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

For further Technical Information, write to Commercial Engineering, Tube Division, Radio Corporation of America, Harrison, N. J.
CATHODE-RAY TUBE,
STORAGE TUBE, & MONOSCOPE
CLASSIFICATION CHART

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

### PICTURE TUBES

#### BLACK-AND-WHITE TELEVISION TYPES

<table>
<thead>
<tr>
<th>Round Metal-Shell</th>
<th>Magnetic Focus</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
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<td>19AP4-B</td>
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<th>Electrostatic Focus</th>
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<th>Electrostatic Focus</th>
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<tr>
<td>10BP4-A</td>
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<tr>
<td>10FP4-A*</td>
<td>16LP4-A</td>
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<td>20HP4-D*</td>
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* Type having aluminized screen.
CATHODE-RAY TUBE,
STORAGE TUBE, & MONOSCOPE
CLASSIFICATION CHART

**PICTURE TUBES (Cont'd)**

### BLACK-AND-WHITE TELEVISION TYPES

**Rectangular Glass**

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<td>14RP4</td>
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### COLOR-TELEVISION TYPES

**Round Metal-Shell**

| 21AXP22*                        |
| 21AXP22-A*                      |

**Round Glass**

| 15GP22*                         |
| 21CYP22*                        |

* Type having aluminized screen.

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ELECTRON TUBE DIVISION
CLASSIFICATION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
CHART 1
# Special-Purpose Kinescopes

<table>
<thead>
<tr>
<th>Monitor Types</th>
<th>Focusing Method</th>
<th>Deflection Method</th>
<th>Minimum Screen Size Inches</th>
<th>Maximum Ultron Volts°</th>
<th>Tube Type</th>
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<th>Minimum Screen Size Inches</th>
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<td>M</td>
<td>5 x 3-3/4**</td>
<td>80000†</td>
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<td>5 x 3-3/4**</td>
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<th>Deflection Method</th>
<th>Minimum Screen Size Inches</th>
<th>Maximum Ultron Volts°</th>
<th>Tube Type</th>
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</thead>
<tbody>
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<td>M</td>
<td>4-1/4 Diameter</td>
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<table>
<thead>
<tr>
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<th>Deflection Method</th>
<th>Minimum Screen Size Inches</th>
<th>Maximum Ultron Volts°</th>
<th>Tube Type</th>
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</thead>
<tbody>
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<td>E</td>
<td>M</td>
<td>4-1/4 Diameter*</td>
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## Storage Tubes

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<th>Name</th>
<th>Description</th>
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<td>Single-Beam, Barrier-Grid Type</td>
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<tr>
<td>Computer</td>
<td>Single-Beam, Primary-Current-Modulation Type</td>
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<tr>
<td>Display</td>
<td>Direct-View, 5-Inch, 2-Gun Type with Electrostatically Deflected Writing Beam</td>
<td>6866</td>
</tr>
<tr>
<td>Display</td>
<td>Direct-View, 5-Inch, 2-Gun Type with Magnetically Deflected Writing Beam</td>
<td>7183</td>
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<tr>
<td>Graphechon</td>
<td>Signal-Converter Type with Reading Gun and Writing Gun</td>
<td>6896/1855</td>
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</tbody>
</table>

* Design-center values except as noted.
* Type having aluminized screen.
* Quality-circle diameter of faceplate. When used with suitable reflective optical system, the 5AZP4 provides an 8' x 6' picture.
† Absolute value.
* Quality-circle diameter of faceplate. When used with suitable reflective optical system, the 5TP4 provides a 24" x 18" picture.
* Quality rectangle of faceplate. When used with suitable reflective optical system, the 7NP4 provides a 20' x 15' picture at a projection-throw distance of 60'.
* Like footnote, except projection-throw distance is 80'.
E = Electrostatic.
M = Magnetic.
## FLYING-SPOT CATHODE-RAY TUBES

<table>
<thead>
<tr>
<th>Approx. Bulb Dia. Inches</th>
<th>Focusing Method</th>
<th>Deflection Method</th>
<th>Phosphor</th>
<th>Maximum Ulterior Volts</th>
<th>TUBE TYPE</th>
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<tbody>
<tr>
<td>Black-and-White Television Types</td>
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## MONOSCOPES

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<th>Focusing Method</th>
<th>Deflection Method</th>
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<td>M</td>
<td>Resolution Chart</td>
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See sheet FEATURES OF FLUORESCENT SCREENS.

* Design-center values.

E = Electrostatic.

M = Magnetic.

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

CLASSIFICATION

CHART 2
### Oscillograph Tubes

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- Design-center values.
- See sheet FEATURES OF FLUORESCENT SCREENS.
- Similar to Type 3RP1 except for flat faceplate.
- Maximum post-ultron volts.
- Similar to Type 5FP14 except for high-resolution capability.
- Similar to Type 5AHPP7 except for aluminized screen.
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# Picture-Tube Replacement Guide

**Bold-Face Type Indicates an Aluminized Tube**

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**RADIO CORPORATION OF AMERICA**  
Electron Tube Division  
Harrison, N. J.  
REPLACEMENT GUIDE 2  
I-62
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<tr>
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<td>21DEP4A</td>
</tr>
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<td>21DEP4A</td>
</tr>
<tr>
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<td>21DEP4A</td>
</tr>
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<td>21FAP4</td>
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<td>21FMP4</td>
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<td>21FDP4</td>
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* The RCA type shown is a direct replacement unless otherwise indicated.

