No. J1-22)
**Base Method:** Medium-Shell Diheptal 12-Pin (JETEC No. B12-37)

**Basing Designation for BOTTOM VIEW:** 14J1
- Pin 1 - Heater
- Pin 2 - Cathode
- Pin 3 - Grid No. 1
- Pin 4 - Internal Con. Do not use
- Pin 5 - Anode No. 1
- Pin 7 - Deflecting Electrode DJ3
- Pin 8 - Deflecting Electrode DJ4
- Pin 9 - Anode No. 2
- Pin 10 - Deflecting Electr. DJ2
- Pin 11 - Deflecting Electr. DJ1
- Pin 12 - No Connection
- Pin 14 - Heater
- Cap - Anode No. 3

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

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

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

The angle between the trace produced by DJ1 and DJ2 and the trace produced by DJ3 and DJ4 is 90° ± 30°.
### Maximum Ratings, Design-Center Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANODE-No.3 VOLTAGE</td>
<td>4000 max. volts</td>
</tr>
<tr>
<td>ANODE-No.2 VOLTAGE</td>
<td>2000 max. volts</td>
</tr>
<tr>
<td>Ratio of ANODE-No.3 Voltage to ANODE-No.2 Voltage</td>
<td>2.3:1</td>
</tr>
<tr>
<td>ANODE-No.1 VOLTAGE</td>
<td>1000 max. volts</td>
</tr>
<tr>
<td>Grid-No.1 VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max. volts</td>
</tr>
<tr>
<td>PEAK VOLTAGE BETWEEN ANODE No.2 AND ANY DEFLECTING ELECTRODE</td>
<td>500 max. volts</td>
</tr>
<tr>
<td>PEAK HEATER-CATHODE VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>125 max. volts</td>
</tr>
</tbody>
</table>

### Equipment Design Ranges:

- For any anode-No.3 voltage ($E_b_3$) between 2000** and 4000 volts and any anode-No.2 voltage ($E_b_2$) between 1500* and 2000 volts.

### Deflection Factors:

- When $E_b_3 = 2 \times E_b_2$
  - $DJ_1$ & $DJ_2$: 39 to 53 v dc/in./kv of $E_b_2$
  - $DJ_3$ & $DJ_4$: 33 to 45 v dc/in./kv of $E_b_2$
- When $E_b_3 = E_b_2$
  - $DJ_1$ & $DJ_2$: 31 to 42 v dc/in./kv of $E_b_2$
  - $DJ_3$ & $DJ_4$: 27 to 37 v dc/in./kv of $E_b_2$

### Examples of Use of Design Ranges:

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

### Maximum Circuit Values:

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

---

*Indicates a change.

OCTOBER 1, 1951

DATA 1
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 ac/in.

With heater voltage of 6.3 volts, anode-No.3 voltage of 3000 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.
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

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

92CM-6408R4
E_± = 6.3 VOLTS
ANODE-NO.1 VOLTS ADJUSTED FOR FOCUS
ANODE-NO.3 VOLTS = 2 x ANODE-NO.2 VOLTS

DEC. 23, 1948
TUBE DEPARTMENT
SABINO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-8820
**AVERAGE CHARACTERISTICS**

\[ E_f = 6.3 \text{ VOLTS} \]

Anode-No. 1 Volts Adjusted to Give Focus

<table>
<thead>
<tr>
<th>CURVE</th>
<th>ELECTRODE CURRENT</th>
<th>ANODE-No. 2 VOLTS</th>
<th>ANODE-No. 3 VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ANODE No. 1</td>
<td>2000</td>
<td>2000-4000</td>
</tr>
<tr>
<td>B</td>
<td>ANODE No. 1</td>
<td>1500</td>
<td>1500-3000</td>
</tr>
<tr>
<td>C</td>
<td>ANODE No. 2</td>
<td>2000</td>
<td>4000</td>
</tr>
<tr>
<td>D</td>
<td>ANODE No. 2</td>
<td>1500</td>
<td>3000</td>
</tr>
<tr>
<td>E</td>
<td>ANODE No. 3</td>
<td>2000</td>
<td>4000</td>
</tr>
<tr>
<td>F</td>
<td>ANODE No. 3</td>
<td>1500</td>
<td>3000</td>
</tr>
</tbody>
</table>

**Graph:**
- Grid-No. 1 Volts
- Anode-No. 2 Microamperes
- Anode-No. 3 Microamperes

---

**Notes:**
- DEC 28, 1946
- TUBE DEPARTMENT, RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
- 92CM - 6414 R2
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**

### 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)

#### Diagram:
- 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**
  - Maximum: 8000 volts
- **GRID-No.2 VOLTAGE**
  - Maximum: 410 volts
- **GRID-No.1 VOLTAGE**
  - Negative bias value: 125 volts
  - Positive bias value: 0 volts
  - Positive peak value: 2 volts
- **PEAK HEATER—CATHODE VOLTAGE**
  - Heater negative with respect to cathode: 150 volts
  - Heater positive with respect to cathode: 150 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 \( \pm \) 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 3-1/8" 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.
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

Eg = 6.3 VOLTS
ANODE VOLTS = 6000
GRID-NO.2 VOLTS = 250
GRID-N01 BIASED TO CUTOFF OF UNDEFLCTED FOCUSED SPOT
RASTER SIZE = $3\frac{1}{8}'' \times 2\frac{3}{8}''$ (FOCUSED FOR AVERAGE BRIGHTNESS)

[Graph depicting highlight brightness in foot-lamberts against video signal volts from cutoff]
### OSCILLOGRAPH TUBE

#### 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 **µf**
  - Cathode to All Other Electrodes: 5 **µf**
- **Phosphor (For Curves, see front of this Section):** P7 Blue
  - Fluorescence
  - Phosphorescence
  - 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. 88-65)

#### Bottom View

<table>
<thead>
<tr>
<th>Pin 1-No Connection</th>
<th>Pin 5-Grid No. 1 Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin 2-Heater</td>
<td>Pin 6-No Connection</td>
</tr>
<tr>
<td>Pin 3-Grid No. 2</td>
<td>Pin 7-Cathode</td>
</tr>
<tr>
<td>Pin 4-No Connection</td>
<td>Pin 8-Heater</td>
</tr>
<tr>
<td></td>
<td>Cap - Anc-e</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ANODE VOLTAGE</strong></td>
<td>8000 max. volts</td>
</tr>
<tr>
<td><strong>GRID-No.2 VOLTAGE</strong></td>
<td>7000 max. volts</td>
</tr>
<tr>
<td><strong>GRID-No.1 VOLTAGE:</strong></td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>180 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max. volts</td>
</tr>
<tr>
<td><strong>PEAK GRID-No.1 DRIVE FROM CUTOFF</strong></td>
<td>65 max. volts</td>
</tr>
<tr>
<td><strong>PEAK HEATER-CATHODE VOLTAGE:</strong></td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>125 max. volts</td>
</tr>
</tbody>
</table>

#### Typical Operation:

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage**</td>
<td>4000</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>250</td>
</tr>
</tbody>
</table>

**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.**

---

**AUG. 1, 1951**

TUBE DEPARTMENT

BENDY CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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

0 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

AUG. 1, 1951  TUBE DEPARTMENT  DATA
BELL CORPORATION OF AMERICA, HARRISON, NEW JERSEY
General:
Heater, for Unipotential Cathode:
Voltage: 6.3 ac or dc volts
Current: 0.6 ± 10% amp
Direct Interelectrode Capacitances (Approx.):
Grid No.1 to all other electrodes: 8 µf
Cathode to all other electrodes: 5 µf
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: 4-1/16" ± 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 Base: Medium-Shell Octal 8-Pin (JETEC No. 88-11)
Basing Designation for BOTTOM VIEW: 5AN

<table>
<thead>
<tr>
<th>Pin 1-</th>
<th>Pin 2-Heater</th>
<th>Pin 3-Grid No.2</th>
<th>Pin 4-No Connection</th>
<th>Pin 5-Grid No.1</th>
<th>Pin 6-No Connection</th>
<th>Pin 7-Cathode</th>
<th>Pin 8-Heater (Grid No.3, Collector)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-No Connection</td>
<td>2-Heater</td>
<td>3-Grid No.2</td>
<td>4-No Connection</td>
<td>5-Grid No.1</td>
<td>6-No Connection</td>
<td>7-Cathode</td>
<td>8-Heater (Grid No.3, Collector)</td>
</tr>
</tbody>
</table>

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.
**OScillograph Tube**

**Equipment Design Ranges:**

With any ultor voltage \(E_C\) between 4000 and 8000 volts
and grid-No.2 voltage \(E_{C2}\) between 150 and 700 volts

Grid-No.1 Voltage for Visual Extinction of Undelected Focused
Spot \(-10\% \text{ to } -28\% \text{ of } E_{C2}\) volts

Grid-No.2 Current \(-15\% \text{ to } +15\% \text{ of } \sqrt{E_{C3}}/4000 \times 96 \pm 15\% \text{ ma}\)

Focusing-Coil Current (DC) \(96 \pm 15\% \text{ to } 107 \pm 15\% \text{ ma}\)

**Spot Position:**

**Examples of Use of Design Ranges:**

With ultor voltage of 4000 volts and grid-No.2 voltage of 250 volts
Grid-No.1 Voltage for Visual Extinction of Undelected Focused
Spot \(-25 \text{ to } -70 \text{ volts}\)
Focusing-Coil Current (DC) \(96 \pm 15\% \text{ ma}\)

**Maximum Circuit Values:**

Grid-No.1 Circuit Resistance \(1.5 \text{ max. megohms}\)

**SPECIAL PERFORMANCE DATA**

**Line Width:**

For Ultor Voltage of 4000 Volts \(0.010 \text{ max.}^A\) inch
For Ultor Voltage of 5000 Volts \(0.009 \text{ max.}^A\) inch

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

\^\^ 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).

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.
AVERAGE GRID-DRIVE CHARACTERISTIC

\[ E_f = 6.3 \text{ VOLTS} \]
\[ \text{ULTOR VOLTS} = 4000 - 8000 \]
GRID N.1 BIASED TO CUTOFF OF UNDEFLICTED FOCUSED SPOT.

---

**GRID N.2 VOLTS = 250**

**PEAK GRID-N.1 DRIVE FROM SPOT CUTOFF—VOLTS**

<table>
<thead>
<tr>
<th>PEAK GRID-N.1 DRIVE FROM SPOT CUTOFF—VOLTS</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR MICROAMPERES</td>
<td>100</td>
<td>200</td>
<td>300</td>
<td>400</td>
<td>500</td>
</tr>
</tbody>
</table>

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9002
5UPI

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS
ELECTROSTATIC DEFLECTION

**General:**

- **Heater,** for Unipotential Cathode:
  - Voltage: \(6.3 \pm 10\%\) ac or dc volts
  - Current: 0.6 amp

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

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

- **Focusing Method:** Electrostatic
- **Deflection Method:** Electrostatic

**Overall Length:** 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

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

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

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

The angle between the trace produced by DJ3 and DJ4 and the trace produced by DJ1 and DJ2 is 90° \pm 30°.
Maximum Ratings, Design-Center Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode-No.2 Voltage</td>
<td>2500 max. volts</td>
</tr>
<tr>
<td>Anode-No.1 Voltage</td>
<td>1000 max. volts</td>
</tr>
<tr>
<td>Grid-No.1 (Control Electrode) Voltage</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Peak positive value</td>
<td>2 max. volts</td>
</tr>
<tr>
<td>Peak Voltage between Anode No.2 and any deflecting electrode</td>
<td>500 max. volts</td>
</tr>
<tr>
<td>Peak Heater-Cathode Voltage:</td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>125 max. volts</td>
</tr>
</tbody>
</table>

Equipment Design Ranges:

For any anode-No.2 voltage (Eb2) between 1000" and 2500 volts:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode-No.1 Voltage</td>
<td>17% to 32% of Eb2</td>
</tr>
<tr>
<td>Max. Grid-No.1 Voltage for Visual Cutoff</td>
<td>4.5% of Eb2</td>
</tr>
<tr>
<td>Anode-No.1 Current for Any Operating Condition</td>
<td>-15 to +10 microamp</td>
</tr>
</tbody>
</table>

Deflection Factors:

- DJ1 & DJ2: 28 to 38.5 v dc/in./kv of Eb2
- DJ3 & DJ4: 23 to 31 v dc/in./kv of Eb2

Examples of Use of Design Ranges:

For anode-No.2 voltages of 1000 and 2500 volts:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode-No.1 Voltage</td>
<td>170-320</td>
</tr>
<tr>
<td>Max. Grid-No.1 Voltage for Visual Cutoff</td>
<td>340-640</td>
</tr>
<tr>
<td>Deflection Factors:</td>
<td></td>
</tr>
<tr>
<td>DJ1 &amp; DJ2:</td>
<td>28-38.5</td>
</tr>
<tr>
<td>DJ3 &amp; DJ4:</td>
<td>23-31</td>
</tr>
</tbody>
</table>

Maximum Circuit Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1 Circuit Resistance</td>
<td>1.5 max.-megohms</td>
</tr>
<tr>
<td>Resistance in Any Deflecting Electrode Circuit</td>
<td>5.0 max.-megohms</td>
</tr>
</tbody>
</table>

- 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.
TYPICAL CIRCUIT

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: 1.0 µF, 200 Volts
C3: 0.0001 µF, 2500 Volts
C4, C5, C6, C7: 0.1 µF, 600 Volts

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

DEC. 20, 1946
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
CE-6819
SCREEN RADIUS
2 1/4" MIN.

.808" R.
.500" R.
1.71" R.
1.44" R.
5.36" R.
.576" R.

14 1/4" ± 3/8"
14 3/4" ± 3/8"

9 3/8" MAX.

SMALL-SHELL DUODECAL 12-PIN BASE (NOTE 1)

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

NOTE 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".

92CN-6763

DEC. 20, 1946 TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE CHARACTERISTICS

E₂ = 6.3 VOLTS
ANODE-N°1 VOLTS ADJUSTED FOR FOCUS

RELATIVE LINE BRIGHTNESS

1000 1500 2000 2500
ANODE-N°2 VOLTS

NOV. 7, 1946
CHARACTERISTICS

Eφ = 6.3 VOLTS
ANODE-N°1 VOLTS ADJUSTED FOR FOCUS
GRID-N°1 VOLTS = 0
--- TYPICAL FLUORESCENT-SCREEN CURRENT
(SEE TEXT)

OC...11.104
M...001,
ERISCI
paw
MP

1000 1500 2000 2500
ANODE-N°2 VOLTS

10 15 20 25
ANODE-N°2 CURRENT FOR ANODE-NE

FLUORESCENT-SCREEN MICROAMPERES

100 80 60 40 20
1.5 1.0
0.5
0.2

OC, 21, 1949
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-0811IRI
AVERAGE CHARACTERISTICS

---

FLUORESCENT-SCREEN MICROAMPERES

ANODE-\#2 MICROAMPERES

GRID-\#1 VOLTS

-40 -20 0 40

ANODE-\#2 CURRENT (SEE TEXT)

ANODE-\#2 VOLTS = 2000

ANODE-\#1 VOLTS ADJUSTED FOR FOCUS

EF = 6.3 VOLTS

SUP1

[Graph showing fluorescent-screen characteristics with grid and anode currents]
5UP7
Oscillograph Tube

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

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
For Photographic Recording and Visual Observations

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

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 a ......................................... Medium-Short c (Approx. 38 μsec)
Persistence of useful brightness can be obtained with an anode-No. 2 voltage of as low as 1500 volts.
Time for initial brightness to decay to 10% point.
Phosphorescence may have useful brightness for over a minute under conditions of adequate excitation and low-ambient illumination.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.
5WPI

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 .......... μf
Cathode to All Other Electrodes. ....... 5 .......... μf
External Conductive Coating to Anode No.2. 500 max. μf
100 min. μf

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

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.

FEB. 1, 1949
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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 3 183-U7 and 6U6'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 ± 40% when grid—No.1 voltage cutoff is desired at -70 volts.

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

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

FEB. 1, 1949
TENTATIVE DATA 1
The screen of the 5WP11 has highly actinic blue radiation, and is particularly effective for photography. The persistence of the radiation is sufficiently short to prevent "carry over" from one frame to the next. The persistence is dependent to some extent on the current density in the focused spot, and decreases with current density.

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

OUTLINE DIMENSIONS for the 5WP11 are the same as those for the 5WP15.
FLYING-SPOT CATHODE-RAY TUBE

HIGH RESOLUTION CAPABILITY
ELECTROSTATIC FOCUS
ALUMINIZED SCREEN
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: 300 max. 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.1-21)
Socket: See Operating Considerations
Base: Small-Shell Duodecal 7-Pin (JETEC No.87-51)
Basing Designation for BOTTOM VIEW: 120

Pin 1-Heater, Pin 12-Heater Cap-Ultor (Grid No.4, Collector)
Pin 2-Grid No.1, Pin 7-Internal Connection—C-External Conductive Neck Coat-
Pin 6-Grid No.3, Do Not Use C-External Conductive Neck Coat-
Pin 10-Grid No.2, Pin 11-Cathode

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 \(E_{Cu}\) between 20,000* and 27,000 volts

Grid-No.3 Voltage for focus with ultor current of 25 \(\mu\)A or less. ......... 20.5% to 26.5% of \(E_{Cu}\) 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 \(E_{Cu}\) 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 \(E_{Cu}\) volts
Grid-No.2 Current. ......... -15 to +15 \(\mu\)A

Examples of Use of Design Ranges:
For ultor voltage of

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 \(\mu\)A

Maximum Circuit Values:
Grid-No.1-Circuit Resistance ......... 1.5 max. megohms

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

---

7-58

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

DATA 1
FLYING-SPOT CATHODE-RAY TUBE

OPERATING CONSIDERATIONS

X-Ray Warning. X-ray radiation is produced at the face of the 5ZPI6 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 5ZPI6 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 5ZPI6 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 5ZPI6 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 5ZPI6 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 advisable 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.
FLYING-SPOT CATHODE-RAY TUBE

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

VERTICAL & HORIZONTAL SAWTOOTH GENERATORS

VERTICAL OUTPUT AMPLIFIER

HORIZONTAL OUTPUT AMPLIFIER

HIGH-VOLTAGE POWER SUPPLY

HORIZONTAL SCANNING

MULTIPLIER-PHOTOTUBE POWER SUPPLY

VERTICAL OUTPUT AMPLIFIER

VERTICAL SCANNING

Synchronizing SIGNAL GENERATOR

MIXED BLANKING SIGNAL

BLANKING AMPLIFIER

TO LINE AMPLIFIER

DEFLECTING YOKE

OBJECTIVE LENS

TYPE 5ZP16

SLIDE

CONDENSER LENSES

TYPE IP21

VIDEO AMPLIFIER WITH EQUALIZATION

HIGH VOLTAGE ULTOR

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.

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.
E_f = 6.3 VOLTS
ULTOR VOLTS = 27000
GRID-Nø 3 VOLTS ADJUSTED TO GIVE FOCUS.
GRID-Nø 2 VOLTS = 200
7BP7-A
OSCILLOGRAPH TUBE
MAGNETIC FOCUS MAGNETIC DEFORMATION

DATA

General:
Heater, for Unipotential Cathode:
Voltage. 6.3 ac or dc volts
Current. 0.6 amp
Direct Interelectrode Capacitances (Approx.):
Grid No.1 to All Other Electrodes. 8.5 μf
Grid No.2 to All Other Electrodes. 7 μf
Cathode to All Other Electrodes. 5 μf
Phosphor (For Curves, see front of this Section) No.7
Fluorescence. Blue
Phosphorescence. Greenish-Yellow
Persistence of Phosphorescence Long
Focusing Method. Magnetic
Deflection Method. Magnetic
Deflection Angle (Approx.) 53°
Overall Length. 13-1/4" ± 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

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

* O, A, #: See next page.

JUNE 15, 1948
TUBE DEPARTMENT
TENTATIVE DATA

RCA CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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. 20201

- 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.
**DATA**

**General:**
- Heater, for Unipotential Cathode:
  - Voltage: 6.3 ac or dc volts
  - Current: 0.6 amp

**Direct Inter-electrode Capacitances (Approx.):**
- Grid No. 1 to All Other Electrodes: 6 \(\mu F\)
- Cathode to All Other Electrodes: 5 \(\mu F\)

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

**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.

**TUBE DEPARTMENT**

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

OCTOBER 1, 1951
### Typical Operation:

<table>
<thead>
<tr>
<th>Component</th>
<th>Voltage Range</th>
<th>Current Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ulterior Voltage *</td>
<td>4000 to 7000伏</td>
<td></td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>250至250伏</td>
<td></td>
</tr>
<tr>
<td>Grid-No.1 Voltage ≥</td>
<td>-27 to -63伏</td>
<td>-15至15 μAmp</td>
</tr>
<tr>
<td>Grid-No.2 Current</td>
<td>-15至+15 μAmp</td>
<td></td>
</tr>
<tr>
<td>Focusing-Coil Current</td>
<td>64 ± 15% mA</td>
<td>85 ± 15% mA</td>
</tr>
</tbody>
</table>

**Indicates a change**

### Maximum Circuit Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Resistance</th>
<th>Brilliance and definition decrease with decreasing ulterior voltage. In general, the ulterior voltage should not be less than 4000 volts.</th>
</tr>
</thead>
</table>
| 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.109 positioned with air gap toward face plate and center line of air gap 2-3/4 from Reference Line (see Outline Drawing) and ulterior 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.**

---

OCTOBER 1, 1951

TUBE DEPARTMENT

SHENO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
OSCILLOGRAPH TUBE

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No. 3 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND 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.

OCTOBER 1, 1951
TUBE DEPARTMENT
BELL AND HOWELL COMPANY OF AMERICA, HARRISON, NEW JERSEY

CE-7438R3
$E_f = 6.3$ VOLTS
ULTOR VOLTS = 7000
GRID N=1 BIAS TO CUTOFF OF UNDEFLECTED FOCUSED SPOT
SCANNING AREA: 12 X 12 CM

ULTOR CURRENT
HIGHLIGHT BRIGHTNESS

AVerage Grid-Drive Characteristics

JULY 18, 1951
Tube Department
Radio Corporation of America, Harrison, New Jersey
Projection Kinescopes

FORCED-AIR COOLED 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 7 ± 3/16 in
(Excluding side cap or cable)
Cap Medium (JEDEC No.CI-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)

*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™ SERVICE**

**Absolute-Maximum Ratings**

- Anode-to-Grid-No.1 Voltage
  - 80000 V
- Grid-No.3-to-Grid-No.1 Voltage
  - 20000 V
- Grid-No.2-to-Grid-No.1 Voltage
  - 1300 V
- Cathode-to-Grid-No.1 Voltage
  - Positive bias value: 250 V
  - Negative bias value: 0 V
  - Peak negative value: 2 V
- Average Anode Current
  - 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: 160 V
  - Heater positive with respect to cathode: 160 V

**Equipment Design Ranges**

With any anode-to-grid-No.1 voltage \((E_{c1g1})\) between 70000 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 22.0% of \(E_{kgl}\)
- 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 \((E_{kgl})\):
  - 2.50 to 3.87 times \(E_{kgl}\) plus \(E_{kgl}\) voltage

**Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level) to White-Level Value:**

Same values as fixed cathode-to-grid-No.1 voltage except video drive is a negative voltage.

**DATA I**

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.
### 7NP4

**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_{ck1}) 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® SERVICE

### Absolute-Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode-to-Cathode Voltage</td>
<td>80000 V</td>
</tr>
<tr>
<td>Grid-No.3-to-Cathode Voltage</td>
<td>20000 V</td>
</tr>
<tr>
<td>Grid-No.2-to-Cathode Voltage</td>
<td>1050 V</td>
</tr>
<tr>
<td>Grid-No.1-to-Cathode Voltage Negative bias value</td>
<td>250 V</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 V</td>
</tr>
<tr>
<td>Peak positive value</td>
<td>2 V</td>
</tr>
<tr>
<td>Average Anode Current</td>
<td>2 mA</td>
</tr>
<tr>
<td>Peak Heater-Cathode Voltage</td>
<td></td>
</tr>
</tbody>
</table>

- 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 ($E_{ck}$) between 70000 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 $E_{ck}$ V

#### Grid-No.2 Voltage for Visual Extinction of Focused Raster when Circuit Design Utilizes Fixed Grid-No.1 Voltage ($E_{ck1}$)

- 2.58 to 3.87 times $E_{ck1}$ 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.

---

DATA 2

12-66

**RADIO CORPORATION OF AMERICA**

Electronic Components and Devices Harrison, N. J.
Examples of Use of Design Ranges

For anode voltage 75000 V

Grid-No.3 Voltage for Focus... 16000 to 17000 V

Grid-No.2 Voltage for Visual Extinction of Focused Raster when Circuit Design Utilizes Fixed Grid-No.1 Voltage (E_{Clk}) 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 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

TO GRID-No. 1 SUPPLY

TO CATHODE SUPPLY

6.6 V.

AC SUPPLY

92LS-1223R2

TO ANODE SUPPLY,

+ 75 KV

0.5 MΩ

0.1 MΩ

TO GRID-No. 3 (FOCUS ELECTRODE) SUPPLY

(LOW IMPEDANCE RELATIVE TO THE 0.1 MΩ RESISTOR) APPROX. + 20 KV

HERMETICALLY SEALED 20 KV SPARK GAP

0.01 MΩ

1 KV

TO GRID-No. 2 SUPPLY

(LOW IMPEDANCE RELATIVE TO THE 0.01 MΩ RESISTOR), + 600 V

0.1 MΩ

40 KV

0.01 MΩ

1 KV

TO LOW IMPEDANCE SOURCE EQUAL TO AVERAGE VOLTAGE APPLIED TO CATHODE.

92CS-7517R3

SCHEMATIC DIAGRAM SHOWING PRINCIPLES OF CATHODE DRIVE AS WELL AS METHOD FOR AUTOMATICALLY PROTECTING THE TUBE AGAINST OVERDRIVE AND SCANNING FAILURE

ALSO SUPPLY FOR SCANNING CIRCUITS

ELECTRONIC SWITCH

+ 659 V.

+ 497 V.

+ 100 V.

+ 50 V.

+ 175 V.

+ 50 V.

+ 50 V.

TYPE 7NP4, 7WP4, OR 4486

VIDEO OUTPUT TUBE

AC SUPPLY

DATA 3

RADIO CORPORATION OF AMERICA

Electronic Components and Devices

Harrison, N. J.
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 7WP7

Spherical Mirror 7" DIA.
Blower 7" DIA.
Faceplate of Projection Kinescope
Correcting Lens & X-ray Shield
Deflecting Yoke
Viewing Screen 20' x 15'

DIMENSIONS (APPROX.)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>26 inch Diameter</td>
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<tr>
<td>D2</td>
<td>30 inch Radius</td>
</tr>
<tr>
<td>D3</td>
<td>30 inches</td>
</tr>
<tr>
<td>D4</td>
<td>15 inches</td>
</tr>
<tr>
<td>D5</td>
<td>21.5 inches</td>
</tr>
<tr>
<td>D6</td>
<td>60 feet</td>
</tr>
</tbody>
</table>

DATA 4

RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.
Spectral-Energy Emission Characteristic of Phosphor No. 6
SILICATE-SULFIDE TYPE

<table>
<thead>
<tr>
<th>COLOR</th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>6300° K</td>
<td>0.317</td>
<td>0.331</td>
</tr>
</tbody>
</table>

Spectral-Energy Emission Characteristic

COLOR

6300° K

X

0.317

Y

0.331

WAVELENGTH—ANGSTROMS

3000  4000  5000  6000  7000

RELATIVE RADIANT ENERGY

0  20  40  60  80  100

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

DATA 12-66
Typical Drive Characteristics
CATHODE-DRIVE SERVICE

ANODE-TO-GRID-NO.1 VOLTAGE - 80,000 VOLTS
GRID-NO.3-TO-GRID-NO.1 VOLTAGE ADJUSTED FOR FOCUS AT 1.5 MILLIAMPERES ANODE CURRENT.
GRID-NO.2-TO-GRID-NO.1 VOLTAGE ADJUSTED FOR SPOT CUTOFF AT INDICATED CATHODE-TO-GRID-NO.1 VOLTAGE.
• ZERO-BIAS POINT

DATA 6
RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.
7TP4
MONITOR KINESCOPE
METAL—BACKED SCREEN

**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 µuf
  - Cathode to All Other Electrodes: 5 µuf
- 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"
- Minimum Useful Screen Diameter: 6"
- Picture Size (Within minimum-useful-screen area): 5-3/8" x 4"
- Cap: Recessed Small Cavity (JETEC No. J1-21)
- Base: Small-Shell Duodecal 6-Pin (JETEC No. B6-63)

**Pin 1 - Heater**
**Pin 2 - Grid No.1**
**Pin 6 - Grid No.3**
**Pin 10 - Grid No.2**
**Pin 11 - Cathode**

**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.

FEB. 1, 1952 TUBE DEPARTMENT
BRIDG CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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 \( \mu \)amp... 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 \( \mu \)amp

Field Strength of Adjustable
Centering Magnet... 0 to 8 gauss

Examples of Use of Design Ranges:
For ultor voltage of
  and grid-No.2 voltage of

Grid-No.3 Voltage for Focus with
Ultor Current of 100 \( \mu \)amp... 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.
NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN NO. 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND BULB TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS OF \( \pm 10^\circ \)). BULB TERMINAL IS ON SAME SIDE AS PIN NO. 6.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE REFERENCE-LINE GAUGE (JETEC NO. 112) 1.500" \( \pm 0.003" - 0.000" \) 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".

FEB. 1, 1952

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-7691
E_f = 6.3 VOLTS
ULTOR (GRID-N2 4 AND COLLECTOR) VOLTS = 10000
GRID-N2 3 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS
GRID N2 1 BIASED TO CUTOFF OF UNDEFLCETED FOCUSED SPOT
RASTER SIZE = 5 3/8" X 4"

AVERAGE GRID-DRIVE CHARACTERISTICS
E_G = 6.3 VOLTS
ULTOR (GRID-Nr 4 AND COLLECTOR) VOLTS = 10000
GRID-Nr 3 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS
GRID Nr 1 BIASED TO CUTOFF OF UNDEFLECTED FOCUSED SPOT

\[ I_U = \text{GRID} \]

\[ I_{C3} = \text{GRID-Nr} 3 \]

AVERAGE GRID-DRIVE CHARACTERISTICS
General:
Heater, for Unipotential Cathode:
Voltage .......... 6.3 ac or dc volts
Current .......... 0.6 amp

Direct Interelectrode Capacitances (Approx.):
Grid No. 1 to All Other Electrodes .......... 6 µf
DJ1 to DJ2 ......... 3 µf
DJ3 to DJ4 .......... 2 µf
DJ1 to All Other Electrodes .............. 9 µf
DJ2 to All Other Electrodes .............. 9 µf
DJ3 to All Other Electrodes .............. 7 µf
DJ4 to All Other Electrodes .............. 7 µf

Faceplate ......... Clear Glass
Phosphor (For Curves, see front of this Section) .......... P1
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
Pin 8 - Deflecting Electrode
DJ4

Pin 9 - Ultron
(Grid No. 2, Collector)
Pin 10 - Deflecting Elect. DJ2
Pin 11 - Deflecting Elect. DJ1
Pin 12 - Internal Connection - Do Not Use
Pin 14 - Heater

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

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

The plane through the tube axis and pin 5 may vary from the trace produced by DJ1 and DJ2 by an angular tolerance (measured about the tube axis) of ±100°. Angle between DJ1 - DJ2 trace and DJ3 - DJ4 trace is 90° ± 30°.

* See next page.
7VPI

OSCILLOGRAPH TUBE

Maximum Ratings, Design-Center Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR VOLTAGE</td>
<td>4000 max. volts</td>
</tr>
<tr>
<td>GRID-No.3 VOLTAGE</td>
<td>2000 max. volts</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.3 Voltage</td>
<td>27% to 40% of ( E_u )</td>
</tr>
<tr>
<td>Maximum Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot: 2.8% of ( E_u )</td>
<td></td>
</tr>
<tr>
<td>Grid-No.3 Current</td>
<td>-15 to +10 ( \mu )amp</td>
</tr>
</tbody>
</table>

Deflection Factors:
- \( D_1 \) & \( D_2 \): 31 to 41 \( \text{v dc/in./kv of } E_u \)
- \( D_3 \) & \( D_4 \): 25 to 34 \( \text{v dc/in./kv of } E_u \)

Spot Position

Examples of Use of Design Ranges:

For ultor voltage of 1500 to 4000 volts

Grid-No.3 Voltage:
- for Focus: 400 to 600, 800 to 1200 volts
- for Visual Extinction of Undeflected Focused Spot: -42 to -84 volts

Deflection Factors:
- \( D_1 \) & \( D_2 \): 47 to 62, 93 to 123 volts \( \text{dc/in.} \)
- \( D_3 \) & \( D_4 \): 38 to 51, 75 to 102 volts \( \text{dc/in.} \)

Maximum Circuit Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid No.1-Circuit Resistance</td>
<td>1.5 max. mohms</td>
</tr>
<tr>
<td>Resistance in Any Deflecting Electrode Circuit</td>
<td>5.0 max. mohms</td>
</tr>
</tbody>
</table>

In the 7VPI, 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 'ulator.' The 'ulator' 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.

NOV. 1, 1952 TUBE DEPARTMENT TENTATIVE DATA 1

RADIO CORPORATION OF AMERICA, MARRIOTT, NEW JERSEY
Brilliance and definition decrease with decreasing voltage. A value as low as 1000 volts is recommended only for low-velocity deflection and low ambient-light levels.

With 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.

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

#### Grid-No. 3 Volts Adjusted for Focus

<table>
<thead>
<tr>
<th>Curve</th>
<th>Current</th>
<th>Ulterior</th>
<th>Ulterior</th>
<th>Ulterior</th>
<th>Ulterior</th>
<th>Ulterior</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>800</td>
<td>30.00</td>
<td>1.500</td>
<td>10.00</td>
<td>15.00</td>
<td>20.00</td>
</tr>
<tr>
<td>B</td>
<td>2500</td>
<td>6.300</td>
<td>10.00</td>
<td>15.00</td>
<td>20.00</td>
<td>25.00</td>
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<tr>
<td>C</td>
<td>5000</td>
<td>12.500</td>
<td>15.00</td>
<td>17.50</td>
<td>15.00</td>
<td>10.00</td>
</tr>
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<td>D</td>
<td>7500</td>
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<td>15.00</td>
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<td>30.000</td>
<td>20.00</td>
<td>22.50</td>
<td>15.00</td>
<td>10.00</td>
</tr>
</tbody>
</table>

#### Diagram

- **Fluorescent Screen Micromympere**
- **Grid-Nr. Volts**
- **Ulterior Microampere**

---

**Notes:**
- Grid-No. 3 Volts Adjusted for Focus.
- Data provided for various currents and voltages, illustrating the relationship between grid voltage, current, and micromympere output.
Spectral-Energy Emission Characteristic of Phosphor No.6
SILICATE-SULFIDE TYPE

<table>
<thead>
<tr>
<th>COLOR</th>
<th>CIE COORDINATES</th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>6300°K</td>
<td></td>
<td>0.317</td>
<td>0.331</td>
</tr>
</tbody>
</table>

RELATIVE RADIANT ENERGY

WAVELENGTH—ANGSTROMS

92CM-7458RI
Typical Drive Characteristics
CATHODE-DRIVE SERVICE

Anode-to-grid No. 1 voltage = 80,000 Volts
Grid-No. 3-to-grid No. 1 voltage adjusted for focus at 1.5 milliamperes anode current.
Grid-No. 2-to-grid No. 1 voltage adjusted for spot cutoff at indicated cathode-to-grid No. 1 voltage.

Zero-bias point

Video signal from spot cutoff — Volts

Data 6
RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.
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 f
  Cathode to All Other Electrodes 5 \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)

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 utor function, and collector are connected together within the tube and are conveniently referred to collectively as "UTOR." The "UTOR" 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.
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 450 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.
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".
SPECTRAL-ENERGY EMISSION CHARACTERISTIC
OF PHOSPHOR P31

Time for initial brilliance to decay to 1/2 point.

PERSISTENCE: 20 sec.
Medium Short (Approx. 30 sec).
Green
Phosphorescence
Fluorescence
Green
Phosphor (See accompanying curves)

General:

The T7P3 is the same as the T7P2 except for the following items:

HIGH DEFLECTION SENSITIVITY
MEDIUM-SHORT-PERSISTENCE SCREEN

Electrostatic Focus
Oscillograph Tube
7V3P1
PERSISTENCE CHARACTERISTIC OF PHOSPHOR P31

TIME AFTER EXCITATION IS REMOVED—MICROSECONDS

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

FORCED-AIR COOLED MAGNETIC DEFLECTION
ELECTROSTATIC FOCUS 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

QUALITY RECTANGLE (NOTE 1)

7±.3/16
DIA.

.225

3/4 MAX.

115
16 ± 1/8

20.3
L.R.
(NOTE 3)

35°

EXTERNAL CONDUCTIVE COATING (NOTE 6)

REFERENCE LINE (NOTE 5)

213/16
(Note 8)

2 ± 1/16 DIA.

BASE
JEDEC GROUP 5,
No.B14-45 (NOTE 7)

92CM-773IR2

DIMENSIONS IN INCHES

See notes on other side.

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

DATA 12-66
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 Pines 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.)**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D₁</td>
<td>27</td>
</tr>
<tr>
<td>D₂</td>
<td>40</td>
</tr>
<tr>
<td>D₃</td>
<td>40</td>
</tr>
<tr>
<td>D₄</td>
<td>20 inches</td>
</tr>
<tr>
<td>D₅</td>
<td>24.5 inches</td>
</tr>
<tr>
<td>D₆</td>
<td>80 feet</td>
</tr>
</tbody>
</table>

**DATA**

RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.
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: \(0.6 \pm 10\%\) amp

Capacitance between External Conductive Coating and Ultor:
   \(350\) max. \(\mu\text{f}\)
   \(250\) min. \(\mu\text{f}\)

Faceplate, Spherical: Filterglass
Phosphor (for curves, see front of this Section): P4—Sulfide Type

Deflection Angles (Approx.):
   Diagonal: \(90^\circ\)
   Horizontal: \(85^\circ\)
   Vertical: \(68^\circ\)
Electron Gun: Ion-Trap Type Requiring External Single-Field Magnet

Tube Dimensions:
   Overall length: \(10-7/16'' \pm 5/16''\)
   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: \(6-1/2'' \pm 3/16''\)
   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. 86-158)
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

\(\downarrow\) Indicates a change.
## 8DP4 PICTURE TUBE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Negative-peak value</td>
<td>130 max. volts</td>
</tr>
<tr>
<td>Negative-bias value</td>
<td>100 max. volts</td>
</tr>
<tr>
<td>Positive-bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive-peak value</td>
<td>2 max. volts</td>
</tr>
</tbody>
</table>

### 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

---

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Monitor Kinescope

NO ION-TRAP MAGNET REQUIRED
RECTANGULAR GLASS TYPE ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS 90° MAGNETIC DEJECTION

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*

<table>
<thead>
<tr>
<th>Component Description</th>
<th>Maximum Voltage Value</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>14000 max.</td>
<td>volts</td>
</tr>
<tr>
<td>Grid-No.4 (Focusing) Voltage:</td>
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<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>1100 max.</td>
<td>volts</td>
</tr>
<tr>
<td>Negative value</td>
<td>550 max.</td>
<td>volts</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>550 max.</td>
<td>volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative peak value</td>
<td>220 max.</td>
<td>volts</td>
</tr>
<tr>
<td>Negative bias value</td>
<td>155 max.</td>
<td>volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max.</td>
<td>volts</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max.</td>
<td>volts</td>
</tr>
<tr>
<td>Heater Voltage</td>
<td>{6.9, 5.7} min.</td>
<td>volts</td>
</tr>
</tbody>
</table>

### 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*

<table>
<thead>
<tr>
<th>Component Description</th>
<th>Voltage Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>11000</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>0 to 300</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>300</td>
</tr>
<tr>
<td>Grid-No.1 Voltage for visual extinction of focused raster</td>
<td>-28 to -72 volts</td>
</tr>
</tbody>
</table>

### 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:
- Positive value: 550 max. volts
- Negative value: 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

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: 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

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

NO ION-TRAP MAGNET REQUIRED
RECTANGULAR GLASS TYPE
ELECTROSTATIC SELF FOCUS
ALUMINIZED SCREEN
90° MAGNETIC DEFORMATION

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
Electrostatic 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

RECTANGULAR GLASS TYPE
ELECTROSTATIC SELF FOCUS

NO ION-TRAP MAGNET REQUIRED
ALUMINIZED SCREEN
110° MAGNETIC DEFLECTION

Electrical:
Direct Interelectrode Capacitances:
- Cathode to all other electrodes: 4 pf
- Grid No.1 to all other electrodes: 6 pf
Heater Current at 6.3 volts: 600 ma
Electron Gun: Type Requiring No Ion-Trap Magnet

Optical:
Phosphor (For curves, see front of this Section): .P4—Sulfide Type, Aluminized
- Faceplate: Filterglass
- Light transmission (Approx.): 80%

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

For Additional Information on Dimensions:
See Picture-Tube Dimensional-Outlines and Bulb J67-1/2 B sheets at front of this section

Cap.: Recessed Small Cavity (JEDEC No.J1-21)
Bases (Alternates):
- Special 6-Pin (JEDEC No.B6-185)
- Special 6-Pin (JEDEC No.B6-214)

Basing Designation for 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
  - Positive peak value: 2 volts
  - Negative bias value: 155 volts
  - Positive bias value: 0 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
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  
Type (See CRT OUTLINES at front of this section)... Regular-Band  
Contact area for grounding... Near Reference Line  
Cap... Recessed Small Cavity (JEDEC No.J1-21)  
Base... Small-Button Special Miniature 7-Pin (JEDEC No.E7-9J)  

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  

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  

RADIO CORPORATION OF AMERICA  
Electronic Components and Devices  
Harrison, N. J.  
DATA 7-67
Grid-No.1 Voltage

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Negative peak value</td>
<td>220 max V</td>
</tr>
<tr>
<td>Negative bias value</td>
<td>155 max V</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max V</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max V</td>
</tr>
</tbody>
</table>

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 Ω

a Includes implosion protection hardware.

DIMENSIONAL OUTLINE (BULB J71-1/2 B1)
## Monitor Kinescope

### Aluminized Screen

### Data

<table>
<thead>
<tr>
<th>General</th>
<th>Pin 1 - Heater</th>
<th>Pin 2 - Grid No.1</th>
<th>Pin 6 - Grid No.3</th>
<th>Pin 10 - Grid No.2</th>
<th>Pin 11 - Cathode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater, for Unipotential Cathode:</td>
<td>120</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Voltage</td>
<td>6.3</td>
<td>0.6</td>
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<tr>
<td>Current</td>
<td>ac or dc volts</td>
<td>amp</td>
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<td></td>
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<tr>
<td>Direct Interelectrode Capacitances:</td>
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</tr>
<tr>
<td>Grid No.1 to all other electrodes.</td>
<td>6 μF</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Cathode to all other electrodes.</td>
<td>5 μF</td>
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<tr>
<td>Faceplate, Spherical</td>
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<tr>
<td>Light transmission (Approx.)</td>
<td>76%</td>
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<tr>
<td>Phosphor (for curves, see front of this section)</td>
<td>P4-Sulfide Type</td>
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<tr>
<td>Fluorescence</td>
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<td>Phosphorescence</td>
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<td>Persistence</td>
<td>Short</td>
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<td>Focusing Method</td>
<td>Electrostatic</td>
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<tr>
<td>Deflection Method</td>
<td>Magnetic</td>
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<tr>
<td>Deflection Angle (Approx.)</td>
<td>50°</td>
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</tr>
<tr>
<td>Overall Length</td>
<td>16-5/8&quot; ± 3/8&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greatest Diameter of Bulb</td>
<td>10-1/2&quot; ± 1/16&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum Useful Screen Diameter</td>
<td>9-1/8&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Picture Size (Within minimum useful screen area)</td>
<td>8&quot; x 6&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (Approx.)</td>
<td>10 lbs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Position</td>
<td>Any</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cap.</td>
<td>Recessed Small Cavity (JETEC No.J1-21)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulb</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base</td>
<td>Small-Shell Duodecal 6-Pin (JETEC No.B6-63)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basing Designation for BOTTOM VIEW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 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.
## Equipment Design Ranges:

For any ultor voltage ($E_{ul}$) between 10000 and 20000 volts and grid-No.2 voltage ($E_{c2}$) between 150 and 410 volts.

| Grid-No.3 Voltage for focus with ultor current of 100 $\mu$A | $11.7\%$ to $15.9\%$ of $E_{c4}$ volts |
| Grid-No.1 Voltage for visual extinction of $8''$ x $6''$ raster | $9\%$ to $24\%$ of $E_{c2}$ volts |

Maximum Grid-No.3 Current

Grid-No.2 Current: $-15$ to $+15\mu$A

Field Strength of Adjustable Centering Magnet: 0 to 8 gausses

### Examples of Use of Design Ranges:

For ultor voltage of 12000 and grid-No.2 voltage of 200 volts.

| Grid-No.3 Voltage for focus with ultor current of 100 $\mu$A | 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 I-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section.

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.
AVerage Grid-Drive Characteristic

$E_G = 6.3$ Volts

Ultor (Grid-No 4-And-Collector) Volts = 12000

Grid-No 3 Volts Adjusted to Give Focus
At Average Raster Brightness;
Grid No 1 Biased to Raster Cutoff.
Raster Size = 8'' x 6''
AVERAGE GRID-DRIVE CHARACTERISTICS

ULTOR (GRID-N3 AND EF = 6.3 VOLTS)

E.F. = 6.3 VOLTS

ULTRACRISTAL

RASP SIZE = 8 X 6

GRID-N3 BIAS TO CUT-OFF OR RASTER
AT AVERAGE RASTER BRIGHTNESS
GRID-N3 VOLTS ADJUSTED TO GIVE FOCUS
COLLECTION VOLTS = 12000

video signal volts from cutoff
0 20 40 60 80 100
0 20 40 60 80 100
GRID-DRIVE CHARACTERISTICS

\[ E_r = 6.3 \text{ VOLTS} \]

ULTOR (GRID-Nº 4 AND COLLECTOR) VOLTS = 12000
GRID-Nº 3 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS
GRID Nº 1 BIASED TO CUTOFF OF RASTER
RASTER SIZE = 8" x 6"

MAR. 21, 1952
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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: Requires 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:
- Type (See CRT OUTLINES at front of this section): Regular-Band
- Contact area for grounding: Near Reference Line
- Cap: Recessed Small Cavity (JEDEC No.J1-21)
- Base: Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1—Heater
Pin 2—Grid No. 1
Pin 3—Grid No. 2
Pin 4—Grid No. 4
Pin 6—Grid No. 1
Pin 7—Cathode
Pin 8—Heater
Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)
C—External Conductive Coating

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode
Anode Voltage: 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 Ω

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

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

FILLED-RIM TYPE

110° MAGNETIC DEFLECTION  INTERMEDIATE-GRID-No.2 VOLTAGE

Direct Inter electrode 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.) 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. JI-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

<table>
<thead>
<tr>
<th>Component</th>
<th>Voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>11000</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>0</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>150</td>
</tr>
<tr>
<td>Cathode Voltage</td>
<td>31 to 49</td>
</tr>
</tbody>
</table>

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

MINIMUM SCREEN
DIAGONAL 10.250
GREATEST WIDTH 9.000
GREATEST HEIGHT 7.062

SHELL OPENING 7.375 MIN.
CAVITY CAP JEDEC NO. J1-21

MINIMUM SCREEN
SHELL OPENING 9.250 MIN.

REFERENCE LINE DETERMINED BY GAUGE
JEDEC NO. G-126

DIMENSIONS IN INCHES

DATA
RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.
**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: Pu—Sulfide Type, Aluminized
- 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:
  - Type (See CRT OUTLINES at front of this section): Regular-Band
  - Contact area for grounding: Near Reference Line
- Cap: Recessed Small Cavity (JEDEC No.J1-21)
- Base: Small-Button Neoeightar 7-Pin, Arrangement I, (JEDEC No.B7-208)

**TERMINAL DIAGRAM (Bottom View)**

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 3—Grid No.2
- Pin 4—Grid No.4
- Pin 6—Grid No.1
- Pin 7—Cathode
- Pin 8—Heater
- Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)
- C—External Conductive Coating

**MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES**

Voltages are positive with respect to cathode

- Anode Voltage: 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
**11HP4A**

**Peak Heater-Cathode Voltage**

Heater negative with respect to cathode:
- During equipment warm-up period \( \leq 15 \) 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 J878)**

Dimensions in inches
Picture Tube

PAN-O-PLY TYPE
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 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 Neoeightar7-Pin, Arrangement I, (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

ANODE
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

Voltagess are positive with respect to grid No.1

Anode Voltage .................... 13000 V
Grid-No.4 Voltage............... 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 cur-
rent 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)

DATA

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

**RECTANGULAR GLASS TYPE**
**LOW-VOLTAGE ELECTROSTATIC FOCUS**
**ALUMINIZED SCREEN**
**90° MAGNETIC DEFLECTION**

With Heater Having Controlled Warm-Up Time

**GENERAL DATA**

**Electrical:**
- Direct Interelectrode Capacitances:
  - Cathode to all other electrodes: 5 pf
  - Grid No.1 to all other electrodes: 6 pf
- External conductive coating to anode: (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

*Diagram showing pin connections and annotations.*

**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: 0 max. volts
Positive bias value: 2 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:

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.
This data sheet is to be used in conjunction with data for RCA-15NP22.

For general data, maximum and minimum ratings, equipment design ranges, limiting circuit values, and terminal diagram of the 15AEP22, refer to 15NP22 except as noted below.

**MECHANICAL**

**Tube Dimensions (excluding mounting lugs):**
- Diagonal: $14.910 \pm .093$ in ($378.21 \pm 2.36$ mm)
- Greatest width: $12.949 \pm .093$ in ($328.90 \pm 2.36$ mm)
- Greatest height (including tension-band clip): $10.613 \pm .100$ in ($269.57 \pm 2.54$ mm)
- Weight (Approx.): $11.3$ lb ($5.1$ kg)

**DIMENSIONAL OUTLINE**

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

### Top View

### Mounting Lug Detail

**NOTE I**

- $12.949 \pm .093$ in ($328.90 \pm 2.36$ mm) O.D. of tension band
DIMENSIONAL OUTLINE (Cont’d)

Front View

Dimensions in inches 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.
### 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:

<table>
<thead>
<tr>
<th>Voltage (AC or DC)</th>
<th>6.3 volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>1.8 amp</td>
</tr>
</tbody>
</table>

Direct Interelectrode Capacitances (Approx.):

<table>
<thead>
<tr>
<th>Capacitance</th>
<th>Grid No.1 of Any Gun to All Other Electrodes Except the No.1 Grids of the Other Two Guns</th>
<th>7.5 μf</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cathode of Blue Gun + Cathode of Green Gun + Cathode of Red Gun to All Other Electrodes</td>
<td>17.5 μf</td>
</tr>
<tr>
<td></td>
<td>Grid No.3 (Of Each Gun Tied within Tube to No.3 Grids of Other Two Guns) to All Other Electrodes</td>
<td>12 μf</td>
</tr>
<tr>
<td></td>
<td>Grid No.4 (Common to the Three Guns) to All Common Electrodes</td>
<td>7 μf</td>
</tr>
</tbody>
</table>

External Conductive Coating to Ultor.

<table>
<thead>
<tr>
<th>Maximum</th>
<th>3000 max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>1500 min.</td>
</tr>
</tbody>
</table>

**Faceplate, Spherical:**

<table>
<thead>
<tr>
<th>Type</th>
<th>Metal-Backed, Tricolor, Phosphor-Dot Plate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Transmission (Approx.)</td>
<td>70%</td>
</tr>
<tr>
<td>Size (Rounded Sides—See Dimensional Outline)</td>
<td>11-1/2&quot; x 8-5/8&quot;</td>
</tr>
<tr>
<td>Area</td>
<td>88.5 sq. in.</td>
</tr>
</tbody>
</table>

**Phosphor (Three Separate Phosphors, collectively):**

| Fluorescence and Phosphorescence of Separate Phosphors, respectively | Medium |

**Dot Arrangement:**

| Approx. 195,000 triangular groups, each consisting of blue dot, green dot, and red dot (total of 585,000 dots) | P22 |

**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" max. |
|                       | At metal flange 15-3/4" max. |
| Weight                | 25 lbs |

---

MARCH 1, 1954
TRICOLOR KINESCOPE

Mounting Position .................................................... Any
Utor 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: Utor (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 "utor" 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 "utor", 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.