- Minor electrical and/or mechanical set modification may be required.
**Bold-Face Type Indicates an Aluminized Tube**

<table>
<thead>
<tr>
<th>Type to be Replaced</th>
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<tbody>
<tr>
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<td>23XP4</td>
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<tr>
<td>23YP4</td>
<td>23YP4</td>
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<tr>
<td>24ADP4</td>
<td>24ADP4</td>
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<tr>
<td>24VP4A/24CP4A/24TP4</td>
<td>24CP4A</td>
</tr>
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<table>
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<tr>
<td>24DP4A</td>
<td>24DP4A</td>
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<tr>
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<td>24Q4P4</td>
</tr>
<tr>
<td>24TP4</td>
<td>24TP4</td>
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<tr>
<td>27MP4</td>
<td>27MP4</td>
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<tr>
<td>27NP4</td>
<td>27NP4</td>
</tr>
<tr>
<td>27RP4</td>
<td>27RP4</td>
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<tr>
<td>27VP4</td>
<td>27RP4</td>
</tr>
<tr>
<td>27XP4</td>
<td>27RP4</td>
</tr>
</tbody>
</table>

*The RCA type shown is a direct replacement unless otherwise indicated.*

*Minor electrical and/or mechanical set modification may be required.*
FEATURES OF FLUORESCENT SCREENS

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

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

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

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

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

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

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

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

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

11-58

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

SCREEN FEATURES
FEATURES OF FLUORESCENT SCREENS

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

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

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

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

Phosphor P24 is a short-persistence phosphor with green fluorescence and phosphorescence. Its spectral-energy emission characteristic has sufficient range to provide useable energy over the visible spectrum required for generating color signals from color transparencies.
PERSISTENCE CHARACTERISTIC
OF PHOSPHOR P1

CURVE IS ESSENTIALLY INDEPENDENT
OF TUBE OPERATING VALUES

RELATIVE BRIGHTNESS — PER CENT OF MAXIMUM

TIME AFTER EXCITATION IS REMOVED — MILLISECONDS

FEB. 1, 1951
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-5380R2
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P2
PERSISTENCE CHARACTERISTIC
OF PHOSPHOR P2

Subdivisions are 2.4.6.8
SPECTRAL-ENERGY EMISSION CHARACTERISTIC
OF PHOSPHOR P4
SULFIDE TYPE

COLOR TEMPERATURE: 7000°K

WAVELENGTH-ANGSTROMS

RELATIVE RADIANT ENERGY

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
FOR KINESCOPES

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

FOR OSCILLOGRAPH TUBES

The persistence characteristics of the phosphorescence are the same as those shown for the P11 phosphor.
SPECTRAL-ENERGY EMISSION CHARACTERISTIC
OF PHOSPHOR Nº 4
SILICATE-SULFIDE TYPE

COLOR TEMPERATURE: 6300°K

WAVELENGTH-ANGSTROMS

RELATIVE RADIANT ENERGY

MARCH 6, 1950
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-7458
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.
SPECTRAL-ENERGY EMISSION CHARACTERISTIC
OF PHOSPHOR P4
SILICATE TYPE

COLOR TEMPERATURE: 5500°K

RELATIVE RADIANT ENERGY

WAVELENGTH-ANGSTROMS

AUG. 2, 1949
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7335
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.
SPECTRAL-ENERGY EMISSION CHARACTERISTIC
OF PHOSPHOR Nº 5

WAVELENGTH-ANGSTROMS

RELATIVE RADIANT ENERGY

3000 4000 5000 6000 7000

MAY 2, 1949
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-5559R2
PERSISTENCE CHARACTERISTIC OF PHOSPHOR No. 5

TIME AFTER EXCITATION IS REMOVED—MICROSECONDS

RELATIVE BRIGHTNESS—PERCENT OF MAXIMUM
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P7

WAVELENGTH-ANGSTROMS

RELATIVE RADIANT ENERGY

RANGE
AVERAGE
PERSISTENCE CHARACTERISTIC
OF PHOSPHOR P7

Subdivisions are 2, 4, 6.

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

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7015R4
BUILDUP CHARACTERISTICS OF PHOSPHOR P7

FINAL HIGH-VOLTAGE-ELECTRODE VOLTS: 4000–9000
SCANNING AREA (CM): 7 x 7
NUMBER OF LINES: 260 APPROX.
EXCITATION: PULSE OF 1/60-SECOND DURATION
SUPPLIED TO GRID NO.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.

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<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>
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</tbody>
</table>

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7019R3
BUILDUP CHARACTERISTICS
OF PHOSPHOR P7

SCANNING AREA (CM): 7 x 7
NUMBER OF LINES: 260 APPROX.
EXCITATION: PULSE OF 1/60-SECOND DURATION SUPPLIED TO GRID NO1 OF CATHODE-RAY TUBE AT 1-SECOND INTERVALS FOR EACH OF THE LOCI UNDER THE INDICATED CONDITIONS.
BRIGHTNESS: MEASURED JUST BEFORE EACH EXCITATION PULSE.

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

EXCITATION PULSE

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6805R5
PERSISTENCE CHARACTERISTICS OF PHOSPHOR P7

EXCITATION LEVEL (SATURATION)

SCANNING AREA (CM): 7×7
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>
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<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>
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</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 NO. 11

WAVELENGTH — ANGSTROMS

RELATIVE RADIANT ENERGY

APRIL 9, 1946
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6749
PERSISTENCE CHARACTERISTICS
OF PHOSPHOR NO. II

\[ n_{\text{max}} = 0.5 \text{ to } 2 \]
WHERE \( n = \text{slope} \)

CURVE A: \( 2 \mu\text{A/cm}^2, \frac{1}{60} \text{ sec. pulse} \)
B: \( 20 \mu\text{A/cm}^2, \text{single-line scan} \)
C: \( 50 \mu\text{A/cm}^2, \text{single-line scan} \)

RELATIVE BRIGHTNESS — PER CENT OF MAXIMUM

TIME AFTER EXCITATION IS REMOVED—MILLISECONDS

JULY 7, 1950
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8806R2
PERSISTENCE CHARACTERISTIC
OF PHOSPHOR P12

CURVE IS ESSENTIALLY INDEPENDENT
OF TUBE OPERATING VALUES

TIME AFTER EXCITATION IS REMOVED—MILLISECONDS

RELATIVE BRIGHTNESS—PER CENT OF MAXIMUM

FEB. 1, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-7318RI
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P14

AUG. 1, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7675
PERSISTENCE CHARACTERISTIC OF PHOSPHOR P14

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

Subdivisions are 2, 4, 6, 8
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P15

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

RELATIVE RADIANT ENERGY

WAVELENGTH-ANGSTROMS

5000
4000
3000
2000
1000
0
3000 4000 5000 6000 7000 WAVELENGTH-ANGSTROMS

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY 92CM-6915R1
PERSISTENCE CHARACTERISTIC
OF PHOSPHOR P15

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>EACH ESSENTIALLY INDEPENDENT OF TUBE OPERATING VALUES.</th>
</tr>
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<tbody>
<tr>
<td>VISIBLE</td>
<td>SHOWN BY CURVE.</td>
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<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.

![Graph](image)

RELATIVE BRIGHTNESS

TIME AFTER EXCITATION IS REMOVED — MICROSECONDS

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

92CM-8540RI
### Spectral-Energy Emission Characteristic of Phosphor P16

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<th>Y</th>
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<tr>
<td>Visible</td>
<td>Violet</td>
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<td>0.175</td>
<td>0.003</td>
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<td>Near Ultraviolet</td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

#### Graph:
- **Wavelength (Angstroms)**: 3000 to 5000
- **Relative Radiant Energy**: 0 to 100

**Electron Tube Division**
Radio Corporation of America, Harrison, New Jersey

92CM-7563RI
PERSISTENCE CHARACTERISTIC OF PHOSPHOR P16

- CURVE IS ESSENTIALLY INDEPENDENT OF TUBE OPERATING VALUES.
- SPOT: SHARPLY FOCUSED.
SPECTRAL-ENERGY EMISSION CHARACTERISTIC
OF PHOSPHOR P20

<table>
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<th>I.C.I. COORDINATES</th>
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<tr>
<td>YELLOW-GREEN</td>
<td>X 0.422</td>
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<tr>
<td></td>
<td>Y 0.558</td>
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</tbody>
</table>

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
PERSISTENCE CHARACTERISTICS
OF PHOSPHOR P20

\[ n_{\text{max}} = 0.5 \text{ to } 2 \]
WHERE \( n = \text{slope} \)

CURVE A: 2 \( \mu \text{A/CM}^2 \), 1/60-SECOND PULSE.
B: 20 \( \mu \text{A/CM}^2 \), SINGLE-LINE SCAN.
C: 50 \( \mu \text{A/CM}^2 \), SINGLE-LINE SCAN.

RELATIVE BRIGHTNESS—PER CENT OF MAXIMUM

TIME AFTER EXCITATION IS REMOVED—MILLISECONDS

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

92CM-6806R2
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 COLOR</th>
<th>CIE COORDINATES</th>
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<tbody>
<tr>
<td>GENERAL DESCRIPTION</td>
<td>JEDEC DESIGNATION</td>
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<tr>
<td>BLUE</td>
<td>PURPLISH-BLUE</td>
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<tr>
<td>GREEN</td>
<td>YELLOWISH-GREEN</td>
</tr>
<tr>
<td>RED</td>
<td>REDDISH-ORANGE</td>
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</table>

*JEDEC COLOR CLASSIFICATION CORRESPONDING TO CIE COORDINATE VALUES.

---

GROUP PHOSPHOR P22

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

GROUP PHOSPHOR P22
10-60
Group Phosphor P22

PERSISTENCE CHARACTERISTIC

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

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

The curve is essentially independent of tube operating values.
Spot: Sharply focused.

<table>
<thead>
<tr>
<th>TIME AFTER EXCITATION IS REMOVED — MICROSECONDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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<tr>
<td>100</td>
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</tbody>
</table>

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

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 ultror contact.

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

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

Contact Area for Grounding

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

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

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
12-3 MIN.

SCREEN HEIGHT
8\(\frac{5}{8}\) MIN.

SCREEN WIDTH
11\(\frac{1}{2}\) MIN.

12\(\frac{17}{32}\) + \(\frac{1}{8}\)

27 R.

65°

7 + \(\frac{1}{16}\)

1\(\frac{1}{16}\) DIA.
BULB J109-1/2 A/C

OVERALL LENGTH*

9 \frac{11}{32} + \frac{1}{8}

NECK LENGTH*

2 \frac{5}{8} + \frac{1}{4}

CAVITY CAP

JEDEC No. J1-21

REFERENCE LINE DETERMINED BY GAUGE

JEDEC No. G-110

92CL-11528

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
13 MIN.

SCREEN HEIGHT
9 1/2 MIN.

SCREEN WIDTH
12 1/16 MIN.

13 1/16 ± 1/8

85°

24 R.

L 1/16 ± 1/16 DIA.
BULB J112 A/B

OVERALL LENGTH*

7 11/16 ± 1/8

NECK LENGTH*

10 9/16 ± 1/8

CAVITY CAP
JEDEC No. J1-21

2 1/4 ± 1/4

BASE*

68°

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC NO. G-116

14 ± 1/8

90°

92CL-11506

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
14 7/8 MIN.

SCREEN WIDTH
15 15/16 MIN.

SCREEN HEIGHT
10 1/4 MIN.