MARCH 1, 1954

TUBE DEPARTMENT

TENTATIVE DATA 1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Grid-No.2 Voltage (Each Gun)
when circuit design utilizes grid-No.1 Voltage
(Ec1) at fixed value for raster cutoff (each gun) ... 2 to 4.5 times Ec1 volts

Grid-No.1 Voltage for
Visual Extinction of Focused Raster (Each Gun)
when circuit design utilizes grid-No.2 voltage
(Ec2) at fixed value (each gun) ... 22.5% to 50% of Ec2 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 output 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.
TRICOLOR KINESCOPE

SCREEN HEIGHT 85 7/8" 
SCREEN MASK
FACEPLATE SECTION 3 7/16" ± 3/32"
FACEPLATE (NOTE 5)
FACEPLATE SECTION 3 7/16" ± 3/32"
SUPPORT AREA 3 7/16" MIN (NOTE 6)
ULTRAL METAL FLANGE (NOTE 4)
EXTERNAL INSULATING COATING (NOTE 7)
EXTERNAL CONDUCTIVE COATING (NOTE 3)
REFERENCE LINE (NOTE 1)
-SMALL-SHELL BIDEICAL 14-PIN BASE (NOTE 2)
JETEC NO B14-103 SEE DETAIL C

MARCH 1, 1954
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
NOTE 1: REFERENCE LINE IS DETERMINED BY POSITION WHERE A CYLINDRICAL GAUGE 2.400" \( \pm 0.001" \) 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 ULTR 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 LINT-LESS 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 ... \[1300 \text{ max. pf}
- \[800 \text{ 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
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 J295 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

<table>
<thead>
<tr>
<th>Pin 1</th>
<th>Heater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin 2</td>
<td>Grid No.1</td>
</tr>
<tr>
<td>Pin 3</td>
<td>Grid No.2</td>
</tr>
<tr>
<td>Pin 4</td>
<td>Grid No.4</td>
</tr>
<tr>
<td>Pin 5</td>
<td>Grid No.1</td>
</tr>
<tr>
<td>Pin 7</td>
<td>Cathode</td>
</tr>
<tr>
<td>Pin 8</td>
<td>Heater</td>
</tr>
</tbody>
</table>

Cap — Anode (Grid No.3, Screen, Collector)
C — External Conductive Coating
**16BGP4**

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

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Maximum values</th>
<th>Minimum values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>20000 max. volts</td>
<td>12000 min. volts</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>Positive value: 1100 max. volts</td>
<td>Negative value: 550 max. volts</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>Positive value: 550 max. volts</td>
<td>Negative value: 200 min. volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td>Negative peak value: 220 max. volts</td>
<td>Negative bias value: 155 max. volts</td>
</tr>
<tr>
<td></td>
<td>Positive bias value: 0 max. volts</td>
<td>Positive peak value: 2 max. volts</td>
</tr>
<tr>
<td>Heater Voltage</td>
<td>6.9 max. volts</td>
<td>5.7 min. volts</td>
</tr>
</tbody>
</table>

**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*

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>16000 volts</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>100 volts</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>300 volts</td>
</tr>
<tr>
<td>Cathode Voltage</td>
<td>28 to 60 volts</td>
</tr>
<tr>
<td>Field Strength</td>
<td>0 to 8 gauss</td>
</tr>
</tbody>
</table>

**Maximum Circuit Values:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1—Circuit Resistance</td>
<td>1.5 max. megohms</td>
</tr>
</tbody>
</table>

*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 11% 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... .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... Sulfide Type, Aluminized
  - For curves, see front of this section
- Faceplate
  - 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 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)**

**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 Voltageb ................. 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 14Ω

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)
**Picture Tube**

**PAN-O-PLY TYPE**

**ELECTRICAL**

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: 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**
- Pu—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**
- Type (See CRT OUTLINES 1 at front of this section)
  - Regular-Band Contact area for grounding
  - Near Reference Line
  - Recessed Small Cavity (JEDEC No. J1-21)
  - Base
  - Small-Button Neoeightar 7-Pin
  - Arrangement I, (JEDEC No.B7-208)

**TERMINAL DIAGRAM**

(Bottom View)

**MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES**

**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 Ω

* 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 to 750 min pF)

Heater Current at 6.3 V: 600 ± 30 mA

Electron Gun: Type Requiring No Ion-Trap Magnet

OPTICAL

Phosphor: P4—Sulfide Type, Aluminized
Faceplate: Filterglass
Light Transmission (Approx.): 66%

MECHANICAL

Weight (Approx.): 16 lb
Overall Length: 18.750 ± 0.375 in
Neck Length: 7.500 ± 0.188 in
Projected Area of Screen: 139 sq in

External Conductive Coating
- 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
- 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

16RP4B

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

DATA
10-65
**Heater Voltage**

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.9 max</td>
<td>V</td>
</tr>
<tr>
<td>5.7 min</td>
<td>V</td>
</tr>
</tbody>
</table>

**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*

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>12000 V</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>300 V</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td>-28 to -72 V</td>
</tr>
</tbody>
</table>

For visual extinction of focused raster

**MAXIMUM CIRCUIT VALUE**

<table>
<thead>
<tr>
<th>Resistance</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1-Circuit</td>
<td>1.5 max MΩ</td>
</tr>
</tbody>
</table>

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

### DATA

#### General:
Heater, for Unipotential Cathode:
- Voltage: 6.3 ac or dc volts
- Current: 0.6 ± 10% amp
Capacitance between External Conductive Coating and Ultron:
- 2000 max. μF
- 750 min. μF
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 Recessed Small Cavity (JETEC No.J1-21)

#### Basing Designation for BOTTOM VIEW:
12N

#### Pin Designation:
- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater
- Cap—Ultror (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

---

9-58 ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRESON, NEW JERSEY
### 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
**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. μf
- 750 min. μf

**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

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Heater</td>
</tr>
<tr>
<td>2</td>
<td>Grid No.1</td>
</tr>
<tr>
<td>10</td>
<td>Grid No.2</td>
</tr>
<tr>
<td>11</td>
<td>Cathode</td>
</tr>
<tr>
<td>12</td>
<td>Heater</td>
</tr>
</tbody>
</table>

**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.*

---

**DATA**

**MAGNETIC FOCUS**

**MAGNETIC DEFLECTION**

---

**RCA**

**16WP4-A**

**PICTURE TUBE**

**ROUND GLASS TYPE**
### 17CP4 Picture Tube

**Rectangular Metal-Shell Type**

#### 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.*

**ELECTRON TUBE DIVISION**

*Radio Corporation of America, Harrison, New Jersey*
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
**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—Metal-Shell Lip—

(Ultor (Grid No.3, Collector)

(Grid No.5, Collector)

**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**

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

- **ULTOR VOLTAGE:** 16000 max. volts
- **GRID-No.4 (FOCUSBING) 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.
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
**Picture Tube**

**RECTANGULAR GLASS TYPE**

**LOW-VOLTAGE ELECTROSTATIC FOCUS**

**ALUMINIZED SCREEN**

**90° MAGNETIC DEFLECTION**

**GENERAL DATA**

**Electrical:**
- Direct Interelectrode Capacitances:
  - Cathode to all other electrodes: 5 pf
  - Grid No.1 to all other electrodes: 6 pf
  - External conductive coating to anode: 1500 max. pf, 1000 min. pf
- Heater Current at 6.3 volts: 600 ± 30 ma
- Electron Gun: Type Requiring No Ion-Trap Magnet

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

**Mechanical:**
- Weight (Approx.): 15 lbs
- Overall Length: 14-5/8" ± 3/8"
- Neck Length: 5-1/2" ± 3/16"
- Projected Area of Screen: 149 sq. in.
- External Conductive Coating:
  - Type: Regular-Band
  - Contact area for grounding: Near Reference Line

For Additional Information on Coatings and Dimensions:
- See Picture-Tube Dimensional-Outlines and Bulb J193 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**

<table>
<thead>
<tr>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>17500</td>
<td>max.</td>
</tr>
<tr>
<td>11000</td>
<td>min.</td>
</tr>
</tbody>
</table>

**GRID-No.4 (FOCUSING) VOLTAGE**:

<table>
<thead>
<tr>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>1100 max. volts</td>
</tr>
<tr>
<td>Negative</td>
<td>550 max. volts</td>
</tr>
</tbody>
</table>

**GRID-No.2 VOLTAGE**:

<table>
<thead>
<tr>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>220 max. volts</td>
</tr>
<tr>
<td>Positive</td>
<td>155 max. volts</td>
</tr>
</tbody>
</table>

**GRID-No.1 VOLTAGE**:

<table>
<thead>
<tr>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>220 max. volts</td>
</tr>
<tr>
<td>Positive</td>
<td>155 max. volts</td>
</tr>
</tbody>
</table>

**HEATER VOLTAGE**

<table>
<thead>
<tr>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.9</td>
<td>max.</td>
</tr>
<tr>
<td>5.7</td>
<td>min.</td>
</tr>
</tbody>
</table>

**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**

<table>
<thead>
<tr>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>14000</td>
<td>volts</td>
</tr>
</tbody>
</table>

**Grid-No.4 Voltage**

<table>
<thead>
<tr>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>-55 to +300</td>
<td>volts</td>
</tr>
</tbody>
</table>

**Grid-No.2 Voltage**

<table>
<thead>
<tr>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>volts</td>
</tr>
</tbody>
</table>

**Grid-No.1 Voltage for visual extinction of focused raster**

<table>
<thead>
<tr>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>-28 to -72</td>
<td>volts</td>
</tr>
</tbody>
</table>

**Maximum Circuit Value**:

**Grid-No.1-Circuit Resistance**

<table>
<thead>
<tr>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>max.</td>
</tr>
</tbody>
</table>

For X-radiation shielding considerations, see sheet

**I-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. \} 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
Maximum and Minimum Ratings, Design-Maximum Values:

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Maximum</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>17500 max.</td>
<td></td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>550 max.</td>
<td></td>
</tr>
<tr>
<td>Grid-No.1 Voltage:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative peak value</td>
<td>220 max.</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>155 max.</td>
<td></td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max.</td>
<td></td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max.</td>
<td></td>
</tr>
<tr>
<td>Heater Voltage</td>
<td>6.9 max.</td>
<td>5.7 min.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Maximum</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>12000</td>
<td></td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>Grid-No.1 Voltage for visual extinction of focused raster</td>
<td>-28 to -72</td>
<td></td>
</tr>
</tbody>
</table>

Maximum Circuit Value:

<table>
<thead>
<tr>
<th>Component</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1-Circuit Resistance</td>
<td>1.5 max. megohms</td>
</tr>
</tbody>
</table>

For X-radiation shielding considerations, see sheet X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section
# RCA 17CFP4

## Picture Tube

### General:
- **Heater, for Unipotential Cathode:**
  - Voltage (AC or DC): 6.3 volts
  - Current: 0.6 ± 10% amp
- **Direct Inter electrode Capacitances:**
  - Grid No.1 to all other electrodes: 6 μf
  - Cathode to all other electrodes: 5 μf
  - External conductive coating to ultor: 1500 max. μf, 1200 min. μf
- **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:
- **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-Center Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Maximum Value</th>
<th>Minimum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR VOLTAGE</td>
<td>16000 max.</td>
<td>12000 min.</td>
</tr>
<tr>
<td>GRID-No.4 (FOCUSBING) VOLTAGE:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>1000 max.</td>
<td></td>
</tr>
<tr>
<td>Negative value</td>
<td>500 max.</td>
<td></td>
</tr>
<tr>
<td>GRID-No.2 VOLTAGE</td>
<td>500 max.</td>
<td></td>
</tr>
<tr>
<td>GRID-No.1 VOLTAGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative-peak value</td>
<td>200 max.</td>
<td></td>
</tr>
<tr>
<td>Negative-bias value</td>
<td>140 max.</td>
<td></td>
</tr>
<tr>
<td>Positive-bias value</td>
<td>0 max.</td>
<td></td>
</tr>
<tr>
<td>Positive-peak value</td>
<td>2 max.</td>
<td></td>
</tr>
</tbody>
</table>

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_k) between 12000* and 16000 volts and grid-No.2 voltage (E_{c2k}) between 200 and 500 volts

Grid-No.4 Voltage for focus: -50 to +350 volts

Grid-No.1 Voltage 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_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 gauss

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
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

CATMODE-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 (Ec1)g between
12000 and 16000 volts and grid-No.2-to-grid- No.1 voltage (Ec2)g 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 (Ek) 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 except video drive is a negative voltage

Grid-No.4 Current ........ -25 to +25 ma

10-59 ELECTRON TUBE DIVISION
PHILIPS CORPORATION OF AMERICA, HARRISON, NEW JERSEY
DATA 2
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 ulti-to-grid-
No.1 voltage of...
and grid-No.2-to-grid-
No.1 voltage of...
Grid-No.4-to-Grid-No.1
Voltage for focus...
Cathode-to-Grid No.1
Voltage for visual extinction of focused raster...
Cathode-to-Grid-No.1
Video Drive from Raster Cutoff (Black level):
White-level value...

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 cathode potential with respect to cathode.

This value is a working design-center minimum. The equivalent absolute minimum ulti-or ulti-to-grid-No.1 voltage is 10,800 volts, below which the serviceability of the 17CFPs 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 ulti-or ulti-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 ulti current and will remain essentially constant for values of ulti voltage (or ulti-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**

\[ E_f = 6.3 \text{ VOLTS} \]
\[ \text{ULTOR VOLTS} = 12000 \text{ TO } 16000 \]
\[ \text{GRID-N}^24 \text{ VOLTS ADJUSTED FOR FOCUS.} \]

**CATHODE-DRIVE SERVICE**

\[ E_f = 6.3 \text{ VOLTS} \]
\[ \text{ULTOR-TO-GRID-N}^21 \text{ VOLTS} = 12000 \text{ TO } 16000 \]
\[ \text{GRID-N}^24 \text{-TO-GRID-N}^21 \text{ VOLTS ADJUSTED FOR FOCUS.} \]

NOTE 2: WITH TUBE NECK INSERTED THROUGHT FLARED END OF REFERENCE-LINE GAUGE JEDEC NO.6-116 (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 SPIECE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/4", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/8" BEYOND THE ENVELOPE SURFACE AT THE LOCATION SPECIFIED FOR DIMENSIONING THE ENVELOPE WIDTH, DIAGONAL, AND HEIGHT.

NOTE 8: THE TUBE SHOULD BE SUPPORTED ON BOTH SIDES OF THE BULGE. THE MECHANISM USED SHOULD PROVIDE CLEARANCE FOR THE MAXIMUM DIMENSIONS OF THE BULGE.
## 17CFP4 AVERAGE DRIVE CHARACTERISTICS

<table>
<thead>
<tr>
<th>CATHODE-DRIVE SERVICE</th>
<th>GRID-DRIVE SERVICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E_f = 6.3 \text{ VOLTS}$</td>
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</tr>
<tr>
<td>ULTOR-TO-GRID-N$^1$ VOLTS = 16000</td>
<td>ULTOR VOLTS = 16000</td>
</tr>
<tr>
<td>CATHODE BIASED POSITIVE WITH RESPECT TO GRID N$^1$ TO GIVE FOCUSED RASTER CUTOFF.</td>
<td>GRID N$^1$ BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.</td>
</tr>
<tr>
<td>RASTER FOCUSED AT AVERAGE BRIGHTNESS.</td>
<td>RASTER FOCUSED AT AVERAGE BRIGHTNESS.</td>
</tr>
<tr>
<td>RASTER SIZE = 14&quot; x 10½&quot;</td>
<td>RASTER SIZE = 14&quot; x 10½&quot;</td>
</tr>
</tbody>
</table>

**I.C.I. COORDINATES OF SCREEN:** $x=0.270$, $y=0.300$

---

**VIDEO SIGNAL VOLTS FROM RASTER CUTOFF**

**HIGHLIGHT BRIGHTNESS—FOOTLAMBERTS**

- **CATHODE DRIVE**
- **GRID DRIVE**
AVERAGE DRIVE CHARACTERISTICS

<table>
<thead>
<tr>
<th>CATHODE-DRIVE SERVICE</th>
<th>GRID-DRIVE SERVICE</th>
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<tr>
<td>$E_f = 6.3 \text{ VOLS}$</td>
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</tr>
<tr>
<td>$\text{ULTOR-TO-GRID-N} #1$</td>
<td>$\text{ULTOR VOLTS=12000 TO 16000}$</td>
</tr>
<tr>
<td>$\text{VOLTS}=12000 \text{ TO } 16000$</td>
<td>$\text{GRID N} #1 \text{ BIASED NEGATIVE WITH}$</td>
</tr>
<tr>
<td>$\text{CATHODE BIASED POSITIVE WITH}$</td>
<td>$\text{RESPECT TO CATHODE TO GIVE}$</td>
</tr>
<tr>
<td>$\text{RESPECT TO GRID N} #1 \text{ TO GIVE}$</td>
<td>$\text{FOCUSED RASTER CUTOFF.}$</td>
</tr>
<tr>
<td>$\text{FOCUSED RASTER CUTOFF.}$</td>
<td>$\text{FOCUSED RASTER CUTOFF.}$</td>
</tr>
</tbody>
</table>

---

**CATHODE DRIVE**

**GRID DRIVE**

**VIDEO SIGNAL VOLTS FROM RASTER CUTOFF**

**ULTOR MILLIAMPERES**

**ELECTRON TUBE DIVISION**

**RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY**

**92CM-9243**
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 µf
  Cathode to all other electrodes...... 5 µf

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 Jiga-1/a A/8 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

G3,G5,CL ULTOR
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...........
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
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
Light transmission (Approx.): Filterglass: 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:
- Contact area for grounding: Near Reference Line
- Type: Modified-Band

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
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
## 17DSP4 PICTURE TUBE

**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 µuf
- Cathode to all other electrodes: 5 µuf
- External conductive coating to ultror: 1500 max. µuf, 1000 min. µuf

Faceplate, Spherical.
- Light transmission (Approx.): 78%

Phosphor (For curves, see front of this section): P4—Sulfide Type
- 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" ± 3/16"
- Greatest width: 15-5/8" ± 1/8" ± 1/8"
- Greatest height: 12-3/4" ± 1/8" ± 1/8"
- Diagonal: 16-9/16" ± 1/8" ± 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
I7DSP4
PICTURE TUBE

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

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 (Ec4k) between 12000* and 18000 volts
and grid-No.2 voltage (Ec2k) between 200 and 500 volts

Grid-No.4 Voltage for focus$ . . . . . . . . . . . . . . . . . . . . . . . . 0 to 400 volts

Grid-No.1 Voltage (Ec1k)
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
Ec1k except video drive is a positive voltage

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

GRID-DRIVE SERVICE

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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 gauss

**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
- Grid-No.1 Voltage for visual extinction of focused raster: -38 to -72 volts
- Grid-No.1 Video Drive from Raster Cutoff (Black level):
  - White-level value: 38 to 72 volts
  - 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
- GRID-No.4-TO-GRID-No.1 (FOCUSB) 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 \( (E_{c1}) \) between 13000 and 18000 volts and grid-No. 2-to-grid-No. 1 voltage \( (E_{c2}) \) 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 \( (E_{k1}) \) 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: Same value as determined for \( E_{k1} \) except video drive is a negative value
- Grid-No. 4 Current: -25 to +25 \( \mu A \)
- Grid-No. 2 Current: -15 to +15 \( \mu A \)
- Field Strength of Adjustable Centering Magnet: 0 to 8 gauss

Examples of Use of Design Ranges:

- With ultor-to-grid-No. 1 voltage of 16000 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: 35 to 63 volts
- Cathode-to-Grid-No. 1 Video Drive from Raster Cutoff (Black level):
  - White-level value: -35 to -63 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.
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 p.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.
NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF \( \pm 30^\circ \). ULTOR TERMINAL IS ON SAME SIDE AS PIN 4.


NOTE 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 2-9/32" \( \pm 1/32" \) FROM THE PLANE TANGENT TO THE SURFACE OF THE FACEPLATE AT THE TUBE AXIS.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/4", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/8" BEYOND THE ENVELOPE SURFACE AT THE LOCATION SPECIFIED FOR DIMENSIONING THE ENVELOPE WIDTH, DIAGONAL, AND HEIGHT.

NOTE 8: THE TUBE SHOULD BE SUPPORTED ON BOTH SIDES OF THE BULGE. THE MECHANISM USED SHOULD PROVIDE CLEARANCE FOR THE MAXIMUM DIMENSIONS OF THE BULGE. SUPPORTS MUST BE SPACED FROM THE TUBE BY THE USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.
## AVERAGE DRIVE CHARACTERISTICS

<table>
<thead>
<tr>
<th>Cathode-Drive Service</th>
<th>Grid-Drive Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E_f = 6.3\text{ VOLTS}$</td>
<td>$E_f = 6.3\text{ VOLTS}$</td>
</tr>
<tr>
<td>Ulterior-to-Grid-#1 Volts = 16000</td>
<td>Ulterior Volts = 16000</td>
</tr>
<tr>
<td>Cathode biased positive with respect to grid #1 to give focused raster cutoff.</td>
<td>Grid #1 biased negative with respect to cathode to give focused raster cutoff.</td>
</tr>
<tr>
<td>Raster focused at average brightness.</td>
<td>Raster focused at average brightness.</td>
</tr>
</tbody>
</table>
| Raster size = 14" x 10½" | Raster size = 14" x 10½"

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![Graph](image-url)
AVERAGE DRIVE CHARACTERISTICS

**CATHODE-DRIVE SERVICE**

- \( E_f = 6.3 \) Volts
- ULTOR-TO-GRID-N°1 VOLTS = 12000 TO 18000
- CATHODE BIASED POSITIVE WITH RESPECT TO GRID N°1 TO GIVE FOCUSED RASTER CUTOFF.

**GRID-DRIVE SERVICE**

- \( E_f = 6.3 \) Volts
- ULTOR VOLTS = 12000 TO 18000
- GRID N°1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.

---

**Graph:**

- **CATHODE DRIVE**
- **GRID DRIVE**

- ULTOR MILLIAMPERES
  - 2.5
  - 2
  - 1.5
  - 1
  - 0.5

- VIDEO SIGNAL VOLTS FROM RASTER CUTOFF
  - 0
  - 20
  - 40
  - 60
  - 80

---

**Electron Tube Division**

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Picture Tube

**Rectangular Glass Type**
**Low-Voltage Electrostatic Focus**
**Aluminized Screen**
**70° Magnetic Deflection**

**General Data**

**Electrical:**
- Heater Current at 6.3 volts: $600 \pm 10\%$ ma
- Direct interelectrode capacitances:
  - Grid No. 1 to all other electrodes: $6.5 \mu F$
  - Cathode to all other electrodes: $5 \mu F$
  - External conductive coating to ultor: (1500 max.) $\mu F$
- 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.

**Basing Designation**
- 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 Configuration:**
- 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—Ultror**
- (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 µf
Cathode to all other electrodes. .... 5 µf
External conductive coating to ultor. {1500 max. µf
                                           1000 min. µf
Faceplate, Spherical. .......... Filterglass
Light transmission (Approx.). .... 77%
Phosphor (for curves, see front of this section). P4—Sulfide Type
Aluminized White
Fluorescence. ............... White
Phosphorescence. ............ Medium Short
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.). .............. Any
Operating Position. ............ Recessed Small Cavity (JEDEC No.J1-21)
Cap. ................................... J132-1/2 A/B
Bulb. .............................. Ucinite Part No.118546, or equivalent
Socket. .......................... Small-Button Neoelghtar 7-Pin, Arrangement 1,
                             (JEDEC No.B7-208)

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

DATA 1 8-60
Grid-Drive Service

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

Maximum and Minimum Ratings, Design-Center Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Maximum Voltage</th>
<th>Minimum Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultron Voltage</td>
<td>16000 max. volts</td>
<td>12000 min. volts</td>
</tr>
<tr>
<td>Grid-No.3 Voltage</td>
<td>650 max. volts</td>
<td></td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>550 max. volts</td>
<td></td>
</tr>
</tbody>
</table>

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 ultron voltage ($E_{ul}$) between 12000 and 16000 volts and grid-No.2 voltage ($E_{g2}$) between 400 and 550 volts:

- Grid-No.3 Voltage for focus: 0 to 400 volts
- Grid-No.1 Voltage ($E_{c1}$) 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 $E_{c1}$ 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 gauss

Examples of Use of Design Ranges:
- With ultor voltage of 16000 volts and grid-No. 2 voltage of 400 volts
- Grid-No. 3 Voltage for focus: 0 to 400 volts
- Grid-No. 1 Voltage for visual extinction of focused raster: -34 to -63 volts, -43 to -78 volts
- Grid-No. 1 Video Drive from Raster Cutoff (Black level): White-level value: 34 to 63 volts, 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:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultor-To-Grid-No. 1 Voltage</td>
<td>16000 max., volts</td>
</tr>
<tr>
<td>Grid-No. 3-To-Grid-No. 1 (Focusing) Voltage</td>
<td>650 max., volts</td>
</tr>
<tr>
<td>Grid-No. 2-To-Grid-No. 1 Voltage</td>
<td>690 max., volts</td>
</tr>
<tr>
<td>Grid-No. 2-To-Cathode Voltage</td>
<td>550 max., volts</td>
</tr>
<tr>
<td>Cathode-To-Grid-No. 1 Voltage (Positive-Peak)</td>
<td>200 max., volts</td>
</tr>
<tr>
<td>Cathode-To-Grid-No. 1 Voltage (Positive-Bias)</td>
<td>140 max., volts</td>
</tr>
<tr>
<td>Cathode-To-Grid-No. 1 Voltage (Negative-Bias)</td>
<td>0 max., volts</td>
</tr>
<tr>
<td>Cathode-To-Grid-No. 1 Voltage (Negative-Peak)</td>
<td>2 max., volts</td>
</tr>
<tr>
<td>Peak Heater-Cathode Voltage</td>
<td></td>
</tr>
<tr>
<td>Positive with respect to cathode:</td>
<td></td>
</tr>
<tr>
<td>During equipment warm-up period not exceeding 15 seconds</td>
<td>410 max., volts</td>
</tr>
<tr>
<td>After equipment warm-up period</td>
<td>180 max., volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>180 max., volts</td>
</tr>
</tbody>
</table>

Equipment Design Ranges:

With any ultor-to-grid-No. 1 voltage ($E_{cy}$) between 12000 and 16000 volts and grid-No. 2-to-grid-No. 1 voltage ($E_{cg}$) 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 (E_k) for visual extinction of focused raster.

Cathode-to-Grid-No.1
Video Drive from Raster Cutoff [Black level]:
White-level value (Peak negative)

Grid-No.3 Current
Grid-No.2 Current
Field Strength of Adjustable Centering Magnet.

Examples of Use of Design Ranges:

<table>
<thead>
<tr>
<th>With video-to-grid-No.1 voltage of</th>
<th>and grid-No.2 to-grid-No.1 voltage of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.3 to-Grid-No.1 Voltage for focus</td>
<td>0 to 400</td>
</tr>
<tr>
<td>Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster</td>
<td>34 to 56</td>
</tr>
</tbody>
</table>
| Cathode-to-Grid-No.1 Video Drive from Raster Cutoff [Black level]:
White-level value | -34 to -56 | -41 to -69 |

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 45 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 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*

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 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

\[E_F = 6.3 \text{ VOLTS}\]
ULTOR VOLTS = 12000 TO 16000
GRID-N*3 VOLTS ADJUSTED FOR FOCUS.

Cathode-Drive Service

\[E_F = 6.3 \text{ VOLTS}\]
ULTOR-TO-GRID-N*1 VOLTS = 12000 TO 16000
GRID-N*3-TO-GRID-N*1 VOLTS ADJUSTED FOR FOCUS.
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)

RCA Electronic Components
MECHANICAL

Minimum Screen Area (Projected) . . . 145 sq. in (935 sq. cm)
Bulb Funnel Designation .................. JEDEC No.J 139A1
Bulb Panel Designation .................. JEDEC No.FP 139B1
Base Designation .......................... 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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Maximum Value</th>
<th>Minimum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>22,500 max.</td>
<td>17,000 min.</td>
</tr>
<tr>
<td>Total Anode Current,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-Term Average</td>
<td>750 max.</td>
<td></td>
</tr>
<tr>
<td>Grid-No.4 (Focusing Electrode) Voltage:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>1100 max.</td>
<td></td>
</tr>
<tr>
<td>Negative value</td>
<td>550 max.</td>
<td></td>
</tr>
<tr>
<td>Peak Grid-No.2 Voltage,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Including Video Signal Voltage</td>
<td>1000 max.</td>
<td></td>
</tr>
<tr>
<td>Grid-No.1 Voltage:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>400 max.</td>
<td></td>
</tr>
<tr>
<td>Negative operating cutoff value</td>
<td>140 max.</td>
<td></td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max.</td>
<td></td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max.</td>
<td></td>
</tr>
<tr>
<td>Heater Voltage (ac or dc):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under operating conditions</td>
<td>6.9 max.</td>
<td>5.7 min.</td>
</tr>
<tr>
<td>Under standby conditions</td>
<td>5.5 max.</td>
<td></td>
</tr>
<tr>
<td>Peak Heater-Cathode Voltage:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>During equipment warm-up period not exceeding 15 seconds</td>
<td>450 max.</td>
<td></td>
</tr>
<tr>
<td>After equipment warm-up period:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combined AC and DC value</td>
<td>200 max.</td>
<td>200 max.</td>
</tr>
<tr>
<td>DC component value</td>
<td>200 max.</td>
<td></td>
</tr>
</tbody>
</table>

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:
Under operating conditions:
When standby operation is not utilized .......................... 6.3 V
When 5.0-V standby operation is utilized ........................ 6.0 V
Under standby conditions .......................... 5.0 V

Grid-No.4 Current (Total) ......................................... 0 to +60 µA
Grid-No.2 Current .................................................. 0 to +5 µA

To Product White of 9300° K + 27 M.P.C.D.
(CIE Coordinates \(x = 0.281, y = 0.311\)):
Percentage of total anode current supplied by each gun (average) .......................... 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 8 (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. MQ

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

RCA Electronic Components
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.

b 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.

c For “instant on” applications, a maximum heater voltage of 5.5 volts (design-maximum value) may be maintained on the color picture tube when the receiver is in the “off” (stand-by) position. All other voltages normally applied to the tube must be removed during standby operation.

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

X-RADIATION WARNING

Because the 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: Cathode 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
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.
CONTACT AREA OF EXTERNAL CONDUCTIVE COATING (NOTE 3)

INTERNAL RADIAL-CONVERGING POLE PIECES

CAVITY CAP JEDEC No. J1-21

TRANSPARENT INSULATING COATING (NOTE 4)

SEAL LINE

SCREEN WIDTH

SCREEN HEIGHT

BLUE GUN

CLEARANCE FOR TENSION BAND CLIP

SAGITTAL HEIGHTS AT POINTS 1/25 BEYOND EDGE OF MIN. SCREEN

Dimensions in inches / mm unless otherwise noted
HEATER VOLTAGE = 6.3 V
ANODE-TO-CATHODE VOLTAGE = 17,000 TO 22,500 V
GRID-No. 4-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
**Picture Tube**

**Rectangular Glass Type**

**Low-Voltage Electrostatic Focus**

**Aluminized Screen**

**70° Magnetic Deflection**

**Electrical:**

Direct Interelectrode Capacitances:
- Cathode to all other electrodes: 5 pf
- Grid No.1 to all other electrodes: 6 pf
- External conductive coating to anode: 1500 max. pf, 750 min. pf

Heater Current at 6.3 volts: 600 ± 30 ma

Electron Gun: Type Requiring 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: 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

**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:

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>14000 volts</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>-56 to +310 volts</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>300 volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage for visual extinction of focused raster</td>
<td>-28 to -72 volts</td>
</tr>
</tbody>
</table>

Maximum Circuit Value:

<table>
<thead>
<tr>
<th>Circuit Resistance</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1-Circuit Resistance</td>
<td>1.5 max. megohms</td>
</tr>
</tbody>
</table>

For X-radiation shielding considerations, see sheet

X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES

at front of this Section
Picture Tube

**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: Regular-Band Contact area for grounding Near Reference Line

For Additional Information on Coatings and Dimensions:
- See Picture-Tube Dimensional-Outlines and Bulb J139 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

**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
**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*

<table>
<thead>
<tr>
<th>Component</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>14000 volts</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>-56 to +310 volts</td>
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<tr>
<td>Grid-No.2 Voltage</td>
<td>300 volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage for visual extinction of focused raster</td>
<td>-28 to -72 volts</td>
</tr>
</tbody>
</table>

**Maximum Circuit Value:**

<table>
<thead>
<tr>
<th>Circuit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1-Circuit Resistance</td>
<td>1.5 max. megohms</td>
</tr>
</tbody>
</table>

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

RECTANGULAR GLASS TYPE
MAGNETIC FOCUS

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.
Light transmission (Approx.)... 74%

Mechanical:

Weight (Approx.)... 19 lbs
Overall Length... 19-3/16” ± 3/32”
Neck Length... 7-1/2” ± 3/32”
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 J33 C/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

Maximum and Minimum Ratings, Design-Maximum Values:

Anode Voltage... 20000 max. volts
Grid-No.2 Voltage... 550 max. volts

Unless otherwise specified, voltage values are positive with respect to cathode
**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
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 μf
  - Cathode to all other electrodes: 5 μf
- External conductive coating to ultor: \{1500 max. μf
  \[1000 min. μf

**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.

**Contact area for grounding**: Near Reference Line

**For Additional Information on Coatings and Dimensions:**
- See *Picture-Tube Dimensional-Outlines and Bulb J349 C sheets at the front of this section*

**Cap**: Recessed Small Cavity (JEDEC No.J1-21)
**Base**: Small-Button Neeeightar 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

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**RCA**

**Electron Tube Division**

**Harrison, N. J.**

**DATA 5-62**
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.
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. µµf
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: \[19800 \text{ max. volts}\]
\[12000 \text{ min. volts}\]

GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:

Positive value: \[1100 \text{ max. volts}\]
Negative value: \[500 \text{ max. volts}\]

GRID-No.2-TO-GRID-No.1 VOLTAGE: \[70 \text{ max. volts}\]

CATHODE-TO-GRID-No.1 VOLTAGE: \[100 \text{ max. volts}\]

HEATER VOLTAGE: \[7 \text{ max. volts}\]
\[5.8 \text{ min. volts}\]

PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period not exceeding 15 seconds: \[410 \text{ max. volts}\]
After equipment warm-up period: \[180 \text{ max. volts}\]

Heater positive with respect to cathode: \[180 \text{ max. volts}\]

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage of \[14500 \text{ volts}\]
and grid-No.2-to-grid-No.1 voltage of \[50 \text{ volts}\]
Grid-No.4-to-Grid-No.1 Voltage for focus: \[0 \text{ to } 500 \text{ volts}\]
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster: \[31 \text{ to } 49 \text{ volts}\]

Maximum Circuit Values:

Grid-No.1-Circuit Resistance: \[1.5 \text{ max. megohms}\]

For X-radiation shielding considerations, see sheet "\text{I-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES}\" at front of this section.
**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: $600 \pm 30$ 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 $\mu$F
- Cathode to all other electrodes: 5 $\mu$F

**External conductive coating to ultor:**
- 1500 max. $\mu$F
- 1000 min. $\mu$F

**Electron Gun:** Type requiring no ion-trap magnet.

**Optical:**
- Faceplate filter glass
- 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" ± 1/8" ± 1/8" ± 1/8" ± 1/8"
  - Greatest width: 16-13/32" ± 1/8" ± 1/8" ± 1/8" ± 1/8" ± 1/8"
  - Greatest height: 13-11/32" ± 1/8" ± 1/8" ± 1/8" ± 1/8" ± 1/8"
  - Diagonal: 18-5/8" ± 1/8" ± 1/8" ± 1/8" ± 1/8" ± 1/8"
  - Neck length: 4-1/8" ± 1/8" ± 1/8" ± 1/8" ± 1/8" ± 1/8"
- Curvature of faceplate (External Radii):
  - Center: 48" ± 1/8"
  - Edge: 21" ± 1/8"

**Screen Dimensions (Minimum):**
- Greatest width: 15-1/8" ± 1/8" ± 1/8" ± 1/8" ± 1/8" ± 1/8"
- Greatest height: 12" ± 1/8" ± 1/8" ± 1/8" ± 1/8" ± 1/8"
- Diagonal: 17-9/16" ± 1/8" ± 1/8" ± 1/8" ± 1/8" ± 1/8"
- Projected area: 172 sq. in.
- Weight (Approx.): 14 lbs.
- Operating position: Any
- Cap.: Recessed small cavity (JEDEC No. J1-21)
- Bulb: J149A1
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

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 (FOCUSDING) 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 \( E_{c1} \) of 20000 volts
and grid-No.2 voltage \( E_{c2} \) of 400 volts
Grid-No.4 Voltage for focus* ........................................... 0 to 400 volts
Grid-No.1 Voltage for visual extinction of focused raster* ........................................... -36 to -94 volts
Field Strength of Adjustable Centering Magnet* ........................................... 0 to 9 gausses

Maximum Circuit Values:

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

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Harrison, N. J.
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
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
Heater-positive with respect to cathode:
During equipment warm-up period . . . . . . 450 max. volts
After equipment warm-up period. . . . . . . 200 max. volts
Heater-negative with respect to cathode:
PEAK HEATER-CATHODE VOLTAGE:
not exceeding 15 seconds. . . . . . . . . . . . . . . . . 450 max. volts

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage (Eg1) of
and grid-No.2-to-grid-No.1 voltage (Eg2) of

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:

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Harrison, N. J.
DATA 2
10-60
\[
\sqrt{\frac{E_{c_2} k or E_{c_5} g_1 \text{ (volts)}}{16000 \text{ (volts)}}} \times 8 \text{ gausses}
\]

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 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

$E_F = 6.3 \text{ VOLTS}$
ULTOR VOLTS = 15000 TO 23000
GRID-$N^2$ VOLTS ADJUSTED FOR FOCUS.

Cathode-Drive Service

$E_F = 6.3 \text{ VOLTS}$
ULTOR-TO-GRID-$N^1$ VOLTS = 15000 TO 23000
GRID-$N^2$-TO-GRID-$N^1$ VOLTS ADJUSTED FOR FOCUS.


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 WAFFER 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 SPECIFIED FROM THE TUBE BY USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.
NOTE: PLANES A THROUGH G ARE NORMAL TO THE TUBE AXIS AND AT FIXED LOCATIONS FROM THE Y AXIS. THESE COORDINATES DESCRIBE THE BOGIE-BULB EXTERNAL CONTOUR IN PLANES THROUGH THE TUBE AXIS AND THE RESPECTIVE FACEPLATE AXES.
19AYP4

Picture Tube

- SHORT RECTANGULAR GLASS TYPE
- LOW-VOLTAGE ELECTROSTATIC FOCUS
- ALUMINIZED SCREEN
- 114° MAGNETIC DEFLECTION
- With Heater Having Controlled Warm-Up Time

The 19AYP4 is the same as the 19AVP4 except for the following item:

Electrical:
- Heater Current at 6.3 volts. . . . . . . . . . . 450 ± 20 ma

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Electron Tube Division
Harrison, N. J.
DATA 5-62
Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
LOW-GRID-No. 2 VOLTAGE
With Heater Having Controlled Warm-Up Time

ALUMINIZED SCREEN
92° MAGNETIC DEFLECTION
CATHODE-DRIVE TYPE

GENERAL DATA

Electrical:
- Heater Current at 6.3 volts: 600 ± 10% ma
- Heater Warm-Up Time (Average): 11 seconds
- Direct Interelectrode Capacitances:
  - Grid No.1 to all other electrodes: 6 μf
  - Cathode to all other electrodes: 5 μf
  - External conductive coating to ultor: 2000 max. μf
  - 1500 min. μf

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

**ULTOR-TO-GRID-No.1 VOLTAGE.**
- Maximum: 19800 max. volts
- Minimum: 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.**
- Maximum: 70 max. volts
- Minimum: 40 min. volts

**CATHODE-TO-GRID-No.1 VOLTAGE.**
- Maximum: 100 max. volts
- Minimum: 7 max. volts

**HEATER VOLTAGE.**
- Maximum: 5.6 max. volts

**Peak Heater-Cathode Voltage:**
- Heater negative with respect to cathode:
  - During equipment warm-up period: 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.
SHORT RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
LOW GRID-No. 2 VOLTAGE

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
- Interelectrode Capacitances:
  - Grid No.1 to all other electrodes: 6 μf
  - Grid No.4 to all other electrodes: 5 μf
  - External conductive coating to ultor: 1500 max., 1000 min. μf
- Electron Gun: Type Requiring No Ion-Trap Magnet

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

Mechanical:
- Operating Position: Any
- Weight (Approx.): 14 lbs
- Overall Length: 11-5/8" ± 1/4"
- Neck Length: 4-3/8" ± 1/8"
- Projected Area of Screen: 172 sq. in.
- 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

Data 3-62
**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
19CMP4

Picture Tube

LOW-VOLTAGE ELECTROSTATIC FOCUS  114° MAGNETIC DEFLECTION

Low-Grid-No.2 Voltage — for Cathode-Drive Operation

The 19CMP4 is the same as the 19CHP4 except for the following items:

ELECTRICAL

Heater Current at 6.3 volts ............ 450 ± 20 mA

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Anode Voltage .......................... 12000 min V
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
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 V
                                               12000 min V

Grid-No.4 (Focusing) Voltage
  Positive value ........................................... 1100 max V
  Negative value ......................................... 500 max V

Grid-No.2 Voltage .......................................... 55 max V
                                               30 min V

Cathode Voltage
  Negative peak value ................................... 2 max V
  Negative bias value .................................... 0 max V
  Positive bias value .................................... 100 max V
  Positive peak value ................................... 150 max V

Heater Voltage ............................................ 6.9 max V
                                               5.7 min V

Peak Heater-Cathode Voltage
  Heater negative with respect to cathode:
    During equipment warm-up period
      not exceeding 15 seconds ................................ 450 max V
    After equipment warm-up period ................................ 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:
- 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.J21-21)
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: 16000 V

Grid-No.4 Voltage: 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: 0 to 8 G

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.
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

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

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 \textit{X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES} at front of this Section.

### RASTER-CUTOFF-RANGE CHART

Cathode-Drive Service

<table>
<thead>
<tr>
<th>E_f = 6.3 VOLTS</th>
<th>ANODE-TO-GRID-No.1 VOLTS = 12000 TO 20000</th>
<th>GRID-No.4-TO-GRID-No.1 VOLTS ADJUSTED FOR FOCUS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Graph](image-url)
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* ...... 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 ...... 11.825 ± 0.250 in
Neck Length ...... 4.375 ± 0.125 in
Projected Area of Screen ...... 172 sq in
External Conductive Coating* ...... 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 Neohigher 7-Pin, Arrangement 1, (JEDEC No. B7-20B)
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.
Anode Voltage

Grid-No.4 (Focusing) Voltage
Positive value: 1250 max V
Negative value: 400 max V

Grid-No.2 Voltage
Positive peak value: 2 max V
Negative bias value: 0 max V
Positive bias value: 100 max V
Positive peak value: 150 max V

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
Positive peak value: 6.9 max V
Positive bias value: 100 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

Anode Voltage: 16000 V
Grid-No.4 Voltage: 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 kΩ

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.

DATA

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**Picture Tube**

**FILLED-RIM TYPE**

**Direct Interelectrode Capacitances**
- Cathode to all other electrodes: 5 pF
- Grid No.1 to all other electrodes: 6 pF
- External conductive coating to anode: 1250 min–1750 max pF

**Heater Current at 6.3 V**: 600 ± 30 mA

**Heater Warm-Up Time (Average)**: 11 s

**Electron Gun**: Type Requiring No Ion-Trap Magnet

**OPTICAL**

- Phosphor: P4—Sulfide Type, Aluminized
- For curves, see front of this section

**Faceplate**: Light transmission at center (Approx.): 48%

**MECHANICAL**

- Weight (Approx.): 16 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

**Cap.**: Recessed Small Cavity (JEDEC No. J1-21)

**Base**: Small-Button Neckgart 7-Pin, Arrangement I, (JEDEC No. B7-208)

**TERMINAL DIAGRAM (Bottom View)**

**MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES**

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anode Voltage</strong></td>
<td>11000 min–23000 max V</td>
</tr>
<tr>
<td><strong>Grid-No.4 Voltage</strong></td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>1100 max V</td>
</tr>
<tr>
<td>Negative value</td>
<td>550 max V</td>
</tr>
<tr>
<td><strong>Grid-No.2 Voltage</strong></td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>200 min–550 max V</td>
</tr>
<tr>
<td>Negative value</td>
<td>220 max V</td>
</tr>
<tr>
<td><strong>Grid-No.1 Voltage</strong></td>
<td></td>
</tr>
<tr>
<td>Negative peak value</td>
<td>155 max V</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>0 max V</td>
</tr>
<tr>
<td><strong>Heater Voltage</strong></td>
<td>5.7 min–6.9 max V</td>
</tr>
</tbody>
</table>

VOLTAGES ARE POSITIVE WITH RESPECT TO CATHODE
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)
**Picture Tube**

**FILLED-RIM TYPE**

**114° MAGNETIC DEFLECTION**

*LOW GRID-No.2 VOLTAGE*

**Direct Inter electrode 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.): 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

**Cap**
- Recessed Small Cavity (JEDEC No.JI-21)
- Small-Button Neoeightar 7-Pin, Arrangement I, (JEDEC No.87-208)

**TERMINAL DIAGRAM (Bottom View)**

**MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES**

*Voltages are positive with respect to grid No.1*

<table>
<thead>
<tr>
<th>Anode Voltage</th>
<th>12000 min—21000 max V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.4 Voltage</td>
<td></td>
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<tr>
<td>Positive value</td>
<td>1250 max V</td>
</tr>
<tr>
<td>Negative value</td>
<td>400 max V</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td></td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max V</td>
</tr>
<tr>
<td>Negative bias value</td>
<td>0 max V</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>100 max V</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>150 max V</td>
</tr>
</tbody>
</table>

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Electronic Components and Devices

Harrison, N. J.

DATA 2-67
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

* Includes implosion protection hardware.

DIMENSIONAL OUTLINE

(Bulb J149 F)

DIMENSIONS IN INCHES

MINIMUM SCREEN
DIAGONAL 17.562
GREATEST WIDTH 15.688
GREATEST HEIGHT 12.000

SHELL OPENING 15.845
MIN.

BASE JEDEC NO. 87-208

CAVITY CAP
JEDEC NO. JI-21

SHELL OPENING 12.658
MIN.

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC NO. G-126
92LS-1572
Picture Tube

PAN-O-PLY—INTEGRAL IMPLOSION PROTECTION
LOW-VOLTAGE ELECTROSTATIC FOCUS 110º 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. ... 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. 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 I, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1—Heater
Pin 2—Grid No.1
Pin 3—Grid No.2
Pin 4—Grid No.4
Pin 6—Grid No.1
Pin 7—Cathode
Pin 8—Heater
Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)
C—External Conductive Coating

RADIO CORPORATION OF AMERICA
Electronic Components and Devices  Harrison, N. J.
MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

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

Anode Voltage ........................................... 12000 max V 21000 max V

Grid-No. 4 (Focusing) Voltage
Positive value ........................................ 1250 max V
Negative value .......................................... 400 max V

Grid-No. 2 Voltage ....................................... 60 max V 25 min V

Cathode Voltage
Negative peak value ................................... 2 max V
Negative bias value .................................... 0 max V
Positive bias value ..................................... 100 max V
Positive peak value .................................... 150 max V

Heater Voltage ........................................... 6.9 max V 5.7 min V

Peak Heater-Cathode Voltage
Heater negative with respect to cathode:
During equipment warm-up period not exceeding 15 seconds ................. 450 max V
After equipment warm-up period .................................. 300 max V
Heater positive with respect to cathode:
Combined AC and DC voltage ................................ 200 max V
DC component ........................................... 100 max V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

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

Anode Voltage ........................................... 16000 V
Grid-No. 4 Voltage ....................................... 250 V
Grid-No. 2 Voltage ....................................... 50 V
Cathode Voltage .......................................... 32 to 50 V
For visual extinction of focused raster

MAXIMUM CIRCUIT VALUE

Grid-No. 1-Circuit Resistance .......................... 1.5 max 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-2P21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section
19EXP22

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.

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

* 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

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 25,000 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: 37%
BLUE GUN: 26%
GREEN GUN: 37%
RASTER SIZE: 15.585" X 12.185"
* MEASURED WITHIN 4" DIAMETER AREA CENTERED ON TUBE FACE.

89LM-1032

RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.
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: ............... 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): 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 Pin Position Alignment .................................. Pin 12 Aligns Approx. with Anode Cap

Base ................................................................. Small-Button Diheptar 12-Pin (JEDEC No. 812-244)

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 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.
Heater Voltage (AC or DC)
Under operating conditions\( ^a \) \( \cdots \cdot \cdot \cdot \) \( 6.9 \text{ max } V \)
Under standby conditions\( ^c \) \( \cdots \cdot \cdot \cdot \) \( 5.7 \text{ min } V \)
Peak Heater-Cathode Voltage (Each gun)
Heater negative with respect to cathode:
During equipment warm-up period
not exceeding 15 seconds. \( \cdots \cdot \cdot \cdot \) \( 450 \text{ max } V \)
After equipment warm-up period. \( \cdots \cdot \cdot \cdot \) \( 200 \text{ max } V \)
Heater positive with respect to cathode \( \cdots \cdot \cdot \cdot \) \( 200 \text{ max } V \)

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 \( \cdots \cdot \cdot \cdot \) 16.8% to 20% of anode V
Focusing electrode
Grid-No.2 and
Grid-No.1 Voltages \( \cdots \cdot \cdot \cdot \) See accompanying Cutoff Design Chart
For visual extinction of focused spot
Maximum Ratio of Grid-No.2 Voltages \( \cdots \cdot \cdot \cdot \) 1.86
Highest gun to lowest gun in any tube
(At grid-No.1 spot cutoff voltage of \(-100 \text{ V}\) )
Grid-No.3 Current (Total) \( \cdots \cdot \cdot \cdot \) \(-45 \) to \(+15 \) \( \mu A \)
Grid-No.2 Current \( \cdots \cdot \cdot \cdot \) \(-5 \) to \(+5 \) \( \mu A \)
To produce White of \( 9300^\circ \text{K} + 27 \text{ M.P.C.D.} \)
(CIE Coordinates \( x = 0.281, y = 0.311 \) )
Percentage of total anode
current supplied by
each gun (Average). \( \cdots \cdot \cdot \cdot \) Red Blue Green
37 26 37 %
Red to Blue Red to Green
Ratio of cathode currents. \( \cdots \cdot \cdot \cdot \) 1.00 1.40 2.00 0.75 1.00 1.80
Displacements, Measured at Center of Screen
Raster centering displacement:
Vertical\( ^d \) \( \cdots \cdot \cdot \cdot \) \(-0.45 \) to \(+0.45 \) in
Horizontal\( ^d \) \( \cdots \cdot \cdot \cdot \) \(-0.47 \) to \(+0.47 \) in
Lateral convergence displacement of
blue beam with respect to con-
verged red and green beams. \( \cdots \cdot \cdot \cdot \) \(-0.25 \) to \(+0.25 \) in
Radial convergence displacement
excluding effects of dynamic
convergence (Each beam) \( \cdots \cdot \cdot \cdot \) \(-0.37 \) to \(+0.37 \) in
Maximum Required Correction for Register\( ^d \)
(Including Effect of Earth's Magnetic
Field when Using Recommended Components) \( \cdots \cdot \cdot \cdot \) 0.006 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: 285 to 685 V

When circuit design utilizes grid-No.1 voltage of −150 V for visual extinction of focused spot.

Grid-No.1 Voltage: −95 to −190 V
For visual extinction of focused spot when circuit design utilizes grid-No.2 voltage of 400 V

Heater Voltage
Under operating conditions: 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

REFERENCE LINE
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

CONTACT AREA OF EXTERNAL CONDUCTIVE COATING (NOTE 3)

BASE JEDEC No. B12-244 (NOTE 2)

INTERNAL RADIAL-CONVERGING POLE PIECES

CAVITY CAP JEDEC No. J1-21

400 R.

2.970

2.935

1.438 ±.063 DIA.

.250

.250

5.88 R.

16°

4.25

MIN.

MAX.

7.5

16.766 ±.093

PROTECTIVE WINDOW

16.977 ±.093

MOLD-MATCH LINE

SCREEN WIDTH
15.586 MIN.

12.4 R.

43.6 R.

1.70 R.

46.6 R.

52.2 R.

12 R.

BLUE-GUN

PAD

SCREEN DIAGONAL
18.073 MIN.

8.9°

PAD

SCREEN HEIGHT
12.185

MIN.

13.372 ±.093

MOLD-MATCH LINE

13.664 ±.093 PROTECTIVE WINDOW

11.355 ±.063

18.048 ±.375

10.004 ±.188

92CL-13877R1

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.

DATA 3

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Electronic Components and Devices
Harrison, N. J.
Cutoff Design Chart

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 20,000 TO 27,500 VOLTS
GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.

GRID-No. 1-TO-CATHODE VOLTS

GRID-No. 2-TO-CATHODE VOLTS
Typical Light-Output Characteristic

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 25,000 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: 37%
BLUE GUN: 26%
GREEN GUN: 37%
RASTER SIZE: 15.585" X 12.185"
* MEASURED WITHIN 4"-DIAMETER AREA CENTERED ON TUBE FACE.

RATIONAL CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.
Typical Drive Characteristics
Grid-Drive Service

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 20000 TO 27500 VOLTS
GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
GRID-No. 2-TO-CATHODE VOLTAGE (EACH GUN) ADJUSTED TO PROVIDE SPOT CUTOFF FOR DESIRED FIXED GRID-No. 1-TO-CATHODE (EACH GUN) VOLTAGE (EcIg)
* = ZERO-BIAS POINT

ANODE MICROAMPERES PER GUN

ANODE MICROAMPERES PER GUN

VOLTAGE VOLTS FROM SPOT CUTOFF PER GUN

VIDEO SIGNAL VOLTS FROM SPOT CUTOFF PER GUN

92CM-12807

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DATA 5
9-65
Typical Drive Characteristics

Cathode-Drive Service

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-GRID-No.1 VOLTAGE = 20000 TO 27500 VOLTS
GRID-No.3-TO-GRID-No.1 VOLTAGE ADJUSTED FOR FOCUS.
GRID-No.2-TO-GRID-No.1 VOLTAGE (EACH GUN) ADJUSTED TO PROVIDE SPOT CUTOFF FOR DESIRED FIXED CATHODE-
TO-GRID-No.1 (EACH GUN) VOLTAGE (E_{k1})
* = ZERO-BIAS POINT

ANODE MICROAMPERES PER GUN

VIDEO SIGNAL VOLTS FROM SPOT CUTOFF PER GUN

92CM-12806
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, ... 1.1250 min-1.750 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
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 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 Noeightsar 7-Pin, Arrangement 1, (JEDEC No.B7-20B)

TERMINAL DIAGRAM (Bottom View)

Pin 1—Heater
Pin 2—Grid No.1
Pin 3—Grid No.2
Pin 4—Grid No.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

<table>
<thead>
<tr>
<th>Voltage Type</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>12000 min-</td>
<td>23500 max</td>
<td>V</td>
</tr>
</tbody>
</table>

## Grid-No.4 Voltage

<table>
<thead>
<tr>
<th>Voltage Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>1250 max V</td>
</tr>
<tr>
<td>Negative</td>
<td>400 max V</td>
</tr>
</tbody>
</table>

## Grid-No.2 Voltage

<table>
<thead>
<tr>
<th>Voltage Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 min-</td>
<td>60 max V</td>
</tr>
</tbody>
</table>

## Cathode Voltage

<table>
<thead>
<tr>
<th>Voltage Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative peak value</td>
<td>2 max V</td>
</tr>
<tr>
<td>Negative bias value</td>
<td>0 max V</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>100 max V</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>150 max V</td>
</tr>
</tbody>
</table>

## Heater Voltage

<table>
<thead>
<tr>
<th>Voltage Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.7 min-</td>
<td>6.9 max V</td>
</tr>
</tbody>
</table>

## 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

<table>
<thead>
<tr>
<th>Voltage Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>16000</td>
<td>V</td>
</tr>
</tbody>
</table>

## Grid-No.4 Voltage

<table>
<thead>
<tr>
<th>Voltage Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>V</td>
</tr>
</tbody>
</table>

## Grid-No.2 Voltage

<table>
<thead>
<tr>
<th>Voltage Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>V</td>
</tr>
</tbody>
</table>

## Cathode Voltage

<table>
<thead>
<tr>
<th>Voltage Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 to 45</td>
<td>V</td>
</tr>
</tbody>
</table>

For visual extinction of focused raster:
- Field Strength of required adjustable centering magnet: 0 to 8 G

## Maximum Circuit Value

<table>
<thead>
<tr>
<th>Circuit Resistance</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1</td>
<td>1.5 max MΩ</td>
</tr>
</tbody>
</table>

---

Includes implosion protection hardware.

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.

---

DATA

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**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: 1250 min—1750 max pF

Heater Current at 6.3 V: 450 ± 20 mA
Heater Warm-up Time (Average): 11 s

Electron Gun Type: Type Requiring No Ion-Trap Magnet

**OPTICAL**

Phosphor: P4—Sulfide Type, Aluminized
Faceplate: Filterglass
Light transmission at center (approx.): 48%

**MECHANICAL**

Weight (Approx.): 15 lb
Overall Length: 11.625 ± 0.250 in
Neck Length: 4.975 ± 0.125 in
Projected Area of Screen: 172 sq in

**External Conductive Coating**
- Type (See CRT OUTLINES at front of this section): Regular-Band
- Contact area for grounding: Near Reference Line
- Cap: Recessed Small Cavity (JEDEC No.JI-21)
- Base: Small-Button Neoeightar 7-Pin, Arrangement I, (JEDEC No.B7-208)

**TERMINAL DIAGRAM (Bottom View)**

![Terminal Diagram](image)

**MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES**

Voltages are positive with respect to cathode

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>11000 min—23000 max V</td>
</tr>
<tr>
<td>Grid-No.4 (Focusing) Voltage</td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>1100 max</td>
</tr>
<tr>
<td>Negative value</td>
<td>550 max</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>200 min—550 max V</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td></td>
</tr>
<tr>
<td>Negative peak value</td>
<td>220 max</td>
</tr>
<tr>
<td>Negative bias value</td>
<td>155 max</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max</td>
</tr>
</tbody>
</table>

**RADIO CORPORATION OF AMERICA**

Electronic Components and Devices
Harrison, N. J.

DATA 2-66
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** ..................................... 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

---

**DIMENSIONAL OUTLINE (BULB J149 FA)**

- **Screen Height**: ±0.125
- **Screen Diagonal**: 17502 min.
- **Screen Width**: 15.187 min.
- **Rim-Band Opening**: 15.950 min.
- **Reference Line**: Determined by Gauge JEDEC No. G-126

---

**External conductive coating and implosion protection hardware must be grounded.**

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.
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
Type (see CRT OUTLINES at front of this section).................. Regular-Band Contact area for grounding.............. Near Reference Line
Cap.......................... Recessed Small Cavity (JEDEC No.J1-21)
Base.......................... Small-Button Narstructure 7-Pin, Arrangement 1, (JEDEC No.87-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1—Heater
Pin 2—Grid No. 1
Pin 3—Grid No. 2
Pin 4—Grid No. 4
Pin 6—Grid No. 1
Pin 7—Cathode
Pin 8—Heater
Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)
C—External Conductive Coating

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

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

DATA
7-67
Grid-No.1 Voltage

Negative peak value: 220 max
Negative bias value: 155 max
Positive bias value: 0 max
Positive peak value: 2 max

Heater Voltage: 5.7 min—6.9 max

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:
During equipment warm-up period ≤ 15 s: 450 max
After equipment warm-up period: 300 max

Heater positive with respect to cathode:
Combined AC & DC voltage: 200 max
DC component: 100 max

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No. 1

Anode Voltage: 16000
Grid-No.4 Voltage: 0 to 400
Grid-No.2 Voltage: 300
Cathode Voltage: 28 to 62

For visual extinction of focused raster
Field Strength: D to 8 G
Of required adjustable centering magnet

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance: 1.5 max MΩ

Includes implosion protection hardware.