13 45 ± 1/8

25 3/4 R

102°

1.125 ± .031 .025 DIA.
ALL DIMENSIONS IN INCHES

* See data for specific tube type.
BULB J129 A/B

OVERALL LENGTH*

11 1/4 ± 1/8

NECK LENGTH*

11 ± 1/8

CAVITY CAP
JEDEC No. JI-21

3 5/8 ± 1/8

BASE*

16 1/8 ± 1/8

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No. 6-110

92CL-11517

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

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.

105°

1 1/8 ± 1/32 DIA.

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
BULB J132-1/2 A/B

OVERALL LENGTH

NECK LENGTH

BASE

CAVITY CAP
JEDEC No. J1-21

12 3/4
± 1/8
87°

7 1/8 ± 1/8

13/16 ± 1/8

16 9/16 ± 1/8

110°

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No. G-126

92CL-11589

ALL DIMENSIONS IN INCHES

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

SCREEN DIAGONAL
16 3/4 MIN.

SCREEN HEIGHT
11 11/16 MIN.

SCREEN WIDTH
14 3/4 MIN.

15 5/8 ± 1/8

20 3/4 R.

85°

17/16 ± 1/16 DIA.
BULB J132-1/2 C/D

OVERALL LENGTH: 9 1/2 ± 1/8
NECK LENGTH:

BASE:

CAVITY CAP: JEDEC No. J1-21

3 13/16 ± 1/4

16 3/16 ± 1/8

90°

REFERENCE LINE DETERMINED BY GAUGE JEDEC NO. G-116

92CL-11514

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
15 5/16 MIN.

SCREEN HEIGHT
11 1/8 MIN.

SCREEN WIDTH
14 5/16 MIN.

15 + 1/64

27 R.

65°

7 + 1/16 DIA.
BULB J133 B/D

OVERALL LENGTH

NECK LENGTH

BASE

CAVITY CAP

JEDEC No. J1-21

REFERENCE LINE

DETERMINED BY GAUGE

JEDEC No. G-110

92CL-11526

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
15 2/16 MIN.

SCREEN HEIGHT
10 3/4 MIN.

SCREEN WIDTH
14 1/4 MIN.

15 25/64 + 1/8

27 R.

65°

1 7/16 ± 1/16 DIA.
BULB J133 C/E

OVERALL LENGTH*

NECK LENGTH*

BASE*

CAVITY CAP
JEDEC No. J1-21

- 4 5 + 1
8 - 4

12 9
32

+ 1
8

50°

70°

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No. G-110

92CL-11559

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
15 9/16 MIN.

SCREEN HEIGHT
11 1/8 MIN.

SCREEN WIDTH
14 5/16 MIN.

15 25/64 ± 1/8

27 R.
85°

1 7/16 ± 1/16 DIA.
BULB J133 F/G

OVERALL LENGTH

NECK LENGTH

BASE

CAVITY CAP
JEDEC No. J1-21

\[12 \frac{9}{32} \pm \frac{1}{8}\]

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

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

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No. G-116

92CL-11557

ALL DIMENSIONS IN INCHES

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

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

SCREEN HEIGHT
12 MIN.

SCREEN WIDTH
15\frac{1}{8} MIN.

16\frac{13}{32} \pm \frac{1}{8}

21 R. 48 R.

102°

1.884

1.125 \pm .031 -.025 DIA.
BULB J149 A

OVERALL LENGTH

NECK LENGTH

BASE

CAVITY CAP
JEDEC No. J1-21

13\frac{11}{32}
\pm \frac{1}{8}

85^\circ

19\frac{1}{16}
\pm \frac{1}{8}

18.5\pm \frac{1}{8}

114^\circ

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No. G-126

92CL-11510

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
17 9/16 MIN.

SCREEN HEIGHT
12 MIN.

SCREEN WIDTH
15 1/6 MIN.

16 13/32

21 R.

48 R.

81°

7 7/16 DIA.
BULB J149 B

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
17 5/8 MIN.

SCREEN HEIGHT
12 1/16 MIN.

SCREEN WIDTH
15 1/4 MIN.

17 17 + 3/32
64 - 3/32

20 1/4 R.

53 1/4 R.

102°

1.125 + .043 DIA.

2 7/16

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
BULB J149 C AND PROTECTIVE PANEL

OVERALL LENGTH

NECK LENGTH

BASE

CAVITY CAP
JEDEC No. J1-21

9 + 1/16 - 1/8

14 + 3/32 ± 3/32

85°

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC NO.G-126

19.56 ± 3/32

11/8

92CL-11570

ALL DIMENSIONS IN INCHES

* See data for specific tube type.

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
18 3/8 MIN.

SCREEN HEIGHT
12 3/4 MIN.

SCREEN WIDTH
17 MIN.

18 11/16 ± 1/8

40 R.

66°

7 ± 1/16 DIA.

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
BULB J161 C/D

OVERALL LENGTH: 14 1/4 + 3/16

NECK LENGTH: 14 15/16 + 1/8

BASE:

CAVITY CAP
JEDEC No. JI-21

6 5/8 + 1/4

50°

20 3/32 + 1/8

70°

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No. G-110

92CL-11597

ALL DIMENSIONS IN INCHES

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

SCREEN DIAGONAL
19 1/2 MIN.

SCREEN HEIGHT
13 5/8 MIN.

SCREEN WIDTH
17 3/8 MIN.

18 11/16 ± 1/8

40 R.

66°

1 7/16 ± 1/16 DIA.
ALL DIMENSIONS IN INCHES

*See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
20 7/16 MIN.

SCREEN HEIGHT
13 7/8 MIN.

SCREEN WIDTH
19 7/8 MIN.

20 1/4 ± 1/8

35 R.

65°

7/16 ± 1/16 DIA.
BULB J170 A/C

OVERALL LENGTH*

NECK LENGTH*

BASE*

CAVITY CAP
JEDEC No. J1-21

7 5 + 1
32 4

15 3/16
± 1/8

50°

21 7/32 ± 1/8

70°

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No. G-110

92CL-II598

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL  20 MIN.

SCREEN HEIGHT  14 3/16 MIN.

SCREEN WIDTH  19 1/16 MIN.

20 1/4 + 1/8

40 R.

65°

1 7/16 + 1/16 DIA.
BULB J170 B/D

OVERALL LENGTH

15 17/32 + 3/16

NECK LENGTH

BASE

CAVITY CAP
JEDC No.JI-21

7 5/32 + 1/4

REFERENCE LINE DETERMINED BY GAUGE
JEDC No.G-110

92CL-11566

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
20 1/4 MIN.

SCREEN WIDTH
19 1/16 MIN.

SCREEN HEIGHT
15 1/16 MIN.

20 1/4 ± 1/8

33 R.

67°

7/16 ± 1/16 DIA.

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
Bulb J171 B/F

OVERALL LENGTH

NECK LENGTH

BASE

CAVITY CAP
JEDEC No. J1-21

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No. G-10

ALL DIMENSIONS IN INCHES

*See data for specific tube type.

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
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 1/2 - 3/16

NECK LENGTH*

CAVITY CAP
JEDEC No.J1-21

BASE*

4 1/8 - 1/4

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No. G-16

92CL-11599

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

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

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

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

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

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

105^\circ

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

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
20 4 MIN.

SCREEN HEIGHT
15 1/16 MIN.

SCREEN WIDTH
19 1/16 MIN.

20 1/4 ± 1/8

33 R.

105°

1 1/8 ± 1/32 DIA.
Bulb J171 H/J

OVERALL LENGTH

NECK LENGTH

BASE

CAVITY CAP
JEDEC No. J1-21

NECK LENGTH

9 ± 3
16

16 3
8
± 1
8

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No. G-126

2 ± 1
8

2 ± 1
8

3 ± 1
8

87°

110°

*See data for specific tube type.

ALL DIMENSIONS IN INCHES
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
22 7/8 MIN.

SCREEN HEIGHT
15 1/4 MIN.

SCREEN WIDTH
19 5/16 MIN.

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

OVERALL LENGTH

NECK LENGTH

NECK LENGTH

Neck Length

Neck Length

Base

Cavity Cap

JEDEC No. J1-21

REFERENCE LINE

DETERMINED BY GAUGE

JEDEC No. G-126

37 R.

50 4 R.

10°

17 1/4 R.

24 45 + 3

2 45

16

3 1/2

3

35 R.

45 1/2 R.

82°

17 13/32 + 3/32 - 1/8

10 1/16 + 1/4

2 3/4 + 3/32

10 1/16 + 1/4

2 3/4 + 3/32

* See data for specific tube type.

ALL DIMENSIONS IN INCHES

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

OUTLINES 21
3-62
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL 22 5/16 MIN.

SCREEN HEIGHT 15 5/8 MIN.

SCREEN WIDTH 19 1/4 MIN.

1.125 +0.031 -0.025 DIA.

20 1/2 +1/8 -1/8
BULB J187 B

ALL DIMENSIONS IN INCHES

* See data for specific tube type.

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL 22 3/16

SCREEN HEIGHT 15 1/8 MIN.

SCREEN WIDTH 19 1/4 MIN.

20 1/2 + 1/8

80°

7 ± 1/16 DIA.
BULB J187 C/F

OVERALL LENGTH*

12 1/2

+ 3

16

NECK LENGTH*

16 1/2

+ 1/8

65°

CAVITY CAP
JEDEC No. J1-21

BASE*

4 3/16

+ 1/4

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC No. 6-116

92CL-11584

ALL DIMENSIONS IN INCHES

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

SCREEN DIAGONAL
22-5/16 MIN.

SCREEN HEIGHT
15-1/4 MIN.

SCREEN WIDTH
19-5/16 MIN.

21 5/16 ± 1/8

50 1/4 R.
35 1/4 R.

81°

3/4

7/16 ± 1/16 DIA.
BULB J187 D/G AND PROTECTIVE PANEL

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
22 13/16 MIN.

SCREEN HEIGHT
16 7/8 MIN.

SCREEN WIDTH
21 7/16 MIN.

22 11/16 + 1/8

40 R.

85°

7/16 + 1/16 DIA.

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
22 13/16 MIN.

SCREEN HEIGHT
16 7/8 MIN.

SCREEN WIDTH
21 7/16 MIN.

22 11/16 ± 1/8

32 R.

105°

1 1/8 ± 1/32 DIA.

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
BULB J192 C/D

ALL DIMENSIONS IN INCHES

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

SCREEN DIAGONAL
25 3/4 MIN.

SCREEN HEIGHT
18 5/8 MIN.

SCREEN WIDTH
24 1/4 MIN.

25 9/32 + 1/8

40 R.

85°

7/16 + 1/16 DIA.
BULB J214-1/2 A

OVERALL LENGTH

NECK LENGTH

20 7/32
+ 1/8

68°

NECK

BASE

CAVITY CAP
JEDEC No. J1-21

90°

REFERENCE LINE
DETERMINED BY GAUGE
JEDEC NO. G-116

ALL DIMENSIONS IN INCHES

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

SCREEN DIAGONAL
15 1/4 MIN.

SCREEN HEIGHT
10 11/16 MIN.

SCREEN WIDTH
14 3/8 MIN.

ULTOR LIP-TERMINAL

METAL SHELL

30 R.

66°

15 3/8 + 1/16

7/16 ± 1/16 DIA.
ALL DIMENSIONS IN INCHES

* See data for specific tube type.
Dimensional Outline

FOR PICTURE TUBES UTILIZING

SCREEN DIAGONAL
19 1/8 MIN.