See X-RADIATION PRECAUTIONS at front of this section

DIMENSIONAL OUTLINE (JEDEC BULB J149F2A)
The 19GJP4A is the same as the 19GQP4 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
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 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

MECHANICAL

Tube Dimensions
Overall length .................................... 17.856 ± .375 in (453.5 ± 9.5 mm)
Weight (Approx.) .................................. 21 lb (9.5 kg)

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)

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

DATA
4-67
Typical Light-Output Characteristic

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 25000 VOLTS
GRID-No.3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE
CURRENT TO PRODUCE 9300°K - 27 M.P.C.D. WHITE-LIGHT OUTPUT.
PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN
TO PRODUCE 9300°K - 27 M.P.C.D. WHITE
RED GUN: 34%
BLUE GUN: 32%
GREEN GUN: 34%
RASTER SIZE: 15.585 x 12.185" (395.9 mm X 309.5 mm)
*MEASURED WITHIN 4"-DIAMETER AREA CENTERED ON TUBE FACE

ANODE MICROAMPERES - FOOTLAMBERTS

0 200 400 600 800 1000 1200 1400

0 5 10 15 20 25 30 35 40 45 50

92LM-1990.
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):

<table>
<thead>
<tr>
<th>Percentage of total anode current supply by each gun (average)</th>
<th>Red</th>
<th>Blue</th>
<th>Green</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>34</td>
<td>32</td>
<td>34</td>
</tr>
</tbody>
</table>

Ratio of cathode currents:

<table>
<thead>
<tr>
<th></th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red/blue</td>
<td>0.75</td>
<td>1.10</td>
<td>1.50</td>
</tr>
<tr>
<td>Red/green</td>
<td>0.65</td>
<td>1.00</td>
<td>1.50</td>
</tr>
<tr>
<td>Blue/green</td>
<td>0.60</td>
<td>0.91</td>
<td>1.30</td>
</tr>
</tbody>
</table>

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 Registerd (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.

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.

For curve, see Group Phosphor P22—New Rare-Earth (Red), Sulfide (Blue & Green) at front of this section.

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.

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 12 - Grid No.1 of Blue Gun |
| Pin 2 - Cathode of Red Gun | Pin 13 - Grid No.2 of Blue Gun |
| Pin 3 - Grid No.1 of Red Gun | Pin 14 - Heater |
| Pin 4 - Grid No.2 of Red Gun | CAP - Anode (Grid No.4, Grid No.5, Screen, Collector) |
| Pin 5 - Grid No.2 of Green Gun | |
| Pin 6 - Cathode of Green Gun | |
| Pin 7 - Grid No.1 of Green Gun | C - External Conductive Coating |
| Pin 9 - Grid No.3 | |
| Pin 11 - Cathode of Blue Gun | |

Electronic Components

DATA 2
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.
CUTOFF DESIGN CHART

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 20,000 TO 27,500 VOLTS
GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
**ULTRA-RECTANGULAR**

4 X 3 Aspect Ratio

**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 ........................................ 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
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
\[
\begin{align*}
22.5 \text{ max.} & \quad \text{kV} \\
17 \text{ min.} & \quad \text{kV}
\end{align*}
\]

Anode Current, Long-Term Average\textsuperscript{b}\n\[
1000 \text{ max.} \quad \mu\text{A}
\]

Grid-No.4 (Focusing Electrode) Voltage:
Positive value
\[
1100 \text{ max.} \quad \text{V}
\]
Negative value
\[
550 \text{ max.} \quad \text{V}
\]

Peak-Grid-No.2 Voltage, Including Video Signal Voltage
\[
1000 \text{ max.} \quad \text{V}
\]

Grid-No.1 Voltage:
Negative bias value
\[
400 \text{ max.} \quad \text{V}
\]
Negative operating cutoff value
\[
140 \text{ max.} \quad \text{V}
\]
Positive bias value
\[
0 \text{ max.} \quad \text{V}
\]
Positive peak value
\[
2 \text{ max.} \quad \text{V}
\]

Heater Voltage (ac or dc):\textsuperscript{c}
Under operating conditions
\[
6.9 \text{ max.} \quad \text{V}
\]
Under standby conditions\textsuperscript{d}
\[
5.7 \text{ min.} \quad \text{V}
\]

Heater-Cathode Voltage:
Heater negative with respect to cathode:
During equipment warm-up period not exceeding 15 seconds
\[
450 \text{ max.} \quad \text{V}
\]
After equipment warm-up period:
DC component value
\[
200 \text{ max.} \quad \text{V}
\]
Peak value
\[
200 \text{ max.} \quad \text{V}
\]
Heater positive with respect to cathode:
DC component value
\[
0 \text{ max.} \quad \text{V}
\]
Peak value
\[
200 \text{ max.} \quad \text{V}
\]

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
\[
-75 \text{ to } 400 \quad \text{V}
\]

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
\[
90 \text{ to } 270 \quad \text{V}
\]
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:
Under operating conditions:
  When standby operation is not utilized 6.3 V
  When 5.0-V standby operation is utilized 6.0 V
Under standby conditions 5.0 V

Grid-No.4 Current (Total) ±60 µA
Grid-No.2 Current ±5 µA
Grid-No.1 Current ±5 µA

To Produce White Light of

<table>
<thead>
<tr>
<th>Illum. D</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>6550° K + 7 M.P.C.D.</td>
<td>9300° K + 27 M.P.C.D.</td>
</tr>
</tbody>
</table>

CIE Coordinates:

X Y
0.313 0.281
0.329 0.311

Percentage of total anode current supplied by each gun (average):

<table>
<thead>
<tr>
<th></th>
<th>Red</th>
<th>Blue</th>
<th>Green</th>
</tr>
</thead>
<tbody>
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<td>24</td>
<td>35</td>
</tr>
<tr>
<td>Percentage</td>
<td>30%</td>
<td>31%</td>
<td>39%</td>
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Ratio of cathode currents:

Red/blue:

<table>
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<th></th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
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<td>1.35</td>
<td>1.70</td>
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<tr>
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Red/green:

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<tr>
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<td>0.60</td>
<td>0.75</td>
<td>1.10</td>
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Blue/green:

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<th>Maximum</th>
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<td></td>
<td>0.60</td>
<td>0.70</td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td>0.60</td>
<td>0.80</td>
<td>1.10</td>
</tr>
</tbody>
</table>

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 ± 0.26 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 0.006 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 ftL 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 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 con-
nection in the dc biasing circuit for the heater should be between 100 kilohms and 1 megohm. The surge voltage across the heater must be limited to 9.5 volts rms.

d The use of a 5-volt standby condition in conjunction with 6-volt operating conditions is recommended to improve the reliability of the color picture tube by extending the emission wear-out life and reducing other gun-related defects. A maximum heater voltage of 5.5 volts (Design-Maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.

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 1.25 BEYOND EDGE OF MIN. SCREEN

DIAGONAL 1.488 57.72
WIDTH 2.944 28.82
HEIGHT .582 14.78

RCA Electronic Components
Base Specification — JEDEC No.14BH

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

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

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

[Diagram of internal magnetic shield and radial pole pieces]
Figure 2
Anode Voltage - AV

Figure 1
Anode Current - IA

0.5 mR/h ISODOSAGE - RATE LIMIT CURVE

Anode Voltage varies linearly with anode current.

X-Radiation Limit Curve at a constant anode current.

X-Radiation, 300 µA (X-Radiation at a constant anode current)
Typical Drive Characteristics, Cathode Drive
CUTOFF DESIGN CHART

HEATER VOLTAGE • 6.3 V
ANODE - TO - CATHODE VOLTAGE • 17 TO 22.5 V
GRID - No. 4 - TO - CATHODE VOLTAGE
ADJUSTED FOR FOCUS.

Figure 3

RCA Electronic Components
### 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
- 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
- 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): 186 sq in (1194 sq cm)
- Bulb Funnel Designation: JEDEC No. J510A06
- Bulb Panel Designation: JEDEC No. FP161-3/4 W1
- Base Designation: Small-Button Diheptar 12-Pin (JEDEC No. B12-244)
- Basing Designation: JEDEC No. 148E
- 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 ......................................... \[27.5 \text{ max.} \, \text{kV}, 20 \text{ min.} \, \text{kV}\]
Anode Current, Long-Term Average\(^b\) .................. 1000 max. \(\mu\text{A}\)
Grid-No.3 (Focusing Electrode) Voltage .................. 6000 max. \(\text{V}\)
Peak-Grid-No.2 Voltage, Including Video Signal Voltage ........................................... 1000 max. \(\text{V}\)

Grid-No.1 Voltage:
- Negative bias value ........................................... 400 max. \(\text{V}\)
- Negative operating cutoff value ......................... 200 max. \(\text{V}\)
- Positive bias value ......................................... 0 max. \(\text{V}\)
- Positive peak value ......................................... 2 max. \(\text{V}\)

Heater Voltage (ac or dc):\(^c\)
- Under operating conditions ................................. \[6.9 \text{ max.} \, \text{V}, 5.7 \text{ min.} \, \text{V}\]
- Under standby conditions\(^d\) .......................... 5.5 max. \(\text{V}\)

Heater-Cathode Voltage:
- Heater negative with respect to cathode:
  - During equipment warm-up period not exceeding 15 seconds ............... 450 max. \(\text{V}\)
  - After equipment warm-up period:
    - DC component value .................................. 200 max. \(\text{V}\)
    - Peak value ............................................. 200 max. \(\text{V}\)
- Heater positive with respect to cathode:
  - DC component value .................................. 0 max. \(\text{V}\)
  - Peak value ............................................. 200 max. \(\text{V}\)

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

RCA Electronic Components
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 260 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:
- Under operating conditions:
  - When standby operation in not utilized: 6.3 V
  - When 5.0-V standby operation is utilized: 6.0 V
- Under standby conditions: 5.0 V

Grid-No.3 Current (Total): ±15 µA
Grid-No.2 Current: ±5 µA
Grid-No.1 Current: ±5 µA

To Produce White Light of 6550° K + 9300° K + 7 M.P.C.D. 27 M.P.C.D.

CIE Coordinates:
- X: 0.313 0.281
- Y: 0.329 0.311

Percentage of total anode current supplied by each gun (average):
- Red: 41 %
- Blue: 24 %
- Green: 35 %

Ratio of cathode currents:
- Red/blue:
  - Minimum: 1.35
  - Typical: 1.70
  - Maximum: 2.20
- Red/green:
  - Minimum: 0.95
  - Typical: 1.15
  - Maximum: 1.70
- Blue/green:
  - Minimum: 0.50
  - Typical: 0.70
  - Maximum: 0.95

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) ... \( \pm 0.37 \) in \((\pm 9.4 \) 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 \( \mu \)A
- 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. \( \Omega \)

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

X-Radiation Characteristic:

Maximum Anode Voltage at which the X-radiation emitted will not exceed 0.5 mR/h at an anode current of 300 \( \mu \)A \( \) 33 kV

The X-radiation emitted from this picture tube, as measured in accordance with the procedure of JEDEC Publication No.64A will not exceed 0.5 mR/h throughout the useful life of the tube when operated within the Design-Maximum ratings: 27.5 kV anode voltage and 1000 \( \mu \)A anode current. The tube should not be operated beyond its Design-Maximum ratings stated above (such operation may shorten tube life or have other permanent adverse affects on its performance), but its X-radiation will not exceed 0.5 mR/h for anode voltage and current combinations given by the isodose-rate limit characteristics as shown in Figure 1. Operation above the values shown by the curve may result in failure of the television receiver to comply with the Federal Performance Standard for Television Receivers, Sub-Part C of Part 78 of Title 42, Code of Federal Regulations (PL90-602) as published in the Federal Register Vol.34, No. 247, Thursday, December 25, 1969. Maximum X-radiation as a function of anode voltage at 300 \( \mu \)A anode current is shown by the curve in Figure 2. X-radiation at a constant anode voltage varies linearly with anode current.
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.

* 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 and of referenceline 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: BEYOND EDGE OF MIN. SCREEN

<table>
<thead>
<tr>
<th>DIAGONAL</th>
<th>37.72</th>
<th>WIDTH</th>
<th>20.52</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEIGHT</td>
<td>14.70</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Electronic Components
DIMENSIONAL OUTLINE

CONTACT AREA OF EXTERNAL CONDUCTIVE COATING (NOTE 3)

INTERNAL RADIAL CONVERGING POLE PIECES

ANODE CONTACT JEDEC No. 21

TRANSPARENT INSULATING COATING (NOTE 4)

SEAL LINE

Dimensions in Inches/mm unless otherwise noted
Bottom View of Base

Base Specification – JEDEC No. 14BE

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Heater</td>
</tr>
<tr>
<td>2</td>
<td>Cathode of Red Gun</td>
</tr>
<tr>
<td>3</td>
<td>Grid No. 1 of Red Gun</td>
</tr>
<tr>
<td>4</td>
<td>Grid No. 2 of Red Gun</td>
</tr>
<tr>
<td>5</td>
<td>Grid No. 2 of Green Gun</td>
</tr>
<tr>
<td>6</td>
<td>Cathode of Green Gun</td>
</tr>
<tr>
<td>7</td>
<td>Grid No. 1 of Green Gun</td>
</tr>
<tr>
<td>9</td>
<td>Grid No. 3</td>
</tr>
<tr>
<td>11</td>
<td>Cathode of Blue Gun</td>
</tr>
<tr>
<td>12</td>
<td>Grid No. 1 of Blue Gun</td>
</tr>
<tr>
<td>13</td>
<td>Grid No. 2 of Blue Gun</td>
</tr>
<tr>
<td>14</td>
<td>Heater</td>
</tr>
</tbody>
</table>

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)

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)
TYPICAL DRIVE CHARACTERISTICS,  
CATHODE-DRIVE SERVICE

HEATER VOLTAGE = 6.3 V  
ANODE-TO-GRID No.1 VOLTAGE = 20 to 27.5 kV  
GRID No.3-TO-GRID No.1 VOLTAGE ADJUSTED FOR FOCUS.  
GRID No.2-TO-GRID No.1 VOLTAGE (EACH GUN)  
ADJUSTED TO PROVIDE SPOT CUTOFF.  
+ = ZERO - BIAS POINT

ANDODE CURRENT PER GUN - µA

VIDEO SIGNAL VOLTAGE PER GUN - V
FIGURE 3

Important: Refer to sheet safety precautions for color.

Cut-off Design Chart

Grid - No. 10-Cathode Voltage - V

Grid - No. 10-Cathode Voltage Adjustable for Focus

Anode - 10-Cathode Voltage = 20.7274 Volts

Heater Voltage = 6.3 Volts
# Picture Tube

**SHORT RECTANGULAR GLASS TYPE**

**LOW-VOLTAGE ELECTROSTATIC FOCUS**

**ALUMINIZED SCREEN MAGNETIC DEFLECTION**

With Heater Having Controlled Warm-Up Time

## GENERAL DATA

### Electrical:
- **Heater Current at 6.3 volts:** 600 ± 30 ma
- **Heater Warm-Up Time (Average):** 11 ± 30 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 µf
- **Cathode to all other electrodes:** 5 µf
- **External conductive coating to tube:** 1500 max. µf

### Electron Gun: Type Requiring No Ion-Trap Magnet

### Optical:
- **Faceplate:** Filterglass
- **Light transmission at center (Approx.):** 78%
- **Phosphor (For Curves, see front of this Section):** P4—Sulfide Type Aluminized
- **Fluorescence:** White
- **Phosphorescence:** White
- **Persistence:** Medium Short

### Mechanical:
- **Tube Dimensions:**
  - **Overall length:** 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

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**RCA**

**Radio Corporation of America**

Electron Tube Division

Harrison, N. J.
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

GRID-DRIVE® SERVICE
Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, Design-Maximum Values:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR VOLTAGE</td>
<td>11000</td>
<td>20000</td>
</tr>
<tr>
<td>GRID-No.3 (FOCUSING) VOLTAGE:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>700</td>
<td></td>
</tr>
<tr>
<td>Negative value</td>
<td>350</td>
<td></td>
</tr>
<tr>
<td>GRID-No.2 VOLTAGE</td>
<td>600</td>
<td></td>
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<tr>
<td>GRID-No.1 VOLTAGE</td>
<td>300</td>
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<tr>
<td>Negative-peak value</td>
<td>220</td>
<td></td>
</tr>
<tr>
<td>Negative-bias value</td>
<td>154</td>
<td></td>
</tr>
<tr>
<td>Positive-bias value</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Positive-peak value</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>HEATER VOLTAGE</td>
<td>6.9</td>
<td>5.7</td>
</tr>
</tbody>
</table>
| PEAK HEATER-CATHODE VOLTAGE:
  Heater negative with respect to cathode: |         |         |
  During equipment warm-up period not exceeding 15 seconds. | 450 |         |
  After equipment warm-up period. | 200 |         |
  Heater positive with respect to cathode. | 200 |         |

Typical Operating Conditions:

With ultor voltage (E_{g1}) of 16000 volts
and grid-No.2 voltage (E_{g2}) 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 gauss

Maximum Circuit Values:

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

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
CATHODE-DRIVE® SERVICE

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

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

<table>
<thead>
<tr>
<th>Voltage Description</th>
<th>Maximum Value</th>
<th>Minimum Value</th>
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<tbody>
<tr>
<td>ULTOR-TO-GRID-No.1 voltage</td>
<td>20000 max. volts</td>
<td>11000 min. volts</td>
</tr>
<tr>
<td>GRID-No.3-TO-GRID-No.1 Voltage</td>
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<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>850 max. volts</td>
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<tr>
<td>Negative value</td>
<td>200 max. volts</td>
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<tr>
<td>GRID-No.2-TO-GRID-No.1 Voltage</td>
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<tr>
<td>Positive value</td>
<td>750 max. volts</td>
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<tr>
<td>Negative value</td>
<td>450 min. volts</td>
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<td>GRID-No.2-TO-CATHODE Voltage</td>
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<tr>
<td>Positive-peak value</td>
<td>600 max. volts</td>
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<td>Positive-bias value</td>
<td>220 max. volts</td>
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<tr>
<td>Negative-bias value</td>
<td>154 max. volts</td>
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<tr>
<td>Negative-peak value</td>
<td>0 max. volts</td>
<td></td>
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<tr>
<td>Negative-bias value</td>
<td>2 max. volts</td>
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<tr>
<td>HEATER VOLTAGE</td>
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<tr>
<td>PEAK HEATER-CATHODE VOLTAGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>During equipment warm-up period</td>
<td>450 max. volts</td>
<td></td>
</tr>
<tr>
<td>not exceeding 15 seconds.</td>
<td>200 max. volts</td>
<td></td>
</tr>
<tr>
<td>After equipment warm-up period</td>
<td>450 max. volts</td>
<td></td>
</tr>
<tr>
<td>Heater positive with respect to cathode:</td>
<td>200 max. volts</td>
<td></td>
</tr>
</tbody>
</table>

**Typical Operating Conditions:**

- With ultor-to-grid-No.1 voltage ($E_{u1}$) of grid-No.2-to-grid-No.1 voltage ($E_{u3}$) of
- 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 gaussess

### 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:

\[
\sqrt{\frac{E_{ca,k} \text{ or } E_{ca,g1} (\text{volts})}{16000 (\text{volts})}} \times 10 \text{ gaussess}
\]

The equipment manufacturer must determine and supply additional compensation for the effects of the earth's magnetic field and extraneous fields due to choice of circuitry and components. The additional compensation should preferably be applied as part of the magnetic field of the deflecting yoke.

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

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

OPERATING CONSIDERATIONS

*X-Ray Warning.* When operated at ultraviolet voltages up to 16 kilovolts, this picture tube does not produce any harmful X-ray radiation. However, because the rating of this type permits operation at voltages as high as 20 kilovolts (Design-maximum value), shielding of this picture tube for X-ray radiation may be needed to protect against possible injury from prolonged exposure at close range whenever the operating conditions involve voltages in excess of 16 kilovolts.

Shatter-Proof Cover Over the Tube Face. Following conventional picture-tube practice, it is recommended that the cabinet be provided with a shatterproof, glass cover over the face of this picture tube to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.
NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 30^\circ$. ULTOR TERMINAL IS ON SAME SIDE AS PIN 4.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No.6-126 (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

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

$E_f = 6.3$ VOLTS
ULTOR VOLTS = 11000 TO 20000
GRID-N\#3 VOLTS ADJUSTED FOR FOCUS.

Cathode-Drive Service

$E_f = 6.3$ VOLTS
ULTOR-TO-GRID-N\#1 VOLTS = 11000 TO 20000
GRID-N\#2-TO-GRID-N\#1 VOLTS ADJUSTED FOR FOCUS.
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*: 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
Grid-No.4 Voltage:
- Positive value: 1250 max. V
- Negative value: 400 max. V
**DIMENSIONAL**

Bulb Designation

- **SCREEN DIAGONAL:** 18.625 MIN.
- **SCREEN HEIGHT:** 12.125 MIN.
- **SCREEN WIDTH:** 15.500 MIN.
- **TOR.**
- **73 R.**
- **150 R.**
- **1.4 R.**
- **.9 R**
- **.250**
- **4.50 MAX.**
- **1.75 MIN.**

**NOTE:** KEEP THIS SPACE CLEAR OF ANY MECHANICAL OBSTRUCTION

- **BASE JEDEC NO. B7-208**
- **EXTERNAL CONDUCTIVE COATING (NOTE 1)**
- **1.750 ±.025**
- **1.125 ±.043**
- **.043**
- **99°**
- **37.1 R**
- **16.830 ±.125**

**RCA**

Electronic Components

DATA 1
OUTLINE
JEDEC NO. J157-1/2 A1

DIMENSIONS IN INCHES

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)

<table>
<thead>
<tr>
<th>Grid-No.2 Voltage</th>
<th>60 max.</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cathode Voltage:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative peak value</td>
<td>2 max.</td>
<td>V</td>
</tr>
<tr>
<td>Negative bias value</td>
<td>0 max.</td>
<td>V</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>100 max.</td>
<td>V</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>150 max.</td>
<td>V</td>
</tr>
<tr>
<td>Heater Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.9 max.</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>5.7 min.</td>
<td>V</td>
</tr>
</tbody>
</table>

Peak Heater-Cathode Voltage:
Heater negative with respect to cathode:
During equipment warm-up period not exceeding 15 seconds
After equipment warm-up period
Heater positive with respect to cathode:
Combined AC & DC voltage
DC Component

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

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

<table>
<thead>
<tr>
<th>Anode Voltage</th>
<th>16,000</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.4 Voltage</td>
<td>100</td>
<td>V</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>30</td>
<td>V</td>
</tr>
<tr>
<td>Cathode Voltage for visual extinction of focused raster</td>
<td>22 to 40</td>
<td>V</td>
</tr>
<tr>
<td>Field Strength of required adjustable Centering Magnet</td>
<td>0 to 8</td>
<td>G</td>
</tr>
</tbody>
</table>

MAXIMUM CIRCUIT VALUE

| Grid-No.1 Circuit Resistance | 1.5 max. | Ω |

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

Pon-o-Ply Type
Low-Voltage Electrostatic Focus
114° Magnetic Deflection

Direct Inter-electrode 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, 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
Grid-No.4 Voltage:
- Positive value: 1100 max. V
- Negative value: 550 max. V

RCA Electronic Components
20TP4

DIMENSIONAL
Bulb Designation

SCREEN DIAGONAL
15.625 MIN.

SCREEN HEIGHT
12.125 MIN.

SCREEN WIDTH
15.500 MIN.

KEEP THIS SPACE CLEAR OF ANY MECHANICAL OBSTRUCTION

EXTERNAL CONDUCTIVE COATING
(NOTE I)

RCA
Electronic Components

DATA 1
OUTLINE
JEDEC No.J157-1/2 A1

DIMENSIONS IN INCHES

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 \text{ max.} \ V \}
Grid-No.1 Voltage:
  Negative peak value ............... 220 \text{ max.} \ V
  Negative bias value ............... 155 \text{ max.} \ V
  Positive bias value ............... 0 \text{ max.} \ V
  Positive peak value ............... 2 \text{ max.} \ V
Heater Voltage ..................... \{6.9 \text{ max.} \ V \}
Peak Heater-Cathode Voltage:
  Heater negative with respect to cathode:
    During equipment warm-up period not exceeding 15 seconds ............... 450 \text{ max.} \ V
  After equipment warm-up period .......... 300 \text{ max.} \ V
Heater positive with respect to cathode:
  Combined AC & DC Voltage ............. 200 \text{ max.} \ V
  DC Component ...................... 100 \text{ 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 \text{ V}
Grid-No.4 Voltage \text{b} ............. 200 \text{ V}
Grid-No.2 Voltage ............... 300 \text{ V}
Cathode Voltage for visual extinction of focused raster ............... 28 to 62 \text{ V}
Field Strength of required adjustable Centering Magnet ............... 0 to 8 \text{ G}

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance ............... 1.5 \text{ max.} \ \Omega

\text{aInclude implosion protection hardware.}

\text{bThe grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 11.25-inch by 15-inch pattern from an RCA-2F21 monoscope, or equivalent.}

See X-RADIATION PRECAUTIONS at front of this section.
**Picture Tube**

**RECTANGULAR GLASS TYPE**
**MAGNETIC FOCUS**

**Electrical:**
- Heater Current at 6.3 volts: 600 ma
- 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

**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: 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
P4 - Sulfide Type, Aluminized

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

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 J172 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
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
Magnetic Focus
Aluminized Screen
72° Magnetic Deflection

Electrical:
Direct Interelectrode Capacitances:
- Cathode to all other electrodes: 5 pf
- Grid No.1 to all other electrodes: 6 pf
External conductive coating to anode: [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-Outline 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:
\[
\begin{align*}
\text{Negative} & : 6.9 \text{ max. volts} \\
\text{Positive} & : 5.7 \text{ min. volts}
\end{align*}
\]

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.
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 (ShiftR - ShiftG) . . . . . . . 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.
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 (4) 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.
- 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.
\[ E_F = 6.3 \text{ VOLTS} \]

Ultor-to-Cathode (of each gun) Volts = 20000 to 25000

Grid-No. 3-to-Cathode (of each gun) Volts =

Adjusted for focus

\[ \text{TUBE DIVISION} \]

RADIO CORPORATION OF AMERICA, HAMILTON, NEW JERSEY
COLOR KINESCOPE

TOP VIEW

SCREEN HEIGHT 15 5/8" MIN.

125° BLUE GUN

3 BOSSES ON FLANGE

SCREEN WIDTH 19 3/16" MIN.

1 5/8" MIN FOR TUBE SUPPORT

20 9/16" ± 1/8"

20°5/16 ± 3/16" DIA.

4 3/16 ± 1/8" ULTR TERMINAL METAL SHELL (NOTE 3)

255°

1.270° R.

70°

10 3/32 ± 1/8"

20 3/8"

25 3/16" MAX.

3" R.

2" ± 1/8"

1 11/32 ± 1/8"

3/32 ± 1/8"

2 1/4" ± 1/8"

RADIAL-CONVERGING POLE PIECES

LATERAL-CONVERGING POLE PIECES

SMALL-SHELL NECOHERTAL 12-PIN BASE (NOTE 2)

JETEC No B/12-13

REFERENCE LINE (NOTE 1)

EXTERNAL INSULATING COATING

FLANGE

19 3/16 ± 3/32" METAL PANEL SECTION

4° 1/16 ± 1/16" LATERAL-CONVERGING POLE PIECES

SMALL-SHELL NECOHERTAL 12-PIN BASE (NOTE 2)

JETEC No B/12-13

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-8399R4A
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 ULT FOR VOLTAGE.

REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE

REFERENCE LINE IS DETERMINED BY PLANE C-C' WHEN GAUGE IS SEATED AGAINST FUNNEL.
<table>
<thead>
<tr>
<th>y (&quot; IN)</th>
<th>x (&quot; IN) ± 0.001&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.875</td>
<td>2.258</td>
</tr>
<tr>
<td>1.000</td>
<td>2.352 ± 0.001</td>
</tr>
<tr>
<td>1.125</td>
<td>2.465 ± 0.001</td>
</tr>
<tr>
<td>1.250</td>
<td>2.604 ± 0.001</td>
</tr>
<tr>
<td>1.375</td>
<td>2.778 ± 0.001</td>
</tr>
<tr>
<td>1.500</td>
<td>2.990 ± 0.001</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>y (&quot; IN)</th>
<th>x (&quot; IN) ± 0.001&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.625</td>
<td>3.216 ± 0.001</td>
</tr>
<tr>
<td>1.750</td>
<td>3.440 ± 0.001</td>
</tr>
<tr>
<td>1.875</td>
<td>3.678 ± 0.001</td>
</tr>
<tr>
<td>2.000</td>
<td>3.958 ± 0.001</td>
</tr>
<tr>
<td>2.125</td>
<td>4.332 ± 0.001</td>
</tr>
</tbody>
</table>
**TYPICAL DRIVE CHARACTERISTICS**

<table>
<thead>
<tr>
<th>CURVES</th>
<th>DRIVE</th>
<th>EC2K</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GRID N°1</td>
<td>MEASURED WITH ZERO VIDEO DRIVE</td>
</tr>
<tr>
<td></td>
<td>CATHODE</td>
<td></td>
</tr>
</tbody>
</table>

- \( E_f = 6.3 \) VOLTS
- ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = \( 20000 \) TO \( 25000 \)
- GRID-N°2-TO-CATHODE (OF EACH GUN) VOLTS = EC2K

**Graph:**

- Video signal volts from Ultor
- Current cutoff per gun

**Notes:**

- Caution of anica, manson, nav

Tube Division

RADIO CORPORATION OF AMERICA, MARRISON, NEW JERSEY

92CM-8566RI
TYPICAL LIGHT-OUTPUT CHARACTERISTICS

E_f = 6.3 VOLTS
GRID-NR. 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"

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HAUPPAUGE, LONG ISLAND
# 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. 214NMINC (Radial leads), 214NMINC (Axial leads), or equivalent

---

For curves, see front of this section.

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

TENTATIVE DATA 1

6-59
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

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 megarohms.

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.

**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.
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 μf
Cathode to all other electrodes ............. 5 μf
External conductive coating to ultor. 2500 max. μf
2000 min. μf
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

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

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

DATA
I-63
### 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

**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** .......... 1600 volt
**and grid-No.2 voltage of** .......... 900 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-LOW ATION PRECAUTIONS FOR CATHODE-RAY TUBES at front of this section"
# PICTURE TUBE

## DATA

**General:**
- Heater, for Unipotential Cathode:
  - Voltage: \(6.3\) ac or dc volts
  - Current: \(0.6\) amp
- Direct Interelectrode Capacitances:
  - Grid No.1 to all other electrodes: \(6\) \(\mu F\)
  - Cathode to all other electrodes: \(5\) \(\mu F\)
- External conductive coating to ultron: \(2500\) max. \(\mu F\), \(2000\) min. \(\mu F\)
- Faceplate, Spherical: Filterglass
- Light transmission (Approxi.): \(73\%\)
- 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: \(14\frac{7}{16}\)" ± \(\frac{5}{16}\)"
- Greatest width: \(20\frac{1}{4}\)" ± \(\frac{1}{8}\)"
- Greatest height: \(16\frac{3}{8}\)" ± \(\frac{1}{8}\)"
- Diagonal: \(21\frac{3}{8}\)" ± \(\frac{1}{8}\)"
- Neck length: \(5\frac{7}{16}\)" ± \(\frac{1}{8}\)"

**Screen Dimensions (Minimum):**
- Greatest width: \(19\frac{1}{16}\)"
- Greatest height: \(15\frac{1}{16}\)"
- Diagonal: \(20\frac{1}{4}\)"
- Projected area: \(262\) sq. in.
- Weight (Approx.): \(23\) lbs

**Mounting Position:**
- Recessed Small Cavity [JETEC No. J1-21]
- Small-Button Eightar 7-Pin, Arrangement 2, (JETEC No. B7-183)

**Basing Designation for BOTTOM VIEW:**
- \(8HR\)

### Pin Configuration

- **Cap-Ultron**
- 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—Ultron**
- (Grid No.3, Grid No.5, Collector)
- C—External
- Conductive
- Coating

---

*Electron Tube Division, Tentative Data 1*

RCA Corporation of America, Harrison, New Jersey
GRID-DRIVE® SERVICE

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

Maximum Ratings, Design-Center Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultor Voltage</td>
<td>(18000) max. volts</td>
</tr>
<tr>
<td>Grid-No.4 Voltage:</td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>(12000^*) min. volts</td>
</tr>
<tr>
<td>Negative value</td>
<td>(1000) max. volts</td>
</tr>
<tr>
<td>Grid-No.2 Voltage:</td>
<td>(500) max. volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage:</td>
<td>(500) max. volts</td>
</tr>
<tr>
<td>Negative peak value</td>
<td>(200) max. volts</td>
</tr>
<tr>
<td>Negative bias value</td>
<td>(140) max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>(0) max. volts</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>(2) max. volts</td>
</tr>
<tr>
<td>Peak Heater-Cathode Voltage:</td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode</td>
<td>(180) max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>(180) max. volts</td>
</tr>
</tbody>
</table>

Equipment Design Ranges:

With any ultor voltage \((E_{c4})\) between 12000 and 18000 volts and grid-No.2 voltage \((E_{c2})\) between 200 and 500 volts:

- Grid-No.4 Voltage for Focus: 0 to 400 volts
- Grid-No.1 Voltage \((E_{c1})\) 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 \(E_{c1}\) except video drive is a positive voltage
- Grid-No.4 Current: -25 to +25 \(\mu\)A
- Grid-No.2 Current: -15 to +15 \(\mu\)A
- Field Strength of Adjustable Centering Magnet*: 0 to 8 gausses

Examples of Use of Design Ranges:

With ultor voltage of \(14000\) 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

* Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

P.S.*: See next page.
### PICTURE TUBE

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

<table>
<thead>
<tr>
<th>Grid-No.1 Video Drive</th>
<th>28 to 72</th>
<th>36 to 94</th>
</tr>
</thead>
<tbody>
<tr>
<td>from Raster Cutoff</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Black Level):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White-level value.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Maximum Circuit Values:**  
Grid-No.1-Circuit Resistance . . . . . . 1.5 max. megohms

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**CATHODE-DRIVE SERVICE**

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

<table>
<thead>
<tr>
<th>Maximum Ratings, Design-Center Values:</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR-TO-GRID-No.1 VOLTAGE . . . . . .</td>
</tr>
<tr>
<td>GRID-No.4-TO-GRID-No.1 VOLTAGE:</td>
</tr>
<tr>
<td>Positive value . . . . . . . . . . . .</td>
</tr>
<tr>
<td>Negative value . . . . . . . . . . . .</td>
</tr>
<tr>
<td>GRID-No.2-TO-GRID-No.1 VOLTAGE . . . .</td>
</tr>
<tr>
<td>GRID-No.2-TO-CATHODE VOLTAGE . . . . .</td>
</tr>
<tr>
<td>CATHODE-TO-GRID-No.1 VOLTAGE:</td>
</tr>
<tr>
<td>Positive peak value . . . . . . . . .</td>
</tr>
<tr>
<td>Positive bias value . . . . . . . . .</td>
</tr>
<tr>
<td>Negative bias value . . . . . . . . .</td>
</tr>
<tr>
<td>Negative peak value . . . . . . . . .</td>
</tr>
<tr>
<td>PEAK HEATER-CATHODE VOLTAGE:</td>
</tr>
<tr>
<td>Heater negative with respect to cathode.</td>
</tr>
<tr>
<td>Heater positive with respect to cathode.</td>
</tr>
</tbody>
</table>

**Equipment Design Ranges:**  
With any ultiro-to-grid-No.1 voltage \( E_{CB1} \) between 12000 and 18000 volts  
and grid-No.2-to-grid-No.1 voltage \( E_{CB2} \) between 225 and 640 volts

<table>
<thead>
<tr>
<th>Grid-No.4-to-Grid-No.1 Voltage for Focus</th>
<th>0 to 400 volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cathode-to-Grid-No.1 Voltage ( E_{K1} ) for Visual Extinction of Focused Raster . . . . . See Raster-Cutoff-Range Chart for Cathode-Drive Service</td>
<td></td>
</tr>
</tbody>
</table>

- 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.1 voltage or grid-No.4-to-grid-No.1 voltage required for focus of any individual tube is independent of ultiro current and will remain essentially constant for values of ultiro voltage (or ultiro-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.*
### Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level):

<table>
<thead>
<tr>
<th></th>
<th>White-level value</th>
<th>Same value as determined for Ekg₁, except video drive is a negative voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.4 Current</td>
<td>-25 to +25 µa</td>
<td></td>
</tr>
<tr>
<td>Grid-No.2 Current</td>
<td>-15 to +15 µa</td>
<td></td>
</tr>
</tbody>
</table>

Field Strength of Adjustable Centering Magnet:

|         | 0 to 8 gauss |

### Examples of Use of Design Ranges:

**With ½-to-grid-No.1**

- Voltage of 14000 volts
- Voltage of 16000 volts

**and grid-No.2-to-grid-No.1**

- Voltage of 900 volts
- Voltage of 400 volts

**Grid-No.4-to-Grid-No.1 Voltage for Focus**

- 0 to 400 volts
- 0 to 400 volts

**Cathode-to-Grid-No.1 Voltage for Visual Extinction of Focused Raster**

- 28 to 60 volts
- 36 to 78 volts

**Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level):**

|         | -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 ½-to-grid or ½-to-grid-No.1 voltage is 11000 volts, below which the serviceability of the PICTUBE 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 ½-to-grid or ½-to-grid-No.1 voltage is never less than 11000 volts.*

**Distance from Reference Line for suitable PM centering magnet should not exceed 2-½/₄.** 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.
GRID-DRIVE SERVICE

$E_p = 6.3 \text{ VOLTS}$
ULTOR VOLTS = 12000 TO 18000
GRID-N#4 VOLTS ADJUSTED FOR FOCUS.

CATHODE-DRIVE SERVICE

$E_p = 6.3 \text{ VOLTS}$
ULTOR-TO-GRID-N#1 VOLTS = 12000 TO 18000
GRID-N#4-TO-GRID-N#1 VOLTS ADJUSTED FOR FOCUS.

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 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.
CATHODE-DRIVE SERVICE

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

GRID-DRIVE SERVICE

- $E_f = 6.3$ 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"
### AVERAGE DRIVE CHARACTERISTICS

<table>
<thead>
<tr>
<th>CATHODE-DRIVE SERVICE</th>
<th>GRID-DRIVE SERVICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E_f = 6.3$ VOLTS</td>
<td>$E_f = 6.3$ VOLTS</td>
</tr>
<tr>
<td>ULTORM-TO-GRID-NO.1 VOLTS = 12000 TO 18000</td>
<td>ULTORM VOLTS = 12000 TO 18000</td>
</tr>
<tr>
<td>CATHODE BIASED POSITIVE WITH RESPECT TO GRID NO.1 TO GIVE FOCUSED RASTER CUTOFF.</td>
<td>GRID NO.1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.</td>
</tr>
</tbody>
</table>

---

**Diagram Details:**
- **Cathode Drive**
- **Grid Drive**

- **Axes:**
  - **Ulterior Milliamperes**
  - **Video Signal Volts from Raster Cutoff**

- **Curves:**
  - Ulterior No. 1 to Ulterior No. 2 to Cathode Volts = 500
  - Ulterior No. 1 to Cathode Volts = 300

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**Designation:**
- **Electron Tube Division**
- **RCA Corporation of America, Harrison, New Jersey**
2ICQP4
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 .................. 110°
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, Collector)
C—External
Conductive Coating

Maximum Ratings, Design-Center Values:
ULTOR VOLTAGE .......... 18000 max. volts
GRID-No.4 (FOCUSBING) VOLTAGE:
Positive value .............. 1000 max. volts
Negative value .............. 500 max. volts
GRID-No.2 VOLTAGE ........ 500 max. volts
## GRID-No.1 VOLTAGE:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative-peak value</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Negative-bias value</td>
<td>140 max. volts</td>
</tr>
<tr>
<td>Positive-bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive-peak value</td>
<td>2 max. volts</td>
</tr>
</tbody>
</table>

## 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 Inter-electrode 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
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. 214NMINS C (Radial leads),
214NMINC (Axial leads), or equivalent
Base: Small-Shell Neodihpeal 12-Pin (JEDEC No. B12-131)
Basing Designation for BOTTOM VIEW: 14 AL

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)

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:
21CYP22-A
RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
Equipment Design Ranges:

With ultor voltage \(E_{c1k}\) each gun between 20000 and 25000 volts

Grid-No.3 (Focusing Electrode)-to-Cathode (Of each gun) Voltage.  
16.8% to 20% of \(E_{c1k}\) each gun volts

Grid-No.2-to-Cathode Voltage (Each gun) when circuit design utilizes grid-No.1-to-cathode voltage \(E_{c1k}\) at fixed value for raster cutoff.

Grid-No.1-to-Cathode Voltage (Each gun) for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2-to-cathode voltage \(E_{c2k}\) at fixed value.

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 N.P.C.D. (CIE Coordinates \(\times = 0.287, \ y = 0.316\)):  
Red gun............. 49 %  
Blue gun............ 18 %  
Green gun........... 33 %

Ratios of Cathode Currents:  
To Produce White of 8500°K + 27 N.P.C.D. (CIE Coordinates \(\times = 0.287, \ y = 0.316\)):  
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:
- Shift of ±5/8"

For static convergence including compensation for dc component of dynamic convergence (Each beam).

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 1/10" 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 continuous short-circuit current to 50 milliamperes. In addition, to prevent cathode damage with resultant decrease in tube life, an external resistor having a value of 50,000 ohms must be connected between the two bulb terminals and the effective resistance between the grid-No.3 power-supply output capacitor and the grid-No.3 electrode should not be less than 50,000 ohms. These resistances should be capable of withstanding the maximum instantaneous currents and voltages in their respective circuits. It is to be noted that the high voltage must be connected only to the High-Voltage-Supply Terminal—never directly to the Ultor Terminal. A resistor of 50,000 ohms must be connected between the Ultor Terminal and the High-Voltage-Supply Terminal.

In equipment utilizing a well-regulated high-voltage power supply, the grid-No.3-circuit resistance should be limited to 7.5 megohms.
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 1.2 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 (ultral cap).

Brilliance and definition decrease with decreasing ultral voltage. In general, ultral 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 (6).

The direction of movement of the red and green beam is opposite to that of the blue beam.

Indicated values apply when RCA test yoké 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 ultraviolet 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 Volatges. 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

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 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

$E_f = 6.3$ VOLTS
ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 20000 TO 25000
GRID-№ 3-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS

GRIDS-TO-CATHODE VOLTS

0 100 200 300 400 500 600

GRID-№ 2-TO-CATHODE VOLTS

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
DATA 6
10-60
TYPICAL DRIVE CHARACTERISTICS

**CATHODE-DRIVE SERVICE**

- $E_F = 6.3$ VOLTS
- ULTOR-TO-GRID-#1 (OF EACH GUN) VOLTS = 2000 TO 2500
- 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 ($E_{KG}$)

**GRID-DRIVE SERVICE**

- $E_F = 6.3$ VOLTS
- ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 20000 TO 25000
- 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 ($E_{CK}$)

### Diagram

- **Grid Drive**
- **Cathode Drive**
- **Zero-Bias Point**

**Video Signal Volts from Ultor-Current Cutoff Per Gun**

- $E_{FG} = 50$
- $E_{FG} = 75$
- $E_{FG} = 100$
- $E_{FG} = 125$
- $E_{FG} = 150$
- $E_{FG} = 175$
- $E_{CK} = 75$

**Radio Corporation of America**

Electron Tube Division
Harrison, N. J.
TYPICAL LIGHT-OUTPUT CHARACTERISTICS

$E_F = 6.3$ VOLTS
GRID-NR 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.R.C.D. WHITE LIGHT OUTPUT.
PERCENTAGE OF TOTAL ULTOR CURRENT SUPPLIED BY EACH GUN TO PRODUCE 8500° K+27 M.R.C.D. WHITE:
- RED GUN: 50%
- BLUE GUN: 19%
- GREEN GUN: 31%

RASTER SIZE: 19$\frac{1}{4}$" x 14$\frac{1}{2}$" CENTERED ON TUBE FACE.
*MEASURED WITHIN 5" DIAMETER AREA CENTERED ON TUBE FACE.
DETAIL SHOWING EXTERNAL CONDUCTIVE COATING

REFERENCE LINE

92CL-10323
PICTURE TUBE

SCREEN DIAGONAL: 20 1/4" MIN.

SCREEN HEIGHT: 15 1/16" MIN.

SCREEN WIDTH: 19 1/16" MIN.

20 1/4" ± 1/8"

2 7/8" R.

2 7/8" R.

2 1/2" R.

2 1/2" R.

15 1/4" R.

10 5/8" R.

10 5/8" R.

2" ± 1/8"

X AXIS

REFERENCE LINE (NOTE 2)

SMALL-BUTTON EIGHTAR 7-PIN BASE ARRANGEMENT 2 JEDEC N887-183 (NOTE 3)

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

CE-10329A


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.
**ELEON LOMNT DIVISION**

**RCA**

**21DEP4-A**

**RASTER-CUTOFF-RANGE CHARTS**

**GRID-DRIVE SERVICE**

$E_c = 6.3$ VOLTS

ULTOR VOLTS = 15000 TO 20000

GRID-N°4 VOLTS ADJUSTED FOR FOCUS.

**CATHODE-DRIVE SERVICE**

$E_c = 6.3$ VOLTS

ULTOR-TO-GRID-N°1 VOLTS = 15000 TO 20000

GRID-N°4-TO-GRID-N°1 VOLTS ADJUSTED FOR FOCUS.
AVERAGE DRIVE CHARACTERISTICS

<table>
<thead>
<tr>
<th>CATHODE-DRIVE SERVICE</th>
<th>GRID-DRIVE SERVICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>( E_c = 6.3 ) VOLTS</td>
<td>( E_c = 6.3 ) VOLTS</td>
</tr>
<tr>
<td>ULTOR-TO-GRID-( N_1 ) VOLTS = 16000</td>
<td>ULTOR VOLTS = 16000</td>
</tr>
<tr>
<td>CATHODE BIASED POSITIVE WITH RESPECT TO GRID ( N_1 ) TO GIVE FOCUSED RASTER CUTOFF.</td>
<td>GRID ( N_1 ) BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.</td>
</tr>
<tr>
<td>RASTER FOCUSED AT AVERAGE BRIGHTNESS.</td>
<td>RASTER FOCUSED AT AVERAGE BRIGHTNESS.</td>
</tr>
</tbody>
</table>
| RASTER SIZE = 18" x 13\( \frac{1}{2} \)" | RASTER SIZE = 18" x 13\( \frac{1}{2} \)"

I.C.I. COORDINATES OF SCREEN: \( x = 0.270, y = 0.300 \)

**Graph:**
- **Cathode Drive**
- **Grid Drive**

**Axes:**
- **Video Signal Volts from Raster Cutoff**
- **Highlight Brightness—Foot-Lamberts**

**Points:**
- Video Signal: 0 to 80 Volts
- Highlight Brightness: 0 to 800 Foot-Lamberts

**Additional Information:**
- **Electron Tube Division**
- **Radio Corporation of America, Harrison, New Jersey**
- **92CM-10323**
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 21DBP4-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: $450 \pm 5\%$ ma
- Heater Warm-Up Time (Average): 11 seconds
- Direct Interelectrode Capacitances:
  - Grid No.1 to all other electrodes: 6 $\mu$F
  - Cathode to all other electrodes: 5 $\mu$F
  - External conductive coating to ultor: 2500 max. $\mu$F, 1700 min. $\mu$F

**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 J1716K 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.B7-2D8)
- Basing Designation for BOTTOM VIEW: 8HR

### Pinout Diagram

- 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—Ulter (Grid No.3, Collector)
- C—External Conductive Coating

**RADIO CORPORATION OF AMERICA**

Electron Tube Division

Harrison, N. J.

**DATA**

3–62
**Maximum Ratings, Design-Maximum Values:**

<table>
<thead>
<tr>
<th>ULTOR VOLTAGE</th>
<th>19800 max. volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRID-No.4 (FOCUSING) VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>1100 max. volts</td>
</tr>
<tr>
<td>Negative value</td>
<td>550 max. volts</td>
</tr>
<tr>
<td>GRID-No.2 VOLTAGE</td>
<td>550 max. volts</td>
</tr>
<tr>
<td>GRID-No.1 VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Negative peak value</td>
<td>220 max. volts</td>
</tr>
<tr>
<td>Negative bias value</td>
<td>154 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max. volts</td>
</tr>
<tr>
<td>PEAK HEATER-CATHODE VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode:</td>
<td></td>
</tr>
<tr>
<td>During equipment warm-up period not exceeding 15 seconds</td>
<td>450 max. volts</td>
</tr>
<tr>
<td>After equipment warm-up period</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>200 max. volts</td>
</tr>
</tbody>
</table>

**Typical Operating Conditions:**

With uttor 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 | -95 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

**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 µf
  - Cathode to all other electrodes: 5 µf
- **External conductive coating to ultor:**
  - 2500 max. µf
  - 2000 min. µf
- **Faceplate, Spherical:** Filterglass
- **Light transmission (Approx.):** 74%
- **Phosphor (For curves, see front of this section):** P4—Sulfide Type
  - Aluminized White
- **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

---

**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 µf
  - Cathode to all other electrodes: 5 µf
- **External conductive coating to ultor:**
  - 2500 max. µf
  - 2000 min. µf
- **Faceplate, Spherical:** Filterglass
- **Light transmission (Approx.):** 74%
- **Phosphor (For curves, see front of this section):** P4—Sulfide Type
  - Aluminized White
- **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
GRID-DRIVE SERVICE

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

Maximum and Minimum Ratings, Design-Center Values:

**ULTOR VOLTAGE**

\[
\begin{align*}
\text{12000} & \text{ max. volts} \\
\text{12000} & \text{ min. volts}
\end{align*}
\]

**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 \((E_{c,k})\) between 12000 and 20000 volts and grid-No.2 voltage \((E_{s2})\) between 200 and 500 volts:

- Grid-No.4 Voltage for focus: -50 to +400 volts
- Grid-No.1 Voltage \((E_{c1k})\) for visual extinction of focused raster: See Raster-Cutoff-Range Chart for Grid-Drive Service
- Grid-No.1 Video Drive from Raster Cutoff (Black Level):
  - White-level value (Peak positive): Same value as determined for \(E_{c1k}\) except video drive is a positive voltage
- Grid-No.4 Current: -25 to +25 \(\mu\)A
- Grid-No.2 Current: -15 to +15 \(\mu\)A
- Field Strength of Adjustable Centering Magnet: 0 to 8 gausses

**Examples of Use of Design Ranges**:

- With ultor voltage of 16000 volts and grid-No.2 voltage of 300 volts
- Grid-No.4 Voltage for focus: 0 to 400 volts

\[\text{See next page.}\]

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*Note: See tentative data.*

---

9-58 ELECTRON TUBE DIVISION TENTATIVE DATA 1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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
GRID-No.4-TO-GRID-No.1 VOLTAGE: 12000* min. volts
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 (Ec581) between 12000 and 20000 volts and grid-No.2-to-grid-No.1 voltage (Ec261) 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 (Ekg1) 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
Ekg, 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 Adjust-
able Centering Magnet* .......... 0 to 8 gausses

Examples of Use of Design Ranges:
With ultor-to-grid-
No.1 voltage of
and grid-No.2-to-grid-
No.1 voltage of
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 abso-
lute minimum ultor or ultor-to-grid-No.1 voltage is 11,000 volts, be-
low 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 condi-
tions 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-
gird-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
undelected 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
E.F = 6.3 VOLTS
ULTOR VOLTS = 12000 TO 20000
GRID-N24 VOLTS ADJUSTED FOR FOCUS.

CATHODE-DRIVE SERVICE
E.F = 6.3 VOLTS
ULTOR-TO-GRID-N1 VOLTS = 12000 TO 20000
GRID-N24-TO-GRID-N1 VOLTS ADJUSTED FOR FOCUS.
SHORT SMALL-SHELL DUODECAL 6-PIN BASE JETEC GROUP 4, NO. 86-203
OR
SMALL-SHELL DUODECAL 6-PIN BASE JETEC GROUP 4, NO. 86-63
(NOTE 3)


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 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**

**AVERAGE DRIVE CHARACTERISTICS**

<table>
<thead>
<tr>
<th>CATHODE-DRIVE SERVICE</th>
<th>GRID-DRIVE SERVICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E_f = 6.3$ VOLTS</td>
<td>$E_f = 6.3$ VOLTS</td>
</tr>
<tr>
<td>ULTOR-TO-GRID-NO.1</td>
<td>ULTOR VOLTS = 16000</td>
</tr>
<tr>
<td>VOLTS = 16000</td>
<td>GRID NO. 1 BIASED NEGATIVE</td>
</tr>
<tr>
<td>CATHODE BIASED POSITIVE WITH RESPECT TO GRID NO. 1 TO GIVE FOCUSED RASTER CUTOFF.</td>
<td>WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.</td>
</tr>
<tr>
<td>RASTER FOCUSED AT AVERAGE BRIGHTNESS.</td>
<td>RASTER FOCUSED AT AVERAGE BRIGHTNESS.</td>
</tr>
<tr>
<td>RASTER SIZE = 18&quot; × 13-1/2&quot;</td>
<td>RASTER SIZE = 18&quot; × 13-1/2&quot;</td>
</tr>
</tbody>
</table>

---

**Highlight Brightness vs. Video Signal Volts from Raster Cutoff**

- **Cathode Drive**
- **Grid Drive**

**Video Signal Volts from Raster Cutoff**

- 0
- 10
- 20
- 30
- 40
- 50
- 60
- 70
- 80

---

**Electron Tube Division**

Radio Corporation of America, Harrison, New Jersey
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE

$E_f = 6.3$ VOLTS
ULTOR-TO-GRID-NO.1 VOLTS = 12000 TO 20000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID NO.1 TO GIVE FOCUSED RASTER CUTOFF.

GRID-DRIVE SERVICE

$E_f = 6.3$ VOLTS
ULTOR VOLTS = 12000 TO 20000
GRID NO.1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.

--- CATHODE DRIVE
--- GRID DRIVE

---

VIDEO SIGNAL VOLTS FROM RASTER CUTOFF

RCA CORPORATION OF AMERICA, HARRISON, NEW JERSEY
## 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 μf
  - Cathode to all other electrodes ... 5 μf
- **External conductive coating to ultor:**
  - Filterglass
  - 2500 max. μf
  - 2000 min. μf
- **Faceplate, Spherical:**
  - Light transmission (Approx.) ... 74%
- **Phosphor (for curves, see front of this Section):**
  - P4—Sulfide Type Aluminized
  - White
  - Medium-Short
- **Deflection Method:**
  - Electrostatic
  - 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:**
  - Recessed Small Cavity (JEDEC No.J1-21)
  - 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)
Basing Designation for BOTTOM VIEW

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 ($E_{c6}$) between 12000 and 20000 volts and grid-No.2-to-grid-No.1 voltage ($E_{c2}$) 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: $E_{kg1}$ 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 gauss

Examples of Use of Design Ranges:

With ultor-to-grid -
No.1 voltage of 18000 volts
and grid-No.2-to-grid -
No.1 voltage of 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.1 voltage or grid-No.4-to-grid-No.1 voltage required for focus of any individual tube is independent of ultor current and will remain essentially constant for values of ultor-to-grid-No.1 voltage or grid-No.2-to-grid-No.1 voltage within design ranges shown for these items.

\^ Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 7/16-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

\( The cathode-to-grid-No.1 voltage \(E_{kg1}\) for visual extinction of focused raster will increase by approximately 2 per cent for every 1000-volt increase in ultor-to-grid-No.1 voltage and will decrease by approximately 2 per cent for every 1000-volt decrease in ultor-to-grid-No.1 voltage.

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

SCREEN DIAGONAL 20 1/4 MIN.
SCREEN HEIGHT 15 1/16
SCREEN WIDTH 19 1/6 MIN.

2 1/4" ± 1/8"

33" R.

17" R.

3" R.

17 1/2" R.

30 25/32 R.
33" R.

ULTOR RECESSED SMALL CAVITY CAP JEDEC NO. JI-21 (NOTE 1)

REFERENCE LINE

SMALL-SHELL DUODECAL 6-PIN BASE JEDEC GROUP 4, NO. B6-63
OR
SHORT SMALL-SHELL DUODECAL 6-PIN BASE JEDEC GROUP 4, NO. B6-203 (NOTE 3)

10-59 ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-10255A

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 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.
$E_c = 6.3 \text{ VOLTS}$

ULTOR-TO-GRID-N1 VOLTS $= 18000$

GRID-N2-TO-GRID-N1 VOLTAGE ADJUSTED FOR FOCUS.