SCREEN HEIGHT
13 11/16 MIN.

SCREEN WIDTH
18 1/8 MIN.

19 23/32 - 1/8

ULTOR LIP-TERMINAL

METAL SHELL

33 R.

66°

1 7/16 - 1/16 DIA.
BULB MJ166 A

ALL DIMENSIONS IN INCHES

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

SCREEN DIAGONAL
25 7/16 MIN.

SCREEN HEIGHT
18 1/8 MIN.

SCREEN WIDTH
23 7/16 MIN.

25 1/4 ± 3/16

ULTOR LIP - TERMINAL

METAL SHELL

85°

1 7/16 ± 1/16 DIA.
BULB MJ214 A

ALL DIMENSIONS IN INCHES

* See data for specific tube type.
REFERENCE-LINE GAUGE
JETEC NO. 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
WHEN TUBE NECK IS INSERTED THROUGH GAUGE, REFERENCE LINE WILL BE DETERMINED BY PLANE C-C' WHEN GAUGE IS RESTING ON FUNNEL.
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
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 "ультор" 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-ультор" in a cathode-ray tube is the element to which is applied a dc voltage higher than the ultor voltage for accelerating the electrons in the beam after its deflection.
IEPI
Oscillograph Tube
Electrostatic Focus
Electrostatic Deflection

DATA

General:
Heater, for Unipotential Cathode:
Voltage: 6.3 \text{ ac or dc volts}
Current: 0.6 \pm 10\% \text{ amp}

Direct Interelectrode Capacitances (Approx.):
- Grid No. 1 to all other electrodes: 6.5 \mu F
- Deflecting electrode DJ 1 to deflecting electrode DJ 2: 1.7 \mu F
- Deflecting electrode DJ 3 to deflecting electrode DJ 4: 0.6 \mu F
- DJ 1 to all other electrodes: 5 \mu F
- DJ 2 to all other electrodes: 5 \mu F
- DJ 3 to all other electrodes: 3.8 \mu F
- DJ 4 to all other electrodes: 3.8 \mu F

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

Focusing Method: Electrostatic
Deflection Method: Electrostatic

Maximum Overall Length: 4-11/16" ± 1/16"
Maximum Diameter: 1-1/4" ± 1/16"
Minimum Useful Screen Diameter: 1-1/16"
Mounting Position: Any

Weight (Approx.): 2 oz

Bulb: Small-Button Unidekar 11-Pin (JETEC No. E11-22)
Basing Designation for BOTTOM VIEW: 11V

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

DJ 1 and DJ 2 are nearer the screen
DJ 3 and DJ 4 are nearer the base

6-56
Tube Division
Radio Corporation of America, Harrison, New Jersey
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 ±100°.

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>Parameter</th>
<th>Value</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 negative bias value</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>GRID-No.1 VOLTAGE positive bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>GRID-No.1 VOLTAGE 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 ultor voltage \((E_c)\) between recommended minimum and 1500 volts

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.3 Voltage for Focus</td>
<td>10% to 30% of (E_c)</td>
</tr>
<tr>
<td>Grid-No.1 Voltage for Visual Extinction of</td>
<td></td>
</tr>
<tr>
<td>Undeflected Focused Spot.</td>
<td>-1.4% to -4.2% of (E_c)</td>
</tr>
<tr>
<td>Grid-No.3 Current for Any Operating Condition</td>
<td>-15 to +10 μamp</td>
</tr>
<tr>
<td>Deflection Factors:</td>
<td></td>
</tr>
<tr>
<td>DJ1 &amp; DJ2</td>
<td>210 to 310 v dc/in./kv of (E_c)</td>
</tr>
<tr>
<td>DJ3 &amp; DJ4</td>
<td>240 to 350 v dc/in./kv of (E_c)</td>
</tr>
<tr>
<td>Spot Position</td>
<td></td>
</tr>
</tbody>
</table>

**Examples of Use of Design Ranges:**

For ultor voltage of 500 1000 volts

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</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.
### Oscilloscope Tube

**Grid-No. 1 Voltage for Visual Extinction of Undeflected Focused Spot**

- 500 volts: -7 to -21 volts
- 1000 volts: -14 to -42 volts

**Deflection Factors:**

- DJ₁ & DJ₂: 105 to 155 volts dc/in.
- DJ₃ & DJ₄: 120 to 175 volts dc/in.

**Maximum Circuit Values:**

- Grid-No. 1 Circuit Resistance: 1.5 max. megohms
- Resistance in Any Deflecting-Electrode Circuit: 2.0 max. megohms

---

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

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

---

![Diagram of the oscilloscope tube](image-url)

**Dimensions:**

- Screen Diameter: 1 1/4" ± 1/16" min.
- Overall Height: 4 1/16" max.
- Small Button Unidekar 11-Pin Base: Jetec No. EII-22

**Model:**

92CS-8924

---

**RCA**

IEPI

**Oscilloscope Tube**

---

**Notes:**

6-56

TENTATIVE DATA 2

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
 OSCILLOGRAPH TUBE 

TYPICAL OSCILLOGRAPH CIRCUIT

C1: 0.5 µf, 2000 volts  
C2: 1 µf, 200 volts  
C3: 1 µf, 200 volts  
C4: 0.05 µf, 1600 volts  
C5 C6 C7 C8: 0.05 µf, 600 volts  
R1 R2: 51,000 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  
R18: Transformer, 6.3 volts at 1 ampere, insulated for 2000 volts, such as Thordarson T21F08  
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.

6-56 TUBE DIVISION  
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
IEPI

AVERAGE CHARACTERISTICS

$E_c = 6.3\ \text{VOLTS}$

GRID-N$^\#3$ VOLTS ADJUSTED FOR SHARP FOCUS

AT CENTER OF RASTER.