% INCREASES OR DECREASES DIRECTLY BY APPROX. 2% FOR EVERY 1000-VOLT CHANGE IN ULTOR-TO-GRID-N1 VOLTAGE.
CATHODE-DRIVE CHARACTERISTICS

Ee = 6.3 VOLTS
ULTOR-TO-GRID-N21 VOLTS = 18000
GRID-N22-TO-GRID-N21 VOLTS = 50
CATHODE BIASED POSITIVE WITH RESPECT TO
GRID N21 TO GIVE FOCUSED RASTER CUTOFF.
RASER FOCUSED AT AVERAGE BRIGHTNESS.
RASER SIZE = 18" x 13-1/2"

VIDEO SIGNAL VOLTS FROM RASTER CUTOFF

HIGH CUTOFF

LOW CUTOFF
CATHODE-DRIVE CHARACTERISTICS

E_g = 6.3 VOLTS
ULTOR-TO-GRID-N2I VOLTS = 18000
GRID-N2 2-TO-GRID-N2I VOLTS = 50
CATHODE BIASED POSITIVE WITH RESPECT TO GRID N2I TO GIVE FOCUSED RASTER CUTOFF.
**Picture Tube**

**RECTANGULAR GLASS TYPE**
**MAGNETIC FOCUS**

**ALUMINIZED SCREEN**
**70° MAGNETIC DEFLECTION**

**Electrical:**

Direct Inter electrode Capacitances:
- Cathode to all other electrodes: 5 pf
- Grid-No. 1 to all other electrodes: 6 pf
- External conductive coating to anode: 750 max. to 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.): 20 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

[Diagram of pin configuration]

**ANODE**

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**

RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.
Maximum and Minimum Ratings, Design-Maximum Values:

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Maximum Value</th>
<th>Minimum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANODE VOLTAGE</td>
<td>20000 max.</td>
<td></td>
</tr>
<tr>
<td>GRID-No. 2 VOLTAGE</td>
<td>550 max.</td>
<td></td>
</tr>
<tr>
<td>GRID-No. 1 VOLTAGE:</td>
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<tr>
<td>Negative peak value</td>
<td>220 max.</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>155 max.</td>
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<tr>
<td>Positive bias value</td>
<td>0 max.</td>
<td></td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max.</td>
<td></td>
</tr>
<tr>
<td>HEATER VOLTAGE</td>
<td>5.7 min.</td>
<td>6.9 max.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>12000 volts</td>
</tr>
<tr>
<td>Grid-No. 2 Voltage</td>
<td>300 volts</td>
</tr>
<tr>
<td>Grid-No. 1 Voltage</td>
<td>-28 to -72 volts</td>
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Maximum Circuit Value:

<table>
<thead>
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<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No. 1-Circuit Resistance</td>
<td>1.5 max. megohms</td>
</tr>
</tbody>
</table>

For X-radiation shielding considerations, see sheet X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section.
2IEQP4

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 &mu;f
Cathode to all other electrodes. 5 &mu;f
External conductive coating to ultor. \{2500 max. &mu;f
\(2000 \text{ min.} \quad &mu;f

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)
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
GRID-No. 3 VOLTAGE: 12000 min. volts
GRID-No. 2 VOLTAGE: 650 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 ($E_{c1k}$) between 12000 and 18000 volts and grid-No. 2 voltage ($E_{c2k}$) between 400 and 550 volts

Grid-No. 3 Voltage for focus: 0 to 400 volts
Grid-No. 1 Voltage ($E_{c1k}$) for visual extinction of focused raster:

See Raster-Cutoff-Range Chart for Grid-Drive Service

Grid-No. 1 Video Drive from Raster Cutoff (Black level):
White-level value
(Peak positive) Same value as determined for $E_{c1k}$ except video drive is a positive voltage

Grid-No. 3 Current: -25 to +25 μA

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ELECTRON TUBE DIVISION TENTATIVE DATA 1
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Grid-No.2 Current ........... -15 to +15 \( \mu \)a
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
GRID-No.3-TO-GRID-No.1 VOLTAGE ........... 12000* min. volts
GRID-No.2-TO-GRID-No.1 VOLTAGE ........... 650 max. volts
GRID-No.2-TO-CATHODE VOLTAGE ........... 690 max. volts
GRID-No.2-TO-CATHODE VOLTAGE ........... 550 max. volts
GRID-No.2-TO-CATHODE VOLTAGE ........... 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 \( (E_{c2g1}) \) between 12000 and 18000 volts and grid-No.2-to-grid-No.1 voltage \( (E_{c2g1}) \) 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 (Ekg1) 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 Ekg1 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 ultror-to-grid-No.1 voltage of and grid-No.2-to-grid-No.1 voltage of 16000 18000 volts 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 ultror- or ultror-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 ultror- or ultror-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 ultror voltage, ultror current, and grid-No.2 voltage. It changes directly with the ultror voltage at the rate of approximately 46 volts for each 1000-volt change in ultror 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 ultror current at the rate of about 60 volts for each 100-microampere change in ultror 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

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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.
2IEQP4

PICTURE TUBE

SCREEN DIAGONAL 20\frac{1}{4}" MIN.

SCREEN HEIGHT 15 \frac{1}{16}" MIN.

SCREEN WIDTH 19\frac{1}{16}” MIN.

17\frac{1}{2}” R.

32” R.

30\frac{25}{32}” R.

17\frac{1}{2}” R.

3.97” R.

3.50” R.

20\frac{1}{4}” \pm \frac{1}{8}”

27\frac{1}{8}” R.

33” R.

105°

15\frac{1}{4}” R.

2” \pm \frac{1}{6}”

1\frac{1}{8}” \pm \frac{1}{32}”

(NOTE 9)

X AXIS

Y AXIS

REFERENCE LINE

(SMALL-BUTTON NEOEIGHTAR 7-PIN BASE JEDEC NRB7-208 (NOTE 3)

ELECTRON TUBE DIVISION

RAHCO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6-59

CE-9936R1A
NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF \pm 30^\circ. ULTOR TERMINAL IS ON SAME SIDE AS PIN 4.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC NO. G-126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY 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.
CATHODE-DRIVE SERVICE

$E_F = 6.3$ VOLTS
ULTOR VOLTS = 12000 TO 18000
GRID-N2 VOLTS ADJUSTED FOR FOCUS.

Grid-N2 VOLTS

CATHODE-DRIVE SERVICE

$E_F = 6.3$ VOLTS
ULTOR-TO-GRID-N1 VOLTS = 12000 TO 18000
GRID-N3-TO-GRID-N1 VOLTS ADJUSTED FOR FOCUS.

Grid-N3-TO-GRID-N1 VOLTS
Video Signal Volts from Raster Cutoff

Highlight Brightness—Foot-Lamberts

I.C.I. Coordinates of Screen: X = 0.70, Y = 0.300

Contrast of Raster Size

Grid Drive — Cathode Drive

Raster Size = 18” x 13½”

At Average Brightness, Raster Focused Respect to Grid No. 1 to Give Grid Net Bias Suitable with Cathode Base Positive with Ultron-10 Grid No. 1600 Volts E.F. = 9.3 Volts

Cathode Drive Service

Average Drive Characteristics

2104

RA

2104
**2IEQP4**

**AVERAGE DRIVE CHARACTERISTICS**

<table>
<thead>
<tr>
<th>CATHODE-DRIVE SERVICE</th>
<th>GRID-DRIVE SERVICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E_f = 6.3$ VOLS</td>
<td>$E_f = 6.3$ VOLS</td>
</tr>
<tr>
<td>ULTOR-TO-GRID-$N_1$ VOLTS = 12000 TO 18000</td>
<td>ULTOR VOLTS = 12000 TO 18000</td>
</tr>
<tr>
<td>CATHODE BIASED POSITIVE WITH RESPECT TO GRID $N_1$ TO GIVE FOCUSED RASTER CUTOFF.</td>
<td>GRID $N_1$ BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.</td>
</tr>
</tbody>
</table>

---

**Graph:**

- **CATHODE DRIVE**
- **GRID DRIVE**

---

**Video Signal Volts from Raster Cutoff**

<table>
<thead>
<tr>
<th>Video Signal Volts from Raster Cutoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>1800</td>
</tr>
</tbody>
</table>

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**Electron Tube Division**

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9935
Monitor Kinescope

NO ION-TRAP MAGNET REQUIRED

**RECTANGULAR GLASS TYPE**

**LOW-VOLTAGE ELECTROSTATIC FOCUS**

**ALUMINIZED SCREEN**

**72° MAGNETIC DEFLECTION**

**Electrical:**

Direct Inter-electrode 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

RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.
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
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
"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.
Grid-No.1-to-Cathode Voltage (Each gun) for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2-to-cathode voltage \( V_{C2k} \) at fixed value.

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 \( \mu \text{A} \)
Grid-No.2 Current (Each gun). -5 to +5 \( \mu \text{A} \)

Percentage of Total Ultron Current Supplied by Each Gun (Average):

<table>
<thead>
<tr>
<th></th>
<th>Red Gun</th>
<th>Blue Gun</th>
<th>Green Gun</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min.</td>
<td>44</td>
<td>28</td>
<td>30</td>
</tr>
<tr>
<td>Av.</td>
<td>26</td>
<td>26</td>
<td>30</td>
</tr>
<tr>
<td>Max.</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
</tbody>
</table>

To Produce White of 8500° K + 27 N.P.C.D. (CIE Coordinates \( x = 0.287, y = 0.316 \))

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

Ratios of Cathode Currents:

<table>
<thead>
<tr>
<th>To Produce White of 8500° K + 27 N.P.C.D.</th>
<th>0.9</th>
<th>1.45</th>
<th>2</th>
<th>1</th>
<th>1.7</th>
<th>2.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>To Produce White of 9300° K + 27 N.P.C.D.</td>
<td>0.85</td>
<td>1.4</td>
<td>1.95</td>
<td>0.8</td>
<td>1.5</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Maximum Raster Centering Correction in Any Direction. 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"

- Lateral-Converging Magnet:
  - 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:

<table>
<thead>
<tr>
<th>For ultor voltage of</th>
<th>20000</th>
<th>25000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.3 (Focusing Electrode)-to-Cathode (Of each gun) Voltage.</td>
<td>3360 to 4000</td>
<td>1200 to 5000</td>
</tr>
<tr>
<td>Grid-No.2-to-Cathode Voltage (Each gun) when circuit design utilizes grid-No.1-to-cathode voltage of -70 volts for raster cutoff.</td>
<td>130 to 370</td>
<td>130 to 370</td>
</tr>
<tr>
<td>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.</td>
<td>-45 to -100</td>
<td>-45 to -100</td>
</tr>
</tbody>
</table>

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.

- For Curves, see front of this Section.
- For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts.
- 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. 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 3/8".
- 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

BLUE GUN

HORIZONTAL OF SCREEN

GREEN GUN

RED GUN

PLANE THROUGH θ OF PIN #2 AND TUBE AXIS

BASE BOTTOM VIEW

MOLD-MATCH LINE

1/16" MIN.
UNDISTURBED WIDTH EXCLUDING PADS

1/8" SEAL AREA

8/32" SEAL LINE

(NOTE 5)

DETAIL

92CL=10849

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 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

<table>
<thead>
<tr>
<th>y</th>
<th>x</th>
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</thead>
<tbody>
<tr>
<td>0.000&quot;</td>
<td>2.062&quot; + 0.001&quot; - 0.000&quot;</td>
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<tr>
<td>0.125&quot;</td>
<td>2.062&quot; + 0.001&quot; - 0.000&quot;</td>
</tr>
<tr>
<td>0.250&quot;</td>
<td>2.062&quot; + 0.001&quot; - 0.000&quot;</td>
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<table>
<thead>
<tr>
<th>y</th>
<th>x</th>
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<td>0.375&quot;</td>
<td>2.062&quot; + 0.001&quot; - 0.000&quot;</td>
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<tr>
<td>0.385&quot;</td>
<td>2.062&quot; + 0.001&quot; - 0.000&quot;</td>
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<tr>
<td>0.500&quot;</td>
<td>2.084&quot; ± 0.001&quot;</td>
</tr>
<tr>
<td>0.625&quot;</td>
<td>2.122&quot; ± 0.001&quot;</td>
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RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
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<td>2.778&quot; ± 0.001&quot;</td>
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<td>3.958&quot; ± 0.001&quot;</td>
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<tr>
<td>2.125&quot;</td>
<td>4.332&quot; ± 0.001&quot;</td>
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CUTOFF DESIGN CHART

$E_F = 6.3$ VOLTS
ULTOR-TO-CATHODE (OF EACH GUN) VOLTS=20000 TO 27500
GRID-N° 3-TO-CATHODE (OF EACH GUN) VOLTS=ADJUSTED
FOR FOCUS
TYPICAL DRIVE CHARACTERISTICS

**CATHODE-DRIVE SERVICE**
- $E_f = 6.3 \text{ VOLTS}$
- ULTOR-TO-GRID-N$_1$ (OF EACH GUN) VOLTS = 20000 TO 27500
- GRID-N$_3$-TO-GRID-N$_1$ (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS
- GRID-N$_2$-TO-GRID-N$_1$ VOLTS (EACH GUN) = ADJUSTED TO PROVIDE ULTOR-CURRENT CUT-OFF FOR DESIRED FIXED CATHODE-TO-GRID-N$_1$ (EACH GUN) VOLTAGE ($E_{kin}$)

**GRID-DRIVE SERVICE**
- $E_f = 6.3 \text{ VOLTS}$
- ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 20000 TO 27500
- GRID-N$_3$-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS
- GRID-N$_2$-TO-CATHODE VOLTS (EACH GUN) = ADJUSTED TO PROVIDE ULTOR-CURRENT CUT-OFF FOR DESIRED FIXED GRID-N$_1$-TO-CATHODE (EACH GUN) VOLTAGE ($E_{ck1}$)

**Graph**
- **GRID DRIVE**
- **CATHODE DRIVE**
- **ZERO-BIAS POINT**

**Video Signal Volts from Ultor-Current Cutoff Per Gun**

**Data 6**
Electron Tube Division
Harrison, N. J.

92CL-10845
TYPICAL LIGHT-OUTPUT CHARACTERISTICS

E_r = 6.3 VOLTS
GRID-NR 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: 19½" X 14½" CENTERED ON TUBE FACE.
× MEASURED WITHIN 5°-DIAMETER AREA CENTERED ON TUBE FACE.

0 200 400 600 800 1000 1200 1400 1600
ULTOR MICROAMPERES

0 5 10 15 20 25 30 35 40
ULTOR WHITE LIGHT OUTPUT * - FOOT LAMBERTS

9300°K+27 M.P.C.D. WHITE LIGHT OUTPUT ** - FOOT LAMBERTS

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
**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 µf
  - Cathode to all other electrodes: 5 µf
- External conductive coating to ultor: 2000 max. µf, 1500 min. µf
- Electron Gun: Type Requiring No Ion-Trap Magnet

**Optical:**
- Faceplate: Filterglass
- Light transmission (Approx.): 76%
- Phosphor (For curves, see front of this section): P4—Sulfide Type, Aluminized

**Mechanical:**
- Operating Position: Any
- Weight (Approx.): 20 lbs
- Overall Length: 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.87-208)

**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:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR VOLTAGE</td>
<td>20000 max. volts</td>
</tr>
<tr>
<td>GRID-No.4 (FOCUSING) VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Positive Value</td>
<td>1100 max. volts</td>
</tr>
<tr>
<td>Negative Value</td>
<td>550 max. volts</td>
</tr>
<tr>
<td>GRID-No.2 VOLTAGE</td>
<td></td>
</tr>
<tr>
<td>550 max. volts</td>
<td></td>
</tr>
<tr>
<td>GRID-No.1 VOLTAGE</td>
<td></td>
</tr>
<tr>
<td>Negative peak value</td>
<td>400 max. volts</td>
</tr>
<tr>
<td>Negative bias value</td>
<td>155 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max. volts</td>
</tr>
</tbody>
</table>

PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period 450 max. volts
After equipment warm-up period 200 max. volts
Heater positive with respect to cathode 200 max. volts

Typical Operating Conditions:
With uktor 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 1-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES at front of this section
Equipment Design Ranges:

With ultor voltage (Eck each gun) between 20000° and 27500 volts

- Grid-No. 3 (Focusing Electrode)-to-Cathode voltage (of each gun) Voltage, 16.8% to 20% of Ec each gun volts
- Grid-No. 2-to-Cathode Voltage (Each gun) when circuit design utilizes grid-No. 1- to-cathode voltage (Ec1) 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 (Ec2) 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° I + 27 N.P.C.D.
(CIE Coordinates:
\[ x = 0.281, y = 0.311 \])

Ratios of Cathode Currents:

- Red to Green
- Red to Blue

\[ \begin{array}{ccc}
\text{Red Gun} & \text{Blue Gun} & \text{Green Gun} \\
\text{Min.} & \text{Av.} & \text{Max.} & \text{Min.} & \text{Av.} & \text{Max.} \\
42 & 28 & 30 & \% \\
\end{array} \]

To Produce White of 9300° I + 27 N.P.C.D. Max. Raster Centering Correction in Any Direction: 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°
- Lateral-Converging Magnet: Maximum lateral shift of blue beam: ±1/4"
21FKP22
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

25o00

volts

1200 to 5000

volts

130 to 370

volts

-45 to-100

volts

20000

Grid-No.3 (Focusing
Electrode)-to-Cathode
(Of each gun) Voltage.
3360 to 4000
Grid-No.2-to-Cathode
Voltage (Each gun)
when circuit design
utilizes grid-No.1-tocathode voltage of -70
volts for raster cutoff.
130 to 370
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
Limiting Circuit Values:
High—Voltage C:rcutts:
In ordertominimize the
caused

by amomentary

possibility of damage to the tube

internal

arc,

it

is

recommended that the

high —voltage power

supp/y and the grid—No.3

the

type.

limited—energy

power supply

Grid-No.3 Circuit Resistance (Each gun)

be of

7 5 max.

megohms

0.75 max.

megohm

Low-Voltage Circuits:
Effective Grid-No.1 -toCathode-Circuit Resistance
(Each gun)
The grid—No.2—to—heater circuit,
circuit,

.
—

the grid—No.l—to—heater

and the cathode—to—heater circuit

should

each

have an

impedance such that their respective power sources in combi—
nation will not supply a continuous short—circuit current of
more

than

will

prevent

300 milliamperes
heater burnout

total.
in

Such

current

limitation

case of a momentary

Internal

(

arc within the tube.
For Curves,

see front of this Section.

For maximum cathode life,
regulated at 6.3 volts.

it

is recomended that

the beater supply be

C Brilliance and definition decrease with decreasing altor voltage.
general,

In

the altar 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.

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

r
--


The equivalent raster movement is about \( 3/4^\circ \).

A 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 \( 1/4^\circ \), the shift of the red beam and green beam should be in the range of \( 1/8^\circ \) to \( 3/8^\circ \).

**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 ultraviolet 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.
PLACE TUBE IN TV SET SO THAT PANEL PAD WITH V-GROOVE IS TOPMOST

SCREEN WIDTH 19 1/2" MIN.

3 PAIRS OF PADS ON BULB SPACED 120°

20 7/8" MAX.

EXTERNAL CONDUCTIVE COATING (NOTE 3)

REFERENCE LINE (NOTE 1)

13/32 ± 1/32

RADIAL-CONVERGING POLE PIECES

LATERAL-CONVERGING POLE PIECES

BASE JEDEC N8182-131 (NOTE 2)

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS

LOCATION OF LATERAL-CONVERGING POLE PIECES WITH RESPECT TO GUNS

BLUE GUN HORIZONTAL % OF SCREEN
GREEN GUN
RED GUN

PLANЕ THВRHROUGH % OF PIN NR2 AND TUBE AXIS

BASE BOTTOM VIEW

TRANSPARENT TAPE

MOLD-MATCH LINE

20% MIN. UNDISTURBED WIDTH EXCLUDING PADS

1/8" SEAL AREA

5/8" SEAL LINE

DETAIL

NOTE 5

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Electron Tube Division
Harrison, N. J.

DATA 4
7-61

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 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

<table>
<thead>
<tr>
<th>y</th>
<th>x</th>
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<tbody>
<tr>
<td>0.000&quot;</td>
<td>2.062&quot; + 0.001&quot;</td>
</tr>
<tr>
<td>0.125&quot;</td>
<td>2.062&quot; + 0.001&quot;</td>
</tr>
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CUTOFF DESIGN CHART

$E_f = 6.3$ VOLTS
ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 20000 TO 27500
GRID-N°3-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS

GRID-N°1-TO-CATHODE VOLTS

GRID-N°2-TO-CATHODE VOLTS

MINIMUM RASTER CUTOFF OF ANY TUBE

MAXIMUM RASTER CUTOFF OF ANY TUBE

RIVER CUTOFF OF ANY TUBE

92CM-10846

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

**CATHODE-DRIVE SERVICE**

- $E_F = 6.3$ VOLTS
- ULTOR-TO-GRID-N1 (OF EACH GUN) VOLTS = 20000 TO 27500
- GRID-N3-TO-GRID-N1 (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS
- GRID-N2-TO-GRID-N1 VOLTS (EACH GUN) = ADJUSTED TO PROVIDE ULTOR-CURRENT CUT-OFF FOR DESIRED FIXED CATHODE-TO-GRID-N1 (EACH GUN) VOLTAGE ($E_{kg}$)

**GRID-DRIVE SERVICE**

- $E_F = 6.3$ VOLTS
- ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 20000 TO 27500
- GRID-N3-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS
- GRID-N2-TO-CATHODE VOLTS (EACH GUN) = ADJUSTED TO PROVIDE ULTOR-CURRENT CUT-OFF FOR DESIRED FIXED GRID-N1-TO-CATHODE (EACH GUN) VOLTAGE ($E_{kc}$)
TYPICAL LIGHT-OUTPUT CHARACTERISTICS

E = 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 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: 19 1/4"X14 1/2" CENTERED ON TUBE FACE,
*MEASURED WITHIN 5"—DIAMETER AREA CENTERED ON TUBE FACE.

ULTOR MICROAMPERES

0 200 400 600 800 1000 1200 1400 1600

ULTOR LIGHT OUTPUT # FOOT-LAMBERTS

0 2 4 6 8 10 12 14 16 18 20 22

9300° K+27 M.P.C.D. WHITE LIGHT OUTPUT # FOOT-LAMBERTS

ULTOR MICROAMPERES

ULTOR-TO—CATHODE (OF EACH GUN) VOLTS: 2500 5000

92CM—11150
**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: 1750 max. pf, 500 min. pf
- Heater Current at 6.3 volts: 600 ± 60 ma
  - 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" ± 3/16"  
- Neck Length: 7-1/2" ± 3/16"  
- Projected Area of Screen: 248 sq. in.
- External Conductive Coating: 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

**Maximum and Minimum Ratings, Design-Maximum Values:**
- **ANODE VOLTAGE**: 20000 max. volts
- **GRID-No.4 (FOCUSBING) VOLTAGE:**
  - Positive value: 1100 max. volts
  - Negative value: 550 max. volts

---

**RCA**
**RADIO CORPORATION OF AMERICA**
**Electronic Components and Devices**
**Harrison, N. J.**
**DATA 1-64**
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 IMPELSON PROTECTION
NO ION-TRAP MAGNET REQUIRED
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—23000 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:
  - Type (See CRT OUTLINES at front of this section): Regular-Rand
  - Contact area for grounding: Near Reference Line
- Cap: Recessed Small Cavity (JEDEC No.J1-21)
- Base: Small-Button Neopbghtar 7-Pin, Arrangement I, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

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 \( \text{V} \)
  After equipment warm-up period. ......... 300 max \( \text{V} \)
Heater positive with respect to cathode:
  Combined AC & DC voltage. .......... 200 max \( \text{V} \)
  DC component. .......... 100 max \( \text{V} \)

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE
Voltages are positive with respect to grid No. 1

- Anode Voltage. ............... 20000 \( \text{V} \)
- Grid-No. 4 Voltage\(^a\) ............... 100 \( \text{V} \)
- Grid-No. 2 Voltage. ............... 400 \( \text{V} \)
- Cathode Voltage. ............... 96 to 76 \( \text{V} \)

For visual extinction of focused raster

Field Strength ............... 0 to 10 \( \text{V} \)

Of required adjustable centering magnet

MAXIMUM CIRCUIT VALUE

Grid-No. 1 Circuit Resistance ............... 1.5 max \( \text{M} \)

\(^a\) 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)
Color Picture Tube

New Rare-Earth (Red) Phosphor

70° Round

Unity Current Ratios

HI-LITE Screen

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

TUBE DIMENSIONS

Overall length

25-1/32 ± 3/8 in

Diameter

20-13/16 ± 1/8 in

Weight (Approx.)

36.5 lb

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.

MOLD-MATCH LINE

SEAL LINE

28 R

92CL-10849RI

RCA Electronic Components
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+ M.P.C.D. WHITE:
RED GUN: 34%
BLUE GUN: 32%
GREEN GUN: 34%

RASER SIZE: 191/4" X 16"
*MEASURED WITHIN 5" DIAMETER AREA CENTERED ON TUBE FACE.

![Graph showing light output characteristics](image-url)
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 voltsa .................... 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. pF
........................................ 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 Nedupehtal 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 .......................... $\begin{cases} 27,500 \text{ max. volts} \\ 20,000 \text{ min. volts} \end{cases}$
Total Anode Current,
  Long-Term Average .................. 1000 max. $\mu$A
Grid-No.3 (Focusing Electrode) Voltage .... 6000 max. volts
Peak Grid-No.2 Voltage, Including Video Signal Voltage ........... 1000 max. volts
Grid-No.1 Voltage:
  Negative bias value .................. 400 max. volts
  Negative operating cutoff value .... 200 max. volts
  Positive bias value .................. 0 max. volts
  Positive peak value .................. 2 max. volts
Heater Voltage (ac or dc):
  Under operating conditions$^a$ ........... $\begin{cases} 6.9 \text{ max. volts} \\ 5.7 \text{ min. volts} \\ 5.5 \text{ max. volts} \end{cases}$
  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):  

<table>
<thead>
<tr>
<th>Red</th>
<th>Blue</th>
<th>Green</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>32</td>
<td>34</td>
</tr>
</tbody>
</table>

Percentage of total anode current supply by each gun (average)  

Ratio of cathode currents:  

<table>
<thead>
<tr>
<th>Red/blue</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.75</td>
<td>1.10</td>
<td>1.50</td>
<td></td>
</tr>
<tr>
<td>Red/green</td>
<td>0.65</td>
<td>1.00</td>
<td>1.50</td>
</tr>
<tr>
<td>Blue/green</td>
<td>0.60</td>
<td>0.91</td>
<td>1.30</td>
</tr>
</tbody>
</table>

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 Registerd (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)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Heater</td>
</tr>
<tr>
<td>2</td>
<td>Grid No.1 of Red Gun</td>
</tr>
<tr>
<td>3</td>
<td>Grid No.2 of Red Gun</td>
</tr>
<tr>
<td>4</td>
<td>Cathode of Red Gun</td>
</tr>
<tr>
<td>5</td>
<td>Cathode of Green Gun</td>
</tr>
<tr>
<td>6</td>
<td>Grid No.1 of Green Gun</td>
</tr>
<tr>
<td>7</td>
<td>Grid No.2 of Green Gun</td>
</tr>
<tr>
<td>9</td>
<td>Grid No.3</td>
</tr>
<tr>
<td>11</td>
<td>Grid No.2 of Blue Gun</td>
</tr>
<tr>
<td>12</td>
<td>Grid No.1 of Blue Gun</td>
</tr>
<tr>
<td>13</td>
<td>Cathode of Blue Gun</td>
</tr>
<tr>
<td>14</td>
<td>Heater</td>
</tr>
<tr>
<td>C</td>
<td>External Conductive Coating</td>
</tr>
</tbody>
</table>

\[14AU\]
LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS

LOCATION OF LATERAL-CONVERGING POLE PIECES WITH RESPECT TO GUNS

DIMENSIONAL OUTLINE DETAIL
DIMENSIONAL OUTLINE (Top View)

PLACE TUBE IN TV SET SO THAT PANEL PAD WITH V-GROOVE IS TOPMOST

HORIZONTAL OF SCREEN

ANODE TERMINAL CAP JEDEC NRJ1-21

BLUE GUN

3 PAIRS OF PADS ON BULB SPACED 120°

SCREEN HEIGHT 16 MIN.

SCREEN WIDTH 19 1/4 MIN.

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 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

HEATER VOLTAGE - 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE - 20,000 TO 27,500 VOLTS
GRID-No.3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
2IMP4
PICTURE TUBE
RECTANGULAR METAL-SHELL TYPE

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.66-63)
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

Maximum Ratings, Design-Center Values:
ULTOR VOLTAGE...16000 max. volts
GRID-No.4 (FOCUSBING) 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

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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 Hi-Lite Matrix Screen
4 X 3 Aspect Ratio Light Neutral Screen Appearance

Electrical

Electron Guns, Three with Axes Red, Blue, Green
Tilted Toward Tube Axis
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 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 ..................................................... $27.5 \text{ max.} \ kV$
Anode Current, Long-Term Average$^b$ .................................. $1000 \ max. \ \mu A$
Grid-No.3 (Focusing Electrode) Voltage ................................... $6000 \ max. \ V$
Peak-Grid-No.2 Voltage, Including Video Signal Voltage ................. $1000 \ max. \ V$
Grid-No.1 Voltage:
  Negative bias value ........................................... $400 \ max. \ V$
  Negative operating cutoff value ................................ $200 \ max. \ V$
  Positive bias value ............................................. $0 \ max. \ V$
  Positive peak value ............................................ $2 \ max. \ V$
Heater Voltage (ac or dc)$^c$:
  Under operating conditions ................................... $6.9 \ max. \ V$
  Under standby conditions$^d$ ...................................... $5.7 \ min. \ V$
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 \(\ldots\) \(80\) to \(280\) V
At Grid No.1 voltage of \(-125\) V \(\ldots\) \(215\) to \(550\) V
At Grid No.1 voltage of \(-175\) V \(\ldots\) \(355\) 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) \(\ldots\) \(1.86\)

Heater Voltage:

Under operating conditions:
- When standby operation in not utilized \(\ldots\) \(6.3\) V
- When 5.0-V standby operation is utilized \(\ldots\) \(6.0\) V

Under standby conditions:
- \(6.0\) V

Grid-No.3 Current (Total) \(\ldots\) \(\pm 15\) \(\mu\)A
Grid-No.2 Current \(\ldots\) \(\pm 5\) \(\mu\)A
Grid-No.1 Current \(\ldots\) \(\pm 5\) \(\mu\)A

To Produce White Light of

<table>
<thead>
<tr>
<th>CIE Coordinates:</th>
<th>Illum. D</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>0.313</td>
<td>0.281</td>
</tr>
<tr>
<td>Y</td>
<td>0.329</td>
<td>0.311</td>
</tr>
</tbody>
</table>

Percentage of total anode current supplied by each gun (average):
- Red \(\ldots\) 41 \% 30 \%
- Blue \(\ldots\) 24 \% 31 \%
- Green \(\ldots\) 36 \% 39 \%

Ratio of cathode currents:
- Red/blue:
  - Minimum \(\ldots\) 1.35 \(0.75\)
  - Typical \(\ldots\) 1.70 \(0.96\)
  - Maximum \(\ldots\) 2.20 \(1.26\)
- Red/green:
  - Minimum \(\ldots\) 0.95 \(0.60\)
  - Typical \(\ldots\) 1.15 \(0.75\)
  - Maximum \(\ldots\) 1.70 \(1.10\)
- Blue/green:
  - Minimum \(\ldots\) 0.50 \(0.60\)
  - Typical \(\ldots\) 0.70 \(0.80\)
  - Maximum \(\ldots\) 0.95 \(1.10\)

Displacements, Measured at Center of Screen:
- Raster centering displacement:
  - Horizontal \(\ldots\) \(\pm 0.45\) in \((\pm 11.4\) mm\)
  - Vertical \(\ldots\) \(\pm 0.45\) in \((\pm 11.4\) mm\)
- Lateral distance between the blue beam and the converged red and green beams \(\ldots\) \(\pm 0.25\) in \((\pm 6.4\) mm\)
Radial convergence displacement excluding effects of dynamic convergence 
(each beam).......................... ± 0.37 in (± 0.4 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...................... 3000° 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 .......... 58 fl
........................................ 200 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 .................................. 36 kV

The X-radiation emitted from this picture tube, as measured in ac-
cordance with the procedure of JEDEC Publication No.64A will not
exceed 0.5 mR/h throughout the useful life of the tube when oper-
ted 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 effects on its per-
formance), 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 Re-
cievers, Sub-Part C of Part 78 of Title 42, Code of Federal Regula-
tions (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.
The mating socket, including its associated, physically-attached hardware and circuitry, must not weigh more than one pound (one-half kilogram).

The short-term average anode current should be limited by circuitry to 1500 microamperes.

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.

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.

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 BEYOND EDGE OF MIN. SCREEN

\[
\begin{align*}
\text{DIAGONAL} & \quad 3.18 \\
\text{HORIZONTAL} & \quad 16.00 \\
\text{VERTICAL} & \quad 0.630 \\
\end{align*}
\]
21VAK22

BOTTOM VIEW OF BASE

BLUE GUN

GREEN GUN

RED GUN

HORIZONTAL OF SCREEN

8.5° ± 5°

PLANE THROUGH OF PIN No. 2 AND TUBE AXIS

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

RCA Electronic Components

DATA 4
0.5 mR/h ISODOSE-RATE LIMIT CURVE
(JEDEC CURVE No.XC-4)

Figure 1
X-RADIATION LIMIT CURVE AT A CONSTANT ANODE CURRENT OF 300 µA (X-RADIATION AT A CONSTANT ANODE VOLTAGE VARIES LINEARLY WITH ANODE CURRENT) (JEDEC CURVE No.XC-3)

Figure 2
TYPICAL DRIVE CHARACTERISTICS, GRID-DRIVE SERVICE

HEATER VOLTAGE = 6.3 V
ANODE-TO-CATHODE VOLTAGE = 20 TO 27.5 kV
GRID No.3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
GRID No.2-TO-CATHODE VOLTAGE (EACH GUN) ADJUSTED TO PROVIDE SPOT CUTOFF.
* = ZERO - BIAS POINT

VIDEO SIGNAL VOLTAGE PER GUN - V

RCA Electronic Components

DATA 5
CUTOFF DESIGN CHART

HEATER VOLTAGE = 6.3 V
ANODE-TO-CATHODE VOLTAGE = 20 TO 27.5 kV
GRID-No.3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.

Figure 3

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

MAGNETIC FOCUS

NO ION-TRAP MAGNET REQUIRED

70° MAGNETIC DEFLECTION

ELECTRICAL

Direct interelectrode Capacitances

- Cathode to all other electrodes: 5 pF
- Grid No.1 to all other electrodes: 6 pF
- External conductive coating to anode: 750 max. pF
- 500 min. pF

Heater Current at 6.3 V: 600 ± 30 mA

Electron Gun: Type Requiring No Ion-Trap Magnet

OPTICAL

Phosphor: P4—Sulfide Type, Aluminized

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

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

DATA 10-65
**TYPICAL OPERATING CONDITIONS FOR GRID-DRIVE SERVICE**

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

<table>
<thead>
<tr>
<th>Node</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode</td>
<td>16000 V</td>
</tr>
<tr>
<td>Grid-No. 2 Voltage</td>
<td>300 V</td>
</tr>
<tr>
<td>Grid-No. 1 Voltage</td>
<td>-28 to -72 V</td>
</tr>
<tr>
<td>Combined AC and DC voltage</td>
<td>200 max V</td>
</tr>
<tr>
<td>DC Component</td>
<td>100 max V</td>
</tr>
<tr>
<td><strong>Maximum Circuit Value</strong></td>
<td></td>
</tr>
<tr>
<td>Grid-No. 1 Circuit Resistance</td>
<td>1.5 max MΩ</td>
</tr>
</tbody>
</table>

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, 2000 min pF

Heater Current at 6.3 V: 600 ± 30 mA
Electron Gun Type: Requires No Ion-Trap Magnet

OPTICAL

Phosphor: P4—Sulfide Type, Aluminized
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 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

- Anode Voltage: 20000 max V
- Grid-No.4 (Focusing) Voltage
  - Positive value: 1100 max V
  - Negative value: 550 max V

DATA
Electronic Components and Devices
RADIO CORPORATION OF AMERICA
Harrison, N. J.
**21XP4B**

### Grid-No. 2 Voltage

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>550 max V</td>
</tr>
</tbody>
</table>

### Grid-No. 1 Voltage

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative peak value</td>
<td>220 max V</td>
</tr>
<tr>
<td>Negative bias value</td>
<td>155 max V</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max V</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max V</td>
</tr>
</tbody>
</table>

### Heater Voltage

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>6.9 max V</td>
</tr>
</tbody>
</table>

#### Peak Heater-Cathode Voltage

- Heater negative with respect to cathode:
  - During equipment warm-up period: 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.

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>16000 V</td>
</tr>
<tr>
<td>Grid-No. 4 Voltage</td>
<td>-64 to 352 V</td>
</tr>
<tr>
<td>Grid-No. 2 Voltage</td>
<td>300 V</td>
</tr>
<tr>
<td>Grid-No. 1 Voltage</td>
<td>-28 to -72 V</td>
</tr>
</tbody>
</table>

**For visual extinction of focused raster**

### Maximum Circuit Value

<table>
<thead>
<tr>
<th>Circuit Resistance</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No. 1</td>
<td>1.6 max Ω</td>
</tr>
</tbody>
</table>

**For X-radiation shielding considerations, see sheet **

**X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES**

at front of this section
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 .....
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. 86-63)
Basing Designation for BOTTOM VIEW. .... 12L

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: ...................................
\[
\begin{align*}
\text{Positive} & : 6.9 \text{ max. volts} \\
\text{Negative} & : 5.7 \text{ min. volts}
\end{align*}
\]

PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period .......................... 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... \[ 750 \text{ max. pf} \]
- \[ 1500 \text{ min. pf} \]
- 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.
- Light transmission (Approx.) ... 75%

Mechanical:
- Weight (Approx.) ... 24 lbs
- Overall Length ... 23-1/32" ± 3/16"
- 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

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
# 21ZP4-A, 21ZP4-B

## Picture Tubes

### Rectangular Glass Types

## 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. μf, 500 min. μf
- **Faceplate**, Spherical Filterglass
- Phosphor (for curves, see front of this section):
  - Type 21ZP4-A: P4—Sulfide Type
  - Type 21ZP4-B: Aluminized 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: 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)
  - Small-Shell Duodecal 5-Pin (JETEC Group 4, No. BS5-57)

## Basing Designation for BOTTOM VIEW
- 12N

## Maximum Ratings, Design-Center Values:
- **ULTOR VOLTAGE**: 18000 max. volts
- **GRID-No.2 VOLTAGE**: 500 max. volts
# 2IZP4-A, 2IZP4-B
## PICTURE TUBES

<table>
<thead>
<tr>
<th>Grid-No.1 Voltage:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative-peak value.</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Negative-bias value.</td>
<td>140 max. volts</td>
</tr>
<tr>
<td>Positive-bias value.</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive-peak value.</td>
<td>2 max. volts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Peak Heater-Cathode Voltage:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater negative with respect to cathode</td>
<td></td>
</tr>
<tr>
<td>During equipment warm-up period not exceeding 15 seconds</td>
<td>410 max. volts</td>
</tr>
<tr>
<td>After equipment warm-up period</td>
<td>180 max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>180 max. volts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum Circuit Values:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1-Circuit Resistance</td>
<td>1.5 max. megohms</td>
</tr>
</tbody>
</table>

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

"PERMA-CHROME" ASSEMBLY FOR OPTIMUM FIELD PURITY AND UNIFORMITY DURING WARM-UP

RECTANGULAR TUBE

90° MAGNETIC DEFLECTION

ALUMINIZED TRICOLOR PHOSPHOR-DOT HI-LITE SCREEN

(Utilizing a New Improved Rare-Earth Red-Emitting Phosphor)

INTEGRAL FILTERGLASS PROTECTIVE WINDOW

MAGNETIC CONVERGENCE

3 ELECTROSTATIC-FOCUS GUNS

*For Use in Color-TV Receivers*

**Electrical**

Electron Guns, Three ............... Red, Blue, Green

Axes tilted toward tube axis

Heater, of Each Gun

Series connected within tube with each of the other two heaters

Current at 6.3 volts** ............... 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)** ............... 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)

RADIO CORPORATION OF AMERICA

Electronic Components and Devices

Harrison, N. J.

DATA 1

4-67
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.JI73-1/2 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.JI-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

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
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
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: 6.9 max V
- Under standby conditions: 5.7 min V

Peak Heater-Cathode Voltage
- Heater negative with respect to cathode:
  - During equipment warm-up period: 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

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)

Percentage of total anode current supplied by each gun (Average): Red 34, Blue 32, Green 34%

Ratio of cathode currents:
- Red/blue: Min 0.75, Typ 1.10, Max 1.50
- Red/green: Min 0.65, Typ 1.00, Max 1.50
- Blue/green: Min 0.60, Typ 0.91, Max 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 \( \text{c} \) (Including Effect of Earth's Magnet Field when Using Recommended Components)

Measured at the center of the screen in any direction. \( \ldots \) \( 0.005 \text{ in} (0.13 \text{ mm}) \text{ max} \)

**EXAMPLES OF USE OF DESIGN RANGES**

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

- **Anode Voltage** \( \ldots \) \( 25,000 \text{ V} \)
- **Grid-No.3 (Focusing Electrode) Voltage** \( \ldots \) \( 4200 \text{ to } 5000 \text{ V} \)
- **Grid-No.2 Voltage when circuit design utilizes grid-No.1 voltage of -150 volts for visual extinction of focused spot** \( \ldots \) \( 285 \text{ to } 685 \text{ V} \)
- **Grid-No.1 Voltage for visual extinction of focused spot when circuit design utilizes grid-No.2 voltage of 400 volts** \( \ldots \) \( -95 \text{ to } -190 \text{ V} \)

- **Heater Voltage**
  - Under operating conditions \( \ldots \) \( 6.3 \text{ V} \)
  - Under standby conditions \( \ldots \) \( 5.0 \text{ V} \)

**LIMITING CIRCUIT VALUES**

**High-Voltage Circuits**

- **Grid-No.3 circuit resistance** \( \ldots \) \( 7.5 \text{ max } \Omega \)

  In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the high-voltage power supply and the grid-No.3 power supply be of the limited-energy type, in which the short-circuit current does not exceed 20 \( \text{mA} \).

**Low-Voltage Circuits**

- **Effective grid-No.1-to-cathode-circuit resistance (Each gun)** \( \ldots \) \( 0.75 \text{ max } \Omega \)

  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 \( \text{mA} \) total in the assumed picture tube heater ground connection. The leads from all other circuits must be separated from the picture tube leads by a minimum distance of 0.25 inch (6.4 mm) to prevent energy transfer to the picture tube circuits. Such current limitation will help prevent picture tube damage in case of momentary cascade arcing."
For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts. The series impedance to any chassis connection in the DC biasing circuit for the heater should be between 100,000 ohms and 1 megohm.

For curve, see Group znaphor P22—New Rare-Earth (Red), Sulfide (Blue and Green) at front of this section.

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.

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. 0162

Reference Line is determined by plane C-C' when gauge is seated.
Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge and with tube seated in gauge, the reference line is determined by the intersection on the plane C-C' of the gauge with the glass funnel.

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

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

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

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

for type 22JP22 is the same as that shown for type 25XP22
Typical Light-Output Characteristic

HEATER VOLTAGE: 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE: 25000 VOLTS
GRID-No.3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE
CURRENT TO PRODUCE 9300° K+27 M.C.P.D. WHITE-LIGHT OUTPUT.
PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN
TO PRODUCE 9300° K+27 M.P.C.D. WHITE:
- RED GUN: 34%
- BLUE GUN: 22%
- 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.
HEATER VOLTAGE: 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE: 20,000 TO 27,500 VOLTS
GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS

GRID-No. 1-TO-CATHODE VOLTS

GRID-No. 2-TO-CATHODE VOLTS

MAXIMUM SPOT CUT-OFF OF ANY GUN

RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.
Typical Drive Characteristics
Cathode-Drive Service

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-GRID- No.1 VOLTAGE = 20000 TO 27500 VOLTS
GRID-No. 3-TO-GRID-No.1 VOLTAGE ADJUSTED FOR FOCUS.
GRID-No. 2-TO-GRID-No.1 VOLTAGE (EACH GUN) ADJUSTED
TO PROVIDE SPOT CUTOFF FOR DESIRED FIXED CATHODE-
TO-GRID-No.1 (EACH GUN) VOLTAGE (E_{kcl})
- ZERO-BIAS POINT

ANODE MICROAMPERES PER GUN

VIDEO SIGNAL VOLTS FROM SPOT CUTOFF PER GUN

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

DATA 5
4-67
Typical Drive Characteristics
Grid-Drive Service

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 20000 TO 27500 VOLTS
GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
GRID-No. 2-TO-CATHODE VOLTAGE (EACH GUN) ADJUSTED
TO PROVIDE SPOT CUTOFF FOR DESIRED FIXED GRID-No. 1-
TO-CATHODE (EACH GUN) VOLTAGE (Eclk)
• = ZERO-BIAS POINT

\[
\begin{align*}
\text{Video Signal Volts} & \text{ From Spot Cutoff Per Gun} \\
\text{Anode Microamperes Per Gun} & \\
\text{Eclk (For Spot Cutoff) Volts} & = -50
\end{align*}
\]
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

MECHANICAL

Tube Dimensions
Overall length ...................................... 18.012 ± .375 in (482.9 ± 9.5 mm)
Weight (Approx.) .................................... 28 lb (12.7 kg)

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

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

DATA
4-67
Typical Light-Output Characteristic

HEATER VOLTAGE: 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE: 25000 VOLTS
GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE CURRENT TO PRODUCE 9300° K + 27 M.P.C.D. WHITE-LIGHT OUTPUT.
PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN TO PRODUCE 9300° K + 27 M.P.C.D. WHITE:

- RED GUN: 34%
- BLUE GUN: 32%
- GREEN GUN: 34%

RASTER SIZE: 17.446" X 13.640" (443.1 mm X 346.5 mm)

*MEASURED WITHIN 4" - DIAMETER AREA CENTERED ON TUBE FACE.

ANODE MICROAMPERES
0 200 400 600 800 1000 1200 1400

50 45 40 35 30 25 20 15 10 5 0

500° K + 27 M.P.C.D. WHITE-LIGHT OUTPUT - FOOT AMBERTS

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>{27,500 max., 20,000 min.}</td>
</tr>
<tr>
<td>Total Anode Current,</td>
<td>1000 max. µA</td>
</tr>
<tr>
<td>Long-Term Average</td>
<td></td>
</tr>
<tr>
<td>Grid-No.3 (Focusing Electrode) Voltage</td>
<td>6000 max. V</td>
</tr>
<tr>
<td>Peak Grid-No.2 Voltage, Including Video Signal Voltage</td>
<td>1000 max. V</td>
</tr>
<tr>
<td>Grid-No.1 Voltage:</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>400 max. V</td>
</tr>
<tr>
<td>Negative operating cutoff value</td>
<td>200 max. V</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max. V</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max. V</td>
</tr>
<tr>
<td>Heater Voltage (ac or dc):</td>
<td></td>
</tr>
<tr>
<td>Under operating conditions</td>
<td>{6.9 max., 5.7 min.}</td>
</tr>
<tr>
<td>Under standby conditions</td>
<td>5.5 max. V</td>
</tr>
<tr>
<td>Peak Heater-Cathode Voltage</td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode:</td>
<td></td>
</tr>
<tr>
<td>During equipment warm-up period</td>
<td>450 max. V</td>
</tr>
<tr>
<td>not exceeding 15 seconds</td>
<td></td>
</tr>
<tr>
<td>After equipment warm-up period:</td>
<td></td>
</tr>
<tr>
<td>Combined AC and DC value</td>
<td>200 max. V</td>
</tr>
<tr>
<td>DC component value</td>
<td>200 max. V</td>
</tr>
<tr>
<td>Heater positive with respect to cathode:</td>
<td></td>
</tr>
<tr>
<td>AC component value</td>
<td>200 max. V</td>
</tr>
<tr>
<td>DC component value</td>
<td>0 max. V</td>
</tr>
</tbody>
</table>

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):

Percentage of total anode
current supplied by
each gun (average) .......... 34 32 34 %

Ratio of cathode currents:
Red/blue .................. Min. Typ. Max.
Red/green .................. 0.75 1.10 1.50
Blue/green .................. 0.65 1.00 1.50

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
Registered (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. MQ

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 meghm.

b For curve, see Group Phosphor - P22 - New Rare Earth (Red), Sulfide (Blue & Green) at front of this section.

c For “instant on” applications, a maximum heater voltage of 5.5 volts (design-maximum value) may be maintained on the color picture tube when the receiver is in the “off” (standby) position. All other voltages normally applied to the tube must be removed during standby operation.

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

X-RADIATION WARNING

Because the 22UP22 is designed to be operated at anode voltages as high as 27.5 kilovolts (design-maximum value), shielding of the 22UP22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

BASE SPECIFICATION - JEDEC No. 14BE

Pin 1: Heater    Pin 11: Cathode of Blue Gun
Pin 2: Cathode of Red Gun    Pin 12: Grid No.1 of Blue Gun
Pin 3: Grid No.1 of Red Gun    Pin 13: Grid No.2 of Blue Gun
Pin 4: Grid No.2 of Red Gun    Pin 14: Heater
Pin 5: Grid No.2 of Green Gun    Cap: Anode (Grid No.4, Screen, Collector)
Pin 6: Cathode of Green Gun    C: External Conductive Coating
Pin 7: Grid No.1 of Green Gun
Pin 8: Grid No.3
**BOTTOM VIEW OF BASE**

![Diagram showing the bottom view of a base with labels for Blue, Green, and Red Gun, along with angles and dimensions.]

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

![Diagram showing the location of radial-converging pole pieces with angles 120° and 8.5° ± 2°.]

**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.
HEATER VOLTAGE = 6.3 V
ANODE-TO-CATHODE VOLTAGE = 20,000 TO 27,500 V
GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.

GRID-No. 2-TO-CATHODE VOLTAGE - V

GRID-No. 1-TO-CATHODE VOLTAGE - V

MINIMUM SPOT CUTOFF OF ANY GUN

MAXIMUM SPOT CUTOFF OF ANY GUN
Color Picture Tube

Perma-Chrome Banded-Type Implosion Protection
90° Rectangular HI-LITE Screen
New Rare-Earth (Red) Phosphor Unity Current Ratios

This data sheet is to be used in conjunction with data for RCA-22UP22.

For general data, maximum and minimum ratings, equipment design ranges, limiting circuit values, x-radiation warning, and base specification of the 22WP22, refer to the 22UP22 except as noted below.

MECHANICAL

Tube Dimensions (excluding mounting lugs):
- Diagonal .............. 21.971 ± .093 in (558.06 ± 2.36 mm)
- Greatest Width .......... 19.118 ± .093 in (485.60 ± 2.36 mm)
- Greatest Height (including tension-band clip) ...... 15.527 ± .100 in (394.39 ± 2.54 mm)
- Weight (Approx.) ............ 29 lb (13.3 kg)

DIMENSIONAL OUTLINE

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

Top View
DIMENSIONAL OUTLINE (Cont'd)

Front View

Dimensions in \( \text{inches} \) unless otherwise noted

Note 1: "Z" is located on the outside surface of the faceplate, on the screen diagonal at a point .125" beyond the minimum screen. This point is used as a reference for the mounting lugs.

Note 2: The tolerance of the mounting lug holes will accommodate mounting screws up to 0.375 in (9.5 mm) in diameter when positioned on the true hole centers.
Picture Tube

**GENERAL DATA**

**Electrical:**
- Heater Current at 6.3 volts: $600 \pm 30$ ma
- Heater Warm-Up Time (Average): 11 seconds
- Focusing Method: Electrostatic
- Deflection Method: Magnetic
- Deflection Angles (Approx.):
  - Diagonal: $92^\circ$
  - Horizontal: $80^\circ$
  - Vertical: $85^\circ$
- Direct Interelectrode Capacitances:
  - Grid No.1 to all other electrodes: 6 $\mu$F
  - Cathode to all other electrodes: 5 $\mu$F
- External conductive coating to ultr.
  - $2500$ max. $\mu$F
  - $1700$ min. $\mu$F

**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
  - White Phosphorescence
  - White Persistence
  - Medium Short

**Mechanical:**
- Tube Dimensions:
  - Overall length: $18'' \pm 3/8''$
  - Greatest width: $20-1/2'' + 1/16'' - 1/8''$
  - Greatest height: $16-1/2'' \pm 1/8''$
  - Diagonal: $23-25/64'' + 3/32'' - 1/8''$
  - Neck length: $5-1/2'' \pm 3/16''$
- 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: $262$ sq. in.
- Weight (Approx.): 25 lbs
- Operating Position: Any
- Cap: Recessed Small Cavity (JEDEC No.J1-21)
- Bulb: J187C1
**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-Ulter**
- (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 ($E_{c1}$) of 18000 volts and grid-No.2 voltage ($E_{c2}$) 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 gauss

**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.**

Minimum: 11000 min. volts
Maximum: 22000 max. volts

**GRID-No.4-TO-GRID-No.1 (FOCUSBNG) VOLTAGE:**

Positive value: 1250 max. volts
Negative value: 400 max. volts

**GRID-No.2-TO-GRID-No.1 VOLTAGE.**

Minimum: 350 min. volts
Maximum: 700 max. volts

**GRID-No.2-TO-CATHODE VOLTAGE.**

Minimum: 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.**

Minimum: 5.7 min. volts
Maximum: 6.9 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 (Eco) of 18000 volts
and grid-No.2-to-grid-No.1 voltage (Eco) of 400 volts

Grid-No.4-to-Grid-No.1 Voltage for focus:

Minimum: 0 to 400 volts

Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster:

Minimum: 36 to 78 volts

Field Strength of Adjustable Centering Magnet:

Minimum: 0 to 11 gausses

**Maximum Circuit Values:**

Grid-No.1-Circuit Resistance:

Minimum: 1.5 max. megohms

Data 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.

Distances 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.

RADIO CORPORATION OF AMERICA

Electron Tube Division

Somerville, N.J.
Maximum field strength of adjustable centering magnet equals:

\[ \sqrt{\frac{E_{C5k} \text{ or } E_{C5g1} \text{ (volts)}}{16000 \text{ (volts))} \times 10 \text{ gausses}}} \]

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 Master-Cutoff-Range Chart for Cathode-Drive Service.

**OPERATING CONSIDERATIONS**

**X-Ray Warning.** When operated at 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

$E_f = 6.3 \text{ VOLTS}$

ULTOR VOLTS = 11000 TO 22000
GRID-N2 4 VOLTS ADJUSTED FOR FOCUS.

Cathode-Drive Service

$E_f = 6.3 \text{ VOLTS}$

ULTOR-TO-GRID-N4I VOLTS = 11000 TO 22000
GRID-N4 TO GRID-N4I VOLTS ADJUSTED FOR FOCUS.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC NO.G-116 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

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

NOTE 6: MEASURED AT THE MOLD-MATCH LINE.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/16" BEYOND THE ENVELOPE SURFACE AT THE LOCATION SPECIFIED FOR DIMENSIONING THE ENVELOPE WIDTH, DIAGONAL, AND HEIGHT.

NOTE 8: AREA BETWEEN MOLD-MATCH LINE AND SEAL BULGE IS 1/2" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF TUBE SUPPORT BAND. SUPPORTS MUST BE SPACED FROM THE TUBE BY THE USE OF CUSHIONING PADS MADE OF ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.
BULB-CONTOUR DIMENSIONS

LONG-SIDE VIEW

SHORT-SIDE VIEW

REFERENCE LINE
C-D LINE

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

Heater Current at 6.3 V: 600 ± 30 mA
Heater Warm-up Time (Average): 11 s

**OPTICAL**

Phosphor: P4—Sulfide Type, Aluminized
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.JI-21)
Base: Small-Button Neoeightar 7-Pin, Arrangement I (JEDEC No.B7-208)

**TERMINAL DIAGRAM (Bottom View)**

Pin 1—Heater
Pin 2—Grid No.1
Pin 3—Grid No.2
Pin 4—Grid No.4
Pin 6—Grid No.1
Pin 7—Cathode
Pin 8—Heater
Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)
C—External Conductive Coating
### Maximum and Minimum Ratings, Design-Maximum Values

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Maximum Value</th>
<th>Minimum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anode Voltage</strong></td>
<td>22000 max V</td>
<td>12000 min V</td>
</tr>
<tr>
<td><strong>Grid-No. 4 (Focusing) Voltage</strong></td>
<td>Positive value: 1100 max V</td>
<td>Negative value: 550 max V</td>
</tr>
<tr>
<td><strong>Grid-No. 2 Voltage</strong></td>
<td>550 max V</td>
<td>200 min V</td>
</tr>
<tr>
<td><strong>Grid-No. 1 Voltage</strong></td>
<td>Negative peak value: 220 max V</td>
<td>Negative bias value: 155 max V</td>
</tr>
<tr>
<td><strong>Heater Voltage</strong></td>
<td>6.9 max V</td>
<td>5.7 min V</td>
</tr>
<tr>
<td><strong>Peak Heater-Cathode Voltage</strong></td>
<td>Heater negative with respect to cathode: During equipment warm-up period not exceeding 15 seconds: 450 max V</td>
<td>After equipment warm-up period: 200 max V</td>
</tr>
</tbody>
</table>

### Typical Operating Conditions for Cathode-Drive Service

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anode Voltage</strong></td>
<td>16000 V</td>
</tr>
<tr>
<td><strong>Grid-No. 4 Voltage</strong></td>
<td>0 to 400 V</td>
</tr>
<tr>
<td><strong>Grid-No. 2 Voltage</strong></td>
<td>400 V</td>
</tr>
<tr>
<td><strong>Cathode Voltage</strong></td>
<td>43 to 78 V</td>
</tr>
</tbody>
</table>

For visual extinction of focused raster.

### Maximum Circuit Value

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grid-No. 1 Circuit Resistance</strong></td>
<td>1.5 max Ω</td>
</tr>
</tbody>
</table>
**Picture Tube**

- RECTANGULAR GLASS TYPE
- LOW-VOLTAGE ELECTROSTATIC FOCUS
- ALUMINIZED SCREEN MAGNETIC DEFLECTION
- With Heater Having Controlled Warm-Up Time

The 23ASP4 is the same as the 23ABP4 except for the following items:

**Mechanical:**
- Tube Dimensions:
  - Overall length: \(17'' \pm 3/8''\)
  - Neck length: \(4-1/2'' \pm 3/16''\)
Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
ALUMINIZED SCREEN
92° MAGNETIC DEFLECTION
With Heater Having Controlled Warm-Up Time

The 23BDP4 is the same as the 23YP4 except for the following item:

Optical:
Surface of Protective Panel . . . . . . . Treated to reduce specular reflection
Picture Tube

LOW-VOLTAGE ELECTROSTATIC FOCUS
BI-PANEL TYPE
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: 12500 max. 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 \text{ max. volts)}, (12000 \text{ min. volts})\}

Grid-No.4 (Focusing) Voltage:
- Positive value: 1100 max. volts
- Negative value: 550 max. volts

Grid-No.2 Voltage:
- Positive value: 70 max. volts
- Negative value: 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 \text{ max. volts}, 5.7 \text{ 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.
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 µf
Cathode to all other electrodes.
5 µf
External conductive coating to ultor.
(2500 max.
1700 min.

Electrostatic Focus
92° Magnetic Deflection
Cathode-Drive Type
With Heater Having Controlled Warm-Up Time

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" ± 3/16"
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 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
### Maximum and Minimum Ratings, Design-Maximum Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Maximum Value</th>
<th>Minimum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ULTOR-TO-GRID-NO.1 VOLTAGE</strong></td>
<td>25000 max.</td>
<td>11000 min.</td>
</tr>
<tr>
<td><strong>GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>1250 max.</td>
<td></td>
</tr>
<tr>
<td>Negative value</td>
<td>450 max.</td>
<td></td>
</tr>
<tr>
<td><strong>GRID-No.2 TO-GRID-No.1 VOLTAGE:</strong></td>
<td>225 max.</td>
<td>40 min.</td>
</tr>
<tr>
<td><strong>GRID-No.2-TO-CATHODE VOLTAGE:</strong></td>
<td>220 max.</td>
<td>70 max.</td>
</tr>
<tr>
<td><strong>CATHODE-TO-GRID-No.1 VOLTAGE:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive peak value</td>
<td>220 max.</td>
<td></td>
</tr>
<tr>
<td>Positive bias value</td>
<td>154 max.</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>0 max.</td>
<td></td>
</tr>
<tr>
<td>Negative peak value</td>
<td>2 max.</td>
<td></td>
</tr>
<tr>
<td><strong>HEATER VOLTAGE:</strong></td>
<td>6.9 max.</td>
<td>5.7 min.</td>
</tr>
<tr>
<td><strong>PEAK HEATER-CATHODE VOLTAGE:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>During equipment warm-up period not exceeding 15 seconds.</td>
<td>450 max.</td>
<td></td>
</tr>
<tr>
<td>After equipment warm-up period.</td>
<td>200 max.</td>
<td></td>
</tr>
<tr>
<td>Heater positive with respect to cathode.</td>
<td></td>
<td>200 max.</td>
</tr>
</tbody>
</table>

### Typical Operating Conditions:
- With ultor-to-grid No.1 voltage of 20000 volts
- 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:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1-Circuit Resistance.</td>
<td>1.5 max. megohms</td>
</tr>
</tbody>
</table>

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

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 µf
Cathode to all other electrodes ........ 5 µf
External conductive coating to ultor. ... {2500 max. µf
                                             1700 min. µf
Electron Gun ............ Type Requiring No Ion-Trap Magnet

Optical:
Faceplate 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 DIG sheets
at the front of this section
Cap .................................. Recessed Small Cavity (JEDEC No.J1-21)
Base ................................... Short Small-Shell Duodecal 6-Pin
(BJEDEC 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: \[ 25000 \text{ max. volts} \]
\[ 15000 \text{ min. volts} \]

GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:
- Positive value: \[ 1250 \text{ max. volts} \]
- Negative value: \[ 400 \text{ max. volts} \]

GRID-No.2-TO-GRID-No.1 VOLTAGE: \[ 225 \text{ max. volts} \]
\[ 40 \text{ min. volts} \]

GRID-No.2-TO-CATHODE VOLTAGE: \[ 70 \text{ max. volts} \]

CATHODE-TO-GRID-No.1 VOLTAGE:
- Positive peak value: \[ 220 \text{ max. volts} \]
- Positive bias value: \[ 154 \text{ max. volts} \]
- Negative bias value: \[ 0 \text{ max. volts} \]
- Negative peak value: \[ 2 \text{ max. volts} \]

HEATER VOLTAGE: \[ 6.9 \text{ max. volts} \]
\[ 5.7 \text{ min. volts} \]

PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
- During equipment warm-up period not exceeding 15 seconds: \[ 450 \text{ max. volts} \]
- After equipment warm-up period: \[ 200 \text{ max. volts} \]
Heater positive with respect to cathode: \[ 200 \text{ max. volts} \]

Typical Operating Conditions:
- With ultor-to-grid-No.1 voltage of \[ 20000 \text{ volts} \] and grid-No.2-to-grid-No.1 voltage of \[ 50 \text{ volts} \]
- Grid-No.4-to-Grid-No.1 Voltage for focus: \[ 0 \text{ to } 400 \text{ volts} \]
- Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster: \[ 36 \text{ to } 54 \text{ volts} \]

Maximum Circuit Values:
- Grid-No.1-Circuit Resistance: \[ 1.5 \text{ max. megohms} \]

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

**BI-PANEL RECTANGULAR GLASS TYPE**

**LOW-VOLTAGE ELECTROSTATIC FOCUS**

**ALUMINIZED SCREEN**

**110° MAGNETIC DEFLECTION**

*With Heater Having Controlled Warm-Up Time*

### GENERAL DATA

**Electrical:**

- Heater Current at 6.3 volts: \(450 \pm 5\%\) ma
- Heater Warm-Up Time (Average): \(11\) seconds

**Direct Interelectrode Capacitances:**

- Grid No.1 to all other electrodes: \(6\) \(\mu F\)
- Cathode to all other electrodes: \(5\) \(\mu F\)

**External conductive coating to utor:**

\[
\begin{align*}
2500 \text{ max.} & \quad \mu F \\
2000 \text{ min.} & \quad \mu F 
\end{align*}
\]

**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: \(15-3/16" \pm 3/8"\)
- Neck Length: \(5-1/8" \pm 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:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value 1</th>
<th>Value 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ULTOR VOLTAGE</strong></td>
<td>$23000$ max. volts</td>
<td>$12000$ min. volts</td>
</tr>
</tbody>
</table>

**GRID-No.4 (FOCUSED) VOLTAGE:**
- Positive value: $1100$ max. volts
- Negative value: $550$ max. volts

**GRID-No.2 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

**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
- 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 **I-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 23QP4 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 23ABP4 except for the following item:
Electrical:
Heater Current at 6.3 volts. . . . . . . . 450 ± 20 ma
Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
ALUMINIZED SCREEN
MAGNETIC DEFLECTION
With Heater Having Controlled Warm-Up Time

DATA

General:
Heater, for Unipotential Cathode:
Voltage (AC or DC) .... 6.3 ± 10% volts
Current at 6.3 volts ........ 0.6 ± 5% amp
Warm-up time (Average) ...... 11 sec

Direct Interelectrode Capacitances:
Grid No.1 to all other electrodes ... 6 μf
Cathode to all other electrodes .. 5 μf

External conductive coating to ultror. 
{2500 max. μf
2000 min. μf

Faceplate and Protective Panel ........ Filterglass
Total light transmission (Approx.) .... 40%
Phosphor (for curves, see front of this section) .. P4-Sulfide Type Aluminized Fluorescence .......... White
Phosphorescence .......... White
Persistence .......... Medium Short
Focusing Method .......... Electrostatic
Deflection Method .......... Magnetic

Deflection Angles (Approx.):
Diagonal ........ 110°
Horizontal .......... 99°
Vertical ........ 82°

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

Tube Dimensions:
Overall length ........ 15-3/16" ± 3/8"
Greatest width ........ 21-5/16" + 1/8" - 1/16"
Greatest height ......... 17-5/16" + 1/8" - 1/16"
Diagonal ........ 24-45/64" + 3/32" - 1/16"
Neck length ........ 5-1/8" ± 1/8"

Radius of curvature of protective panel (External surface):

<table>
<thead>
<tr>
<th>Plane of Deflection</th>
<th>Radius at Center</th>
<th>Radius at Edge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagonal</td>
<td>50-1/4&quot;</td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>50-1/4&quot;</td>
<td>35-1/4&quot;</td>
</tr>
<tr>
<td>Vertical</td>
<td>45-1/2&quot;</td>
<td>35&quot;</td>
</tr>
</tbody>
</table>

Radius of curvature of faceplate (Internal surface):

<table>
<thead>
<tr>
<th>Plane of Deflection</th>
<th>Radius at Center</th>
<th>Radius at Edge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagonal</td>
<td>39-1/2&quot;</td>
<td>31-1/2&quot;</td>
</tr>
<tr>
<td>Horizontal</td>
<td>39-3/4&quot;</td>
<td>26-1/2&quot;</td>
</tr>
</tbody>
</table>
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

**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 \( E_{\text{c}} \) between 12000* and 20000 volts and grid-No. 2 voltage \( E_{\text{c}} \) between 200 and 500 volts.

**Grid-No. 4 Voltage for focus:** 0 to 400 volts

---

RADIO CORPORATION OF AMERICA
Electron Tube Division  
Harrison, N. J.
Grid-No.1 Voltage ($E_{c1k}$) for visual extinction of focused raster ....... See Raster-Cutoff-Range Chart for Grid-Drive Service

Grid-No.1 Video Drive from Raster Cutoff (Black level):
White-level value (Peak positive) .......... Same value as determined for $E_{c1k}$ except video drive is a positive voltage

Grid-No.4 Current ........................................ $-25$ to $+25 \mu \text{A}$
Grid-No.2 Current ........................................ $-15$ to $+15 \mu \text{A}$
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 ................. $1.5 \text{ max. meghms}$

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
- GRID-No.4-TO-GRID-No.1 (FOCUSBING) 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... 120 max. volts
Heater positive with respect to cathode... 180 max. volts

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage \( (E_{cg1}) \) between 10000 and 20000 volts and grid-No.2-to-grid-No.1 voltage \( (E_{cg2}) \) 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 (\( E_{cg1} \)) for visual extinction of focused raster... See Raster-Cutoff-Range Chart for Cathode-Drive Service

Examples of Use of Design Ranges:

With ultor-to-grid-No.1 voltage of 8000 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 70 volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level):
White-level value... -42 to -70 volts

Maximum Circuit Values:

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

* Grid drive is the operating condition in which the video signal verifies the grid-No.1 potential with respect to cathode.

This value is a working design-center minimum. The equivalent absolute minimum ultor (or ultor-to-grid-No.1) voltage is 11,000 volts below which the serviceability of the 23CP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor (or ultor-to-grid-No.1) voltage is never less than 11,000 volts.

The grid-No.1 (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 3/8" MIN.

LOCATION OF "B"

.463" ±.030"

LOCATION OF "A"

50 1/8" R.

35 1/4" R.

20.725" MAX.

4 1/2" R.

14 1/2" R.

2 1/8"

REFERENCE LINE (NOTE 2)

1.25" ±.043" - .025"

SMALL-BUTTON NEIGHBOR
7-PIN BASE
ARRANGEMENT I
JEDEC NMB7-208
(NOTE 3)

TRANSPARENT PROTECTIVE
COATING

2 1/2" ± 1/16

- 1/16

0.463 ± .030"

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

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC NO.6-126 (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 WAFFER 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

\[ E_f = 6.3 \text{ VOLTS} \]

ULTOR VOLTS = 12000 TO 20000
GRID-N\#4 VOLTS ADJUSTED FOR FOCUS.

\[ \begin{array}{c}
\text{GRID-N\#1 VOLTS} \\
-125 \\
-100 \\
-75 \\
-50 \\
-25 \\
0
\end{array} \]

\[ \begin{array}{c}
\text{GRID-N\#2 VOLTS} \\
100 \\
200 \\
300 \\
400 \\
500
\end{array} \]

Cathode-Drive Service

\[ E_f = 6.3 \text{ VOLTS} \]

ULTOR-TO-GRID-N\#1 VOLTS = 12000 TO 20000
GRID-N\#4-TO-GRID-N\#1 VOLTS ADJUSTED FOR FOCUS.

\[ \begin{array}{c}
\text{CATHODE-TO-GRID-N\#1 VOLTS} \\
125 \\
100 \\
75 \\
50 \\
25 \\
0
\end{array} \]

\[ \begin{array}{c}
\text{GRID-N\#2-TO-GRID-N\#1 VOLTS} \\
100 \\
200 \\
300 \\
400 \\
500
\end{array} \]

92CS-10313
# Average Drive Characteristics

<table>
<thead>
<tr>
<th>Cathode-Drive Service</th>
<th>Grid-Drive Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>E_f = 6.3 Volts</td>
<td>E_f = 6.3 Volts</td>
</tr>
<tr>
<td>Ultor-to-Grid-N#1 12000 to 20000 Volts</td>
<td>Ultor Volts 12000 to 20000</td>
</tr>
<tr>
<td>Cathode Biased Positive with Respect to Grid N#1 to give Focused Raster Cutoff.</td>
<td>Grid N#1 Biased Negative with Respect to Cathode to give Focused Raster Cutoff.</td>
</tr>
</tbody>
</table>

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**Diagram:**

- **Cathode Drive**
- **Grid Drive**

---

**Graph:**

- **Video Signal Volts from Raster Cutoff**
- **Ultor Milliamperes**

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**Notes:**

- Radio Corporation of America
  - Electron Tube Division
  - Harrison, N.J.
  - Data 6
  - 8-60
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 Noveightar 7-Pin Arrangement 1, (JEDEC No.B7-208)

Basing Designation for BOTTOM VIEW: 8HR

Pin 1—Heater
Pin 2—Grid No.1
Pin 3—Grid No.2
Pin 4—Grid No.4
Pin 6—Grid No.1
Pin 7—Cathode
Pin 8—Heater
Cap—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: \[ \begin{align*} \text{max.} & \quad 23500 \text{ volts} \\ \text{min.} & \quad 11000 \text{ volts} \end{align*} \]

Grid-No.4 (Focusing) Voltage:
- Positive value: 1100 max. volts
- Negative value: 550 max. volts

Grid-No.2 Voltage: \[ \begin{align*} \text{max.} & \quad 550 \text{ volts} \\ \text{min.} & \quad 200 \text{ volts} \end{align*} \]

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: \[ \begin{align*} \text{max.} & \quad 6.9 \text{ volts} \\ \text{min.} & \quad 5.7 \text{ volts} \end{align*} \]

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 \textit{X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES} at front of this section
RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
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
  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 Bs
  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

RCA
RADIO CORPORATION OF AMERICA
Electronic Components and Devices in Harrison, N.J.
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.
LOW-VOLTAGE ELECTROSTATIC FOCUS
NO ION-TRAP MAGNET REQUIRED
RECTANGULAR GLASS TYPE
110° MAGNETIC DEFORMATION
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.
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.R7-208) 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 \text{ max. volts}\} \quad \{15000 \text{ min. volts}\}

Grid-No.4 (Focusing) Voltage:
- Positive value: 1250 max. volts
- Negative value: 400 max. volts

Grid-No.2 Voltage: 250 max. volts

Grid-No.2 to Cathode Voltage: \[\{100 \text{ max. volts}\} \quad \{40 \text{ min. volts}\}

Cathode Voltage:
- Positive peak value: 220 max. volts
- Positive bias value: 155 max. volts
- Negative bias value: 0 max. volts
- Negative peak value: 2 max. volts

Heater Voltage: \[\{6.9 \text{ max. volts}\} \quad \{5.7 \text{ min. volts}\}

Peak Heater-Cathode Voltage:
- Heater negative with respect to cathode:
  - During equipment warm-up period not exceeding 15 seconds: 450 max. volts
  - After equipment warm-up period: 300 max. volts
- Heater positive with respect to cathode: 200 max. volts

Typical Operating Conditions for Cathode-Drive Service:

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

Anode Voltage: 18000 volts

Grid-No.4 Voltage: 250 volts

Grid-No.2 Voltage: 50 volts

Cathode Voltage for visual extinction of focused raster: 34 to 52 volts

Maximum Circuit Value:

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

For X-radiation shielding considerations, see sheet X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES at front on this Section.
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
LOW-VOLTAGE ELECTROSTATIC FOCUS
92° MAGNETIC DEFLECTION
NO ION-TRAP MAGNET REQUIRED

Electrical:
Direct Interelectrode Capacitances:
  Cathode to all other electrodes: \(5 \text{ pf}\)
  Grid No.1 to all other electrodes: \(6 \text{ pf}\)
  External conductive coating to anode: \(5 \text{ pf} \text{ (max.)}, 4 \text{ pf} \text{ (min.)}\)
Heater Current at 6.3 volts: \(450 \pm 20 \text{ mA}\)
Heater Warm-Up Time (Average): \(11 \text{ seconds}\)
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. 86-203)

Basing Designation for BOTTOM VIEW: 12L

Pin 1—Heater
Pin 2—Grid No.1
Pin 6—Grid No.4
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater

Cap—Anode.
(Cap—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...

\[
\begin{align*}
25000 \text{ max. volts} & \\
11000 \text{ min. volts} & 
\end{align*}
\]

Grid-No.4 Voltage:

Positive value...

1100 max. volts

Negative value...

550 max. volts

Grid-No.2 Voltage...

\[
\begin{align*}
550 \text{ max. volts} & \\
200 \text{ min. volts} & 
\end{align*}
\]

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...

\[
\begin{align*}
6.9 \text{ max. volts} & \\
5.7 \text{ min. volts} & 
\end{align*}
\]

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...

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

\[\text{a Includes implosion protection hardware.}\\ \text{b The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +1000 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13-1/2-inch by 18-inch pattern from an RCA-2F21 monoscope, or equivalent.}\]

For X-radiation shielding considerations, see sheet I-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... [2500 max. pf 1700 min.]
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

DATA
Electronic Components and Devices
Harrison, N. J.
8-64
Maximum and Minimum Ratings, Design-Maximum Values:

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Maximum Value</th>
<th>Minimum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>25000 max.</td>
<td>11000 min.</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>1250 max.</td>
<td>400 max.</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>70 max.</td>
<td>40 min.</td>
</tr>
<tr>
<td>Cathode Voltage</td>
<td>2 max.</td>
<td>0 max.</td>
</tr>
<tr>
<td></td>
<td>100 max.</td>
<td>150 max.</td>
</tr>
<tr>
<td>Heater Voltage</td>
<td>6.9 max.</td>
<td>5.7 min.</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>20000 volts</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>200 volts</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>50 volts</td>
</tr>
<tr>
<td>Cathode Voltage</td>
<td>36 to 54 volts</td>
</tr>
<tr>
<td>Field Strength</td>
<td>0 to 12 gauss</td>
</tr>
</tbody>
</table>

Maximum Circuit Value:
- Grid-No.1 Circuit Resistance: 1.5 max. megohms

*Includes implosion protection hardware.

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**

With Heater Having Controlled Warm-Up Time

### Data

**General:**

Heater, for Unipotential Cathode:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage (AC or DC)</td>
<td>6.3 ± 10% volts</td>
</tr>
<tr>
<td>Current at 6.3 volts</td>
<td>0.6 amp</td>
</tr>
<tr>
<td>Warm-up time (Average)</td>
<td>11 sec</td>
</tr>
</tbody>
</table>

**Direct Inter-electrode Capacitances:**

<table>
<thead>
<tr>
<th>Electrode Configuration</th>
<th>Value [µf]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid No.1 to all others</td>
<td>6</td>
</tr>
<tr>
<td>Cathode to all others</td>
<td>5</td>
</tr>
</tbody>
</table>

**External conductive coating to ultor.**

- 2500 max. [µf]
- 1700 min. [µf]

**Faceplate and Protective Panel:**

- Filterglass
- Total light transmission (Approx.) 40%

**Phosphor (for curves, see front of this Section):**

- P4—Sulfide Type
- Aluminized

- Fluorescence: White
- Phosphorescence: White
- Persistence: Medium Short

**Focusing Method:**

- Electrostatic

**Deflection Method:**

- Magnetic

**Deflection Angles (Approx.):**

- Diagonal: 110°
- Horizontal: 99°
- Vertical: 82°

**Electron Gun:**

- Type Requiring No Ion-Trap Magnet

**Tube Dimensions:**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall length</td>
<td>15-3/16&quot; ± 3/8&quot;</td>
</tr>
<tr>
<td>Greatest width</td>
<td>21-5/16&quot; + 1/8&quot; - 1/16&quot;</td>
</tr>
<tr>
<td>Greatest height</td>
<td>17-5/16&quot; + 1/8&quot; - 1/16&quot;</td>
</tr>
<tr>
<td>Diagonal</td>
<td>24-45/64&quot; + 3/32&quot; - 1/16&quot;</td>
</tr>
<tr>
<td>Neck length</td>
<td>5-1/8&quot; ± 1/8&quot;</td>
</tr>
</tbody>
</table>

**Radius of curvature of protective panel (External surface):**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>In plane of diagonal deflection</td>
<td>50-1/4&quot;</td>
</tr>
<tr>
<td>In plane of horizontal deflection</td>
<td>50-1/4&quot;</td>
</tr>
<tr>
<td>In plane of vertical deflection</td>
<td>45-1/2&quot;</td>
</tr>
</tbody>
</table>

**Radius of curvature of faceplate (Internal surface):**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>In plane of diagonal deflection</td>
<td>39-1/2&quot;</td>
</tr>
</tbody>
</table>

---

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

DATA 1
8—60
In plane of horizontal deflection... 39-3/4"  28-1/2"
In plane of vertical deflection... 36-3/4"  19-1/2"

Radius at center  Radius at edge

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

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 \text{ max. volts} \}
GRIND-No. 4-TO-GRID-No. 1 (FOCUSING) VOLTAGE:
Positive value. ................................................. 1000 \text{ max. volts}
Negative value. ................................................. 500 \text{ max. volts}
GRIND-No. 2-TO-GRID-No. 1 VOLTAGE. ................................................. \{ 64 \text{ max. volts} \}
CATHODE-TO-GRID-No. 1 VOLTAGE:
Positive-peak value ................................................. 200 \text{ max. volts}
Positive-bias value ................................................. 140 \text{ max. volts}
Negative-bias value ................................................. 0 \text{ max. volts}
Negative-peak value ................................................. 2 \text{ max. volts}
PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period not exceeding 15 seconds. ................................................. 410 \text{ max. volts}
After equipment warm-up period. ................................................. 180 \text{ max. volts}
Heater positive with respect to cathode. ................................................. 180 \text{ max. volts}
Equipment Design Ranges:

With an ultor-to-grid-No. 1 voltage ($E_{g1}$) between 12000 and 20000 volts and grid-No. 2-to-grid No. 1 voltage ($E_{g2}$) 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 ($E_{kg}$), 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 $E_{kg}$ 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 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 ........ 32 to 47 volts

Cathode-to-Grid-No. 1 Video Drive from Raster Cutoff (Black level):
White-level value .... -32 to -47 volts

Max. 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-in. 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**

\[ V_{e} = 6.3 \text{ VOLTS} \]

ULTOR-TO-GRID-N\#1 VOLTS = 16000

GRID-N\#4-TO-GRID-N\#1 VOLTS ADJUSTED FOR FOCUS,

*CATHODE-TO-GRID-N\#1* VOLTAGE FOR VISUAL EXTINCTION

OF FOCUSED RASTER INCREASES OR DECREASES

DIRECTLY BY APPROX. 2% FOR EVERY 1000-VOLT

CHANGE IN ULTOR-TO-GRID-N\#1 VOLTAGE

*CATHODE-TO-GRID-N\#1* VOLTAGE FOR VISUAL EXTINCTION

OF FOCUSED RASTER INCREASES OR DECREASES

DIRECTLY BY APPROX. 2% FOR EVERY 1000-VOLT

CHANGE IN ULTOR-TO-GRID-N\#1 VOLTAGE.
SCREEN DIAGONAL 22.5/16 MIN.

LOCATION OF "B" 

LOCATION OF "A"

REFERENCE LINE (NOTE 2)

SMALL-BUTTON NEONIGHTAR 
7-PIN BASE, ARRANGEMENT 2 
JEDEC MNB7-219 (NOTE 3)

LOWEST 
3/4" .

REFERENCE POINT "C" SEE NOTE 6

SCREEN WIDTH 19 5/16 MIN.

REFERENCE POINT "B" SEE NOTE 6

REFERENCE POINT "A" SEE NOTE 6

LOCATION OF "B"

463'' ±.030

20.725 MAX

41/2 R

14 1/2 R

90°

2 1/8

1.125'' +.043'' - .025

REFERENCE LINE (NOTE 2)

TRANSPARENT PROTECTIVE COATING

0.125"+0.043"-0.025

SCREEN HEIGHT 15 1/4 MIN.

POIN "B" REFERENCE POINT "C"

SCREEN HEIGHT 15 1/4 MIN.

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Harrison, N. J.
TRANSPARENT INSULATING COATING (NOTE 5)

LOCATION OF SEAL BULGE

PROTECTIVE BASE PLATE (NOTE 2)

LOCATION OF "A"

LOCATION OF "C"

EXTERNAL CONDUCTIVE (NOTE 4)

DIAGONAL VIEW

92CL-10315RI

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

DATA 4
8-60
NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN B MAY VARY FROM THE PLANF 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 B.


NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS OF THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

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

NOTE 6: REFERENCE POINTS A, B, AND C ARE PROVIDED FOR USE IN DESIGN OF A MASK CONTOURED FOR CLOSE FIT TO THE PROTECTIVE PANEL.

NOTE 7: THE CENTER OF THE PROTECTIVE PANEL MAY BE ECCENTRIC WITH RESPECT TO THE AXIS OF THE TUBE ENVELOPE. ASSOCIATED SHIFT OF THE PROTECTIVE PANEL ALONG ITS MINOR AND/OR MAJOR AXIS WILL NOT EXCEED 1/16".

NOTE 8: KEEP THIS CIRCUMFERENTIAL AREA FREE OF MOUNTING HARDWARE.

NOTE 9: ADEQUATE TUBE SUPPORT IS OBTAINED BY CLAMPING TO THE MOUNTING LUGS PROVIDED AT EACH CORNER OF THE PROTECTIVE PANEL. TUBE MOUNTING AND YOKE SUPPORT CLAMPS MUST BE SPACED FROM THE TUBE BY USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.
CATHODE-DRIVE CHARACTERISTICS

$E_f = 6.3\ \text{volts}$

ULTOR-TO-GRID-$N_1$ VOLTS=16000
GRID-$N_2$-TO-GRID-$N_1$ VOLTS=50
CATHODE BIASED POSITIVE WITH RESPECT TO
GRID $N_1$ TO GIVE FOCUSED RASTER CUTOFF.
RASTER FOCUSED AT AVERAGE BRIGHTNESS.
RASTER SIZE=$18'' \times 13-1/2''$

I.C.I. COORDINATES OF SCREEN: $X=0.287, Y=0.315$

LOW-CUTOFF TUBE

HIGH-CUTOFF TUBE

VIDEO SIGNAL VOLTS FROM RASTER CUTOFF

92CM-10314RI
CATHODE-DRIVE CHARACTERISTICS

$E_P = 6.3$ VOLTS
ULTOR-TO-GRID-N\textsuperscript{21} VOLTS = 16000
GRID-N\textsuperscript{22} TO GRID-N\textsuperscript{21} VOLTS = 50
CATHODE BIASED POSITIVE WITH RESPECT TO GRID N\textsuperscript{21} TO GIVE FOCUSED RASTER CUTOFF.

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

ELECTRICAL

Direct Interelectrode Capacitances
- Cathode to all other electrodes...
- Grid No.1 to all other electrodes...
- External conductive coating to anode...

Heater Current at 6.3 volts...

Heater Warm-Up Time (Average)...

Electron Gun...

Type Requiring No Ion-Trap Magnet

OPTICAL

Phosphor...

Faceplate...

Light Transmission (Approx.)...

MECHANICAL

Weight (Approx.)...

Overall Length...

Neck Length...

Projected Area of Screen...

External Conductive Coating...

Type...

Contact area for grounding...

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.JI-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.

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

DATA 12-66
### Maximum and Minimum Ratings, Design-Maximum Values

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>11000 min—23000 max V</td>
</tr>
<tr>
<td>Grid-No.4 (Focusing) Voltage</td>
<td>1100 max V</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>200 min—550 max V</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td>220 max V</td>
</tr>
<tr>
<td>Heater Voltage</td>
<td>5.7 min—6.9 max V</td>
</tr>
</tbody>
</table>

#### 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*

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>18000 V</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>200 V</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>300 V</td>
</tr>
<tr>
<td>Cathode Voltage for visual extinction of focused raster</td>
<td>28 to 62 V</td>
</tr>
<tr>
<td>Field Strength of required adjustable centering magnet</td>
<td>0 to 12 G</td>
</tr>
</tbody>
</table>

### Maximum Circuit Value

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1 Circuit Resistance</td>
<td>1.5 max MO</td>
</tr>
</tbody>
</table>

*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.
23ERP4

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
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 Intere electrode Capacitances:
- Cathode to all other electrodes. . 5 pf
- Grid No.1 to all other electrodes. . 6 pf
- External conductive coating to anode\(^a\): \(2500 \text{ max.}\) \(1700 \text{ min.}\) 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 J387 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.

<table>
<thead>
<tr>
<th>Component</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>11000</td>
<td>23000</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>1100</td>
<td>max.</td>
</tr>
<tr>
<td>Negative value</td>
<td>550</td>
<td>max.</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>550</td>
<td>max.</td>
</tr>
<tr>
<td>Negative value</td>
<td>200</td>
<td>min.</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative peak value</td>
<td>220</td>
<td>max.</td>
</tr>
<tr>
<td>Negative bias value</td>
<td>155</td>
<td>max.</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0</td>
<td>max.</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2</td>
<td>max.</td>
</tr>
<tr>
<td>Heater Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heaeter negative</td>
<td>6.9</td>
<td>max.</td>
</tr>
<tr>
<td>Heater positive</td>
<td>5.7</td>
<td>min.</td>
</tr>
</tbody>
</table>

#### 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.

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>18000</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>200</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>300</td>
</tr>
<tr>
<td>Cathode Voltage</td>
<td>28 to 62</td>
</tr>
<tr>
<td>Field Strength</td>
<td>0 to 12</td>
</tr>
</tbody>
</table>

#### Maximum Circuit Value:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1 Circuit Resistance</td>
<td>1.5 max. megohms</td>
</tr>
</tbody>
</table>

---

*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.
PAN-O-PLY TYPE WITH MOUNTING LUGS

94° MAGNETIC DEFLECTION
LOW-VOLTAGE ELECTROSTATIC FOCUS

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 Coatinga
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

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Electronic Components and Devices
Harrison, N. J.
DATA
10-66
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 | 1250 max V |
| Positive value | 400 max V |
| Negative value | 20 min—70 max V |
| Cathode Voltage | 2 max V |
| Negative peak value | 0 max V |
| Negative bias value | 100 max V |
| Positive bias value | 150 max V |
| Positive peak value | 5.7 min—6.9 max V |
| Heater Voltage | 450 max V |
| Peak Heater-Cathode Voltage | 300 max V |
| Heater negative with respect to cathode: | 200 max V |
| During equipment warm-up period < 15 s | 100 max V |
| After equipment warm-up period | 250 max V |
| Heater positive with respect to cathode: | Combined AC & DC voltage |
| Combined AC & DC voltage | 450 max V |
| DC component | 300 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 | 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 |

Includes implosion protection hardware.

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-2P21 monoscope, or equivalent.

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

LOW-VOLTAGE ELECTROSTATIC FOCUS 110° MAGNETIC DEFLECTION

NO ION-TRAP MAGNET REQUIRED

The 23FMP4 is the same as the 23FMP except for the following item:

Electrical:

Heater Current at 6.3 volts. . . . . . . . . . . 450 ± 20 ma
**Picture Tube**

**FILLED-RIM TYPE**

**410° 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**: 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
- Faceplate: 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 at front of this section): Regular-Band
- Contact area for grounding: Near Reference Line
- Cap: Recessed Small Cavity (JEDEC No.JI-21)
- Base: Small-Button Neeleightar 7-Pin, Arrangement 1, (JEDEC No.87-208)

**TERMINAL DIAGRAM (Bottom View)**

**MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES**

Voltages are positive with respect to grid No.1

- **Anode Voltage**: 11000 min--23000 max V
- **Grid-No.4 Voltage**
  - Positive value: 1250 max V
  - Negative value: 400 max V
- **Grid-No.2 Voltage**: 25 min--60 max V
- **Cathode Voltage**
  - Negative peak value: 2 max V
  - Negative bias value: 0 max V
  - Positive bias value: 100 max V
  - Positive peak value: 150 max V
- **Heater Voltage**: 5.7 min--6.9 max V

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Electronic Components and Devices
Harrison, N.J.

DATA 2-61
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

• Includes implosion protection hardware.

DIMENSIONAL OUTLINE
(Bulb J187 K)

MINIMUM SCREEN
DIAGONAL 22.312
GREATEST WIDTH 19.250
GREATEST HEIGHT 15.125
SHELL OPENING 19.939 MIN.
SHELL OPENING 15.814 MIN.

BASE JEDEC NO. 87-208
CAVITY CAP JEDEC NO.JI-21
SHELL OPENING 22.017 MIN.
SHELL OPENING 23.079 MIN.
REFERENCE LINE DETERMINED BY GAUGE JEDEC NO. 6-126

DATA
RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.
**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: 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
- Faceplate: Filterglass
- Light transmission at center: 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: Regular-Band
- Near Reference Line
- Cap: Recessed Small Cavity (JEDEC No.JI-21)
- Base: Small-Button Neoeightar 7-Pin, Arrangement 1 (JEDEC No.B7-208)

**TERMINAL DIAGRAM (Bottom View)**

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 3—Grid No.2
- Pin 4—Grid No.4
- Pin 6—Grid No.1
- Pin 7—Cathode
- Pin 8—Heater

**Cap—Anode**

- (Grid No.3)
- (Grid No.5, Screen, Collector)

- C—External Conductive Coating

**MAXIMUM AND MINIMUM RATINGS, DESIGN—MAXIMUM VALUES**

**Voltages are positive with respect to cathode**

- **Anode Voltage**: 11000 min—23000 max V
- **Grid-No.4 Voltage**
  - Positive value: 1100 max V
  - Negative value: 550 max V
- **Grid-No.2 Voltage**: 200 min—550 max V
- **Grid-No.1 Voltage**
  - Negative peak value: 220 max V
  - Negative bias value: 155 max V
  - Positive bias value: 0 max V
  - Positive peak value: 2 max V
- **Heater Voltage**: 5.7 min—6.9 max V

**RADIO CORPORATION OF AMERICA**

Electronic Components and Devices  Harrison, N. J.  DATA 2-67
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

MINIMUM SCREEN
DIAGONAL 22.312
GREATEST WIDTH 19.250
GREATEST HEIGHT 15.125

SHELL OPENING 19.939 Min.

50 R.

MINIMUM SCREEN DIAGONAL 22.312
GREATEST WIDTH 19.250
GREATEST HEIGHT 15.125

SHELL OPENING 19.939 MIN.

25.969 ± 0.094
SHELL OPENING 23.017 MIN.

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC NO. G-126
92CS-14561

BASE JEDEC
NO. 187-208

CAVITY CAP
JEDEC
NO. J1-21

SHELL OPENING 15.814 MIN.

17.328 ± 0.062
82°

14.875 ± 0.281
5.125 ± 0.125
9.750 ± 0.156

14.375 ± 0.031

MINIMUM SCREEN DIAGONAL 22.312
GREATEST WIDTH 19.250
GREATEST HEIGHT 15.125

SHELL OPENING 19.939 MIN.

50 R.

MINIMUM SCREEN DIAGONAL 22.312
GREATEST WIDTH 19.250
GREATEST HEIGHT 15.125

SHELL OPENING 19.939 MIN.

25.969 ± 0.094
SHELL OPENING 23.017 MIN.

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC NO. G-126
92CS-14561

BASE JEDEC
NO. 187-208

CAVITY CAP
JEDEC
NO. J1-21

SHELL OPENING 15.814 MIN.

17.328 ± 0.062
82°

14.875 ± 0.281
5.125 ± 0.125
9.750 ± 0.156

14.375 ± 0.031

MINIMUM SCREEN DIAGONAL 22.312
GREATEST WIDTH 19.250
GREATEST HEIGHT 15.125

SHELL OPENING 19.939 MIN.

50 R.

MINIMUM SCREEN DIAGONAL 22.312
GREATEST WIDTH 19.250
GREATEST HEIGHT 15.125

SHELL OPENING 19.939 MIN.

25.969 ± 0.094
SHELL OPENING 23.017 MIN.

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC NO. G-126
92CS-14561

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NO. 187-208

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JEDEC
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17.328 ± 0.062
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MINIMUM SCREEN DIAGONAL 22.312
GREATEST WIDTH 19.250
GREATEST HEIGHT 15.125

SHELL OPENING 19.939 MIN.

50 R.

MINIMUM SCREEN DIAGONAL 22.312
GREATEST WIDTH 19.250
GREATEST HEIGHT 15.125

SHELL OPENING 19.939 MIN.

25.969 ± 0.094
SHELL OPENING 23.017 MIN.

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC NO. G-126
92CS-14561

BASE JEDEC
NO. 187-208

CAVITY CAP
JEDEC
NO. J1-21

SHELL OPENING 15.814 MIN.

17.328 ± 0.062
82°

14.875 ± 0.281
5.125 ± 0.125
9.750 ± 0.156

14.375 ± 0.031

MINIMUM SCREEN DIAGONAL 22.312
GREATEST WIDTH 19.250
GREATEST HEIGHT 15.125

SHELL OPENING 19.939 MIN.

50 R.
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
- Faceplate ... Light transmission at center (Approx.) ... 42%

**MECHANICAL**

- Weight (Approx.) ... 28 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 (see CRT OUTLINES at front of this section) ... Regular-Band
- Cap ... Recessed Small Cavity (JEDEC No.JI-21)
- Base ... Small-Button Neoeightar 7-Pin, Arrangement I, (JEDEC No.B7-208)

**TERMINAL DIAGRAM (BOTTOM VIEW)**

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 3—Grid No.2
- Pin 4—Grid No.4
- Pin 6—Grid No.1
- Pin 7—Cathode
- Pin 8—Heater

**MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES**

- **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

<table>
<thead>
<tr>
<th>Anode Voltage</th>
<th>Grid-No.4 Voltage</th>
<th>Grid-No.2 Voltage</th>
<th>Cathode Voltage</th>
<th>Field Strength</th>
<th>For visual extinction of focused raster</th>
</tr>
</thead>
<tbody>
<tr>
<td>18000 V</td>
<td>200 V</td>
<td>300 V</td>
<td>28 to 62 V</td>
<td>0 to 12 G</td>
<td></td>
</tr>
</tbody>
</table>

MAXIMUM CIRCUIT VALUE
Grid-No.1 Circuit Resistance. ... 1.5 max MO

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 10-inch pattern from an RCA-2721 monoscope, or equivalent.

DIMENSIONAL OUTLINE
FOR PICTURE TUBE UTILIZING BULB J187K WITH MOUNTING LUGS

MINIMUM SCREEN
DIAGONAL 22.3/2
GREATEST WIDTH 19.250
GREATEST HEIGHT 15.125

DIAMETERS:
RIM-BAND OPENING 15.930 MIN

MINUS GAUGE:
JEDEC No.JI-21

REFERENCE LINE DETERMINED BY GAUGE JEDEC No. G-126
92CL-13501
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 23EFP4 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
23NP4

**Picture Tube**

**NO ION-TRAP MAGNET REQUIRED**

**RECTANGULAR GLASS TYPE**

**LOW-VOLTAGE ELECTROSTATIC FOCUS**

**LOW GRID-No. 2 VOLTAGE**

**ALUMINIZED SCREEN**

**11° MAGNETIC DEFLECTION**

**CATHODE-DRIVE TYPE**

**Electrical:**

Direct Interelectrode Capacitances:
- Grid No.1 to all other electrodes: 6 pf
- Cathode to all other electrodes: 5 pf
- External conductive coating to anode: [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

Faceplate: Aluminized Filterglass Light transmission at center (Approx.): 78%

**Mechanical:**

Weight (Approx.): 24 lbs

Overall Length: 14.531" ± 0.281"

Neck Length: 5.125" ± 0.125"

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.B7-2081)

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: 1700 max. min. 2500 max. 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. volts
- 11000 min. volts

**GRID-No.4 (FOCUSING) VOLTAGE:**
- Positive value: 1100 max. volts
- Negative value: 550 max. volts

**GRID-No.2 VOLTAGE**
- 550 max. volts
- 200 min. volts

**GRID-No.1 VOLTAGE:**
- Negative peak value: 200 max. volts
- Negative bias value: 154 max. volts
- Positive bias value: 0 max. volts
- Positive peak value: 2 max. volts

**HEATER VOLTAGE**
- 6.9 max. volts
- 5.7 min. volts

**PEAK HEATER–CATHODE VOLTAGE:**
Heater negative with respect to cathode:
- During equipment warm-up period not exceeding 15 seconds: 450 max. volts
- After equipment warm-up period: 200 max. volts
Heater positive with respect to cathode:
- Combined AC and DC voltage: 200 max. volts
- DC component: 100 max. volts

**Typical Operating Conditions for Grid-Drive Service:**

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

- Anode Voltage: 14000 volts
- Grid-No.4 Voltage: 0 to 400 volts
- Grid-No.2 Voltage: 450 volts
- Grid-No.1 Voltage for visual extinction of focused raster: -45 to -105 volts

**Maximum Circuit Value:**
- Grid-No.1-Circuit Resistance: 1.5 max. megohms

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  
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
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:
- 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 I, (JEDEC No.B7-208)

**TERMINAL DIAGRAM** (Bottom View)

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 3—Grid No.2
- Pin 4—Grid No.4
- Pin 6—Grid No.1
- Pin 7—Cathode
- Pin 8—Heater

Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)
C—External Conductive Coating

**RADIO CORPORATION OF AMERICA**
Electronic Components and Devices
Harrison, N. J.
### Maximum and Minimum Ratings, Design-Maximum Values

Voltages are positive with respect to grid No.1

<table>
<thead>
<tr>
<th>Component</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>11000</td>
<td>23000</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>1250</td>
<td>max</td>
</tr>
<tr>
<td>Negative value</td>
<td>400</td>
<td>max</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>40</td>
<td>min</td>
</tr>
<tr>
<td>Cathode Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative peak value</td>
<td>2</td>
<td>max</td>
</tr>
<tr>
<td>Negative bias value</td>
<td>0</td>
<td>max</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>100</td>
<td>max</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>150</td>
<td>max</td>
</tr>
<tr>
<td>Heater Voltage</td>
<td>5.7</td>
<td>min</td>
</tr>
<tr>
<td></td>
<td>6.9</td>
<td>max</td>
</tr>
</tbody>
</table>

### Peak Heater-Cathode Voltage

Heater negative with respect to cathode:
- During equipment warm-up period ≤ 15 s: 450 max
- After equipment warm-up period: 300 max

### Heaters positive with respect to cathode

- Combined AC & DC voltage: 200 max
- DC component: 100 max

### Typical Operating Conditions for Cathode-Drive Service

Voltages are positive with respect to grid No.1

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>18000</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>0 to 400</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>50</td>
</tr>
<tr>
<td>Cathode Voltage</td>
<td>34 to 52</td>
</tr>
</tbody>
</table>

For visual extinction of focused raster

### Maximum Circuit Value

Grid-No.1 Circuit Resistance: 1.5 max

*Includes implosion protection hardware.

For X-radiation shielding considerations, see sheet X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES at front of this section.
PAN-O-PLY TYPE WITH MOUNTING LUGS

110° MAGNETIC DEFLECTION    LOW-VOLTAGE ELECTROSTATIC FOCUS

Direct Inter-electrode 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
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.JI-21)
Base... Small-Button Neoeighter 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 RECESSED SMALL CAVITY
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
23HGP4

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:
  During equipment warm-up period \( \leq 15 \) s \( \cdots \) 450 max V
  After equipment warm-up period \( \cdots \) 300 max V

Heater positive with respect to cathode:
  Combined AC & DC voltage \( \cdots \) 200 max V
  DC component \( \cdots \) 100 max V

**TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE**

Volages are positive with respect to grid No. 1

- **Anode Voltage** \( \cdots \) 18000 V
- **Grid-No.4 Voltage** \( b \cdots \) 200 V
- **Grid-No.2 Voltage** \( \cdots \) 300 V

**Cathode Voltage**

For visual extinction of focused raster

- **Field Strength** \( \cdots \) 0 to 12 G

Of required adjustable centering magnet

**MAXIMUM CIRCUIT VALUE**

- **Grid-No.1 Circuit Resistance** \( \cdots \) 1.5 max M\( \Omega \)

**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-2P21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet

**I-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES**

at front of this section

**DIMENSIONAL OUTLINE (Bulb J187 K With Mounting Lugs)**

**REFERENCE LINE**

**DETERMINED BY GAUGE**

**JEDEC No.1-21**

**JEDEC No.G-126**

**DATA**

**RADIO CORPORATION OF AMERICA**

Electronic Components and Devices

Harrison, N. J.
Picture Tube

PAN-O-PLY TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
LOW-GRID-No. 2 VOLTAGE
110° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances
Cathode to all other electrodes... 5 pF
Grid No.1 to all other electrodes... 6 pF
External 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
Meck Length ...................... 4.375 ± .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 J187K sheets at front of this section
Cap .................. Recessed Small Cavity (JEDEC No.J1-21)
Base .................. Small-Button Neoeightar 7-Pin, Arrangement I, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1—Heater
Pin 2—Grid No.1
Pin 3—Grid No.2
Pin 4—Grid No.4
Pin 6—Grid No.1
Pin 7—Cathode
Pin 8—Heater
Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)
C—External Conductive Coating

Indicates a change.
### Maximum and Minimum Ratings, Design-Maximum Values

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anode Voltage</strong></td>
<td>12000</td>
<td>12000</td>
</tr>
<tr>
<td>Grid-No.4 (Focusing) Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>1250</td>
<td></td>
</tr>
<tr>
<td>Negative value</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>Cathode Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative peak value</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Positive bias value</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Positive peak value</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>Heater Voltage</td>
<td></td>
<td>5.7</td>
</tr>
<tr>
<td>Heater negative with respect to cathode:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>During equipment warm-up period</td>
<td>450</td>
<td>max</td>
</tr>
<tr>
<td>not exceeding 15 seconds.</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>After equipment warm-up period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heater positive with respect to cathode:</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Combined AC and DC voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC component</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

**Typical Operating Conditions for Cathode-Drive Service**

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anode Voltage</strong></td>
<td>18000</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>200</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>30</td>
</tr>
<tr>
<td>Cathode Voltage</td>
<td>22 to 45</td>
</tr>
<tr>
<td>For visual extinction of focused raster</td>
<td>0 to 12</td>
</tr>
</tbody>
</table>

**Field Strength of required adjustable centering magnet.**

**Maximum Circuit Value**

| Circuit Resistance | 1.5 max |

---

### Footnotes:

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-2P21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet *X-Radiation Precautions for Cathode-Ray Tubes* at front of this section.
PAN-O-PLY TYPE WITH MOUNTING LUGS

110° MAGNETIC DEFLECTION
LOW GRID-No.2 VOLTAGE

**ELECTRICAL**

Direct Interelectrode Capacitances
- Cathode to all other electrodes: 5 pF
- Grid No.1 to all other electrodes: 6 pF
- External conductive coating to anode: 1700 min—2500 max pF

Heater Current at 6.3 V: 450 ± 20 mA
Heater Warm-Up Time (Average): 11 s
Electron Gun: Type Requiring No Ion-Trap Magnet

**OPTICAL**
Phosphor: Pt4—Sulfide Type, Aluminized
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: Regular-Band
Contact area for grounding: Near Reference Line
Cap: Recessed Small Cavity (JEDEC No.J1-21)
Base: Small-Button Noveightar 7-Pin, Arrangement I, (JEDEC No.B7-208)

**TERMINAL DIAGRAM (Bottom View)**

Pin 1—Heater
Pin 2—Grid No.1
Pin 3—Grid No.2
Pin 4—Grid No.4
Pin 6—Grid No.1
Pin 7—Cathode
Pin 8—Heater

Cap—Anode (Grid No.3, Grid No.5, Screen Collector)
C—External Conductive Coating

**MAXIMUM AND MINIMUM RATINGS, DESIGN—MAXIMUM VALUES**

*Voltages are positive with respect to grid No.1*

<table>
<thead>
<tr>
<th>Component</th>
<th>Min—Max Values</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>12000—22000</td>
<td>V</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>1250 max</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>400 max</td>
<td>V</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>30 min—70 max</td>
<td>V</td>
</tr>
<tr>
<td>Cathode Voltage</td>
<td>2 max</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>0 max</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>100 max</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>150 max</td>
<td>V</td>
</tr>
</tbody>
</table>

**DATA**
Radio Corporation of America
Electronic Components and Devices
Harrison, N. J.
Heater Voltage .................. 5.7 min—6.9 max V

Peak Heater-Cathode Voltage
- Heater negative with respect to cathode:
  During equipment warm-up periods < 15 s ... 450 max V
  After equipment warm-up period ... 300 max V
- Heater positive with respect to cathode:
  Combined AC & DC voltage ......... 200 max V
  DC component .................. 100 max V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1:
- Anode Voltage .................. 16000 V
- Grid-No.4 Voltage ............ 0 to 400 V
- Grid-No.2 Voltage ............ 50 V
- Cathode Voltage .......... 32 to 50 V

For visual extinction of focused raster:
- Field Strength .................. 0 to 10 G
  Of required adjustable centering magnet

MAXIMUM CIRCUIT VALUE
- Grid-No.1 Circuit Resistance .... 1.5 max Ω
  a Includes implosion protection hardware.

For X-radiation shielding considerations, see sheet X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES at front of this section.
23HXP4

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 J1-7 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

<table>
<thead>
<tr>
<th>Component</th>
<th>Maximum Value</th>
<th>Minimum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>22,000 max.</td>
<td>15,000 min.</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>1,100 max.</td>
<td>550 max.</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>70 max.</td>
<td>44 min.</td>
</tr>
<tr>
<td>Cathode Voltage</td>
<td>Negative peak value: 2 max.</td>
<td>0 max.</td>
</tr>
<tr>
<td></td>
<td>Positive bias value: 100 max.</td>
<td>150 max.</td>
</tr>
<tr>
<td></td>
<td>Positive peak value:</td>
<td></td>
</tr>
<tr>
<td>Heater Voltage</td>
<td>6.9 max.</td>
<td>5.7 min.</td>
</tr>
</tbody>
</table>

Peak Heater-Cathode Voltage:

Heater negative with respect to cathode:
- During equipment warm-up period: 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

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>16,000 volts</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>0 to 500 volts</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>50 volts</td>
</tr>
<tr>
<td>Cathode Voltage for visual extinction of focused raster</td>
<td>35 to 50 volts</td>
</tr>
</tbody>
</table>

Maximum Circuit Value:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1-Circuit Resistance</td>
<td>1.5 max. megohms</td>
</tr>
</tbody>
</table>

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. \(600 \pm 30\) ma
Heater Warm-Up Time (Average). 11 seconds

Direct Interelectrode Capacitances:
Grid No.1 to all other electrodes. \(6\) \(\mu F\)
Cathode to all other electrodes. \(5\) \(\mu F\)
External conductive coating to ultor. \(2500\) max. \(\mu F\)
\(1700\) min. \(\mu F\)

Focusing Method. Electrostatic
Deflection Method. Magnetic

Deflection Angles (Approx.):
Diagonal \(114^\circ\)
Horizontal \(102^\circ\)
Vertical \(84^\circ\)

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 White
Fluorescence White
Phosphorescence White
Persistence Medium Short

Mechanical:

Tube Dimensions:
Overall length \(14-3/8\)" \(\pm 5/16\)"
Greatest width \(20-1/2\)" \(+ 1/16\)" \(- 1/8\)"
Greatest height \(16-1/2\)" \(\pm 1/8\)"
Diagonal \(23-25/64\)" \(+ 3/32\)" \(- 1/8\)"
Neck length. \(5-1/8\)" \(\pm 1/8\)"

Curvature of faceplate (Radii):
Center \(50^\circ\) 36-3/4"
Intermediate 30" 48" 24"
Edge

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\(^\circ\))
23MP4
Base

Small-Button Neoeightar 7-Pin, Arrangement 1.
(JEDEC No. B7-208)
8HR

Rasing Designation for BOTTOM VIEW.
Pin
Pin
Pin
Pin
Pin
Pin
Pin

1-Heater
2-Grid No.1
3-Grid No.2
4-Grid No.4
6-Grid No.1
7-Cathode
8-Heater

Cap-Ultor
(Grid No.3,
Grid No.5,
Collector)
C-External
Conductive
Coating
CRID-DRIVE A SERVICE

Unless otherwise specified, voltage values
are posittve with respect to cathode
Maximum and Minimum Ratings, Design-Nastnun Values:
ULTOR VOLTAGE
GRID-No.4 (FOCUSING) VOLTAGE:
Positive value
Negative value
GRID-No.? VOLTAGE
GRID-No.1 VOLTAGE:
Negative-peak value
Negative-bias value
Positive-bias value
Positive-peak value
HEATER VOLTAGE
PEAK HEATER-CATHODE VOLTAGE:
Heater negative with
respect to cathode:
During equipment warm-up period
not exceeding 15 seconds
After equipment warm-up period.
Heater positive with
respect to cathode

f22000 max.
111000 min.
1100
550
f550
1200

volts
volts

max.
max.
max.
min.

volts
volts
volts
volts

220 max.
154 max.
0 max.
2 max.
f6.9 max.
15.7 min.

volts
volts
volts
volts
volts
volts

450 max.
200 max.

volts
volts

200 max.

volts

Equipment Design Ranges:
With anyultorvoltage (Eo 5h) betweenil000 and 22000 volts
and grid—No.2 voltage (Sc 2h) between 220 and 550 volts
Grid-No.4 Voltage
for focus .
Grid-No.1 Voltage (E c o.) for
visual extinction
of focused raster

0 to 400

volts

See Roster—Cutoff—Ronge 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 ok except video drive is a
positive voltage

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Electron Tube Division
Harrison, N. J.