GRID-N$^\#1$ VOLTS ADJUSTED TO GIVE INDICATED

BRIGHTNESS VALUE ON A 2 CM x 2 CM, 25-LINE RASTER.

* LINE WIDTH MEASURED BETWEEN POINTS WHERE

BRIGHTNESS WAS APPROX. $\frac{1}{2}$ THAT AT CENTER OF LINE.
AVERAGE CHARACTERISTICS

E_f = 6.3 VOLTS
GRID-No3 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
MAXIMUM ULTOR-CURRENT REQUIREMENTS FROM POWER SUPPLY

$E_L = 6.3\ \text{VOLTS}$

GRID-$N^2$3 VOLTS ADJUSTED FOR FOCUS

MAX. ULTOR CURRENT FOR ANY TUBE AT ZERO GRID-$N^2$1 VOLTAGE
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

\[
\begin{align*}
E_f &= 6.3 \text{ VOLTS} \\
\text{GRID-N\#3 VOLTS ADJUSTED FOR SHARP FOCUS AT CENTER OF RASTER.} \\
\text{GRID-N\#1 VOLTS ADJUSTED TO GIVE INDICATED BRIGHTNESS VALUE ON A 2 CM x 2 CM, 25-LINE RASTER.} \\
* \text{LINE WIDTH MEASURED BETWEEN POINTS WHERE BRIGHTNESS WAS APPROX. } \frac{1}{2} \text{ THAT AT CENTER OF LINE.}
\end{align*}
\]
AVERAGE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ULTOR VOLTS = 1000
GRID-N° 3 VOLTS ADJUSTED FOR FOCUS.
The 1EP11 is the same as the 1EP1 except for the following items:

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

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

AVERAGE CHARACTERISTICS

$E_f = 6.3 \text{ VOLTS}$
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

$E_f = 6.3$ VOLTS
ULTOR VOLTS = 1000
GRID-Nº 3 VOLTS ADJUSTED FOR FOCUS.
2API-A

HIGH-VACUUM CATHODE-RAY TUBE
Supersedes Type 2API

General:
Heater, for Unipotential Cathode:
  Voltage: $6.3 \pm 10\%$ ac or dc volts
  Current: 0.6 amp.
Direct Inter-electrode Capacitances (Approx.):
  Grid No. 1 to All Other Electrodes: 8.0 $\mu$uf
  Cathode to All Other Electrodes: 5.5 $\mu$uf
  DJ1 to DJ2: 0.6 $\mu$uf
  DJ3 to DJ4: 1.1 $\mu$uf
  DJ1 to All Other Electrodes: 8.5 $\mu$uf
  DJ3 to All Other Electrodes: 9.0 $\mu$uf
  DJ2 to All Other Electrodes except DJ2: 8.0 $\mu$uf
  DJ2 to All Other Electrodes except DJ1: 4.6 $\mu$uf
  DJ3 to All Other Electrodes except DJ4: 7.5 $\mu$uf
  DJ4 to All Other Electrodes except DJ3: 6.0 $\mu$uf

Phosphor (For Curves, see front of this Section) No. 1
  Fluorescence: Green
  Persistence: Medium
  Focusing Method: Electrostatic
  Deflection Method: Electrostatic
  Overall Length: 7-7/16" ± 3/16"
  Greatest Diameter of Bulb: 2" ± 1/16"
  Minimum Useful Screen Diameter: 1-3/4"
  Mounting Position: Any
  Base: Small Shell Magnal 11-Pin

Basing Designation for BOTTOM VIEW
  Pin 1 - Heater
  Pin 2 - Cathode
  Pin 3 - Deflecting Electrode DJ1
  Pin 4 - Anode No. 1
  Pin 5 - No Connection
  Pin 6 - Deflecting Electrode DJ4
  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

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

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

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

The angle between the trace produced by $DJ_3$ and $DJ_4$ and the trace produced by $DJ_1$ and $DJ_2$ is $90^\circ \pm 4^\circ$.

JULY 1, 1945

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Maximum Ratings, Absolute Values:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANODE-No.2 &amp; GRID-No.2 VOLTAGE</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) 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:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode-No.2 &amp; Grid-No.2 Voltage*</td>
<td>500 1000 . . . volts</td>
</tr>
<tr>
<td>Anode-No.1 Voltage for Focus at 75% of Grid-No.1 Voltage for Cutoff*</td>
<td>125 250 . . . volts</td>
</tr>
<tr>
<td>Grid-No.1 Volt. for Visual Cutoff#</td>
<td>-30 -60 . . . volts</td>
</tr>
<tr>
<td>Max. Anode-No.1 Current Range¹</td>
<td>Between -50 and +10 . µamp.</td>
</tr>
</tbody>
</table>

Deflection Sensitivity:

<table>
<thead>
<tr>
<th>Electrode</th>
<th>Sensitivity (mm/v dc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DJ1 and DJ2</td>
<td>0.220 0.110</td>
</tr>
<tr>
<td>DJ3 and DJ4</td>
<td>0.260 0.130</td>
</tr>
</tbody>
</table>

Deflection Factor:**

<table>
<thead>
<tr>
<th>Electrode</th>
<th>Factor (v dc/in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DJ1 and DJ2</td>
<td>115 230</td>
</tr>
<tr>
<td>DJ3 and DJ4</td>
<td>98 196</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 500 volts.

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

¹ Visual extinction of stationary focused spot. Supply should be adjustable to ± 50% of these values.

² 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:

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

JULY 1, 1945

RCA VICTOR DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Resistance in Any Deflecting-Electrode Circuit 5.0 max. megohms

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

TYPICAL OSCILLOGRAPH CIRCUIT

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

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

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

SCREEN RADIUS
7\(\frac{1}{6}\)" MIN.