Grid-No.4 Current: \(-25\) to \(+25\) \(\mu\)A
Grid-No.2 Current: \(-15\) to \(+15\) \(\mu\)A

Field Strength of Adjustable Centering Magnet*: 0 to 8 gauss

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 \(E_{c581}\) between \(11080\) and \(22000\) volts and grid-No.2-to-grid-No.1 voltage \(E_{c241}\) 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_k1) 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_k1 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 gauss

Examples of Use of Design Ranges:
With ultor-to-grid-No.1 voltage of
and grid-No.2-to-grid-No.1 voltage of
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.
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.
TRANSPARENT INSULATING COATING (NOTE 5)

ULTOR RECESSED SMALL CAVITY CAP JEDEC NO. 21-21 (NOTE 1)

REINFORCING RIBS SEE DETAIL

FOR THIS CONTOUR

Y = \frac{575}{2} \times Y + 575

(\text{X, Y in inches})

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC NO.G-126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUITRY CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

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

NOTE 6: MEASURED AT THE MOLD-MATCH LINE.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/16" BEYOND THE ENVELOPE SURFACE AT THE LOCATION SPECIFIED FOR DIMENSIONING THE ENVELOPE WIDTH, DIAGONAL, AND HEIGHT.

NOTE 8: AREA BETWEEN MOLD-MATCH LINE AND SEAL BULGE IS 1/2" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF TUBE SUPPORT BAND. SUPPORTS MUST BE SPACED FROM THE TUBE BY THE USE OF CUSHIONING PADS MADE OF ASPHALT, IMPREGNATED FELT OR EQUIVALENT.
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.
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE

E_f = 6.3 VOLTS
ULTOR-TO-GRID-N1 VOLTS = 16000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID N1 TO GIVE FOCUSED RASTER CUTOFF.
RASTER FOCUSED AT AVERAGE BRIGHTNESS.
RASTER SIZE = 18" x 13 1/2"

GRID-DRIVE SERVICE

E_f = 6.3 VOLTS
ULTOR VOLTS = 16000
GRID N1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.
RASTER FOCUSED AT AVERAGE BRIGHTNESS.
RASTER SIZE = 18" x 13 1/2"

CIE COORDINATES OF SCREEN: X = 0.287, Y = 0.315

---

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Electron Tube Division
Harrison, N. J.
AVERAGE DRIVE CHARACTERISTICS

<table>
<thead>
<tr>
<th>CATHODE-DRIVE SERVICE</th>
<th>GRID-DRIVE SERVICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>( E_f = 6.3 \text{ VOLTS} )</td>
<td>( E_f = 6.3 \text{ VOLTS} )</td>
</tr>
<tr>
<td>ULTOR-TO-GRID-NO.1 VOLTS = 10000 TO 22000</td>
<td>ULTOR VOLTS = 11000 TO 22000</td>
</tr>
<tr>
<td>CATHODE BIASED POSITIVE WITH RESPECT TO GRID NO.1 TO GIVE FOCUSED RASTER CUTOFF.</td>
<td>GRID NO.1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.</td>
</tr>
</tbody>
</table>

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**Diagram:**
- Cathode Drive
- Grid Drive

**Graph:**
- Video Signal Volts from Raster Cutoff
- Ultron Milliamperes

**Legend:**
- Cathode Drive
- Grid Drive

**Note:**
- Video Signal Volts from Raster Cutoff
- Ultron Milliamperes

**Reference:**
92CM-10618

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Harrison, N. J.
Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE

LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN

92° MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:
- Heater Current at 6.3 volts: 600 ± 5% ma
- Heater Warm-Up Time (Average): 11 seconds

Direct Interelectrode Capacitances:
- Grid No. 1 to all other electrodes: 6 µf
- Cathode to all other electrodes: 5 µf
- External conductive coating to ultor: [2500 max. µf, 2000 min. µf]

Electron Gun: Type Requiring No Ion-Trap Magnet

Optical:
- Faceplate and Protective Panel: Filterglass
- Light transmission (Approx.): 40%
- Phosphor (For curves, see front of this Section): P4—Sulfide Type, Aluminized

Mechanical:
- Operating Position: Any
- Weight (Approx.): 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. 66-203)

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

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DATA 3-62
### Maximum and Minimum Ratings, Design-Maximum Values:

- **ULTOR VOLTAGE:**
  - max.: 22000 volts
  - min.: 12000 volts

- **GRID-No.4 (FOCUSING) VOLTAGE:**
  - Positive value: 1100 volts
  - Negative value: 550 volts

- **GRID-No.2 VOLTAGE:**
  - 550 volts

- **GRID-No.1 VOLTAGE:**
  - Negative peak value: 220 volts
  - Negative bias value: 155 volts
  - Positive bias value: 220 volts
  - Positive peak value: 2 volts

- **PEAK HEATER-CATHODE VOLTAGE:**
  - Heater negative with respect to cathode:
    - During equipment warm-up period: 450 volts
    - After equipment warm-up period: 200 volts
  - Heater positive with respect to cathode: 200 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.
## General Data

### Electrical:
- Heater Current at 6.3 volts: 600 ± 10% ma
- Direct Interelectrode Capacitances:
  - Grid No.1 to all other electrodes: 6 µF
  - Cathode to all other electrodes: 5 µF
- External conductive coating to ultor: 2500 max. µF, 2000 min. µF

### 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: Special Contact area for grounding. Near Reference Line

For Additional Information on Coatings and Dimensions:
- See Picture-Tube Dimensional-Outlines and Bulb Jigs 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

### Diagram

```
Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater

ULTOR Cap - Ultor
(ULTOR: Grid No.3, Grid No.5, Collector)
CL - External Conductive Coating
```

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Electron Tube Division
Harrison, N. J.

DATA 1-63
## Maximum Ratings, Design-Maximum Values:

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<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
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<td><strong>ULTOR VOLTAGE</strong></td>
<td>22000 max. volts</td>
</tr>
<tr>
<td><strong>GRID-No. 4 (FOCUSING) VOLTAGE:</strong></td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>1100 max. volts</td>
</tr>
<tr>
<td>Negative value</td>
<td>550 max. volts</td>
</tr>
<tr>
<td><strong>GRID-No. 2 VOLTAGE</strong></td>
<td>550 max. volts</td>
</tr>
<tr>
<td><strong>GRID-No. 1 VOLTAGE:</strong></td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>155 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max. volts</td>
</tr>
<tr>
<td><strong>PEAK HEATER-CATHODE VOLTAGE:</strong></td>
<td></td>
</tr>
<tr>
<td>Heater negative with</td>
<td></td>
</tr>
<tr>
<td>respect to cathode:</td>
<td></td>
</tr>
<tr>
<td>During equipment warm-up</td>
<td>450 max. volts</td>
</tr>
<tr>
<td>period, not exceeding 15</td>
<td></td>
</tr>
<tr>
<td>seconds</td>
<td></td>
</tr>
<tr>
<td>After equipment warm-up</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>period</td>
<td></td>
</tr>
<tr>
<td>Heater positive with</td>
<td></td>
</tr>
<tr>
<td>respect to cathode:</td>
<td>200 max. volts</td>
</tr>
<tr>
<td><strong>Typical Operating Conditions:</strong></td>
<td></td>
</tr>
<tr>
<td>With ultor voltage of</td>
<td>18000 volts</td>
</tr>
<tr>
<td>and grid-No. 2 voltage of</td>
<td>300 volts</td>
</tr>
<tr>
<td>Grid-No. 4 Voltage for focus</td>
<td>-50 to +350 volts</td>
</tr>
<tr>
<td>Grid-No. 1 Voltage for visual extinction of focused raster:</td>
<td>-28 to -72 volts</td>
</tr>
<tr>
<td><strong>Maximum Circuit Values:</strong></td>
<td></td>
</tr>
<tr>
<td>Grid-No. 1-Circuit Resistance</td>
<td>1.5 max. megohms</td>
</tr>
</tbody>
</table>

For X-radiation shielding considerations, see sheet

*X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES*

at front of this section
## 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 µf
  - Cathode to all other electrodes: 5 µf
  - External conductive coating to ultor: 2500 max. µf, 2000 min. µf
- 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: BHR
- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 3—Grid No.2
- Pin 4—Grid No.4
- Pin 6—Grid No.1
- Pin 7—Cathode
- Pin 8—Heater
- Cap—Ultor (Grid No.3, Grid No.5, Collector)
- C—External Conductive Coating

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**Electron Tube Division**
BASCO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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**TENTATIVE DATA 1**
GRID-DRIVE* SERVICE

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

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

**ULTOR VOLTAGE**

- Positive value: 20000 max. volts
- Negative value: 12000 min. volts

**GRID-No.4 VOLTAGE:**

- Positive value: 1000 max. volts
- Negative value: 500 max. volts

**GRID-No.2 VOLTAGE:**

- Positive value: 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 ($E_{C4k}$) between 12000 and 20000 volts and grid-No.2 voltage ($E_{C2k}$) between 200 and 500 volts

- Grid-No.4 Voltage for Focus: -50 to +350 volts
- Grid-No.1 Voltage ($E_{C1k}$) for Visual Extinction of Focused Raster: See Raster-Cutoff-Range Chart for Grid-Drive Service
- Grid-No.1 Video Drive from Raster Cutoff (Black Level):
  - White-level value (Peak positive): Same value as determined for $E_{C1k}$ except video drive is a positive voltage
  - Grid-No.4 Current: -25 to +25 $\mu$A
  - Grid-No.2 Current: -15 to +15 $\mu$A
  - Field Strength of Adjustable Centering Magnet*: 0 to 8 gauss

**Examples of Use of Design Ranges:**

- With ultor voltage of 14000 and grid-No.2 voltage of 300, 400 volts
- Grid-No.4 Voltage for Focus: -50 to +350 in both cases

* Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

**See next page.**
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 \( E_{c4} \) between 12000 and 20000 volts
and grid-No.2-to-grid-No.1 voltage \( E_{c2} \) 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 abso-
  lute minimum ultor or ultor-to-grid-No.1 voltage is 11000 volts, be-
  low 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 abso-
lute minimum ultor or ultor-to-grid-No.1 voltage is never less than
11000 volts.
§, §: See next page.
Cathode-to-Grid-No.1 Voltage (Ekg1) 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 Ekg1 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 2-1/2". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 7/16-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

§ The grid-No.4 voltage or grid-No.4-to-grid-No.1 voltage required for focus of any individual tube is independent of ultor current and will remain essentially constant for values of ultor voltage (or ultor-to-grid-No.1 voltage) or grid-No.2 voltage (or grid-No.2-to-grid-No.1 voltage) within design ranges shown for these items.

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section.
24AHP4
RASTER-CUTOFF-RANGE CHART
For Grid-Drive Service

$E_f = 6.3$ VOLTS
ULTOR VOLTS = 12000 TO 20000
GRID-NO.4 VOLTS ADJUSTED FOR FOCUS.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No.126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

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

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

NOTE 7: UNDISTURBED AREA BETWEEN MOLD-MATCH LINE AND SPLICE LINE IS 1" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF TUBE SUPPORT BAND.
For Cathode-Drive Service

\[ E_f = 6.3 \text{ VOLTS} \]

ULTOR-TO-GRID-NO.1 VOLTS = 12000 TO 20000

GRID-NO.4-TO-GRID-NO.1 VOLTS ADJUSTED FOR FOCUS.
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE

\[ E_f = 6.3 \text{ VOLTS} \]
ULTOR-TO-GRID-No.1 VOLTS = 16000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID No.1 TO GIVE FOCUSED RASTER CUTOFF.
RASTER FOCUSED AT AVERAGE BRIGHTNESS.
RASTER SIZE = 21" x 16"

GRID-DRIVE SERVICE

\[ E_f = 6.3 \text{ VOLTS} \]
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"
CATHODE-DRIVE SERVICE

\[ E_f = 6.3 \text{ VOLTS} \]
ULTOR-TO-GRID-NO. 1 VOLTS = 12000 TO 20000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID NO. 1 TO GIVE FOCUSED RASTER CUTOFF.

GRID-DRIVE SERVICE

\[ E_f = 6.3 \text{ VOLTS} \]
ULTOR VOLTS = 12000 TO 20000
GRID NO. 1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.

---

CATHODE DRIVE

GRID DRIVE

VIDEO SIGNAL VOLTS FROM RASTER CUTOFF

ULTOR MILLIAMPERES

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**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 µuf
- Cathode to all other electrodes: 5 µuf

- External conductive coating to ultor: 2500 max. µuf
- (1700 min. µuf)

- 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: Electrostastic
- 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.86-203), or Small-Shell Duodecal 6-Pin, Arrangement 1 (JEDEC Group 4, No.86-63)
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

GRID-DRIVE® SERVICE

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

Maximum Ratings, Design-Center Values:

ULTOR VOLTAGE .............................................. 20000 max. volts
GRID-No.4 (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_{C4}) between 1200 and 2000 volts and grid-No.2 voltage (E_{C2}) between 200 and 500 volts

Grid-No.4 Voltage for focus$ ........................................ -75 to +400 volts
Grid-No.1 Voltage (E_{C1k}) for visual extinction of focused raster ................................ See Raster-Cutoff-Range Chart for Grid-Drive Service

Grid-No.1 Video Drive from Raster Cutoff (Black Level):
  White-level value (Peak positive) ................................ Same value as determined for E_{C1k} except video drive is a positive voltage

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

---

$ See next page.
### PICTURE TUBE

- **Grid-No.2 Current**: -15 to +15 ma
- **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**: 1000 max. volts
- **GRID-No.2-TO-GRID-No.1 VOLTAGE**: 640 max. volts
  - Positive value: 200 max. volts
  - Positive-bias value: 140 max. volts
  - Negative-bias value: 0 max. volts
  - Negative-peak value: 2 max. volts
- **CATHODE-TO-GRID-No.1 VOLTAGE**:
  - Positive-peak value: 410 max. volts
  - Positive-bias value: 180 max. volts
  - Negative-bias value: 180 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 ($E_{cg1}$) between 12000 and 20000 volts and grid-No.2-to-grid-No.1 voltage ($E_{cg2}$) between 225 and 640 volts
- **Grid-No.4-to-Grid-No.1 Voltage for focus**: -75 to +400 volts
- **Cathode-to-Grid-No.1 Voltage ($E_{kg1}$) for visual extinction of focused raster**: See Raster-Cutoff-Range Chart for Cathode-Drive Service

---

4-59

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

TENTATIVE DATA 2
PICTURE TUBE

Cathode-to-Grid-No.1 Video
Drive from Raster Cutoff
(Black Level):
White-level value ............ Same value as determined for
(Peak negative) .............. $E_{kg1}$ 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 gauss

Examples of Use of Design Ranges:

With utor-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 +40C. volts

Cathode-to-Grid-No.1 Volt-
age 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 abso-
lute minimum utor-or utor-to-grid-No.1 voltage is 11,000 volts, be-
low 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 abso-
lute minimum utor-or utor-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 utor current and will
remain essentially constant for values of utor voltage (or utor-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 un-
deflected 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 deflec-
tion 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 elec-
trodes.

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

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

4-59 TENTATIVE DATA 2
PICe TUBE

SCREEN DIAGONAL 22 1/16 MIN.

SCREEN WIDTH 21 7/16 MIN.

22R.

35R.

36R.

4 3/16 R.

22R.

3 3/4 R.

SCREEN HEIGHT 16 7/8 MIN.

22 1/16 " ± 1/8"

REFERENCE LINE

6 3/8 ± 1/4"

1 7/16 ± 1/8"

85°

32R.

4 1/2 R.

7/16 R.

SHORT SMALL-SHELL DUODECAL 6-PIN BASE JEDEC GROUP 4, NMB6-203 OR SMALL-SHELL DUODECAL 6-PIN BASE, ARRANGEMENT I JEDEC GROUP 4, NMB6-63 (NOTE 3)

ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY


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.
### Average Drive Characteristics

<table>
<thead>
<tr>
<th>Cathode Drive Service</th>
<th>Grid-Drive Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>( E_f = 6.3 \text{ Volts} )</td>
<td>( E_f = 6.3 \text{ Volts} )</td>
</tr>
<tr>
<td>Ultor-to-Grid No.1 Volts = 16000</td>
<td>Ultron Volts = 16000</td>
</tr>
<tr>
<td>Cathode biased positive with respect to Grid No.1 to give focused raster cutoff.</td>
<td>Grid No.1 biased negative with respect to Cathode to give focused raster cutoff.</td>
</tr>
<tr>
<td>Raster focused at average brightness.</td>
<td>Raster focused at average brightness.</td>
</tr>
<tr>
<td>Raster Size = 21&quot; x 16&quot;</td>
<td>Raster Size = 21&quot; x 16&quot;</td>
</tr>
</tbody>
</table>

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**Diagram:**

- **Cathode Drive**
- **Grid Drive**

---

**Graph:**

- **Highlight Brightness — Foot-Lamberts**
- **Video Signal Volts From Raster Cutoff**

---

**Text:**

- Electron Tube Division
- Radio Corporation of America, Harrison, New Jersey

**Document Code:** 92CM-9352
**AVERAGE DRIVE CHARACTERISTICS**

**CATHODE-DRIVE SERVICE**
- \( E_C = 6.3 \text{ VOLTS} \)
- \( \text{ULTOR-TO-GRID-} N^2I \text{ VOLTS} = 12000 \text{ TO } 20000 \)
- Cathode biased positive with respect to Grid \( N^2I \) to give focused raster cutoff.

**GRID-DRIVE SERVICE**
- \( E_C = 6.3 \text{ VOLTS} \)
- \( \text{ULTOR VOLTS}=12000 \text{ TO } 20000 \)
- Grid \( N^2I \) biased negative with respect to cathode to give focused raster cutoff.

---

**Diagram**
- Cathode Drive
- Grid Drive

**Axes**
- Video Signal Volts from Raster Cutoff
- Milliamperes

**Voltage Ranges**
- 0 to 80 video signal volts
- 0.5 to 2.5 milliamperes

**Footnotes**
- Electron Tube Division
- Radio Corporation of America, Harrison, New Jersey
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 \text{ max.}\} \text{ pf}
  \[\{1700 \text{ min.}\} \text{ 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.
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 Neoguide 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

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

DATA
10-64
<table>
<thead>
<tr>
<th>Component</th>
<th>Voltage Specifications</th>
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</thead>
<tbody>
<tr>
<td>Grid-No.2 Voltage</td>
<td>550 max. volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage:</td>
<td></td>
</tr>
<tr>
<td>Negative peak value</td>
<td>220 max. volts</td>
</tr>
<tr>
<td>Negative bias value</td>
<td>154 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max. volts</td>
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<tr>
<td>Positive peak value</td>
<td>2 max. volts</td>
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<tr>
<td>Heater Voltage</td>
<td>6.9 max. volts</td>
</tr>
<tr>
<td></td>
<td>5.7 min. volts</td>
</tr>
<tr>
<td>Peak Heater-Cathode Voltage:</td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode:</td>
<td></td>
</tr>
<tr>
<td>During equipment warm-up period not exceeding 15 seconds</td>
<td>450 max. volts</td>
</tr>
<tr>
<td>After equipment warm-up period</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>200 max. volts</td>
</tr>
</tbody>
</table>

**Typical Operating Conditions for Cathode-Drive Service:**

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Voltage Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>16000 volts</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>200 volts</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>400 volts</td>
</tr>
<tr>
<td>Cathode Voltage for visual extinction of focused raster</td>
<td>42 to 78 volts</td>
</tr>
</tbody>
</table>

**Maximum Circuit Value:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Resistance Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1 Circuit Resistance</td>
<td>1.5 max. megohms</td>
</tr>
</tbody>
</table>

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

**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: 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 A1B 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

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: 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 I-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^\circ . . . . . . . . 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
  {12000 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 Panel Designation: JEDEC No.FP196-1/2

Base: Small-Button Diheptar 12-pin

Basing Designation: JEDEC No.14BE

Pin Position Alignment: Pin No.12 Aligns Approx. with Anode Bulb Contact

Operating Position: Anode Bulb Contact on Top

Weight (Approx.): 38 lb (17.4 kg)

MAXIMUM AND MINIMUM RATINGS, Design-Maximum Values

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

Anode Voltage: {27,500 max. V

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: 6.9 max. V
- Under standby conditions: 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: 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............... 6.3 V
Under standby conditions............... 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 Blue Green

34 32 34 %

Ratio of cathode currents:
Min. Typ. Max.
Red/blue .................. 0.75 1.10 1.50
Red/green ................. 0.65 1.00 1.50
Blue/green ............... 0.60 0.91 1.30

Displacements, Measured at Center of Screen:
Raster centering displacement:
Horizontal .................. ±0.47 in (±11.9 mm)
Vertical .................. ±0.45 in (±11.4 mm)

Lateral distance between the blue beam and the converged red and green beams.................. ±0.25 in (±6.4 mm)

Radial convergence displacement excluding effects of dynamic convergence (each beam) ........... ±0.37 in (±9.4 mm)

Maximum Required Correction for Register° (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 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 8: Cathode of Blue Gun
- Pin 9: Grid No.3
- Pin 10: 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**

![Diagram of bottom view of base]

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

![Diagram of location of radial-converging pole pieces]

**NOTES FOR DIMENSIONAL OUTLINE**

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

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

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

**Note 4:** To clean this area, wipe only with soft, dry, lintless cloth.
Dimensions in Inches/mm

**OUTLINE**

- TENSION BAND
- RIM BAND

**Dimensions**

- 2.584 ± 0.125
- 65.63 ± 3.16
- 3.434
- 0.722
- 4.302 ± 0.125
- 109.27 ± 3.16
- 355.83 ± 4.78
- 207.02 ± 3.76
- 525.83 ± 9.53

**Note:**

- 18.330
- 414.78

**Reference Line:**

- MIN.
- OPENING

**Units:**

- Inches/mm

**RCA Electronic Components**

**DATA 4**

9-68
CUTOFF DESIGN CHART

HEATER VOLTAGE: 6.3 V

ANODE-TO-CATHODE VOLTAGE: 20,000 TO 27,500 V

GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
Color Picture Tube

Hi-Lite Matrix Screen
90° Rectangular
New Green Phosphor
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° .......................... 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 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 5.7 min.—6.9 max. V
  Under standby conditions 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:

- When standby operation is not utilized ........................................ 6.3 V
- When 5.0-V standby operation is utilized ........................................ 6.0 V

Under standby conditions ........................................ 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:
  - Red/blue ........................................ 0.75 Min., 1.10 Typ., 1.50 Max.
  - Red/green ........................................ 0.65 Min., 1.00 Typ., 1.50 Max.
  - Blue/green ........................................ 0.60 Min., 0.91 Typ., 1.30 Max.

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.

LIMITING CIRCUIT VALUES

High-Voltage Circuits:

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

* 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 8: Grid No.3 of Green Gun
Pin 9: Grid No.3 of Green Gun
Pin 10: Grid No.2 of Green Gun
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.
CUTOFF DESIGN CHART

HEATER VOLTAGE = 6.3 V
ANODE - TO - CATHODE VOLTAGE = 20,000 TO 27,500 V
GRID No. 3 - TO - CATHODE VOLTAGE ADJUSTED FOR FOCUS.
Color Picture Tube

Hi-Lite Matrix Screen
90° Rectangular
New Green Phosphor

Integral Implosion Protection – Banded 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)

SCREEN WIDTH
19.875 MIN.
504.82

SCREEN HEIGHT
19.875 MIN.
399.60

CLEARANCE AREA FOR TENSION BAND CLIP

SAGITTAL HEIGHTS AT POINTS \( \frac{125}{3.16} \) BEYOND THE EDGE OF MINIMUM SCREEN

- DIAGONAL: 2.063
- WIDTH: 1.524
- HEIGHT: 0.950

DATA 1
DIMENSIONAL OUTLINE (Right Oblique View)

- Tension Band
- Rim Band
- Reference Line
- Seal Line

Dimensions:
- 23.978 MIN Rim Force
- 24.860 MAX Rim Band Opening
- Q.D. of Tension Band

RCA Electronic Components

Data 2
8-69
**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 [Inches mm] unless otherwise shown*
25AP22A
Color Picture Tube
RECTANGULAR TUBE

90° MAGNETIC DEFLECTION

ALUMINIZED TRICOLOR PHOSPHOR-DOT !IL-Lit e SCREEN
(Utilizing aRare-Earth Red-Emitting Phosphor)
INTEGRAL FILTERGLASS PROTECTIVE WINDOW
(Treated toMinimize SpecularReflection)
MAGNETIC CONVERGENCE

ELECTROSTATIC-FOCUS GUNS

For Use in Color-TV Receivers
Electrical:

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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 .

f2500 max.
12000 min.

pf
pf

Optical:

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'

Faceplate and Protective Window
Light transmission at center (Approx.)
Surface of Protective Window

Filterglass
41%
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 á 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"

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RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. 1.

DATA

5-65

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**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. mA

- **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: 6.9 max. volts
- Under standby conditions: 5.7 min. volts

Peak Heater-Cathode Voltage (Each gun):
- Heater negative with respect to cathode:
  - During equipment warm-up period: 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 +27M.P.C.D. (CIE Coordinates x = 0.281, y = 0.311):
- Percentage of Total Anode Current Supplied by Each Gun (Average):
  Red 42  Blue 25  Green 33

Ratios of Cathode Currents:
- Min. 1.0  1.7  2.0  Min. 1.0  1.3  1.8
- Typ. Max.

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 Registere (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: 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.

---

RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.
LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS

BASE
BOTTOM VIEW

HORIZONTAL £ OF SCREEN

BLUE GUN

GREEN GUN

RED GUN

PLANE THROUGH £ OF PIN No. 2 AND TUBE AXIS

92CS-12835R1

92CS-12846

DATA 3

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

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 20,000 TO 27,500 VOLTS
GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.

GRID-No.2-TO-CATHODE VOLTS

GRID-No.1-TO-CATHODE VOLTS

MINIMUM SPOT CUTOFF OF ANY GUN

MAXIMUM SPOT CUTOFF OF ANY GUN
Spectral-Energy Emission Characteristic of Group Phosphor P22—Rare-Earth (Red), Sulfide (Blue & Green) Type

Simultaneous Excitation of Red Phosphor, Blue Phosphor, and Green Phosphor to Produce 9300° K + 27 M.P.C.D. White ($X = 0.281$, $Y = 0.311$).

<table>
<thead>
<tr>
<th>COMPONENT COLOR</th>
<th>C.I.E. COORDINATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED</td>
<td>$0.676$ $0.324$</td>
</tr>
<tr>
<td>BLUE</td>
<td>$0.155$ $0.061$</td>
</tr>
<tr>
<td>GREEN</td>
<td>$0.290$ $0.590$</td>
</tr>
</tbody>
</table>

Peaks in this area have been reduced by a factor of 5.
Typical Light-Output Characteristic

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 25,000 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: 42%
- BLUE GUN: 25%
- GREEN GUN: 33%

RASTER SIZE: 19.675" x 15.575"
*MEASURED WITHIN 5"-DIAMETER AREA CENTERED ON TUBE FACE.
HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 20000 TO 27500 VOLTS
GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
GRID-No. 2-TO-CATHODE VOLTAGE (EACH GUN) ADJUSTED TO PROVIDE SPOT CUTOFF FOR DESIRED FIXED GRID-No.1-TO-CATHODE (E_G1K)

\( E_{G1K} \) FOR SPOT CUTOFF VOLTS \( \approx 50 \)

\( 100 \) \( 200 \) \( 300 \) \( 400 \) \( 500 \)

ANODE MICROAMPERES PER GUN

VIDEO SIGNAL VOLTS FROM SPOT CUTOFF PER GUN

RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.
DATA 6
5-65
Typical Drive Characteristics
Cathode-Drive Service

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-GRID-No. 1 VOLTAGE = 20000 TO 27500 VOLTS
GRID-No. 3-TO-GRID-No. 1 VOLTAGE ADJUSTED FOR FOCUS.
GRID-No. 2-TO-GRID-No. 1 VOLTAGE (EACH GUN) ADJUSTED
TO PROVIDE SPOT CUTOFF FOR DESIRED FIXED CATHODE-
TO-GRID-No. 1 (EACH GUN) VOLTAGE (E_{k1})
* = ZERO-BIAS POINT

ANODE MICROAMPERES PER GUN

GRID-No. 2-TO-GRID-No.1 (EACH GUN) VOLTAGE ADJUSTED TO PROVIDE SPOT CUTOFF FOR DESIRED FIXED CATHODE-TO-GRID-No. 1 (EACH GUN) VOLTAGE (E_{k1})

VIDEO SIGNAL VOLTS FROM SPOT CUTOFF PER GUN

DATA 6
RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.
Color Picture Tube

PERMA-CHROME
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.PP196-1/2A3

OPTICAL

Faceplate and Protective Window
Light Transmission at center (Approx.) ................. 52.5%

EQUIPMENT DESIGN RANGES

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

Percentage of total anode current supplied by each gun (average) ......................... 30 31 39 %

Ratio of cathode currents:

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red/blue</td>
<td>0.75</td>
<td>0.95</td>
<td>1.25</td>
</tr>
<tr>
<td>Red/green</td>
<td>0.60</td>
<td>0.75</td>
<td>1.10</td>
</tr>
<tr>
<td>Blue/green</td>
<td>0.60</td>
<td>0.80</td>
<td>1.10</td>
</tr>
</tbody>
</table>

RCA Electronic Components
HEATER VOLTAGE = 6.3 V
ANODE - TO - CATHODE VOLTAGE = 25,000 V
GRID No. 3 - TO - CATHODE VOLTAGE ADJUSTED FOR FOCUS.
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE CURRENT
TO PRODUCE 9300°K 27 M.P.C.D. WHITE - LIGHT OUTPUT.
PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN TO
PRODUCE 9300°K + 27 M.P.C.D. WHITE:
RED GUN: 30%
BLUE GUN: 31%
GREEN GUN: 39%
RASTER SIZE: 19.875" x 15.575" (504.82 mm x 395.60 mm)
* MEASURED WITHIN 5" (127 mm) DIAMETER AREA CENTERED ON
TUBE FACE.

TYPICAL LIGHT-OUTPUT CHARACTERISTIC

ANODE CURRENT — μA

RCA Electronic Components
DATA
Color Picture Tube

PERMA-CHROME

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 \(9300^\circ\) K + 27 M.P.C.D.
(CIE Coordinates \(x = 0.281, y = 0.311\)):

Percentage of total anode current supplied by each gun (average) .......... Red 30 Blue 31 Green 39

Ratio of cathode currents:
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" x 15.575" (504.82 mm x 395.60 mm)
* MEASURED WITHIN 5" (127 mm) DIAMETER AREA CENTERED ON
TUBE FACE.

ANODE CURRENT — uA

RCA Electronic Components
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
  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 Panel Designation ......................... JEDEC No.FP209-3/4 W2
- Base Designationa ............................... 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.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>20 min.</td>
<td>27.5 max. kV</td>
</tr>
<tr>
<td>Anode Current, Long-Term Average</td>
<td>1000 max. µA</td>
<td></td>
</tr>
<tr>
<td>Grid-No.3 (Focusing Electrode) Voltage</td>
<td>6000 max. V</td>
<td></td>
</tr>
<tr>
<td>Peak-Grid-No.2 Voltage, Including Video Signal Voltage</td>
<td>1000 max. V</td>
<td></td>
</tr>
<tr>
<td>Grid-No.1 Voltage:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>400 max. V</td>
<td></td>
</tr>
<tr>
<td>Negative operating cutoff value</td>
<td>200 max. V</td>
<td></td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max. V</td>
<td></td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max. V</td>
<td></td>
</tr>
<tr>
<td>Heater Voltage (ac or dc):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under operating conditions</td>
<td>6.9 max. V</td>
<td></td>
</tr>
<tr>
<td>Under standby conditions</td>
<td>5.7 min. V</td>
<td></td>
</tr>
<tr>
<td>Heater-Cathode Voltage:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>During equipment warm-up period</td>
<td></td>
<td>450 max. V</td>
</tr>
<tr>
<td>After equipment warm-up period:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC component value</td>
<td>200 max. V</td>
<td></td>
</tr>
<tr>
<td>Peak value</td>
<td>200 max. V</td>
<td></td>
</tr>
<tr>
<td>Heater positive with respect to cathode:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC component value</td>
<td>0 max. V</td>
<td></td>
</tr>
<tr>
<td>Peak value</td>
<td>200 max. V</td>
<td></td>
</tr>
</tbody>
</table>

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

For anode voltages between 20 and 27.5 kV
Grid-No.3 (Focusing Electrode) Voltage 16.8% to 20% of Anode voltage
Grid-No.2 Voltage for Visual Extinction of Undelected Focused Spot... See CUTOFF DESIGN CHART in Figure 3

At Grid No.1 voltage of -75 V .......................... 95 to 295 V
At Grid No.1 voltage of -125 V ....................... 205 to 535 V
At Grid No.1 voltage of -175 V ....................... 315 to 780 V

Maximum Ratio of Grid-No.2 Voltages, Highest Gun to Lowest Gun in Any Tube (At grid-No.1 spot cutoff voltage of -100 V) .................. 1.86

Heater Voltage:
Under operating conditions:
  - When standby operation is not utilized ........ 6.3 V
  - When 5.0-V standby operation is utilized 6.0 V
  - Under standby conditions 5.0 V

Grid-No.3 Current (Total) ......................... ±15 µA
Grid-No.2 Current ......................... ±5 µA
Grid-No.1 Current ......................... ±5 µA

To Produce White Light of ......................... 6550ºK + 9300ºK +

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 ...................................... 36 39 %

Ratio of cathode currents:
Red/blue:
  - Minimum .......................... 1.36 0.75
  - Typical ..................... 1.70 0.92
  - 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 ....................................... 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 ........................ 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 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 inches/mm unless otherwise noted
DIMENSIONAL OUTLINE

Sagittal Heights with Reference to Centerface at Points (3.18 mm) Beyond Edge of Minimum Screen.

<table>
<thead>
<tr>
<th>Station No.</th>
<th>Coordinates</th>
<th>Sagittal Height</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X (mm)</td>
<td>Y (mm)</td>
</tr>
<tr>
<td>1 (Minor)</td>
<td>0 (0)</td>
<td>7.916 (201.07)</td>
</tr>
<tr>
<td>2</td>
<td>1.000 (25.40)</td>
<td>7.912 (200.96)</td>
</tr>
<tr>
<td>3</td>
<td>2.000 (50.80)</td>
<td>7.901 (200.69)</td>
</tr>
<tr>
<td>4</td>
<td>3.000 (76.20)</td>
<td>7.882 (199.20)</td>
</tr>
<tr>
<td>5</td>
<td>4.000 (101.60)</td>
<td>7.856 (199.54)</td>
</tr>
<tr>
<td>6</td>
<td>5.000 (127.00)</td>
<td>7.822 (198.68)</td>
</tr>
</tbody>
</table>

(continued on next page.)
Sagittal Heights (Cont'd)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Height (mm)</th>
<th>Height (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>6.000 (152.40)</td>
<td>7.781 (197.64)</td>
</tr>
<tr>
<td>8</td>
<td>7.000 (177.80)</td>
<td>7.732 (196.39)</td>
</tr>
<tr>
<td>9</td>
<td>8.000 (203.20)</td>
<td>7.676 (194.97)</td>
</tr>
<tr>
<td>10</td>
<td>9.000 (228.60)</td>
<td>7.612 (193.34)</td>
</tr>
<tr>
<td>11</td>
<td>9.540 (242.32)</td>
<td>7.574 (192.38)</td>
</tr>
<tr>
<td>12</td>
<td>10.132 (257.35)</td>
<td>7.242 (183.95)</td>
</tr>
<tr>
<td>13</td>
<td>10.279 (261.09)</td>
<td>6.832 (173.53)</td>
</tr>
<tr>
<td>14</td>
<td>10.333 (262.46)</td>
<td>6.000 (152.40)</td>
</tr>
<tr>
<td>15</td>
<td>10.388 (263.86)</td>
<td>5.000 (127.00)</td>
</tr>
<tr>
<td>16</td>
<td>10.433 (265.00)</td>
<td>4.000 (101.60)</td>
</tr>
<tr>
<td>17</td>
<td>10.468 (265.89)</td>
<td>3.000 (76.20)</td>
</tr>
<tr>
<td>18</td>
<td>10.493 (266.52)</td>
<td>2.000 (50.80)</td>
</tr>
<tr>
<td>19</td>
<td>10.508 (266.90)</td>
<td>1.000 (25.40)</td>
</tr>
<tr>
<td>20</td>
<td>10.513 (267.03)</td>
<td>0.00 (0.00)</td>
</tr>
</tbody>
</table>

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 8:** 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

25VABP22
TYPICAL DRIVE CHARACTERISTICS, GRID-DRIVE SERVICE

HEATER VOLTAGE = 6.3V
ANODE — TO — CATHODE VOLTAGE = 20 TO 27.5 kV.
GRID No. 3 — TO — CATHODE VOLTAGE ADJUSTED FOR FOCUS.
GRID No. 2 — TO — CATHODE VOLTAGE (EACH GUN) ADJUSTED TO PROVIDE SPOT CUTOFF.
• = ZERO — BIAS POINT
Typical Drive Characteristics

Cathode-Drive Service

- ZCRO - BIAS POINT
- PROVIDE SPOT CUTOFF
  (EACH GUN) ADJUSTED TO
  GRID No. 2 - 10 - GRID No. 4 VOLTAJE
  ADJUSTED FOR FOCUS.
  GRID No. 3 - 10 - GRID No. 4 VOLTAJE
  ANODE - 10 - GRID No. 4 VOLTAJE
  HEATER VOLTAJE - 6.3V

RCA Components Data 2.12
Fig. 3

IMPORTANT: Refer to sheet Safety Precautions for Color Picture 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 25BP22A is the same as the 25AP22A except for the following items:

Optical:
- Faceplate Filterglass  
  Light transmission (Approx.)  
  Faceplate does not have an integral protective window.

Mechanical:
- Tube Dimensions:  
  Overall length  
  Weight (Approx.)  
- 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

---

RADIO CORPORATION OF AMERICA  
Electronic Components and Devices  
Harrison, N. J.  
DATA  
5-65
**Typical Light-Output Characteristic**

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 25,000 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: 42%
BLUE GUN: 25%
GREEN GUN: 33%

RASTER SIZE: 19.875" x 15.575"
*MEASURED WITHIN 5"-DIAMETER AREA CENTERED ON TUBE FACE.*

---

**Graph:**

- **Anode Microamperes** vs. **3200° K + 27 M.P.C.D. White-Light Output (Footlamberts)**

---

**RCA**
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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 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*.....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)

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: $20.924 \pm 0.375$ in ($531.5 \pm 9.5$ mm)
- Neck length: $6.693 \pm 0.188$ in ($170.0 \pm 4.8$ mm)
- Diagonal: $24.566 \pm 0.093$ in ($624.0 \pm 2.4$ mm)
- Greatest width: $21.500 \pm 0.093$ in ($546.1 \pm 2.4$ mm)
- Greatest height: $17.200 \pm 0.093$ in ($438.5 \pm 2.4$ 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.JI95-1/2
**Bulb Panel Designation**: JEDEC No.FPI96-1/2 A
**Protective Window Designation**: JEDEC No.FP196-1/2 C
**Bulb Contact Designation**: Recessed Small Cavity Cap (JEDEC No.JI-21)

**Pin Position Alignment**
- Pin No. 12 Aligns Approx. with Anode Bulb Contact

**Operating Position**
- Anode Bulb Contact on Top

**Weight (Approx.)**
- Small-Button Diheptar 12-pin: 42 lb (19.1 kg)

**TERMINAL DIAGRAM (Bottom View)**

**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
- **Total Anode Current, Long-Term Average**: $20,000$ min V
- **Grid-No.3 (Focusing Electrode) Voltage**: $1000$ max $\mu$A
- **Peak Grid-No.2 Voltage, Including Video Signal Voltage**: $6000$ max V

DATA 1

RADIO CORPORATION OF AMERICA
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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: 6.9 max V
- Under standby conditions: 5.7 min V

Peak Heater-Cathode Voltage
- Heated 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
- Heated 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

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) 34% Red, 32% Blue, 34% Green

Ratio of cathode currents:
- Min: 0.75 Red/blue, 0.65 Red/green, 0.60 Blue/green
- Typ: 1.00 Red/blue, 1.00 Red/green, 0.91 Blue/green
- Max: 1.50 Red/blue, 2.50 Red/green, 1.30 Blue/green

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 \(\Omega\)

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the high-voltage power supply and the grid-No.3 power supply be of the limited-energy type, in which the short-circuit current does not exceed 20 mA.

Low-Voltage Circuits
Effective grid-No.1-to-cathode-circuit resistance (Each gun) ........................................ 0.75 max \(\Omega\)

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.

\(^a\) See Section 2.5.
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.

For curve, see Group Phosphor P22—New Rare-Earth (Red), Sulfide (Blue & Green) at front of this section.

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.

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.6162

REFERENCE LINE

DIMENSIONS IN INCHES (mm)

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

BLUE GUN

HORIZONTAL ø OF SCREEN

GREEN GUN

RED GUN

120°

LOCATION OF RADIAL-CONVERGING POLE PIECES

VIEWED FROM SCREEN END OF GUNS

RADIAL POLE PIECES

INTERNAL MAGNETIC SHIELD

.235 (6.0)

.300 (7.6)

.590 R. (15.0)

92CS-12835R2

DIMENSIONS IN INCHES (mm)

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

**BASE**
JEDEC No. BZ-244
(NOTE 2)

**INTERNAL RADIAL-CONVERGING POLE PIECES**

**CAVITY CAP**
JEDEC No. J-2I

**CONTACT AREA OF EXTERNAL CONDUCTIVE COATING (NOTE 3)**

**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 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.

---

**RADIO CORPORATION OF AMERICA**

Electronic Components and Devices

Harrison, N. J.

DATA 4

4-67
Typical Light-Output Characteristic

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 25000 VOLTS
GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE CURRENT TO PRODUCE 9300° K 27 M.P.C.D. WHITE-LIGHT OUTPUT.
PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN TO PRODUCE 9300° K+27 M.P.C.D. WHITE:
RED GUN: 34%
BLUE GUN: 32%
GREEN GUN: 34%
RASTER SIZE: 19.875" X 15.575" (504.8 mm X 395.6 mm)
*MEASURED WITHIN 5" - DIAMETER AREA CENTERED ON TUBE FACE.

ANODE MICROAMPERES

RCA
RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.
DATA 5
4-67
Typical Drive Characteristics
Grid-Drive Service

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 20000 TO 27500 VOLTS
GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
GRID-No. 2-TO-CATHODE VOLTAGE (EACH GUN) ADJUSTED TO PROVIDE SPOT CUTOFF FOR DESIRED FIXED GRID-No. 1- TO-CATHODE (EACH GUN) VOLTAGE (E<sub>c,1</sub>)
\( E_c = \text{ZERO-BIAS POINT} \)

![Graph showing typical drive characteristics](image-url)

VIDEO SIGNAL VOLTS FROM SPOT CUTOFF PER GUN
ANODE MICROAMPERES PER GUN

DATA 5
RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.
Typical Drive Characteristics
Cathode-Drive Service

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-GRID-No.1 VOLTAGE = 20000 TO 27500 VOLTS
GRID-No. 3-TO-GRID-No.1 VOLTAGE ADJUSTED FOR FOCUS.
GRID-No. 2-TO-GRID-No.1 VOLTAGE (EACH GUN) ADJUSTED TO PROVIDE SPOT CUTOFF FOR DESIRED FIXED CATHODE-TO-GRID-No.1 (EACH GUN) VOLTAGE ($E_{kcl}$)

- ZERO-BIAS POINT

---

**Diagram:**

- Graph showing relationship between Video Signal Volts from Spot Cutoff and Anode Microamperes per Gun.
- Key points:
  - $E_{kcl}$ (for spot cutoff) Volts = 50
  - Voltages marked: 100, 150, 200

---

25XP22

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

DATA 6
4-67
Color Picture Tube

"PERMA-CHROME" ASSEMBLY FOR OPTIMUM FIELD PURITY AND UNIFORMITY DURING WARM-UP

RECTANGULAR TUBE

MAGNETIC CONVERGENCE

3 ELECTROSTATIC-FOCUS GUNS

ALUMINIZED TRICOLOR PHOSPHOR-DOT Hi-Lite SCREEN

(Using 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.) ............. 65%

Faceplate does not have an integral protective window.

MECHANICAL

Tube Dimensions
Overall length ........ 20.732 ± .375 in (526.6 ± 9.5 mm)
Weight (Approx.) .......... 37 lb (16.8 kg)

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 explosion 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

Note: In side view, spherical radius = 34.000 in (876.3 mm).

RCA

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

DATA

4-67
Typical Light-Output Characteristic

HEATER VOLTAGE: 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE: 25000 VOLTS
GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE CURRENT TO PRODUCE 9300° K+27 M.P.C.D. WHITE-LIGHT OUTPUT.
PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN TO PRODUCE 9300° K+27 M.P.C.D. WHITE:
  RED GUN: 34%
  BLUE GUN: 32%
  GREEN GUN: 34%
RASTER SIZE: 19.875" X 15.575" (504.8 mm X 395.6 mm)
*MEASURED WITHIN 5° - DIAMETER AREA CENTERED ON TUBE FACE.

ANODE MICROAMPERES

9300° K+27 M.P.C.D. WHITE-LIGHT* = FOOTLAMBERTS

RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.
HIGH-VACUUM CATHODE-RAY TUBE

Supersedes Type 902

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

Direct Interelectrode Capacitances (Approx.):
- Grid No. 1 to All Other Electrodes: 7.5 μf
- DJ1 to All Other Electrodes: 8.5 μf
- DJ4 to All Other Electrodes: 6.0 μf

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

Focusing Method: Electrostatic Deflection Method: Electrostatic

Overall Length: 7-7/16" ± 3/16"
Greatest Diameter of Bulb: 2" ± 1/16"
Minimum Useful Screen Diameter: 1-3/4"

Mounting Position: Any

Base: Medium Shell Octal 8-Pin

Basing Designation for BOTTOM VIEW: 8CD

Pin 1 - Grid No. 2,
Anode No. 2,
Deflecting Electrode DJ2
Deflecting Electrode DJ3
Pin 2 - Heater, Cathode

Pin 3 - Anode No. 1
Pin 4 - Deflecting Electrode DJ1
Pin 5 - Grid No. 1
Pin 6 - Deflecting Electrode DJ4
Pin 7 - Heater
Pin 8 - No Connection

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

With DJ1 positive with respect to DJ2, the spot is deflected toward pin 3. With DJ3 positive with respect to DJ4, the spot is deflected toward pin 1.

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

The angle between the trace produced by DJ3 and DJ4 and the trace produced by DJ1 and DJ2 is 90° ± 40°.

Maximum Ratings, Absolute Values:
- ANODE-No. 2 & GRID No. 2 VOLTAGE: 660 max. volts
- ANODE-No. 1 VOLTAGE: 330 max. volts
- GRID-No. 1 (CONTROL ELECTRODE) VOLTAGE: Negative Value: 125 max. volts Positive Value: 0 max. volts
- PEAK VOLTAGE BETWEEN ANODE No. 2 AND DEFLECTING ELECTRODE DJ1 OR DJ4: 385 max. volts

JULY 1, 1945

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
HIGH-VACUUM CATHODE-RAY TUBE

Typical Operation:

<table>
<thead>
<tr>
<th>Operation</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode No. 2 &amp; Grid No. 2 Voltage</td>
<td>400  600</td>
</tr>
<tr>
<td>Anode No. 1 Voltage for Focus at 75% of Grid-No. 1 Voltage for Cutoff</td>
<td>100  150</td>
</tr>
<tr>
<td>Grid-No. 1 Volt. for Visual Cutoff</td>
<td>-40 -60</td>
</tr>
<tr>
<td>Max. Anode-No. 1 Current Range Between</td>
<td>-50 +10  µamp.</td>
</tr>
</tbody>
</table>

Deflection Sensitivity:

<table>
<thead>
<tr>
<th>Electrode</th>
<th>Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>DJ1 and DJ2</td>
<td>0.273 0.183 mm/v dc</td>
</tr>
<tr>
<td>DJ3 and DJ4</td>
<td>0.326 0.217 mm/v dc</td>
</tr>
</tbody>
</table>

Deflection Factor:

<table>
<thead>
<tr>
<th>Electrode</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>DJ1 and DJ2</td>
<td>93  139 v dc/in.</td>
</tr>
<tr>
<td>DJ3 and DJ4</td>
<td>78  117 v dc/in.</td>
</tr>
</tbody>
</table>

- 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.

Spot Position:

The undeflected focused spot will fall within a 10-mm square centered at the geometric center of the tube face and having one side parallel to the trace produced by DJ1 and DJ2. Suitable test conditions are: anode-No.2 voltage, 600 volts; anode-No.1 voltage, adjusted for focus; deflecting-electrode resistors, 1 megohm each for DJ1 and DJ4, connected to anode No.2; the tube shielded from all extraneous fields. To avoid damage to the tube, grid-No.1 voltage should be near cutoff before application of anode voltages.

Maximum Circuit Values:

<table>
<thead>
<tr>
<th>Circuit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1-Circuit Resistance</td>
<td>1.5 max. megohms</td>
</tr>
<tr>
<td>Impedance of Any Deflecting-Electrode Circuit at Heater-Supply Frequency</td>
<td>1.0 max. megohm</td>
</tr>
<tr>
<td>Resistance in Any Deflecting- Electrode Circuit</td>
<td>5.0 max. megohms</td>
</tr>
</tbody>
</table>

It is recommended that both deflecting-electrode-circuit resistances be approximately equal.
Projection Kinescope

4486

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)

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)

ANODE MOLDED - ON INSULATED CABLE 48 INCH LONG (APPROX.) TO BULB WALL (ANODE CABLE SHOULD NOT BE SHARPLY BENT WITHIN 3 INCHES OF BULB WALL, ALSO, SEE NOTE 4 UNDER 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 |
| 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 .......................... P3I

Fluorescence and phosphorescence .................. Green

Persistence. ......................... Medium-Short

Faceplate. ......................... Clear Glass

Shape. ....................... Curved, Circular

Minimum Useful Screen Diameter

4490 ................................ 6 in

4491 ................................ 7 in

MECHANICAL

Operating Position ...................... Any

Weight (Approx.) ...................... 3 lb

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

4490 ................................

4491 ................................

Overall Length ...................... 14.62 + 0.25-0.50 16.50 + 0.38 in

Greatest Diameter. .................. 7.12 8.50 in

Bulb .................. J56H1A J67A1A

Terminal Diagram (Bottom View)

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid No.1
Pin 4 - No Connection - Do Not Use
Pin 5 - Grid No.3
Pin 7 - Deflecting Electrode DJ3
Pin 8 - Deflecting Electrode DJ4
Pin 9 - Anode (Grids No.2 & No.4)
Pin 10 - Deflecting Electrode DJ2
Pin 11 - Deflecting Electrode DJ1
Pin 12 - Internal Connection - Do Not Use
Pin 14 - Heater

Cap - Post-Accelerator (Grid No.5 & Collector)
### ABSOLUTE-MAXIMUM AND MINIMUM RATINGS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Maximum/Minimum Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-Deflection Accelerator Voltage</td>
<td>8000 V</td>
</tr>
<tr>
<td>Anode Voltage</td>
<td>4000 V</td>
</tr>
<tr>
<td>Grid-No.3 (Focusing-Electrode) Voltage</td>
<td>2000 V</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>200 max V</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max V</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max V</td>
</tr>
<tr>
<td>Heater Voltage</td>
<td>6.9 max V, 5.7 min V</td>
</tr>
<tr>
<td>Peak Heater-Cathode Voltage</td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode</td>
<td>125 max V</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>125 max V</td>
</tr>
</tbody>
</table>

### TYPICAL OPERATING VALUES

*Unless otherwise specified all values are positive with respect to cathode*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-Deflection Accelerator Voltage</td>
<td>6000 V</td>
</tr>
<tr>
<td>Anode Voltage</td>
<td>3000 V</td>
</tr>
<tr>
<td>Grid-No.3 (Focusing-Electrode) Voltage</td>
<td>750 to 1200 V</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td>-58 to -93 V</td>
</tr>
<tr>
<td>Deflection Factors</td>
<td></td>
</tr>
<tr>
<td>DJ1 and DJ2</td>
<td>133 to 153 V, 107 to 129 V (dc)/in</td>
</tr>
<tr>
<td>DJ3 and DJ4</td>
<td>99 to 115 V, 85 to 101 V (dc)/in</td>
</tr>
</tbody>
</table>

### MAXIMUM CIRCUIT VALUES

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1-Circuit Resistance</td>
<td>1.5 max MΩ</td>
</tr>
<tr>
<td>Resistance in any Deflection Electrode Circuit</td>
<td>5 max MΩ</td>
</tr>
</tbody>
</table>

*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

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

The plane through the tube axis and pin 5 may vary from the trace produced by DJ1 and DJ2 by an angular tolerance (measured about the tube axis) of ±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

C 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 .................................. Pi
- 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 \[ 6.9 \text{ max } \ V \]

Peak Heater-Cathode Voltage
Heater negative with respect to cathode \[ 125 \text{ max } \ V \]
Heater positive with respect to cathode \[ 125 \text{ max } \ V \]

**TYPICAL OPERATING VALUES**

*Unless otherwise specified all values are positive with respect to cathode*

Anode Voltage \[ 2200 \ V \]
Grid-No.3 (Focusing-Electrode) Voltage \[ 750 \text{ to } 1000 \ V \]
Grid-No.1 Voltage \[ -60 \text{ to } -140 \ V \]

For visual cutoff of focused spot

**Deflection Factors**

DJ1 and DJ2 \[ 84 \text{ to } 106 \ V \ (dc)/\text{in} \]
DJ3 and DJ4 \[ 67 \text{ to } 83 \ V \ (dc)/\text{in} \]

**MAXIMUM CIRCUIT VALUES**

Grid-No.1-Circuit Resistance \[ 1.5 \text{ max } \ M\Omega \]
Resistance in any Deflection Electrode Circuit* \[ 5 \text{ max } \ M\Omega \]

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

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 \(10^\circ\). Angle between DJ1 - DJ2 trace and DJ3 - DJ4 trace is \(90^\circ \pm 3^\circ\).

DJ1 and DJ2 are nearer the screen; DJ3 and DJ4 are nearer the base. With DJ1 positive with respect to DJ2, the spot will be deflected toward pin 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 .......................................... <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

RCA Electronic Components
Base ........................................ Small-Shell, Duodecal, 7-Pin
Anode Lead (flying) ................................ 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 \(\mu\)sec

Circuit Requirements
Maximum Grid-No.1 Circuit Resistance .......... 1.0 M\(\Omega\)
Heater Voltage Regulation .......................... See Note f

a The external surface of the faceplate is treated with a multilayer, 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 \(\mu\)A.

e Persistence is defined as the time following cessation of excitation for the light output to decay to 10% of the value observed during excitation. The persistence is measured using a stationary, focused spot. Cathode current during excitation is 1.0 \(\mu\)A.

f Heater voltage must be regulated to within 1.0% to assure optimum tube performance.
SAFETY PRECAUTIONS

X-Radiation Warning
Although X-radiation is generated primarily at the face of the tube when it is operated, the X-rays are emitted in all directions.

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

On the neck of the tube itself the following warning appears and should be strictly adhered to:

X-RAY WARNING
This tube in operation produces X-Rays which can constitute a health hazard unless the tube is adequately shielded for radiation.

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

In the use of the tube it should always be remembered that high voltages may appear at normally low-potential points in the circuit because of capacitor breakdown or incorrect circuit connections, and that the tube surface maintains a static charge for some time after the power has been turned off. Therefore, before any part of the circuit or the tube is touched, the power-supply switch should be
turned off, both terminals of high-voltage capacitors should be grounded, and the terminals of the high-voltage power supply should be grounded.

After these steps have been taken and before touching the tube, discharge the anode terminals, the surface of the 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**

![Terminal Diagram](image)

- 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.

---

**USEABLE SCREEN**

- **6-1/4 MIN.**

**MOLDED ANODE**

- **H.V. CONNECTOR**

- **WITH 24" LEAD**

- **NOTE 2**

---

**BASE B7-51**

- **SMALL SHELL**

- **DUODECAL**

---

**RCA Electronic Components**

**DATA 3**

**7-71**
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 Inter-electrode Capacitances (Approx.)

<table>
<thead>
<tr>
<th>Electrode Combination</th>
<th>Capacitance (pF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid No.1 to all other electrodes</td>
<td>10</td>
</tr>
<tr>
<td>Cathode to all other electrodes</td>
<td>5.5</td>
</tr>
<tr>
<td>DJ1 to DJ2</td>
<td>2.5</td>
</tr>
<tr>
<td>DJ3 to DJ4</td>
<td>3.0</td>
</tr>
<tr>
<td>DJ1 to all other electrodes</td>
<td>10.5</td>
</tr>
<tr>
<td>DJ2 to all other electrodes</td>
<td>8.5</td>
</tr>
<tr>
<td>DJ3 to all other electrodes</td>
<td>8.5</td>
</tr>
<tr>
<td>DJ4 to all other electrodes</td>
<td>9.0</td>
</tr>
</tbody>
</table>

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 ................................................................. JU2 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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-Deflection Accelerator Voltage</td>
<td>6000 max</td>
<td>V</td>
</tr>
<tr>
<td>Anode Voltage</td>
<td>3000 max</td>
<td>V</td>
</tr>
<tr>
<td>Grid-No.3 (Focusing-Electrode) Voltage</td>
<td>1200 max</td>
<td>V</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>200 max</td>
<td>V</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max</td>
<td>V</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max</td>
<td>V</td>
</tr>
<tr>
<td>Heater Voltage</td>
<td>6.9 max</td>
<td>V</td>
</tr>
<tr>
<td>Peak Heater-Cathode Voltage</td>
<td>5.7 min</td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode</td>
<td>125 max</td>
<td>V</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>125 max</td>
<td>V</td>
</tr>
</tbody>
</table>

TYPICAL OPERATING VALUES

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-Deflection Accelerator Voltage</td>
<td>3000</td>
<td>V</td>
</tr>
<tr>
<td>Anode Voltage</td>
<td>1500</td>
<td>V</td>
</tr>
<tr>
<td>Grid-No.3 (Focusing-Electrode) Voltage</td>
<td>475 to 725</td>
<td>V</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td>-40 to -94</td>
<td>V</td>
</tr>
</tbody>
</table>

For visual cutoff of focused spot

Deflection Factors

<table>
<thead>
<tr>
<th>Deflection Factors</th>
<th>Range</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>DJ1 and DJ2</td>
<td>69 to 91</td>
<td>V (dc)/in</td>
</tr>
<tr>
<td>DJ3 and DJ4</td>
<td>57 to 73</td>
<td>V (dc)/in</td>
</tr>
</tbody>
</table>

MAXIMUM CIRCUIT VALUES

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1-Circuit Resistance</td>
<td>1.5 max</td>
<td>MΩ</td>
</tr>
<tr>
<td>Resistance in any Deflection Electrode Circuit</td>
<td>5 max</td>
<td>MΩ</td>
</tr>
</tbody>
</table>

* 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.
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 $10^\circ$. Angle between DJ1 - DJ2 trace and DJ3 - DJ4 trace is $90^\circ \pm 3^\circ$.

DJ1 and DJ2 are nearer the screen; DJ3 and DJ4 are nearer the base. With DJ1 positive with respect to DJ2, the spot will be deflected toward pin 5; likewise, with DJ3 positive with respect to DJ4, the spot will be deflected toward pin 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 (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

RCA Electronic Components
### Maximum Ratings, Absolute Maximum Values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>12000 max. V</td>
</tr>
<tr>
<td>Grid No.4 Voltage</td>
<td>450 max. V</td>
</tr>
<tr>
<td>Grid No.2 Voltage</td>
<td>450 max. V</td>
</tr>
<tr>
<td>Grid No.1 Voltage:</td>
<td></td>
</tr>
<tr>
<td>- Negative bias value</td>
<td>100 max. V</td>
</tr>
<tr>
<td>- Positive bias value</td>
<td>0 max. V</td>
</tr>
<tr>
<td>- Positive peak value</td>
<td>2 max. V</td>
</tr>
<tr>
<td>Peak Heater Cathode Voltage</td>
<td>125 max. V</td>
</tr>
</tbody>
</table>

### Typical Operating Values

All values are specified with respect to cathode.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>8500 V</td>
</tr>
<tr>
<td>Grid No.4 Voltage</td>
<td>40 to 250 V</td>
</tr>
<tr>
<td>Grid No.2 Voltage</td>
<td>250 V</td>
</tr>
<tr>
<td>Grid No.1 Voltage</td>
<td>-25 to -50 V</td>
</tr>
<tr>
<td>Anode Current</td>
<td>100 µA</td>
</tr>
<tr>
<td>Grid No.3 Current</td>
<td>10 µA</td>
</tr>
<tr>
<td>Grid No.2 Current</td>
<td>1.0 µA</td>
</tr>
<tr>
<td>Grid No.1 Drive Voltage</td>
<td>25 V</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.014 in</td>
</tr>
</tbody>
</table>

- For optimum life the heater voltage should be regulated at 6.3 volts.
- A description of the Absolute-Maximum Rating is given in the General Section, titled Rating Systems for Electron Tubes.
- Adjust for best focus.
- Adjust for visual cutoff of undeflected spot.
- 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.
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

<table>
<thead>
<tr>
<th>Tabulated Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 9.812 Max.</td>
</tr>
<tr>
<td>B 9.060 ± .060</td>
</tr>
<tr>
<td>C 0.870 ± .030</td>
</tr>
<tr>
<td>D 4.950 ± .062</td>
</tr>
<tr>
<td>E 5.218 ± .125</td>
</tr>
<tr>
<td>F 1.000 Ref.</td>
</tr>
<tr>
<td>G 1.000 Ref.</td>
</tr>
<tr>
<td>H 4.500 Min.</td>
</tr>
<tr>
<td>J 6.250 Ref.</td>
</tr>
</tbody>
</table>
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 A
Cathode, Semitransparent .......... Potassium-Cesium-Antimony (Bialkali)

Type 4516
- Minimum projected area .......... 0.2 in² (1.26 cm²)
- Minimum diameter .......... 0.5 in (1.27 cm)

Type 4517
- Minimum projected area .......... 1.2 in² (7.8 cm²)
- 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 ................................ Ebyb No.9058, or equivalent
Magnetic Shield ....................... Millen® 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 Currente .................. 0.5 max. mA
Ambient-Temperature Rangef ............. -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)

<table>
<thead>
<tr>
<th>Anode Sensitivity:</th>
<th>Min.</th>
<th>Typical</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiant at 4000 angstroms</td>
<td>—</td>
<td>5.6x10⁴</td>
<td>—</td>
</tr>
<tr>
<td>Luminous (2870°K)</td>
<td>Type 4516</td>
<td>47</td>
<td>170</td>
</tr>
<tr>
<td>Type 4517</td>
<td>47</td>
<td>150</td>
<td></td>
</tr>
</tbody>
</table>

RCA Electronic Components
### CHARACTERISTICS RANGE VALUES (Cont'd)

<table>
<thead>
<tr>
<th>Type 4516</th>
<th>Min.</th>
<th>Typical</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current with blue light source (2870°C + C.S. No.5-58)</td>
<td>1.5x10⁻⁶</td>
<td>7x10⁻⁶</td>
<td>2.6x10⁻⁵ A</td>
</tr>
<tr>
<td>Type 4517</td>
<td>1.5x10⁻⁵</td>
<td>7x10⁻⁶</td>
<td>2.2x10⁻⁴ A</td>
</tr>
</tbody>
</table>

**Cathode Sensitivity:**

**Type 4516**
- Radiant at 4000 angstroms: 0.071 A/W
- Luminous (2870°C) 5.3x10⁻⁵ 6x10⁻⁵ A/Im
- Current with blue light source (2870°C K + C.S. No.5-58): 8x10⁻⁹ 9x10⁻⁹ A
- Quantum Efficiency at 4000 angstroms: 22 %

**Type 4517**
- Radiant at 4000 angstroms: 0.079 A/W
- Luminous (2870°C): 6.7x10⁻⁵ A/Im
- Current with blue light source (2870°C K + C.S. No.5-58): 8x10⁻¹⁰ 1x10⁻⁹ A
- Quantum Efficiency at 4000 angstroms: 24 %

**Equivalent Dark Current Input**
- 2.9x10⁻¹¹ pA 8.6x10⁻¹¹ pA lm
- 2.4x10⁻¹⁴ q 7.2x10⁻¹⁴ q W
- 4.1x10⁻¹³   18 W
- 3.5x10⁻¹⁶ s 18 W

**Dark Pulse Summation:**
- 1 to 32 photoelectrons
- Pulse Height Resolution:
- Anode-Pulse Rise Time at 1800 V: 1.7x10⁻⁹ s
- Electron Transit Time at 1800 V: 1.8x10⁻⁸ s

→ Indicates a change or addition.
CHARACTERISTIC RANGE VALUES (Cont’d)

Type 4517

Current Amplification
Anode Dark Current at 
7 A/ImP

Equivalent Anode Dark Current Input at 
7 A/Im.

Equivalent Noise Input

Dark Pulse Summation:
1 to 32 photoelectrons

(See Typical Dark-Pulse Spectrum)

Pulse Height Resolution

Anode-Pulse Rise Time

Electron Transit Time

Typical Potential Distribution

<table>
<thead>
<tr>
<th>Between:</th>
<th>Type 4516 Voltage (E)</th>
<th>Type 4517 Voltage (E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cathode and Dynode No.1</td>
<td>1.2</td>
<td>1.7</td>
</tr>
<tr>
<td>Dynode No.1 and Dynode No.2</td>
<td>1.2</td>
<td>1.3</td>
</tr>
<tr>
<td>Dynode No.2 and Dynode No.3</td>
<td>1.7</td>
<td>1.3</td>
</tr>
<tr>
<td>Dynode No.3 and Dynode No.4</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Dynode No.4 and Dynode No.5</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Dynode No.5 and Dynode No.6</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Dynode No.6 and Dynode No.7</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Dynode No.7 and Dynode No.8</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Dynode No.8 and Dynode No.9</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Dynode No.9 and Dynode No.10</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Dynode No.10 and Anode</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Anode and Cathode</td>
<td>12.1</td>
<td>12.3</td>
</tr>
</tbody>
</table>

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:

\[
\text{Luminous Sensitivity (A/Im)} = \frac{\text{Anode Current (with blue light source) (A)}}{0.15 \times \text{Light Flux of } 1 \times 10^{-5} \text{ (Im)}}
\]

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 \(1 \times 10^{-5}\) 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:

\[
\text{Cathode Luminous Sensitivity (A/Im)} = \frac{\text{Cathode Current (with blue light source) (A)}}{0.16 \times \text{Light Flux of } 1 \times 10^{-4}}
\]

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 \(1 \times 10^{-4}\) lumen and 200 volts are applied between cathode and all other electrodes connected as anode.
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.

At 4000 angstroms. These values are calculated from the EADCI values in lumens using a conversion factor of 1190 lumens per watt.

Under the following conditions: External shield connected to cathode, an equivalent bandwidth of 1 Hz, tungsten light source at a color temperature of 28700 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.

At 4000 angstroms. This value is calculated from the ENI value in lumens using a conversion factor of 1190 lumens per watt.

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.

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 [Nal (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).
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.

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.

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

<table>
<thead>
<tr>
<th>Lead</th>
<th>Dynode No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dynode No.1</td>
</tr>
<tr>
<td>2</td>
<td>Dynode No.3</td>
</tr>
<tr>
<td>3</td>
<td>Dynode No.5</td>
</tr>
<tr>
<td>4</td>
<td>Dynode No.7</td>
</tr>
<tr>
<td>5</td>
<td>Dynode No.9</td>
</tr>
<tr>
<td>6</td>
<td>Anode</td>
</tr>
<tr>
<td>7</td>
<td>Dynode No.10</td>
</tr>
<tr>
<td>8</td>
<td>Dynode No.8</td>
</tr>
<tr>
<td>9</td>
<td>Dynode No.6</td>
</tr>
<tr>
<td>10</td>
<td>Dynode No.4</td>
</tr>
<tr>
<td>11</td>
<td>Dynode No.2</td>
</tr>
<tr>
<td>12</td>
<td>Photocathode</td>
</tr>
</tbody>
</table>
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)

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Inches</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3.94 max.</td>
<td>100.0 max.</td>
</tr>
<tr>
<td>B</td>
<td>3.50 + .06</td>
<td>88.9 + 1.5</td>
</tr>
<tr>
<td></td>
<td>3.50 − .12</td>
<td>88.9 − 3</td>
</tr>
<tr>
<td>C</td>
<td>.5 min. dia.</td>
<td>12.7 min. dia.</td>
</tr>
<tr>
<td>D</td>
<td>.78 max. dia.</td>
<td>19.8 max. dia.</td>
</tr>
<tr>
<td>E</td>
<td>.755 max. dia.</td>
<td>19.18 max. dia.</td>
</tr>
<tr>
<td>F</td>
<td>.38 max.</td>
<td>9.7 max.</td>
</tr>
<tr>
<td>G</td>
<td>.47 ± .01 dia.</td>
<td>11.9 ± .25 dia.</td>
</tr>
<tr>
<td>H</td>
<td>.75 min.</td>
<td>19.0 min.</td>
</tr>
<tr>
<td>P</td>
<td>.30 max.</td>
<td>7.6 max.</td>
</tr>
<tr>
<td>R</td>
<td>1.0 max.</td>
<td>25 max.</td>
</tr>
<tr>
<td>S</td>
<td>.17 max.</td>
<td>4.3 max.</td>
</tr>
</tbody>
</table>

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.
PHOTOCATHODE DIAMETER
1.24 MIN.
(SEE NOTE)

DIMENSIONAL OUTLINE (4517)

Dimensions in inches

Note: Deviation from flatness will not exceed 0.010" from peak to valley.

Faceplate 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)

C1: 0.05 µF, 500 volts
C2: 0.02 µF, 500 volts
C3: 0.01 µF, 500 volts
C4: 0.005 µF, 500 volts
C5 and C6: 0.005 µF, 3000V
R1 and R2: 560,000 ohms, 1/2 watt
R3: 820,000 ohms, 1/2 watt
R4 through R11: 470,000 ohms, 1/2 watt
R12: 1 megohm, 1/2 watt
R13: 100,000 ohms, 1/2 watt

Note 1: Adjustable between approximately 500 and 1800 V dc.
Note 2: Capacitors C1 through C6 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, RL and CL, depend on the application:
\[ R_L C_L = 10 \text{ milliseconds for most applications} \]
TYPICAL VOLTAGE-DIVIDER ARRANGEMENT WHICH PERMITS DIRECT COUPLING TO THE ANODE (4516, 4517)

R₁ and R₂: 560,000 ohms, 1/2 watt
R₃: 820,000 ohms, 1/2 watt
R₄ through R₁₁: 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 PHOTOCATHODE SPECTRAL RESPONSE CHARACTERISTICS (4517)

RELATIVE SENSITIVITY

ABSOLUTE SENSITIVITY

QUANTUM EFFICIENCY

WAVELENGTH-ANGSTROMS

RCA Electronic Components

DATA 8 11-70
TYPICAL TIME-RESOLUTION CHARACTERISTICS

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 SUCCESSING DYNODE STAGE, AND 1/12 OF E BETWEEN DYNODE No.10 AND ANODE. THE PHOTOCATHODE IS FULLY ILLUMINATED.

SUPPLY VOLTS (E) BETWEEN ANODE AND CATHODE

TYPE 4517

SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER PROVIDING 1/6 OF E BETWEEN CATHODE AND DYNODE No.1; 1/12 OF E FOR EACH SUCCESSING DYNODE STAGE, AND 1/12 OF E BETWEEN DYNODE No.10 AND ANODE. THE PHOTOCATHODE IS FULLY ILLUMINATED.

SUPPLY VOLTS (E) BETWEEN ANODE AND CATHODE

RCA Electronic Components

DATA 8
**SENSITIVITY AND CURRENT AMPLIFICATION CHARACTERISTICS**

**TYPE 4516**

The supply voltage \( E \) is across a voltage divider which provides voltages as follows:

<table>
<thead>
<tr>
<th></th>
<th>( 0.25% ) of ( E ) multiplied by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cathode and Dynode No. 1</td>
<td>1.2</td>
</tr>
<tr>
<td>Dynode No. 1 and Dynode No. 2</td>
<td>1.2</td>
</tr>
<tr>
<td>Dynode No. 2 and Dynode No. 3</td>
<td>1.7</td>
</tr>
<tr>
<td>Each succeeding Dynode stage</td>
<td>1.0</td>
</tr>
<tr>
<td>Anode and Cathode</td>
<td>12.1</td>
</tr>
</tbody>
</table>

![Graph showing Sensitivity and Current Amplification Characteristics](image-url)
TYPICAL SENSITIVITY AND CURRENT AMPLIFICATION CHARACTERISTICS

TYPE 4517

THE SUPPLY VOLTAGE (E) IS ACROSS A VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS.

<table>
<thead>
<tr>
<th>BETWEEN:</th>
<th>8.13% OF (E) MULTIPLIED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>CATHODE AND DYNODE No. 1</td>
<td>1.7</td>
</tr>
<tr>
<td>DYNODE No. 1 AND DYNODE No. 2</td>
<td>1.3</td>
</tr>
<tr>
<td>DYNODE No. 2 AND DYNODE No. 3</td>
<td>1.3</td>
</tr>
<tr>
<td>EACH SUCCEEDING DYNODE-STAGE</td>
<td>1.0</td>
</tr>
<tr>
<td>ANODE AND CATHODE</td>
<td>12.3</td>
</tr>
</tbody>
</table>

SENSITIVITY — AMPERES/LUMEN (COLOR TEMPERATURE 2870°K.)

CURRENT AMPLIFICATION

SUPPLY VOLTAGE (E) — VOLTS

Electronic Components

DATA 9
SPECTRAL ENERGY DISTRIBUTION OF 2870°K LIGHT SOURCE AFTER PASSING THROUGH INDICATED FILTER

SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870°K SOURCE AFTER PASSING THROUGH BLUE FILTER (CORNING C.S. No.5-58 POLISHED TO 1/2 STOCK THICKNESS). MAXIMUM FILTER TRANSMISSION OCCURS AT 4300 ANGSTROMS AND IS 60 PER CENT.

- RELATIVE ENERGY DISTRIBUTION
- WAVELENGTH—ANGSTROMS

MAXIMUM TRANSMISSION AT 4300 ANGSTROMS AND 60 PER CENT.
# 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:

<table>
<thead>
<tr>
<th>BETWEEN</th>
<th>8.25% OF E MULTIPLIED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>CATHODE AND DYNODE No. 1</td>
<td>1.2</td>
</tr>
<tr>
<td>DYNODE No. 1 AND DYNODE No. 2</td>
<td>1.2</td>
</tr>
<tr>
<td>DYNODE No. 2 AND DYNODE No. 3</td>
<td>1.7</td>
</tr>
<tr>
<td>EACH SUCCEEDING DYNODE-STAGE</td>
<td>1.0</td>
</tr>
<tr>
<td>ANODE AND CATHODE</td>
<td>12.1</td>
</tr>
</tbody>
</table>

TUBE TEMPERATURE IS 22°C.

**Figure:**
- **Anode Dark Current - Lumen**: \(10^{-8} \text{ to } 10^{-4}\) Lumen
- **Equivalent Anode-Dark-Current Input - Ampere**: \(10^{-1} \text{ to } 10^{1}\) Ampere

**Graphs:**
- Luminous Sensitivity - Amperes/Lumen
- Equivalent Anode-Dark-Current Input at 1000 Angstroms - Watt

**Table:**
- Supply Volts (E) Between Anode and Cathode

---

Electronic Components

DATA 10
## Type 4517

Luminous sensitivity is varied by adjustment of the supply voltage \((E)\) across a voltage divider which provides voltages as follows:

<table>
<thead>
<tr>
<th>Between</th>
<th>(8.13% \text{ of } E) Multiplied By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cathode and Dynode No. 1</td>
<td>1.7</td>
</tr>
<tr>
<td>Dynode No. 1 and Dynode No. 2</td>
<td>1.3</td>
</tr>
<tr>
<td>Dynode No. 2 and Dynode No. 3</td>
<td>1.3</td>
</tr>
<tr>
<td>Each succeeding dynode stage</td>
<td>1.0</td>
</tr>
<tr>
<td>Anode and Cathode</td>
<td>12.3</td>
</tr>
</tbody>
</table>

### Tube Temperature = 22°C

[Graph showing luminous sensitivity and equivalent anode dark current at 4000 angstroms.]
Typical Anode Characteristics

Type 4517

4516, 4517
TYPICAL DARK-PULSE SPECTRUM

<table>
<thead>
<tr>
<th>4516</th>
<th>4517</th>
</tr>
</thead>
<tbody>
<tr>
<td>CATHODE-TO-DYNOE No.1 VOLTS</td>
<td>149</td>
</tr>
<tr>
<td>DYNODE No.1- TO- DYNODE No. 2 VOLTS</td>
<td>149</td>
</tr>
<tr>
<td>DYNODE No.2- TO- DYNODE No. 3 VOLTS</td>
<td>210</td>
</tr>
<tr>
<td>EACH SUCCEEDING DYNODE- STAGE VOLTS</td>
<td>124</td>
</tr>
<tr>
<td>ANODE- TO- CATHODE VOLTS</td>
<td>1500</td>
</tr>
</tbody>
</table>

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 = 30μ SEC (R_L = 300 Ω C = 100 pF).

\[ \sum \approx 1.5 \times 10^4 \text{ cpm} \]

\[ \sum \approx 2 \times 10^3 \text{ cpm} \]

PHOTOELECTRON COUNTS PER MINUTE PER CHANNEL

PHOTOELECTRON EQUIVALENTS
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.

---

### Relative Anode Current — Per Cent

#### Graph 1

- \( E = 600 \text{ V} \)
- \( E = 500 \text{ V} \)

#### Graph 2

- \( E = 500 \text{ V} \)
- \( E = 600 \text{ V} \)

---

RCA Electronic Components
TYPICAL EFFECT OF INDICATED MAGNETIC FIELD ON ANODE CURRENT

TYPE 4516 (Cont'd)

![Graph showing typical effect of indicated magnetic field on anode current for Type 4516.](image)

MAGNETIC FIELD INTENSITY—OERSTEDS

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:

![Diagram showing tube orientation in magnetic field.](image)

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.)

E = 600 Volts
E = 1500 Volts
E = 1900 Volts
Display-Storage Tube

- Single Writing Gun
- Single Viewing Gun
- High Display Uniformity

**ELECTRICAL**

<table>
<thead>
<tr>
<th>Writing Section</th>
<th>Viewing Section</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater: For Unipotential Cathode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage (AC or DC)</td>
<td>6.3 ± 10%</td>
<td>6.3 ± 10%</td>
</tr>
<tr>
<td>Current at 6.3 V</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Warmup Time</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

- 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) | 11.59 | in |
- Maximum Seated Length (Excluding Ring) | 11.25 | in |
- Maximum Diameter (Silastic Padding Ring) | 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 LGHc No.832692 or equiv.

- Operating Position: Any
- Weight (Approx.): 20 lb

4547

Electronic Components

RCA 2-71
### MAXIMUM RATINGS

Absolute-Maximum Ratings — All voltages are shown with respect to the cathode of the viewing gun unless otherwise specified.

<table>
<thead>
<tr>
<th>Voltage Type</th>
<th>Min.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Screen Voltage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak</td>
<td>0</td>
<td>10,000</td>
<td>V</td>
</tr>
<tr>
<td>DC</td>
<td>0</td>
<td>9,000</td>
<td>V</td>
</tr>
<tr>
<td><strong>Backplate Voltage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak</td>
<td>0</td>
<td>15</td>
<td>V</td>
</tr>
<tr>
<td>DC</td>
<td>-30</td>
<td>10</td>
<td>V</td>
</tr>
<tr>
<td><strong>Viewing Section Voltages</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector (Grid No.5)</td>
<td>180</td>
<td>300</td>
<td>V</td>
</tr>
<tr>
<td>Collimator (Grid No.4)</td>
<td>40</td>
<td>150</td>
<td>V</td>
</tr>
<tr>
<td>Grid No.3f</td>
<td>10</td>
<td>150</td>
<td>V</td>
</tr>
<tr>
<td>Grid No.2</td>
<td>150</td>
<td>150</td>
<td>V</td>
</tr>
<tr>
<td>Grid No.1</td>
<td>-100</td>
<td>0</td>
<td>V</td>
</tr>
<tr>
<td>Heater</td>
<td>-125</td>
<td>125</td>
<td>V</td>
</tr>
<tr>
<td><strong>Writing Section</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grid No.4f</td>
<td>10</td>
<td>150</td>
<td>V</td>
</tr>
<tr>
<td>Grid No.3f</td>
<td>0</td>
<td>1200</td>
<td>V</td>
</tr>
<tr>
<td>Grid No.2f</td>
<td>10</td>
<td>150</td>
<td>V</td>
</tr>
<tr>
<td>Grid No.1f</td>
<td>-200</td>
<td>-200</td>
<td>V</td>
</tr>
<tr>
<td>Cathode</td>
<td>-2750</td>
<td>145</td>
<td>V</td>
</tr>
<tr>
<td>Heater</td>
<td>-125</td>
<td>125</td>
<td>V</td>
</tr>
<tr>
<td><strong>Screen Resistor</strong></td>
<td>1.0</td>
<td></td>
<td>MΩ</td>
</tr>
<tr>
<td>Collector Resistor</td>
<td>5,000</td>
<td></td>
<td>Ω</td>
</tr>
</tbody>
</table>

### RECOMMENDED OPERATING VALUES

All voltages are shown with respect to the cathode of the viewing gun.

<table>
<thead>
<tr>
<th>Voltage Type</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Screen Voltage</strong></td>
<td>8500</td>
<td>V</td>
</tr>
<tr>
<td><strong>Backplate Voltage</strong></td>
<td>0</td>
<td>V</td>
</tr>
<tr>
<td><strong>Viewing Section Voltages</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector (Grid No.5)</td>
<td>200</td>
<td>V</td>
</tr>
<tr>
<td>Collimator (Grid No.4)</td>
<td>60 to 110</td>
<td>V</td>
</tr>
<tr>
<td>Grid No.3f</td>
<td>10 to 60</td>
<td>V</td>
</tr>
<tr>
<td>Grid No.2f</td>
<td>110</td>
<td>V</td>
</tr>
<tr>
<td>Grid No.1f</td>
<td>-40 to 0</td>
<td>V</td>
</tr>
</tbody>
</table>
RECOMMENDED OPERATING VALUES (Cont'd)

Writing Section Voltages

<table>
<thead>
<tr>
<th>Part</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid No.3k</td>
<td>-2075</td>
<td>1575</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grid No.1</td>
<td>-2500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cathode</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screen Resistor</td>
<td></td>
<td></td>
<td>1.0</td>
<td>MΩ</td>
</tr>
<tr>
<td>Collector Resistor</td>
<td></td>
<td></td>
<td>10,000</td>
<td>Ω</td>
</tr>
</tbody>
</table>

PERFORMANCE DATA AND CHARACTERISTICS

<table>
<thead>
<tr>
<th>Part</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Useful Viewing Diameter</td>
<td>4.0</td>
<td></td>
<td></td>
<td>in</td>
</tr>
<tr>
<td>Luminance (Brightness)P</td>
<td>700</td>
<td>1300</td>
<td></td>
<td>fL</td>
</tr>
<tr>
<td>Viewing Durationf</td>
<td></td>
<td>10</td>
<td></td>
<td>s</td>
</tr>
<tr>
<td>Undeflected Spot Position</td>
<td></td>
<td></td>
<td></td>
<td>Note s</td>
</tr>
<tr>
<td>Screen CurrentP</td>
<td>300</td>
<td>750</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>Viewing Gun Collector Current†</td>
<td>1.0</td>
<td>2.4</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Viewing Gun Cathode CurrentU</td>
<td>2.5</td>
<td>4.0</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Writing Gun Cathode CurrentV</td>
<td>2.5</td>
<td>5.0</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>ResolutionW</td>
<td>400</td>
<td></td>
<td></td>
<td>lines</td>
</tr>
<tr>
<td>Erase TimeX</td>
<td>1.5</td>
<td>2.5</td>
<td>3.5</td>
<td>ms</td>
</tr>
</tbody>
</table>

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.

d Grids No.4 and No.2 of Writing Gun and grid No.3 of Viewing Gun are connected within the tube.

e Voltages are shown with respect to cathode of Writing Gun.

f The writing-gun grid No.1 should never be more positive than necessary to write the display to saturated brightness for a given scanning and drive condition. In no case should the writing-gun 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.
The maximum bias-voltage value for writing-beam cutoff is -130 volts with respect to writing-gun cathode.

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.

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.

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.

With writing gun turned off, with no erasing pulse applied, and display erased to cutoff.

Measured with viewing-gun grid No.1 at zero volts and with all other electrodes at voltages shown under Recommended Operating Values.

Measured with writing-gun grid No.1 at zero volts while writing an overscanned TV-type raster.

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 undesirable picture retention. Minor readjustment 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.

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 writing gun neck.

The writing beam may be deflected by two stationary pairs of coils. One pair is used for horizontal deflection, and the other pair for vertical deflection. When these coils are used, centering the undeflected writing beam can be accomplished by passing direct current of the required value through each pair of deflecting coils.

To avoid neck shadow, when the stationary coils are used, it is essential that the center of deflection should be located not more than 0.8 inch from the reference line as shown below. The writing beam must be deflected from its undeflected position, through a typical angle of 34° to sweep fully the storage surface.

LOCATION OF CENTER OF DEFORMATION
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)

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

SOLID-LINE CIRCLES DEPICT MINIATURE 7-PIN BASE
BROKEN-LINE CIRCLES DEPICT NEODITETRAR 8-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)

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 Neoditetrar 8-Pin Base
SMALL BUTTON MINIATURE 7-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 (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 NEO DITETRAR 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”.

X-RADIATION WARNING: Shielding of this cathode-ray tube for x-radiation may be needed to protect against possible danger of personal injury from prolonged exposure at close range.

For further information or application assistance on this device, contact your RCA Field Representative or write, Display Tube Marketing, RCA, Lancaster, PA. 17604
Display Cathode-Ray Tube

12"-Rectangular 70° Magnetic Deflection
Display Cathode-Ray Tube Having Integral
Protective Window and P4 Phosphor Screen

**ELECTRICAL**

Heater Current at 6.3 volts .................. 0.6 A
Focus Method .................................. Electrostatic
Deflection Method .............................. Magnetic

Direct Interelectrode Capacitances (Typical):
- Grid No.1 to all other electrodes ....... 6 pF
- Cathode to all other electrodes ........ 5 pF
- External conductive coating to anode ........................ {1300 max. pF
  700 min. pF

**OPTICAL**

Faceplate, Spherical ........................... Filterglass
Light transmission at center (Approx.) ........ 37%

Phosphor .................................. P4-Sulfide Type, Aluminized

Tube Dimensions:
- Overall length ........................... 16.60 max. in
- Neck length ................................. 7.56 ± 0.25 in
- Greatest width ............................. 10.94 ± 0.12 in
- Greatest height ............................ 8.56 ± 0.12 in

Bulb ......................................... See Dimensional Outline
Anode Cap .................................. Recessed Small Cavity Cap
  (JEDEC No.J1-21)
Base ........................................ Small-Shell Duodecal,
  Arrangement 1,
  6-Pin (JEDEC No.B6-63)

Operating Position .......................... Any
Weight (Approx.) .............................. 9-1/2 lb

MAXIMUM AND MINIMUM RATINGS, Absolute-Maximum Values
Unless otherwise specified, values are positive with respect
to cathode.
Anode Voltage ............................... 16,000 max. V
Grid-No.3 (Focusing-Electrode) Voltage .... 2700 max. V
Grid-No.2 Voltage .......................... 400 max. V

Grid-No.1 Voltage:
- Negative bias value ...................... 80 max. V
- Positive bias value ...................... 0 max. V
Positive peak value ................. 2 max. V

Peak Heater-Cathode Voltage:

Heater negative with respect to cathode ... 180 max. V
Heater positive with respect to cathode ... 180 max. V

Heater Voltage (ac or dc):

Under operating conditionsb ............... \{ 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 Luminancec .......................... See accompanying Typical Trace Luminance Characteristic

Typical Center Line Widthd ....................... 0.010 in

Spot Position ........................................ See footnote o

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.

o 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 (Tap 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)

ANODE TO CATHODE VOLTAGE = 12000 VOLTS
ANODE CURRENT = 100 MICROAMPERES
REFRESH RATE = 60 Hz
SPOT SIZE = 0.010 INCH

--

Electronic Components
DATA 3 2-69
CUTOFF DESIGN CHART

HEATER VOLTAGE = 6.3 VOLTS
ANODE TO CATHODE VOLTAGE = 12000 VOLTS
GRID No. 3 TO CATHODE VOLTAGE ADJUSTED FOR FOCUS

GRID No. 1 TO CATHODE VOLTS
GRID No. 2 TO CATHODE VOLTS
GRID No. 3 TO CATHODE VOLTS

0 10 20 30 40 50 60 70 80

-10 -20 -30 -40 -50 -60 -70 -80

100 200 300 400
Monoscopes

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-Shank, 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

[^b]: Cinch®
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 Conditionsd 6.9 max. V
                            5.7 min. V

RECOMMENDED OPERATING VALUESd

Unless otherwise specified, values are positive with respect to output signal electrode.

Output Signal Electrode Voltage ........ Ground
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 Voltagef (Astigmatism) . 0 to +70 V
Grid-No. 3 (Focusing Electrode) Voltage ....................... -1600 to -1500 V
Grid-No. 1 Voltage ........................................... -1865 to -1800 V
Cathode Voltage ............................................... -1800 V
Heater Voltage .............................................. 6.3 V

**TYPICAL PERFORMANCE CHARACTERISTICS AT RECOMMENDED OPERATING VALUES**

<table>
<thead>
<tr>
<th></th>
<th>Min.</th>
<th>Typical</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Signal Current</td>
<td>5 μA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trace Angle:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertical</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Between Vertical and Horizontal Traces</td>
<td>89</td>
<td>90</td>
<td>91 degrees</td>
</tr>
<tr>
<td>Deflection Factors:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertical (DJ1 and DJ2)</td>
<td>46</td>
<td>60 V/in</td>
<td></td>
</tr>
<tr>
<td>Horizontal (DJ3 and DJ4)</td>
<td>46</td>
<td>60 V/in</td>
<td></td>
</tr>
<tr>
<td>Undeflected Spot Position</td>
<td>-</td>
<td>0.15 in</td>
<td></td>
</tr>
</tbody>
</table>

- A specific tube designation in the 4560 series will be assigned to each type employing a different stencil pattern.
- Made by Cinch Manufacturing Company, 1501 Morse Avenue, Elk Grove Village, IL 60007.
- For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts.
- 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.
- The output signal electrode is grounded through a 1000-ohm load resistor.
- Adjust for minimum astigmatism.
- Adjust as required.
- One side of heater terminal (Pin No. 1) is connected to -1800 V dc.
For cathode current not exceeding 110 microamperes.

Useful area of stencil electrode is 1.1" x 1.1".

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**

```
\& % $ # " : / \_ . - \_ , + * ( 7 6 5 4 3 2 1 0
? > = < ; : 9 8
G F E D C B A @
O N M L K J I H
W V U T S R Q P
J \_ ] \< [ Z Y X
```

**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.
Pin No.1: Heater
Pin No.2: Grid No.1
Pin No.3: Cathode
Pin No.4: No connection
Pin No.5: Grid No.3
Pin No.7: Deflecting Electrode DJ3
Pin No.8: Deflecting Electrode DJ4
Pin No.9: Grid No.4 and Grid No.2
Pin No.10: Deflecting Electrode DJ2
Pin No.11: No connection
Pin No.12: Deflection Electrode DJ1
Pin No.14: Heater
Terminals –
   Nearest Base: Stencil Electrode
   Furthest from Base: Output Signal Electrode

**Note 1:** The plane passing through the tube axis and the key of the base does not deviate more than $\pm 10^\circ$ from the plane passing through the tube axis and the output signal electrode terminal cap.

**Note 2:** The plane passing through the tube axis and Pin No.4 of the base does not deviate more than $\pm 10^\circ$ from the plane passing through the tube axis and the stencil electrode cap.
DIMENSIONAL OUTLINE

STENCIL ELECTRODE TERMINAL
JEDEC No. J1-25
(NOTE 1)

OUTPUT SIGNAL ELECTRODE TERMINAL
JEDEC No. J1-25
(NOTE 2)

BASE
JEDEC No. B12-37

Electronic Components

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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

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Inches</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>11.312 ± .188</td>
<td>287.32 ± 4.77</td>
</tr>
<tr>
<td>C</td>
<td>2.050 ± .050 Dia.</td>
<td>52.07 ± 1.27 Dia.</td>
</tr>
<tr>
<td>J</td>
<td>.500 ± .062</td>
<td>12.70 ± 1.57</td>
</tr>
<tr>
<td>K</td>
<td>1.750 ± .125</td>
<td>44.45 ± 3.17</td>
</tr>
<tr>
<td>M</td>
<td>.185 max.</td>
<td>4.69 max.</td>
</tr>
</tbody>
</table>
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: 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: \(19-1/2 \pm 5/8\) in
- Greatest diameter of bulb (excluding side cap or cable): \(7 \pm 3/16\) 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**

**Average Anode Power:**
- With forced-air cooling of faceplate: \(160\) max. W
- Air Flow to Face: \(40\) 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):** \(6.93\) max. V, \(6.27\) min. V

**Recommended Operating Values**
- Raster Size: \(5" \times 3-3/4"\)
- Anode Voltage: \(75\) kV
- Anode Current, Long-Term Average: \(1000\) \(\mu\)A
- Grid-No.3 Voltage for Focus at an Anode Current of \(1000\) \(\mu\)A: 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

Luminous Output of each Tube at an Anode Current of 1000 μA for each tube
Blue  Green  Red
88  1400  520  lumens

Luminance of Each Tube at an Anode Current of 1000 μA for Each Tube
600  10800  4000  fL

Luminance of Three Tubes Combined at an Anode Current of 100 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
Blue  Green  Red
8  70  22  %

Percentage of Total Anode Current Supplied by Each Tube (Approx.)
50  27  23  %

Center Resolution 600 TV Lines

Grid-No.3 Current (Total)
±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

* 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.
A description of the Absolute Maximum Rating is given in the General Section, titled Rating Systems for Electron Tubes.

The product of anode-to-cathode voltage and anode current (long term average) should never exceed 160 watts.

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.

For maximum cathode life, it is recommended that the heater supply be regulated at 6.6 volts.

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.

Determined for a 3-3/4 inch high TV resolution test pattern with tube operating at a screen current of 1000 microamperes.

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.
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**

![Cutoff Design Chart](image_url)
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.
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.

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.
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 Alignmentb ............................. 0.5 degrees
Undeflected Spot Position, Each Gunc ............ 5% of target diameter
Direct Interelectrode Capacitances:

<table>
<thead>
<tr>
<th></th>
<th>Typ.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output-signal-electrode to all other electrodesd</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td>Reading-gun grid No.1 to all other electrodes</td>
<td>—</td>
<td>15</td>
</tr>
<tr>
<td>Reading-gun cathode to all other electrodes</td>
<td>—</td>
<td>9</td>
</tr>
<tr>
<td>Writing-gun grid No.1 to all other electrodes</td>
<td>—</td>
<td>15</td>
</tr>
<tr>
<td>Writing-gun cathode to all other electrodes</td>
<td>—</td>
<td>9</td>
</tr>
</tbody>
</table>

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.

#### Writing Gun:

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater voltage (AC or DC)</td>
<td>5.7 V</td>
<td>6.9 V</td>
</tr>
<tr>
<td>Cathode voltage</td>
<td>-9000 V</td>
<td>- V</td>
</tr>
<tr>
<td>Heater-cathode voltage</td>
<td>-125 V</td>
<td>10 V</td>
</tr>
<tr>
<td>Grid-No.1 (control grid) voltage</td>
<td>-300 V</td>
<td>0 V</td>
</tr>
<tr>
<td>Grid-No.2 voltage</td>
<td>- V</td>
<td>750 V</td>
</tr>
<tr>
<td>Grid-No.3 (beam focus) voltage</td>
<td>- V</td>
<td>1500 V</td>
</tr>
<tr>
<td>Grid-No.4 (anode) voltage</td>
<td>Ground</td>
<td></td>
</tr>
</tbody>
</table>

#### Reading Gun:

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater voltage (AC or DC)</td>
<td>5.7 V</td>
<td>6.9 V</td>
</tr>
<tr>
<td>Cathode voltage</td>
<td>-1500 V</td>
<td>- V</td>
</tr>
<tr>
<td>Heater-cathode voltage</td>
<td>-125 V</td>
<td>10 V</td>
</tr>
<tr>
<td>Grid-No.1 (control grid) voltage</td>
<td>-300 V</td>
<td>0 V</td>
</tr>
<tr>
<td>Grid-No.2 voltage</td>
<td>- V</td>
<td>750 V</td>
</tr>
<tr>
<td>Grid-No.4 (beam focus) voltage</td>
<td>- V</td>
<td>750 V</td>
</tr>
<tr>
<td>Grids No.3 &amp; No.5 (anode) voltage</td>
<td>-30 V</td>
<td>30 V</td>
</tr>
<tr>
<td>External conductive coating</td>
<td>Ground</td>
<td></td>
</tr>
</tbody>
</table>

#### Target Section:

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output signal electrode voltage</td>
<td>-10 V</td>
<td>10 V</td>
</tr>
<tr>
<td>Shading electrode voltage</td>
<td>-30 V</td>
<td>30 V</td>
</tr>
<tr>
<td>Backplate voltage</td>
<td>-20 V</td>
<td>50 V</td>
</tr>
</tbody>
</table>

### TYPICAL OPERATING CONDITIONS

Voltages are referred to ground unless otherwise specified.

#### Writing Gun:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater voltage (AC or DC)</td>
<td>6.3 V</td>
</tr>
<tr>
<td>Grid-No.1 (control grid) voltage for beam cutoff</td>
<td>-420 to -70 V</td>
</tr>
<tr>
<td>Grid-No.2 voltage</td>
<td>300 V</td>
</tr>
<tr>
<td>Grid-No.3 (beam focus) voltage</td>
<td>600 to 1400 V</td>
</tr>
<tr>
<td>Grid-No.4 (anode) voltage</td>
<td>Ground</td>
</tr>
</tbody>
</table>

#### Reading Gun:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater voltage (AC or DC)</td>
<td>6.3 V</td>
</tr>
<tr>
<td>Cathode voltage</td>
<td>-1200 V</td>
</tr>
</tbody>
</table>
TYPICAL OUTPUT CONDITIONS

Reading Gun:

- Grid-No.1 (control grid) voltage for beam cutoff: -120 to -70 V
- Grid-No.2 voltage: 300 V
- Grid-No.4 (beam focus) voltage: 200 to 440 V
- Grids No.3 & No.5 (anode) voltage: -20 to 0 V
- External conductive coating: Ground

Target Section:

- Output-signal-electrode voltage: 0 V
- Shading electrode voltage: 0 to 20 V
- Backplate voltage: -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.

<table>
<thead>
<tr>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Signal Current</td>
<td>0.5 μA</td>
</tr>
<tr>
<td>Storage Time</td>
<td>See footnote r</td>
</tr>
<tr>
<td>Signal-to-Shading Ratio</td>
<td>5:1</td>
</tr>
<tr>
<td>Signal-to-Background-Shading Ratio</td>
<td>8:1</td>
</tr>
<tr>
<td>Center Resolution, At 50% amplitude response</td>
<td>1600 TV lines/target diameter</td>
</tr>
<tr>
<td>Edge Resolution, At 50% amplitude response</td>
<td>See footnote v</td>
</tr>
<tr>
<td>Writing Speed</td>
<td>200 μs/target diameter</td>
</tr>
<tr>
<td>Shades of Gray</td>
<td>7</td>
</tr>
<tr>
<td>Blemishes</td>
<td>See footnote y</td>
</tr>
</tbody>
</table>

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: 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
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.

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.

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.

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.

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.

One side to be externally connected to writing-gun cathode.

With respect to writing-gun cathode.

Adjust for best focus.

One side to be externally connected to reading-gun cathode.

With respect to reading-gun cathode.

Adjust for optimum signal and storage performance.

This value is the saturated output signal current.

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.

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.
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.

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.

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.

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.

A step voltage waveform with seven equally spaced levels is used as input.

Blemishes are measured within a circular area centered on the target and with a diameter of 90 per cent of the target diameter. Blemish size is specified as a percentage of the target diameter; blemish amplitude, as a percentage of saturated signal amplitude. Blemishes with an amplitude of less than 10 per cent are not counted. Dark blemishes with a size of less than 1/8 per cent are not counted.

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:

<table>
<thead>
<tr>
<th>Amplitude</th>
<th>Maximum Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>10% to 50%</td>
<td>10</td>
</tr>
<tr>
<td>20% to 50%</td>
<td>3</td>
</tr>
<tr>
<td>Greater than 50%</td>
<td>0</td>
</tr>
</tbody>
</table>

The maximum size of any dark blemish is 1/2 per cent. The maximum number of dark blemishes is five.

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.
DIMENSIONAL OUTLINE (cont’d)

Note 1 — All leads are labeled.

Note 2 — Connection to the output signal electrode can be provided by means of a solderable terminal, coaxial connector, or coaxial cable.

TARGET-SECTION LEADS

Lead 1: Writing-Gun Grid No. 4
Lead 2: Backplate
Lead 3: Shading Electrode
Lead 4: Reading Gun Grids No. 3 & 5
Lead 5: Reading-Gun External Conductive Coating

WRITING-GUN SECTION LEADS

Lead 1: Heater
Lead 2: Grid No. 1
Lead 3: Grid No. 3
Lead 4: Grid No. 2
Lead 5: Cathode
Lead 6: Heater

READING-GUN SECTION LEADS

Lead 1: Heater
Lead 2: Grid No. 1
Lead 3: Grid No. 4
Lead 4: Grid No. 2
Lead 5: Cathode
Lead 6: Heater
FREQUENCY RESPONSE CHARACTERISTICS

Orthogonal read-write response is measured by shrinking a raster of scanning lines written perpendicularly to the read raster. Sine-wave response is derived from the orthogonal read-write response.

Orthogonal read-write response

Sine-wave response (r

Spatial frequency — cycles/target diameter

TV lines/target diameter

VIBRATION LEVELS

Double amplitude — inches

Frequency — hertz

LOG ENDURANCE

LOG PERFORMANCE

RCA Electronic Components
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 M.P.C.D.

General Data

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
  - 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) .................................. ±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

- 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.
- A description of the Absolute Maximum Ratings is given in the General Section, titled Rating System for Electron Tubes.
- 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.
- For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts.
- This tube may be operated at reduced anode voltage and/or anode current. At reduced anode voltage, center resolution will decrease. At reduced anode voltage and/or anode current, lumi-
nance will decrease. The grid-No.3 voltage for focus will be reduced in proportion to the reduction in anode voltage. Other performance characteristics may also be affected.

Determined for a 3-inch high TV resolution test pattern with tube operating at a screen current of 300 microamperes.

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

HEATER VOLTAGE = 6.3 VOLTS
ANODE - TO - CATHODE VOLTAGE = 40,000 VOLTS
GRID No. 3 - TO - CATHODE VOLTAGE ADJUSTED FOR FOCUS

<table>
<thead>
<tr>
<th>Grid No. 1 - To - Cathode Volts</th>
<th>Grid No. 2 - To - Cathode Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>-20</td>
<td>1</td>
</tr>
<tr>
<td>-40</td>
<td>2</td>
</tr>
<tr>
<td>-60</td>
<td>3</td>
</tr>
<tr>
<td>-80</td>
<td>4</td>
</tr>
<tr>
<td>-100</td>
<td>5</td>
</tr>
<tr>
<td>-120</td>
<td>6</td>
</tr>
<tr>
<td>-140</td>
<td>7</td>
</tr>
<tr>
<td>-160</td>
<td>8</td>
</tr>
</tbody>
</table>

Range Limit Focused Spot Cutoff

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.
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.
# 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 μf
- Anode to all other electrodes: 5.5 μf

### 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:
- Bottom View: See Dimensional Outline

### Lead 1 – Cathode
- Lead 2 – Dynode No.1
- Lead 3 – Dynode No.2
- Lead 4 – Dynode No.3
- Lead 5 – Dynode No.4
- Lead 6 – Dynode No.5
- Lead 7 –Dynode No.6
- Lead 8 – Dynode No.7
- Lead 9 – Dynode No.8
- Lead 10 – Dynode No.9
- Lead 11 – Anode

### 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**

**TUBE DIVISION**

**TENTATIVE DATA**

**RCA**

**BAINO CORPORATION OF AMERICA, HARRISON, NEW JERSEY**
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

<table>
<thead>
<tr>
<th>Sensitivity:</th>
<th>Min.</th>
<th>Median</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiant, at 4000 angstroms</td>
<td>32500</td>
<td>250</td>
<td>µamp/µwatt</td>
</tr>
<tr>
<td>Luminous:</td>
<td></td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>At 0 cps</td>
<td>5</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>At 100 Mc.</td>
<td>-</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Electrode Dark Current (At 25°C):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anode</td>
<td></td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>Any other electrode</td>
<td></td>
<td>0.75</td>
<td></td>
</tr>
</tbody>
</table>

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

MAY 1, 1955
MULTIPLIER PHOTOTUBE

RECOMMENDED VOLTAGE-DIVIDER NETWORK FOR USE WITH TYPE 6472 IN HEADLIGHT-DIMMING SERVICE

AC OR DC POWER SUPPLY (SEE NOTE)

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.

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.

MAY 1, 1955

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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.

May 1, 1955

Tube Division

Radio Corporation of America, Harrison, New Jersey
VARIATION IN SENSITIVITY OF PHOTOCATHODE ALONG ITS LENGTH

SPOT SIZE: 1 MM APPROX.
VARIATIONS CAUSED BY INTERCEPTION OF LIGHT BY GRILL AS WELL AS SURFACE IRREGULARITIES HAVE BEEN IGNORED

RELATIVE ANODE CURRENT

DISTANCE ALONG CATHODE FROM END OF CATHODE NEARER LEADS-MILLIMETERS

FEB. 11, 1955

TUBE DIVISION

RCA CORPORATION OF AMERICA, HARRISON, NEW JERSEY

82CM-8535
VARIATION IN SENSITIVITY OF PHOTOCATHODE ACROSS ITS PROJECTED WIDTH IN PLANE OF GRILL

SPOT SIZE: 1 MM APPROX.
GRILL TOWARD OBSERVER, LEADS DOWN
CATHODE WIDTH PROJECTED NORMAL TO PLANE OF GRILL
VARIATIONS CAUSED BY INTERCEPTION OF LIGHT BY GRILL AS WELL AS SURFACE IRREGULARITIES HAVE BEEN IGNORED

DISTANCE ALONG PLANE OF GRILL FROM LEFT TO RIGHT — MILLIMETERS

FEB. 11, 1955
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
RADECHON
CHARGE STORAGE TUBE
SINGLE-BEAM, BARRIER-GRID TYPE
NON-EQUILIBRIUM WRITING
CAPACITANCE-DISCHARGE READING

**General:**
Heater, for Unipotential Cathode:
- Voltage: 6.3 AC or DC volts
- Current: 0.6 amp

**Direct Interelectrode Capacitances (Approx.):**
- Grid No. 1 to all other electrodes: 9 μf
- Deflecting electrode DJ₁ to all other electrodes: 13 μf
- Deflecting electrode DJ₂ to all other electrodes: 13 μf
- Deflecting electrode DJ₃ to all other electrodes: 11.5 μf
- Deflecting electrode DJ₄ to all other electrodes: 11.5 μf
- DJ₁ to DJ₂: 3 μf
- DJ₃ to DJ₄: 3 μf
- Grid No. 5 to backing-electrode: 800 μf
- Grid No. 5 and backing-electrode to collector: 4 μf
- Collector to all other electrodes & external cylindrical shield: See Curve

**Focusing Method:** Electrostatic
**Deflection Method:** Electrostatic
**Overall Length:** 11-27/32" ± 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 diontial base is up and the tube axis is at an angle of less than 60° from the vertical.

**Weight (Approx.):** 1 lb

**Base:**
- On large end of tube: Small-Button Twentyninar 8-Pin (JETEC No. E8-19)

**VIEW OF TWENTYNINAR–BASE END OF TUBE**

- Pin 2: Multiple Connections to Backing-Electrode. Only
- Pin 10: One Need be Used
- Pin 14: Pin 21—No Connection
- Pin 25—No Connection
- Pin 28—Grid No. 5

**PINS 2, 6, 10, 18, 19:** ON 1-7/8" DIA. PIN CIRCLE
**PINS 21, 25, 28:** ON 7/8" DIA. PIN CIRCLE

8-56 TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**On small end of tube.**

**Small-Shell Diheptal 14-Pin (JETEC No. 814-45)**

**VIEW OF DIHEPTAL-BASE END OF TUBE**

<table>
<thead>
<tr>
<th>Pin 1</th>
<th>Pin 2</th>
<th>Pin 3</th>
<th>Pin 4</th>
<th>Pin 5</th>
<th>Pin 6</th>
<th>Pin 7</th>
<th>Pin 8</th>
<th>Pin 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater</td>
<td>Cathode</td>
<td>Grid No. 1</td>
<td>Internal Connection</td>
<td>Do Not Use</td>
<td>Grid No. 3</td>
<td>No Connection</td>
<td>Deflecting</td>
<td>Ulor (Grids No. 2 &amp; No. 4)</td>
</tr>
</tbody>
</table>

All voltages are with respect to cathode unless otherwise specified.

**Maximum Ratings, Absolute Values:**

**BACKING-ELECTRODE-TO-GRID-No. 5**

<table>
<thead>
<tr>
<th>(BARRIER-GRID) VOLTAGE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backing-elecrode positive with respect to grid No. 5</td>
</tr>
<tr>
<td>Backing-elecrode negative with respect to grid No. 5</td>
</tr>
</tbody>
</table>

**COLLECTOR-TO-GRID-No. 5 VOLTAGE:**

<table>
<thead>
<tr>
<th>Positive value</th>
<th>Negative value</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 max. volts</td>
<td>0 max. volts</td>
</tr>
</tbody>
</table>

**ULTOR* VOLTAGE:**

<table>
<thead>
<tr>
<th>Positive bias value</th>
<th>Negative bias value</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 max. volts</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>500 max. volts</td>
<td></td>
</tr>
</tbody>
</table>

**GRID-No. 3 VOLTAGE:**

**GRID-No. 1 VOLTAGE:**

<table>
<thead>
<tr>
<th>Positive bias value</th>
<th>Negative bias value</th>
<th>Positive peak value</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 max. volts</td>
<td>0 max. volts</td>
<td>2 max. volts</td>
</tr>
</tbody>
</table>

**PEAK HEATER-CATHODE VOLTAGE:**

<table>
<thead>
<tr>
<th>Heater negative with respect to cathode</th>
<th>Heater positive with respect to cathode</th>
</tr>
</thead>
<tbody>
<tr>
<td>125 max. volts</td>
<td>10 max. volts</td>
</tr>
</tbody>
</table>

**Equipment Design Ranges:**

*For any ulor voltage ($E_u$) between 1000 and 1500 volts*

**Backin-gElectrode-to-Grid-No. 5 Voltage.**

See Note 1

- The "ulator" 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 ulor 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 "ulator" for presenting data.

*: see next page.
### RADECHON

**Collector-to-Grid-No.5 Voltage**
- 0 to 50 volts

**Grid-No.3 Voltage for Focus with grid-No.1 volt = 0**
- 14% to 26% of \( E_c \) volts

**Grid-No.1 Voltage for collector-current cutoff**
- -2.5% to -4.7% of \( E_c \) volts

**Collector Current for grid-No.1 volt = 0**
- 20 to 50 \( \mu \)amps

**Max. Cathode Current for grid-No.1 volt = 0**
- See Curve

**Deflection Factors:**
- \( D_{J1} \) and \( D_{J2} \): 85 to 105 v dc/in./kv of \( E_c \)
- \( D_{J3} \) and \( D_{J4} \): 78 to 96 v dc/in./kv of \( E_c \)

**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 volt = 0: 140 to 260 volts
- Grid-No.1 Voltage for collector-current cutoff: -25 to -47 volts

**Deflection Factors:**
- \( D_{J1} \) and \( D_{J2} \): 85 to 105 v dc/in.
- \( D_{J3} \) and \( D_{J4} \): 78 to 98 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 160 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

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**Note 3:** See next page.
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 DJ₁, b for DJ₂, c for DJ₃, and d for DJ₄.

Spot Position in % of Storage-Surface Diameter
\[ = \frac{1}{2}\sqrt{\left(\frac{b+1}{a}\right)^2 + \left(\frac{c+2}{d}\right)^2} \times 100 \]

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.

![Graph showing indicated capacitance vs. shield diameter](image)
**NOTE 1:** THE ANGLE BETWEEN PLANE THROUGH PIN 6 OF TWENTY-NINE PIN BASE AND TUBE AXIS, AND PLANE THROUGH PIN 2 OF DIHEPTAL BASE AND TUBE AXIS WILL NOT EXCEED 100°. THE INDICATED PINS ARE BOTH ON THE SAME SIDE OF THE TUBE.

**NOTE 2:** DEFLECTING ELECTRODES DJ₁ & DJ₂ ARE NEARER THE TARGET. DEFLECTING ELECTRODES DJ₃ & DJ₄ ARE NEARER THE DIHEPTAL BASE.

**NOTE 3:** ANGLE BETWEEN DJ₁ & DJ₂ DEFLECTION PATH AND DJ₃ & DJ₄ DEFLECTION PATH IS 900 ± 30°.
MAXIMUM CATHODE CURRENT

$E_F = 6.3 \text{ VOLTS}$

$\text{GRID-N} \#1 \text{ VOLTS} = 0$

AVERAGE TRANSFER CHARACTERISTICS

$E_F = 6.3 \text{ VOLTS}$

$\text{GRID-N} \#5 \text{ VOLTS} = \text{BACKING ELECTRODE VOLTS} = \text{ULTOR VOLTS}$

$\text{COLLECTOR VOLTS} = \text{ULTOR VOLTS} + 50 \text{ VOLTS}$

$\text{GRID-N} \#3 \text{ VOLTS} - \text{ADJUSTED FOR BEST OVERALL FOCUS}$
RESOLUTION CHARACTERISTICS

$E_F = 6.3 \text{ VOLTS}$
$\text{GRID-}N_5 \text{ VOLTS} = \text{ULTOR VOLTS} = 1000$
$\text{COLLECTOR VOLTS} = 1050$
$\text{GRID-N}_3 \text{ VOLTS} - \text{ADJUSTED FOR BEST OVERALL FOCUS}$
$\text{GRID-N}_1 \text{ VOLTS} - \text{ADJUSTED TO GIVE EQUILIBRIUM COLLECTOR}$
$\text{CURRENT SHOWN ON EACH CURVE}$
$\text{BACKING-ELECTRODE:}$
$\text{DURING WRITING—PULSED APPROX. 50 VOLTS POSITIVE WITH}$
$\text{RESPECT TO ULTOR}$
$\text{DURING READING—AT GRID-N}_5 \text{ POTENTIAL}$

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**Diagram:**
- **Y-axis:** Relative Amplitude Response—Arbitrary Units
- **X-axis:** Television Line Number
- **Legend:**
  - Equilibrium Collector Current
  - Backing Electrode During Writing
  - Backing Electrode During Reading

**Additional Notes:**
- **Tube Division:** 92CM-8946
- **Radio Corporation of America, Harrison, New Jersey**
RESOLUTION CHARACTERISTICS

$E_f = 6.3 \text{ VOLTS}$

GRID-N$^2$ VOLTS = ULTOR VOLTS

COLLECTOR VOLTS = ULTOR VOLTS + 50 VOLTS

GRID-N$^3$ VOLTS — ADJUSTED FOR BEST OVERALL FOCUS

GRID-N$^4$ VOLTS — ADJUSTED TO GIVE EQUILIBRIUM COLLECTOR CURRENT OF 7.5 MICROAMPERES

BACKING-ELECTRODE:

DURING WRITING — PULSED APPROX. 50 VOLTS POSITIVE WITH RESPECT TO ULTOR

DURING READING — AT GRID-N$^2$ POTENTIAL

RELATIVE AMPLITUDE RESPONSE — ARBITRARY UNITS

TELEVISION LINE NUMBER

PER USEFUL STORAGE-SURFACE DIAMETER
TYPICAL TARGET CHARACTERISTICS

$E_C = 6.3$ VOLTS
GRID-NO.5 VOLTS=ULTOR VOLTS=1000
COLLECTOR VOLTS=1050
GRID-NO.3 VOLTS-ADJUSTED FOR BEST OVERALL FOCUS
GRID-NO.1 VOLTS-ADJUSTED TO GIVE EQUILIBRIUM COLLECTOR
CURRENT OF 15 MICROAMPERES
STORAGE SURFACE IS AT EQUILIBRIUM POTENTIAL PRIOR TO
APPLICATION OF PULSE.
6499
APPROXIMATE
DISCHARGE-FACTOR CHARACTERISTIC

$E_F = 6.3$ VOLTS
GRID-No.5 VOLTS = ULTOR VOLTS = 1000
COLLECTOR VOLTS = 1050
GRID-No.3 VOLTS - ADJUSTED FOR BEST OVERALL FOCUS
GRID-No.1 VOLTS - ADJUSTED TO GIVE EQUILIBRIUM COLLECTOR
CURRENT OF 15 MICROAMPERES
STORAGE SURFACE IS AT EQUILIBRIUM POTENTIAL PRIOR TO
APPLICATION OF PULSE
SWEEP SPEED = 0.012 INCH/µSEC

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, N.J., U.S.A.
## 6866 DISPLAY STORAGE TUBE

**DIRECT-VIEW TYPE**
**4"-DIAMETER DISPLAY**
**NON-EQUILIBRIUM WRITING GRID-CONTROL READING (VIEWING)**

<table>
<thead>
<tr>
<th>Data</th>
<th>Writing Section</th>
<th>Viewing Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage (AC or DC)</td>
<td>6.3</td>
<td>6.3</td>
</tr>
<tr>
<td>Current</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Minimum Cathode Heating Time before other electrode voltages are applied</td>
<td>-</td>
<td>30</td>
</tr>
<tr>
<td>Direct Interelectrode Capacitances (Approx.)</td>
<td>1.8</td>
<td>-</td>
</tr>
<tr>
<td>Grid No. 1 to all other tube electrodes</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>Cathode to all other tube electrodes</td>
<td>4.2</td>
<td>6.5</td>
</tr>
<tr>
<td>Deflecting electrode D1 to deflecting electrode D2</td>
<td>1.8</td>
<td>-</td>
</tr>
<tr>
<td>Deflecting electrode D3 to deflecting electrode D3</td>
<td>1.8</td>
<td>-</td>
</tr>
<tr>
<td>D1 to all other tube electrodes</td>
<td>7.5</td>
<td>-</td>
</tr>
<tr>
<td>D2 to all other tube electrodes</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>D3 to all other tube electrodes</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>Focusing Method</td>
<td>Electrostatic</td>
<td>None</td>
</tr>
<tr>
<td>Deflection Method</td>
<td>Electrostatic</td>
<td>None</td>
</tr>
<tr>
<td>Deflecting-Electrode Arrangement</td>
<td>See Dimensional Outline</td>
<td></td>
</tr>
<tr>
<td>Phosphor</td>
<td>High-Visual-Efficiency Type, Aluminized</td>
<td></td>
</tr>
<tr>
<td>Fluorescence</td>
<td>Yellow</td>
<td></td>
</tr>
<tr>
<td>Phosphorescence</td>
<td>Yellow</td>
<td></td>
</tr>
<tr>
<td>Minimum Useful Screen Diameter</td>
<td>4&quot;</td>
<td></td>
</tr>
<tr>
<td>Maximum Overall Length</td>
<td>15-1/2&quot;</td>
<td></td>
</tr>
<tr>
<td>Seated Length</td>
<td>14&quot; ± 3/8&quot;</td>
<td></td>
</tr>
<tr>
<td>Maximum Tube Radius</td>
<td>3-5/32&quot;</td>
<td></td>
</tr>
<tr>
<td>Bulb-Flange Diameter</td>
<td>5-1/8&quot; ± 1/16&quot;</td>
<td></td>
</tr>
<tr>
<td>Greatest Bulb Diameter</td>
<td>5&quot; ± 1/16&quot;</td>
<td></td>
</tr>
<tr>
<td>Bulb Terminals:</td>
<td>Caps (Two)</td>
<td>Recessed Small Cavity (JETEC No. J1-21)</td>
</tr>
<tr>
<td>Flange</td>
<td>See Dimensional Outline</td>
<td></td>
</tr>
<tr>
<td>Flexible cable</td>
<td>See Dimensional Outline</td>
<td></td>
</tr>
<tr>
<td>Ambient-Temperature Range</td>
<td>-65° to +100 °C</td>
<td></td>
</tr>
<tr>
<td>Mounting Position</td>
<td>Any</td>
<td></td>
</tr>
<tr>
<td>Weight (Approx.)</td>
<td>2 lbs</td>
<td></td>
</tr>
<tr>
<td>Socket, Base</td>
<td>Aliden Part No. 435S6A, or equivalent</td>
<td></td>
</tr>
</tbody>
</table>

**General:**
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.): 1.8 μμμ μμμ μμμ
Grid No. 1 to all other tube electrodes | 6 | 18 | μμμ μμμ μμμ |
Cathode to all other tube electrodes | 4.2 | 6.5 | μμμ μμμ μμμ |
Deflecting electrode D1 to deflecting electrode D2 | 1.8 | - | μμμ μμμ μμμ |
Deflecting electrode D3 to deflecting electrode D3 | 1.8 | - | μμμ μμμ μμμ |
D1 to all other tube electrodes | 7.5 | - | μμμ μμμ μμμ |
D2 to all other tube electrodes | 8 | - | μμμ μμμ μμμ |
D3 to all other tube electrodes | 6 | - | μμμ μμμ μμμ |
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) |
Flexible cable | See Dimensional Outline |
Ambient-Temperature Range | -65° to +100 °C |
Mounting Position | Any |
Weight (Approx.) | 2 lbs |
Socket | Aliden Part No. 435S6A, or equivalent |
Base | Small-Button Thirtyfivar 31-Pin (JETEC No. E31-36) |

10-56 TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
### Maximum Ratings, Absolute Values:

**Writing Section**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen Voltage</td>
<td>3000 max.</td>
</tr>
<tr>
<td>Peak Backing-Electrode Voltage</td>
<td>2000 max.</td>
</tr>
</tbody>
</table>

**Viewing Section**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen Voltage</td>
<td>1000 max.</td>
</tr>
<tr>
<td>Peak Backing-Electrode Voltage</td>
<td>2000 max.</td>
</tr>
</tbody>
</table>

---

*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.*
## Writing Section

<table>
<thead>
<tr>
<th>Equivalent Values</th>
<th>Viewing Section**</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRID-No.4 VOLTAGE</td>
<td>2900 max.*</td>
</tr>
<tr>
<td>GRID-No.3 VOLTAGE</td>
<td>1000 max.*</td>
</tr>
<tr>
<td>GRID-No.2 VOLTAGE</td>
<td>2750 max.*</td>
</tr>
<tr>
<td>CATHODE VOLTAGE</td>
<td>-</td>
</tr>
<tr>
<td>GRID-No.1 VOLTAGE</td>
<td>200 max.*</td>
</tr>
<tr>
<td>PEAK VOLTAGE BETWEEN</td>
<td>500 max.</td>
</tr>
</tbody>
</table>

## Operating Values and Typical Performance Characteristics:

<table>
<thead>
<tr>
<th>Screen Voltage</th>
<th>DC Backing-Electrode</th>
<th>Grid-No.4 Voltage</th>
<th>Grid-No.3 Voltage</th>
<th>Grid-No.2 Voltage</th>
<th>Grid-No.1 Voltage</th>
<th>Maximum Screen Current</th>
<th>Maximum Peak Backing- Electrode Current</th>
<th>Maximum Grid-No.4 Current</th>
<th>Maximum Grid-No.3 Current</th>
<th>Maximum Cathode Current</th>
<th>Writing Speed</th>
<th>Number of Half-Tone Steps</th>
<th>Viewing Duration</th>
<th>Maximum Erasing-Uniformity Factor</th>
<th>Resolution</th>
<th>Brightness</th>
</tr>
</thead>
<tbody>
<tr>
<td>5000</td>
<td>5000</td>
<td>150</td>
<td>210</td>
<td>50 to 125</td>
<td>50 to 150</td>
<td>50 to 75</td>
<td>50 to 125</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>300000</td>
<td>5</td>
<td>40</td>
<td>0.5</td>
<td>50</td>
<td>275</td>
</tr>
<tr>
<td>10000</td>
<td>10000</td>
<td>25 to 125</td>
<td>50 to 150</td>
<td>50 to 75</td>
<td>50 to 75</td>
<td>0 to -50</td>
<td>350</td>
<td>1.5</td>
<td>1.5</td>
<td>3</td>
<td>300000</td>
<td>5</td>
<td>40</td>
<td>1.5</td>
<td>50</td>
<td>2750</td>
</tr>
<tr>
<td>10000</td>
<td>10000</td>
<td>25 to 125</td>
<td>50 to 150</td>
<td>50 to 75</td>
<td>50 to 75</td>
<td>0 to -50</td>
<td>350</td>
<td>1.5</td>
<td>1.5</td>
<td>3</td>
<td>300000</td>
<td>5</td>
<td>40</td>
<td>1.5</td>
<td>50</td>
<td>2750</td>
</tr>
</tbody>
</table>

** 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.

\* indicates a change.
WRITING SECTION

Range Values for Equipment Design:

With any grid-No. 2 voltage (E_{c2}) between 500 and 2750 volts

| Grid-No. 4 Voltage (E_{c4}) | 95% to 105% of E_{c2} volts |
| Grid-No. 3 Voltage for Focus | 14% to 23% of E_{c2} volts |
| Maximum Grid-No. 1 Voltage for Cutoff of Undeflected Focused Spot | \(-4.6\%\) of E_{c2} volts |
| Maximum Grid-No. 3 Current | \(-15\%\) to \(+10\%\) |
| Maximum Cathode Current | See Curve |
| Deflection Factors:       |                               |
| \(D_J^1\) and \(D_J^2\)       | 26 to 38 v dc/in./kv of E_{c4} |
| \(D_J^3\) and \(D_J^4\)       | See Curve |
| Focused Beam Position     |                               |

Examples of Use of Design Ranges:

With grid-No. 2 voltage of 1500 to 2500 volts

| Grid-No. 4 Voltage (E_{c4}) | 1425 to 1575 to 2375 to 2525 volts |
| Grid-No. 3 Voltage for Focus | 210 to 420 to 350 to 700 volts |
| Maximum Grid-No. 1 Voltage for Cutoff of Undeflected Focused Spot | \(-69\%\) to \(-115\%\) |
| Deflection Factors when \(E_{c4} = E_{c2}\): |                               |
| \(D_J^1\) and \(D_J^2\)       | 42 to 57 to 70 to 95 v dc/in. |
| \(D_J^3\) and \(D_J^4\)       | 42 to 57 to 70 to 95 v dc/in. |

Equivalent Values for Examples of Writing-Gun Voltages

Referred to Cathode of Viewing Gun:

| Cathode Voltage | \(-1450\) to \(-1395\) to \(-2450\) to \(-2395\) volts |
| Grid-No. 2 Voltage | \(-25\) to \(+190\) to \(-75\) to \(+230\) volts |
| Grid-No. 3 Voltage for Focus | \(-1240\) to \(-975\) to \(-2100\) to \(-1695\) volts |
| Grid-No. 4 Voltage | 50 to 105 to 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 \(+250\) volts with respect to cathode of Writing Gun.
‡ Observed with an RCA-2F21 Monoscope display.

See next page.
DISPLAY STORAGE TUBE

Expressed in terms of the time required for the brightness of the un-written background to rise from just zero brightness (viewing-beam cutoff) to 10% of the maximum brightness.

Defined as \( \frac{t_2 - t_1}{t_2} \), 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 80% of saturated brightness and with grids No. 2 and No. 4 of Writing Gun at +2500 volts with respect to cathode of Writing Gun.
- Measured with entire storage grid written to produce maximum brightness and with screen at indicated voltage.
- The cathode of the Writing Gun is operated at about -2500 volts with respect to the cathode of the Viewing Gun which is usually operated at ground potential.

The center of the undeflected focused beam will fall within a circle having a 10-mm radius concentric with the center of the face under the following conditions: grids No. 2 and No. 4 of Writing Gun at +2500 volts with respect to cathode of Writing Gun, grid No. 3 of Writing Gun at voltage to give focus, grid No. 1 of Writing Gun at voltage which will permit storage of a charge just sufficient to give a barely perceptible spot on screen, viewing Section operating under normal conditions, and tube shielded against extraneous fields.

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

OPERATING CONSIDERATIONS

Magnetic shielding must be provided to prevent external fields from interfering with the required accurate control of the low-velocity viewing beam. A cylindrical shield of properly annealed high-permeability material about 1/16-inch thick is usually satisfactory. The screen cable should be placed outside the shield.

The metal flange at the face end of the tube requires the use of a spring-contact ring bearing against the edge of the flange.

To prevent possible damage to the tube, allow the viewing-gun beam current to reach normal operating value before turning on the writing-gun beam current, and keep the viewing beam on until the writing beam is turned off.
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 DJ₁ AND DJ₂ BY THE FOLLOWING ANGULAR TOLERANCES (MEASURED ABOUT THE TUBE AXIS): PIN 27, ± 10°; EACH CAVITY CAP (ON SAME SIDE AS PIN 271), ± 17°; ENCAPSULATED JUNCTION, ± 10°. ANGLE BETWEEN DJ₃ - DJ₄ DEFLECTION PATH AND DJ₂ - DJ₄ DEFLECTION PATH IS 90° ± 3°.
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR
AVERAGE CHARACTERISTIC

VIEWING SECTION

$E_f = 6.3\ \text{volts}$

BACKING-ELECTRODE VOLTS* = 5

GRID-N 4 VOLTS* = 210

GRID-N 2 VOLTS* = 85

GRID-N 3 VOLTS* ADJUSTED FOR BRIGHTEST,

GRID-N 1 VOLTS* MOST UNIFORM DISPLAY.

*REFERRED TO CATHODE OF VIEWING GUN.

WRITING SECTION

NORMAL OPERATION

<table>
<thead>
<tr>
<th>SATURATED SCREEN BRIGHTNESS-FOOT-LAMBERTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3000</td>
</tr>
<tr>
<td>2500</td>
</tr>
<tr>
<td>2000</td>
</tr>
<tr>
<td>1500</td>
</tr>
<tr>
<td>1000</td>
</tr>
<tr>
<td>500</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SCREEN KILOVOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>12</td>
</tr>
</tbody>
</table>
TYPICAL ERASURE CHARACTERISTICS

VIEWING SECTION

$E_f = 6.3$ VOLTS
GRID-NO 4 VOLTS* = 210
GRID-NO 3 VOLTS* = ADJUSTED FOR BRIGHTTEST,
GRID-NO 1 VOLTS* = MOST UNIFORM DISPLAY

*REFERRED TO CATHODE OF VIEWING GUN

<table>
<thead>
<tr>
<th>CURVE</th>
<th>DC</th>
<th>BACKING-ELECTRODE VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>B</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
<td>7</td>
</tr>
</tbody>
</table>

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.

![Graph](image-url)

TOTAL ERASING-PULSE DURATION AFTER CESSION OF WRITING—MILLISECONDS

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HAVERISON, N.J., 1945

92CM-9045
CURRENT CHARACTERISTIC FOR WRITING GUN

**WRITING SECTION**

- $E_0 = 6.3$ VOLTS
- GRID-N° 4 VOLTS: GRID-N° 2 VOLTS
- GRID-N° 3 VOLTS: ADJUSTED FOR FOCUS
- GRID-N° 1 VOLTS: $= 0$

*REFERRED TO CATHODE OF WRITING GUN*

**VIEWING SECTION**

NORMAL OPERATION

**GRID-N° 2 VOLTS**

**MAXIMUM PEAK CATHODE OR GRID-N° 2 MILLIAMPERES**

- 500
- 1000
- 1500
- 2000
- 2500
**Typical Drive Characteristic for Writing Gun**

**Writing Section**

- $E_f = 6.3 \text{ Volts}$
- Grid-N2 4 Volts* = 2500
- Grid-N2 3 Volts* = Adjusted for Focus
- Grid-N2 2 Volts* = 2500
- Grid-N2 1* Biased to Spot Cutoff

*Reflected to cathode of writing gun

**Viewing Section**

Normal Operation

Diagram showing relationship between peak grid-N2 drive from spot cutoff in volts and writing beam microamperes at grid-N2 of viewing section.
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

<table>
<thead>
<tr>
<th></th>
<th>Writing Section</th>
<th>Viewing Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater, for Unipotential Cathode:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage (AC or DC)</td>
<td>6.3 ± 10%</td>
<td>6.3 ± 10%</td>
</tr>
<tr>
<td>Current at 6.3 volts</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Cathode Heating Time</td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>(Minimum) before other electrodes are applied</td>
<td>-</td>
<td>q</td>
</tr>
<tr>
<td>Direct Interelectrode Capacitances:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grid No.1 to all other electrodes</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>Cathode to all other electrodes</td>
<td>5</td>
<td>pF</td>
</tr>
<tr>
<td>Backplate to all other electrodes</td>
<td>100</td>
<td>pF</td>
</tr>
<tr>
<td>Focusing Method</td>
<td>Electrostatic</td>
<td></td>
</tr>
<tr>
<td>Deflection Method</td>
<td>Magnetic</td>
<td></td>
</tr>
<tr>
<td>Phosphor</td>
<td>P20, Aluminized</td>
<td></td>
</tr>
</tbody>
</table>

- 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., Type LGH, Part No.832692, 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.*

<table>
<thead>
<tr>
<th>Screen Voltage:</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak DC</td>
<td>0</td>
<td>10,000</td>
</tr>
</tbody>
</table>
| Backplate Voltage: | 0 | 9,000  

| Collector (Viewing-Grid-No.5) Voltage | 180 | 300  |
| Collimator (Viewing-Grid-No.4) Voltage | 50 | 150  |
| Viewing-Grid-No.3 Voltage, Writing-Grid-No.4 and Writing-Grid-No.2 Voltage | 10 | 150  |
| Viewing-Grid-No.2 Voltage | 100 | 150  |
| Viewing-Grid-No.1 Voltage | 0 | -100  |
| Viewing-Gun Heater-to-Cathode Voltage | -125 | 125  |
| Writing-Gun Heater-to-Cathode Voltage | -2750 | 145  |
| Series Current-Limiting Resistor (Unbypassed) in Screen Circuit | 1 | - MQ |
| Series Current-Limiting Resistor (Unbypassed) in Collector (Viewing-Grid-No.5) Circuit | 0.005 | - MQ |

**RECOMMENDED OPERATING VALUES**

*All voltages are shown with respect to the cathode of the viewing gun unless otherwise specified.*

| Screen Voltage | 8500    |
| Backplate Voltage | 0      |
| Collector Voltage | 250    |
| Collimator Voltage | 40 to 115 |
Viewing-Grid-No.3 Voltage \( d, h \) ............ 10 to 40 V
Viewing-Grid-No.2 Voltage ............ 100 V
Viewing-Grid-No.1 Voltage ............ -40 to 0 V
Writing-Grid-No.3 Voltage \( l \) ............ -1925 to -1675 V
Writing-Grid-No.1 Voltage ............ \( f, k \) V
Writing-Gun Cathode Voltage ............ -2500 V
Circuit Values:
  Grid-No.1 circuit resistance (Either gun) ............ 1 max. MΩ
  Backplate-circuit resistance ............ 0.005 max. MΩ
  Series current-limiting resistor (Unbypassed) in screen circuit ............ 1 MΩ
  Series current-limiting resistor (Unbypassed) in collector (Writing-grid-No.5) circuit ............ 0.01 MΩ

PERFORMANCE DATA AND CHARACTERISTICS

<table>
<thead>
<tr>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usef ul Viewing Diameter ............</td>
<td>4.0</td>
<td>—</td>
</tr>
<tr>
<td>Luminance (Brightness) ( m ) ............</td>
<td>—</td>
<td>1300</td>
</tr>
<tr>
<td>Viewing Duration ( n ) ............</td>
<td>10</td>
<td>—</td>
</tr>
<tr>
<td>Erase Time ( p ) ............</td>
<td>—</td>
<td>35</td>
</tr>
<tr>
<td>Erasing Uniformity Factor: For 4&quot;-diameter area ( q ) ............</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Resolution ( r ) ............</td>
<td>50</td>
<td>—</td>
</tr>
<tr>
<td>Undeflected Spot Position ............</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Screen Current ( m ) ............</td>
<td>—</td>
<td>300</td>
</tr>
<tr>
<td>Viewing-Gun Grid-No.5 Current ( f ) ............</td>
<td>1.0</td>
<td>2.4</td>
</tr>
<tr>
<td>Maximum Viewing-Gun Cathode Current ( u ) ............</td>
<td>2.5</td>
<td>4</td>
</tr>
<tr>
<td>Maximum Writing-Gun Cathode Current ( v ) ............</td>
<td>2.5</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Aircraft-Marine Products, Inc., Capitron Division, 155 Park St., Elizabethtown, Pa.

This part mates with Aircraft-Marine Products, Inc., Part No.AMP833589, ceramic terminal, or equivalent.

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.

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.

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.

Adjusted for brightest, most uniform, full-size pattern.

Adjusted for the smallest, most circular spot.

The maximum bias-voltage value for writing-beam cutoff is -130 volts with respect to writing-gun cathode.

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.

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.

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.

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 (t₁) from start of erasing to the instant at which any area within the 4" diameter is reduced to background-brightness level, and time (t₂) 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 (t₂ - t₁) / t₂.

Measured by shrinking-raster method at a display brightness of 50% of saturated brightness and with grids No.2 and No.0 of Writing Gun at about +2500 volts with respect to cathode of Writing Gun.
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.

With writing gun turned off, with no erasing pulse applied, and display erased to cutoff.

Measured with viewing-gun grid No.1 at zero volts and with all other electrodes at voltages shown under Recommended Operating Values.

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:

<table>
<thead>
<tr>
<th>Axis of Vibration</th>
<th>Double Amplitude inches</th>
<th>Frequency in Hz</th>
<th>Cycle Duration minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>0.08</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Y</td>
<td>0.08</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Z</td>
<td>0.08</td>
<td>30</td>
<td>30</td>
</tr>
</tbody>
</table>

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 Orthogonal Axes of 7183A
Used during Environmental Tests

Fig. 1
TERMINAL DIAGRAM (Bottom View)

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.
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
TWO WRITING GUNS
ONE VIEWING GUN

5-INCH DIAMETER
4-INCH-DIAMETER DISPLAY
INTEGRAL MAGNETIC SHIELD

For Use in Military and Commercial Information Handling Displays Where Rough Tube Usage May Be Encountered. The 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.825-216
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.

<table>
<thead>
<tr>
<th>Component</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen Voltage</td>
<td>-11500</td>
<td>11000</td>
</tr>
<tr>
<td>DC Backplate Voltage</td>
<td>0</td>
<td>35</td>
</tr>
<tr>
<td>Collimation System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive-terminal voltage</td>
<td>0</td>
<td>300</td>
</tr>
<tr>
<td>Negative-terminal voltage</td>
<td>-100</td>
<td>-50</td>
</tr>
<tr>
<td>Viewing-Gun Heater</td>
<td>-125</td>
<td>125</td>
</tr>
<tr>
<td>Magnetic Shield Voltage</td>
<td>-200</td>
<td>200</td>
</tr>
<tr>
<td>Deflecting-Electrode Voltage</td>
<td>-600</td>
<td>600</td>
</tr>
<tr>
<td>Each gun</td>
<td>0</td>
<td>2000</td>
</tr>
<tr>
<td>Writing-Grid-No.3 Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Each gun</td>
<td>-200</td>
<td>(c)</td>
</tr>
<tr>
<td>Writing-Grid-No.1 Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Each gun</td>
<td>-2800</td>
<td>0</td>
</tr>
<tr>
<td>Writing-Gun Cathode Voltage</td>
<td>-125</td>
<td>125</td>
</tr>
<tr>
<td>Writing-Gun Heater-to-Cathode Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Series Current-Limiting Resistor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unbypassed, in screen circuit</td>
<td>1</td>
<td>-MΩ</td>
</tr>
<tr>
<td>Unbypassed, in collimation system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>positive terminal circuit</td>
<td>0.006</td>
<td>-MΩ</td>
</tr>
</tbody>
</table>

RECOMMENDED OPERATING VALUES

All voltages are shown with respect to the reference terminal of the collimation system unless otherwise specified.

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen Voltage</td>
<td>10000</td>
</tr>
<tr>
<td>Backplate Voltage</td>
<td>2</td>
</tr>
<tr>
<td>Collimation System</td>
<td></td>
</tr>
<tr>
<td>Positive-terminal voltage</td>
<td>265</td>
</tr>
<tr>
<td>Negative-terminal voltage</td>
<td>-55</td>
</tr>
<tr>
<td>Reference terminal</td>
<td>grounded</td>
</tr>
<tr>
<td>Writing-Grid-No.3 Voltage</td>
<td>-2325  to -1975</td>
</tr>
<tr>
<td>Writing-Grid-No.1 Voltage</td>
<td>(c, f)</td>
</tr>
<tr>
<td>Writing-Gun Cathode Voltage</td>
<td>-2400</td>
</tr>
<tr>
<td>Magnetic Shield Voltage</td>
<td>0</td>
</tr>
<tr>
<td>Average Deflecting Plate Voltage</td>
<td>100</td>
</tr>
<tr>
<td>Circuit Values</td>
<td></td>
</tr>
<tr>
<td>Grid-No.1 circuit resistance (Either gun)</td>
<td>max MΩ</td>
</tr>
<tr>
<td>Impedance in any deflecting</td>
<td>0.01 max MΩ</td>
</tr>
<tr>
<td>electrode circuit</td>
<td></td>
</tr>
<tr>
<td>Backplate-circuit resistance</td>
<td>0.005 max MΩ</td>
</tr>
<tr>
<td>Series current-limiting resistor:</td>
<td></td>
</tr>
<tr>
<td>Unbypassed, in screen circuit</td>
<td>1</td>
</tr>
<tr>
<td>Unbypassed, in collimation system</td>
<td></td>
</tr>
<tr>
<td>positive terminal circuit</td>
<td>0.006 MΩ</td>
</tr>
</tbody>
</table>
### CHARACTERISTICS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Useful Viewing Diameter</td>
<td></td>
<td></td>
<td>in</td>
</tr>
<tr>
<td>Brightness (Luminance)</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>2500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viewing Duration k</td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Erase Time m</td>
<td>15</td>
<td>-</td>
<td>s</td>
</tr>
<tr>
<td>Resolution n</td>
<td>70</td>
<td>-</td>
<td>lines/in</td>
</tr>
<tr>
<td>Undeflected Spot Position</td>
<td></td>
<td></td>
<td>mm</td>
</tr>
<tr>
<td>Deflection Factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DJ1 &amp; DJ2</td>
<td>82</td>
<td>-</td>
<td>100 V/in</td>
</tr>
<tr>
<td>DJ3 &amp; DJ4</td>
<td>82</td>
<td>-</td>
<td>100 V/in</td>
</tr>
</tbody>
</table>

- The collimation system includes a passive internal network which provides the proper voltages for all viewing gun electrodes; except screen, backplate and heater; as well as grids No.2 and 4 of the writing gun.
- Voltages are shown with respect to cathode of writing gun.
- 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.
- The backplate should be maintained at 2 volts between erasing pulses when dynamic erasure is employed.
- Adjusted for the smallest, most circular spot.
- The bias-voltage value for writing-beam cutoff is between -60 and -100 volts with respect to writing-gun cathode.
- With respect to the reference terminal of the collimation system for each pair of deflecting electrodes.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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 not be 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.

<table>
<thead>
<tr>
<th>Double Amplitude inches</th>
<th>Peak Acceleration g's</th>
<th>Sweep Frequency c/s</th>
<th>Sweep Cycle Duration minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.27</td>
<td>0</td>
<td>10 to 20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>20 to 46</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>46 to 500</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>500 to 46</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>46 to 20</td>
<td></td>
</tr>
<tr>
<td>0.27</td>
<td>0</td>
<td>20 to 10</td>
<td></td>
</tr>
</tbody>
</table>
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 IC-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 the highlight level in the display. These adjustments depend on the scanning rate used. Resolution decreases with increasing writing-gun beam current. Excessive writing-gun beam current will produce screen saturation and any further beam-current increase will not produce additional highlight brightness and may also decrease half-tone rendition. It is recommended that the writing-beam current always be adjusted to a minimum value to produce the best display without saturation of highlight brightness. The dynamic erasing-pulse amplitude and duty cycle should be adjusted in accordance with the information contained in ICE-277.

The following operating precautions must be followed to protect the 7268B from inadvertent damage—

1. Do not exceed maximum ratings.
2. Be sure to include the screen resistor.
3. Be sure to include the collimation system positive terminal resistor.
4. Do not apply excessive writing-beam current density.
5. Protect against scanning failure.
6. Protect against loss of bias.
7. Apply voltages to tube in correct order.
8. Never write unless viewing beam is on.
Note 1: The indicated areas are recommended for mounting purposes.

Note 2: Amp Part No. AMP 832 692-0; manufactured by Aircraft Marine Products, Inc., Harrisburg, Pa., or equivalent.
## DATA

<table>
<thead>
<tr>
<th>Writing Section</th>
<th>Viewing Section</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heater, for Unipotential Cathode:</strong></td>
<td></td>
</tr>
<tr>
<td>Voltage (AC or DC)</td>
<td>6.3</td>
</tr>
<tr>
<td>Current</td>
<td>0.6</td>
</tr>
<tr>
<td>Minimum Cathode Heating Time before other electrode voltages are applied</td>
<td>-</td>
</tr>
<tr>
<td>Direct Interelectrode Capacitances (Approx.):</td>
<td></td>
</tr>
<tr>
<td>Grid No.1 to all other tube electrodes</td>
<td>6.5</td>
</tr>
<tr>
<td>Cathode to all other tube electrodes</td>
<td>5.5</td>
</tr>
<tr>
<td>Backplate to all other tube electrodes</td>
<td>-</td>
</tr>
<tr>
<td>Deflecting electrode D1 to deflecting electrode D2</td>
<td>1.9</td>
</tr>
<tr>
<td>Deflecting electrode D3 to deflecting electrode D4</td>
<td>2</td>
</tr>
<tr>
<td>D1 to all other tube electrodes</td>
<td>6</td>
</tr>
<tr>
<td>D2 to all other tube electrodes</td>
<td>7</td>
</tr>
<tr>
<td>D3 to all other tube electrodes</td>
<td>5.5</td>
</tr>
<tr>
<td>D4 to all other tube electrodes</td>
<td>4.8</td>
</tr>
<tr>
<td>Focusing Method</td>
<td>Electrostatic</td>
</tr>
<tr>
<td>Deflection Method</td>
<td>Electrostatic</td>
</tr>
<tr>
<td>Deflecting-Electrode Arrangement</td>
<td>See Dimensional Outline</td>
</tr>
</tbody>
</table>

### 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°C to +100°C
- Storage: -55°C to +85°C

### Operating Position
- Any

### Weight (Approx.)
- 2-3/4 lbs

### Base
- Medium-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-38)
DISPLAY STORAGE TUBE

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 DJ1 of Writing Gun
Pin 5 - Deflecting Electrode DJ3 of Writing Gun
Pin 6 - Grid No.2 of Writing Gun
Pin 7 - Grid No.1 of Writing Gun
Pin 8 - Grid No.3 of Writing Gun
Pin 9 - Heater of Writing Gun
Pin 10 - Heater and Cathode of Writing Gun
Pin 11 - Deflecting Electrode DJ1 of Writing Gun
Pin 12 - Deflecting Electrode DJ2 of Writing Gun

Pin 13 - Cathode of Writing Gun
Pin 14 - Heater of Writing Gun

Recessed Ball Cap:
Over Pin 9 — Grid No.5 of Writing Gun
Over Pin 12 — Grid No.4 of Writing 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

<table>
<thead>
<tr>
<th>Writing Section</th>
<th>Viewing Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCREEN VOLTAGE</td>
<td>11000 max.**</td>
</tr>
<tr>
<td>BACKPLATE VOLT-</td>
<td>20 max.**</td>
</tr>
<tr>
<td>AGE (Peak)</td>
<td>volts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equivalent Values</th>
<th>Equivalent Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRID-No.5 VOLT-</td>
<td>300 max.**</td>
</tr>
<tr>
<td>AGE</td>
<td>volts</td>
</tr>
<tr>
<td>GRID-No.4 VOLT-</td>
<td>300 max.**</td>
</tr>
<tr>
<td>AGE</td>
<td>volts</td>
</tr>
<tr>
<td>GRID-No.3 VOLT-</td>
<td>(200 max.**)</td>
</tr>
<tr>
<td>AGE</td>
<td>10 min.**</td>
</tr>
<tr>
<td>PEAK VOLTAGE</td>
<td>Between Grid No.3</td>
</tr>
<tr>
<td>BETWEEN GRID No.3</td>
<td>AND</td>
</tr>
<tr>
<td>GRIDS No.2 &amp;</td>
<td>No.4.</td>
</tr>
</tbody>
</table>

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ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**DISPLAY STORAGE TUBE**

<table>
<thead>
<tr>
<th>Writing Section</th>
<th>Viewing Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRID-No.2 VOLTAGE</td>
<td>2950 max.**</td>
</tr>
<tr>
<td>CATHODE VOLTAGE</td>
<td>-2750 max.**</td>
</tr>
<tr>
<td>GRID-No.1 VOLTAGE</td>
<td>200 max.**</td>
</tr>
<tr>
<td>Negative-bias value</td>
<td>0 max.**</td>
</tr>
<tr>
<td>Positive-peak value</td>
<td>2 max.**</td>
</tr>
<tr>
<td>PEAK VOLTAGE</td>
<td>500 max.</td>
</tr>
<tr>
<td>BETWEEN GRIDS No.2 &amp; No.4 AND ANY DEFLECTING ELECTRODE</td>
<td>-</td>
</tr>
<tr>
<td>PEAK HEATER-CATHODE VOLTAGE:</td>
<td>-</td>
</tr>
<tr>
<td>Heater negative with respect to cathode</td>
<td>125 max.**</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>125 max.**</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Screen Voltage</th>
<th>10000</th>
<th>10000</th>
<th>volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backplate Voltage (DC)</td>
<td>2</td>
<td>2</td>
<td>volts</td>
</tr>
<tr>
<td>Grid-No.5 Voltage</td>
<td>210</td>
<td>150</td>
<td>volts</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>50 to 150</td>
<td>30 to 90</td>
<td>volts</td>
</tr>
<tr>
<td>Grid-No.3 Voltage</td>
<td>10 to 50</td>
<td>10 to 40</td>
<td>volts</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>150</td>
<td>125</td>
<td>volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td>0 to -80</td>
<td>0 to -60</td>
<td>volts</td>
</tr>
<tr>
<td>Maximum Screen Current</td>
<td>0.75</td>
<td>0.5</td>
<td>ma</td>
</tr>
<tr>
<td>Maximum Backplate Current (Peak)</td>
<td>2</td>
<td>1.5</td>
<td>ma</td>
</tr>
<tr>
<td>Maximum Grid-No.5 Current</td>
<td>3</td>
<td>2.5</td>
<td>ma</td>
</tr>
<tr>
<td>Maximum Grid-No.4 Current</td>
<td>3</td>
<td>2.5</td>
<td>ma</td>
</tr>
<tr>
<td>Maximum Grid-No.3 Current</td>
<td>5</td>
<td>4</td>
<td>ma</td>
</tr>
</tbody>
</table>

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ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
## DISPLAY STORAGE TUBE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value 1</th>
<th>Value 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Grid-No.2 Current.</td>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td>Maximum Cathode Current.</td>
<td>8</td>
<td>6.5</td>
</tr>
<tr>
<td>Number of Half-Tone Steps</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Viewing Duration</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>Maximum Erasing-Uniformity Factor</td>
<td>0.45</td>
<td>0.4</td>
</tr>
<tr>
<td>Resolution</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Brightness</td>
<td>2750</td>
<td>1500</td>
</tr>
</tbody>
</table>

**WRITING SECTION**

### Range Values for Equipment Design:

For any grids-No. 2 & No. 4 voltage ($E_{c2+4}$) between 1500 and 2750 volts:

- Grid-No. 3 Voltage for focus: 17.5% to 37.5% of $E_{c2+4}$ volts
- Maximum Grid-No. 1 Voltage for cutoff of undeflected focused spot: -4.6% of $E_{c2+4}$ volts
- Maximum Grid-No. 3 Current: -15 to +10 μA
- Maximum Cathode Current: See Curve
- Deflection Factors:
  - $D_1$ & $D_2$: 36 to 48 v dc/in./kv of $E_{c2+4}$
  - $D_3$ & $D_4$: 35 to 47 v dc/in./kv of $E_{c2+4}$
- Focused Beam Position: 3000 in./sec
- Writing Speed: 3000 in./sec

### Examples of Use of Design Ranges:

For grids-No. 2 & No. 4 voltage ($E_{c2+4}$):

- 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:

- $D_1$ & $D_2$: 72 to 98 volts
- $D_3$ & $D_4$: 70 to 94 volts

### Equivalent Values of Writing-Gun Voltages Referred to Cathode of Viewing Gun:

- Cathode Voltage: -1875 to -1850 volts
- Grid-No. 3 Voltage for focus: -1125 to -1525 volts
- Grids-No. 2 & No. 4 Voltage: +125 to +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
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.

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.

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, over scan the storage surface with writing beam to obtain maximum pattern brightness. Then cut off writing beam. Apply erasing pulses having an amplitude of between 6 to 10 volts and adjust duty cycle to obtain complete erasure in approximately 10 seconds. Measure time (t1) 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 (t2) 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 (t2 - t1)/t2.

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 drawing). 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.
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

5.25" ±0.06" DIA.
3.8" MIN USEFUL V\nVIEWING DIA.\
(SEE NOTE)

2.00" ±0.12"

4.00" ±0.25"

7.00" ±0.25"

12.50" ±0.39"

13.64" MAX.

1.5" R.

13" R.

.216" R.

2.00" ±0.06" DIA.

MEDIUM-SHELL DIMEPTAL
14-PIN BASE
JEDEC GROUP 5,
#B14-38

92CM-9855R1

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

6-59
NOTE: MINIMUM USEFUL VIEWING AREA MAY BE ECCENTRIC WITH RESPECT TO THE TUBE FACE. THE MINIMUM USEFUL VIEWING AREA WILL HAVE DIAMETER OF 3.8".

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

DEFLECTING ELECTRODES DJ₁ AND DJ₂ ARE NEARER THE SCREEN; DEFLECTING ELECTRODES DJ₃ AND DJ₄ ARE NEARER THE BASE. WITH DJ₁ POSITIVE WITH RESPECT TO DJ₂, THE SPOT WILL BE DEFLECTED TOWARD PIN 8; LIKewise, WITH DJ₃ POSITIVE WITH RESPECT TO DJ₄, THE SPOT WILL BE DEFLECTED TOWARD PIN 4.


Typical Storage Grid Characteristic

Wiring Section

Normal Operation

Saturated Volts

Storage Grid Voltages

Typical Characteristics
TYPICAL ERASURE CHARACTERISTIC

VIEWING SECTION

\[ E_f = 6.3 \text{ VOLTS} \]

\[ \text{GRID-}\#4 \text{ VOLTS ADJUSTED} \]

\[ \text{SCREEN VOLTS}^* = 10000 \]

\[ \text{GRID-}\#3 \text{ VOLTS FOR BEST} \]

\[ \text{BACKPLATE VOLTS}^* = 2 \]

\[ \text{GRID-}\#1 \text{ VOLTS COLLIMATION} \]

\[ \text{GRID-}\#5 \text{ VOLTS}^* = 150 \]

\[ \text{GRID-}\#2 \text{ VOLTS}^* = 125 \]

*REFERRED TO CATHODE OF VIEWING GUN.

ERASING CONDITIONS

- PULSE SHAPE: RECTANGULAR
- PULSE DURATION (\( \mu \text{SEC} \)) = 10 APPROX
- PULSE-REPETITION FREQUENCY (PPS) = 200
- PULSE AMPLITUDE (VOLTS) = 6 TO 10

TIME AFTER WRITING TO SATURATED BRIGHTNESS—SECONDS

WRITING-GUN-CURRENT CHARACTERISTIC

WRITING SECTION

\[ E_f = 6.3 \text{ VOLTS} \]

\[ \text{GRID-}\#3 \text{ VOLTS}^* = \text{ADJUSTED FOR FOCUS} \]

\[ \text{GRID-}\#1 \text{ VOLTS}^* = 0 \]

*REFERRED TO CATHODE OF WRITING GUN.

VIEWING SECTION

NORMAL OPERATION

MAXIMUM PEAK CATHODE OR GRIDS-\#2 & \#4 MILLIAMPERES

5

4

3

2

1

0

500

1000

1500

2000

2500

GRIDS-\#2 & \#4 VOLTS

ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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

<table>
<thead>
<tr>
<th></th>
<th>DR2000 Series</th>
<th>DR2100 Series</th>
<th>DR2200 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting Position</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>Maximum Overall Length</td>
<td>1.875 in.</td>
<td>1.660 in.</td>
<td>1.705 in.</td>
</tr>
<tr>
<td>Maximum Seated Length</td>
<td>1.625 in.</td>
<td>1.450 in.</td>
<td>1.540 in.</td>
</tr>
<tr>
<td>Maximum Diameter</td>
<td>0.785 in.</td>
<td>0.485 in.</td>
<td>0.485 in.</td>
</tr>
<tr>
<td>Base</td>
<td>9-pin min.</td>
<td>9-pin</td>
<td>9-pin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.230 in.</td>
<td>0.380 in.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pin circle</td>
<td>pin circle</td>
</tr>
</tbody>
</table>

CHARACTERISTICS

<table>
<thead>
<tr>
<th></th>
<th>DR2000 Series</th>
<th>DR2100 Series</th>
<th>DR2200 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELECTRICAL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommended DC Segment Operating Voltage Range</td>
<td>3.5 to 5.0 V</td>
<td>3.5 to 5.0 V</td>
<td>1.5 to 3.0 V</td>
</tr>
<tr>
<td>DC Segment Voltage unless otherwise specified</td>
<td>4.5 V</td>
<td>4.5 V</td>
<td>2.5 V</td>
</tr>
<tr>
<td>Segment Current</td>
<td>24 mA</td>
<td>24 mA</td>
<td>14 mA</td>
</tr>
<tr>
<td>Mean Life Expectancy (at 95% confidence)</td>
<td>100 k h</td>
<td>100 k h</td>
<td>100 k h</td>
</tr>
<tr>
<td>VISUAL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viewing Angle (including-angle)</td>
<td>140°</td>
<td>120°</td>
<td>120°</td>
</tr>
<tr>
<td>Segment Luminance (typ.)</td>
<td>7400 fL</td>
<td>7000 fL</td>
<td>4000 fL</td>
</tr>
<tr>
<td>Response Times:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ascent to Visibility (typ.)</td>
<td>15 ms</td>
<td>15 ms</td>
<td>8 ms</td>
</tr>
<tr>
<td>Descent to 50% of Luminance</td>
<td>&lt;20 ms</td>
<td>&lt;20 ms</td>
<td>&lt;10 ms</td>
</tr>
<tr>
<td>Maximum Segment Deflection</td>
<td>0.005 in.</td>
<td>0.004 in.</td>
<td>0.004 in.</td>
</tr>
<tr>
<td>From a Straight Line</td>
<td>30:1</td>
<td>30:1</td>
<td>20:1</td>
</tr>
<tr>
<td>Contrast Ratio</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Electronic Components

DATA 1

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### DR2000 Series

#### Mechanical Characteristics

DR2000 and DR2100 Series

<table>
<thead>
<tr>
<th>TEST</th>
<th>CONDITIONS</th>
<th>DC Segment Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SHOCK</strong></td>
<td></td>
<td>Sales</td>
</tr>
<tr>
<td>a)</td>
<td>100g, 1 ms, Half-Sine Wave</td>
<td>4.5</td>
</tr>
<tr>
<td>b)</td>
<td>50g, 11 ms, Half-Sine Wave</td>
<td>Not Applied</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VIBRATION</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>Variable Frequency: 10 to 44 Hz, 0.1-inch DA</td>
<td>4.5</td>
</tr>
<tr>
<td>b)</td>
<td>Variable Frequency: 44 to 200 Hz, 10g</td>
<td>4.5</td>
</tr>
<tr>
<td>c)</td>
<td>Variable Frequency: 200 to 800 Hz, 1g</td>
<td>4.5</td>
</tr>
<tr>
<td>d)</td>
<td>Variable Frequency: 800 to 2000 Hz, 10g</td>
<td>4.5</td>
</tr>
<tr>
<td>e)</td>
<td>Fatigue: 25 Hz, 2.5g, 96 hr</td>
<td>4.5</td>
</tr>
</tbody>
</table>

### DR2200 Series

<table>
<thead>
<tr>
<th>SHOCK*</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>200g, 1 ms, Half-Sine Wave</td>
<td>2.5</td>
</tr>
<tr>
<td>b)</td>
<td>50g, 11 ms, Half-Sine Wave</td>
<td>Not Applied</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VIBRATION</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>Variable Frequency: 5 to 60 Hz, 0.1-inch DA</td>
<td>2.5</td>
</tr>
<tr>
<td>b)</td>
<td>Variable Frequency: 60 to 500 Hz, 20g</td>
<td>2.5</td>
</tr>
<tr>
<td>c)</td>
<td>Fatigue: 25 Hz, 2.5g, 96 hr</td>
<td>2.5</td>
</tr>
</tbody>
</table>

* 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

<table>
<thead>
<tr>
<th>Display Type</th>
<th>Segment Designations A–H</th>
</tr>
</thead>
<tbody>
<tr>
<td>DR2000</td>
<td>H</td>
</tr>
<tr>
<td>DR2100</td>
<td>E</td>
</tr>
<tr>
<td>DR2200</td>
<td>D</td>
</tr>
<tr>
<td>DR2110</td>
<td>C</td>
</tr>
<tr>
<td>DR2115</td>
<td>G</td>
</tr>
<tr>
<td>DR2210</td>
<td>A</td>
</tr>
<tr>
<td>DR2215</td>
<td>B</td>
</tr>
<tr>
<td>DR2020</td>
<td>F</td>
</tr>
<tr>
<td>DR2120</td>
<td>DR2130</td>
</tr>
<tr>
<td>DR2220</td>
<td>DR2230</td>
</tr>
<tr>
<td></td>
<td>NC</td>
</tr>
<tr>
<td></td>
<td>NC</td>
</tr>
<tr>
<td></td>
<td>NC</td>
</tr>
<tr>
<td></td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>NC</td>
</tr>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>NC</td>
</tr>
<tr>
<td></td>
<td>NC</td>
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<tr>
<td></td>
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<td>NC</td>
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<tr>
<td></td>
<td>NC</td>
</tr>
<tr>
<td></td>
<td>NC</td>
</tr>
</tbody>
</table>

**NC** = no connection – may be used as tie point.
Segment Dimensions and Designations

\[ \phi_H = \text{Horizontal center line of display (bulb outline dimension F) with pin No. 3 toward viewer. Segment } "G" \text{ is 0.030" above } \phi_H. \]

\[ \phi_V = \text{Vertical center line of device.} \]

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.

RCA Electronic Components
Segment Dimensions And Designations – Cont’d

**DR2100**
DR2200

- Segment Dimensions:
  - A: 230 (5.84)
  - B: 400 (10.16)
  - C: 200 (5.08)
  - D: 400 (10.16)
  - E: 120 (3.04)
  - F: 400 (10.16)
  - G: 400 (10.16)
  - H: 120 (3.04)

**DR2115**
DR2215

- Segment Dimensions:
  - A: 230 (5.84)
  - B: 400 (10.16)
  - C: 200 (5.08)
  - D: 400 (10.16)
  - E: 120 (3.04)
  - F: 400 (10.16)
  - G: 400 (10.16)
  - H: 120 (3.04)

**DR2120**
DR2220

- Segment Dimensions:
  - A: 180 (4.57)
  - B: 180 (4.57)
  - C: 400 (10.16)
  - D: 400 (10.16)

**DR2130**
DR2230

- Segment Dimensions:
  - A: 180 (4.57)
  - B: 180 (4.57)
  - C: 400 (10.16)
  - D: 400 (10.16)

**DR2110**
DR2210

- Segment Dimensions:
  - A: 230 (5.84)
  - B: 400 (10.16)
  - C: 200 (5.08)
  - D: 400 (10.16)
  - E: 120 (3.04)
  - F: 400 (10.16)
  - G: 400 (10.16)
  - H: 120 (3.04)

**DR2120**
DR2220

- Segment Dimensions:
  - A: 180 (4.57)
  - B: 180 (4.57)
  - C: 400 (10.16)
  - D: 400 (10.16)
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

<table>
<thead>
<tr>
<th>Display</th>
<th>Device Pin Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DR2000 DR2100 DR2200</td>
</tr>
<tr>
<td>0</td>
<td>3,4,5,7, 8,9</td>
</tr>
<tr>
<td>1</td>
<td>5,8</td>
</tr>
<tr>
<td>2</td>
<td>3,4,6, 7,8</td>
</tr>
<tr>
<td>3</td>
<td>4,5,6, 7,8</td>
</tr>
<tr>
<td>4</td>
<td>5,6,8,9</td>
</tr>
<tr>
<td>5</td>
<td>4,5,6, 7,9</td>
</tr>
<tr>
<td>6</td>
<td>3,4,5,6, 7,9</td>
</tr>
<tr>
<td>7</td>
<td>5,7,8</td>
</tr>
<tr>
<td>8</td>
<td>3,4,5,6, 7,8,9</td>
</tr>
<tr>
<td>9</td>
<td>4,5,6,7, 8,9</td>
</tr>
<tr>
<td>+</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td></td>
</tr>
<tr>
<td>decimal</td>
<td>1</td>
</tr>
</tbody>
</table>

**Pin No. 2 Common For All Types**

**Electronic Components**

**DATA 4 11/72**
**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.


**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
      - 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.
**DR2000 Series**

**DR2100, DR2200 Series**

**Dimensional Outlines**

**Table: Dimensional Outlines**

<table>
<thead>
<tr>
<th>DIMENSION</th>
<th>DR2000 Series</th>
<th>DR2100 and DR2200 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>INCHES</td>
<td>MILLIMETERS</td>
</tr>
<tr>
<td>A</td>
<td>MIN. 0.800</td>
<td>MAX. 20.32</td>
</tr>
<tr>
<td>C</td>
<td>MIN. 1.875</td>
<td>MAX. 47.62</td>
</tr>
<tr>
<td>D</td>
<td>MIN. 1.625</td>
<td>MAX. 41.27</td>
</tr>
<tr>
<td>F</td>
<td>MIN. 0.700</td>
<td>MAX. 17.78</td>
</tr>
</tbody>
</table>

**Millimeter Dimension Derived From Inch Dimension**
Dimensional Outlines – Cont’d

DR2100V1, DR2200V1 Series

<table>
<thead>
<tr>
<th>Dimension</th>
<th>DR2100V1 and DR2200V1 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>INCHES</td>
</tr>
<tr>
<td></td>
<td>MIN.</td>
</tr>
<tr>
<td>A</td>
<td>0.485</td>
</tr>
<tr>
<td>C</td>
<td>1.705</td>
</tr>
<tr>
<td>D</td>
<td>1.450</td>
</tr>
<tr>
<td>F</td>
<td>0.625</td>
</tr>
<tr>
<td>G</td>
<td>0.060</td>
</tr>
<tr>
<td>H</td>
<td>0.136</td>
</tr>
</tbody>
</table>

Segment Luminance Characteristics

Based on measurement with a 50 micron fiber-optic probe.
Segment Current Characteristics

![Graph showing recommended segment voltage operating ranges for DR2000, DR2100, and DR2200 series]

Envelope Temperature Characteristics

![Graph showing envelope temperature characteristics for DR2000, DR2100, and DR2200 series]