3\(\frac{1}{16}\)"

1\(\frac{3}{8}\)\(\pm\) \(\frac{1}{16}\)"

SMALL SHELL MAGNAL 11-PIN BASE

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

.225"

.188" R.

8" R.

12° 37'

7\(\frac{7}{16}\)"

\(\pm\) \(\frac{3}{16}\)"

6\(\frac{7}{8}\)"

\(\pm\) \(\frac{3}{16}\)"

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

JULY 1, 1945

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

DATA 2
### 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 \( \mu \text{F} \)
  - \( DJ_1 \) to \( DJ_2 \): 2 \( \mu \text{F} \)
  - \( DJ_2 \) to \( DJ_4 \): 2 \( \mu \text{F} \)
  - \( DJ_1 \) to All Other Electrodes: 11 \( \mu \text{F} \)
  - \( DJ_2 \) to All Other Electrodes: 8 \( \mu \text{F} \)
  - \( DJ_3 \) to All Other Electrodes: 7 \( \mu \text{F} \)
  - \( DJ_4 \) to All Other Electrodes: 8 \( \mu \text{F} \)

- **Phosphor (For Curves, see front of this Section):**
  - No.1: Green
  - No.2: Persistance

- **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

#### Basing Designation for BOTTOM VIEW

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

\( DJ_1 \) and \( DJ_2 \) are nearer the screen

\( DJ_3 \) and \( DJ_4 \) are nearer the base

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

The plane through the tube axis and pin No.4 may vary from the trace produced by \( DJ_1 \) and \( DJ_2 \) by an angular tolerance (measured about the tube axis) of 10°.

The angle between \( DJ_1 \) - \( DJ_2 \) trace and \( DJ_3 \) - \( DJ_4 \) trace is 90° ± 30°.

---

**Indicates a change.**

---

**SEPT. 1, 1950**

**TUBE DEPARTMENT**

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

Maximum Ratings, Design-Center Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</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 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. 2 voltage ($E_{b2}$) between 500* and 2500 volts:

<table>
<thead>
<tr>
<th>Component</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode-No.1 Voltage</td>
<td>15% to 28% of $E_{b2}$</td>
</tr>
<tr>
<td>Max. Grid-No.1 Voltage</td>
<td>6.75% of $E_{b2}$</td>
</tr>
<tr>
<td>Max. Anode-No.1 Current Range</td>
<td>-15 to +10 microamperes</td>
</tr>
</tbody>
</table>

Deflection Factors:

<table>
<thead>
<tr>
<th>Factor</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>$DJ_1$ &amp; $DJ_2$.</td>
<td>115 to 155 v dc/in./kv of $E_{b2}$</td>
</tr>
<tr>
<td>$DJ_3$ &amp; $DJ_4$.</td>
<td>74 to 100 v dc/in./kv of $E_{b2}$</td>
</tr>
</tbody>
</table>

Examples of Use of Design Ranges:

For anode-No. 2 voltage of 1000 to 2000 volts:

<table>
<thead>
<tr>
<th>Component</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode-No.1 Voltage</td>
<td>150 - 280 300 - 560</td>
</tr>
<tr>
<td>Max. Grid-No.1 Voltage</td>
<td>-67.5 -135</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>

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

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

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

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

* Indicates a change.
2BPI
OSCILLOGRAPH TUBE

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
- **R4**: 1.0-Megohm Potentiometer
- **R5**: 0.5 Megohm, 0.5 Watt
- **R6**: 0.38 Megohm, 0.5 Watt
- **R7 R8**: Dual 5-Megohm Potentiometer
- **R9 R10**: Dual 5-Megohm Potentiometer
- **R11 R12 R13 R14**: 2 Megohms, 0.5 Watt

*When cathode is grounded, capacitors should have high voltage rating; when anode No. 2 is grounded, they may have low voltage rating. For dc amplifier service, deflecting electrodes should be connected 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.*

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.

SEPT. 1, 1950
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
CE-6777R1
SCREEN RADIUS
1/8" MIN.

3 1/16" ± 1/16"

1 3/8" ± 1/16"

8" R.

12° 37'

7 1/8" ± 3/16"

7 5/8" ± 3/16"

SMALL-SHELL DUODECAL 12-PIN BASE

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

92CS-6689

SEPT. 1, 1950

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-6689
$E_f = 6.3 \text{ VOLTS}$

Anode-N°1 Volts Adjusted for Focus

Max. Anode-N°2 Current for Any Tube at Zero Grid-N°1 Voltage

Anode-N°2 Milliamperes

Anode-N°2 Volts

Relative Brightness

AUGUST 14, 1950
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6748RI
E_f = 6.3 VOLTS
ANODE - N° 2 VOLTS = 1000
ANODE - N° 1 VOLTS ADJUSTED FOR FOCUS

AUGUST 14, 1950
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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:
Basing Designation for BOTTOM VIEW .... 6BV
Pin 1-Heater ................. End Cap - Pattern Electrode
Pin 2-Grid No.2 ............... Side Cap - Grid No.4
Pin 3-Grid No.3 ............... Grid No.4
Pin 4-Grid No.1 ............... Grid No.4
Pin 5-Cathode ................. Grid No.2

Maximum Ratings, Design-Center Values:
PATTERN-ELECTRODE VOLTAGE .......... 1500 max. volts
GRID-No.4 (COLLECTOR) VOLTAGE .... 1500 max. volts
GRID-No.3 (FOCUSING ELECTRODE) VOLTAGE .... 600 max. volts
GRID-No.2 (ACCELERATING ELECTRODE) VOLT. 1600 max. volts
GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:
Negative Bias Value ............ 125 max. volts
Positive Bias Value ............ 0 max. volts
PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode 125 max. volts
Heater positive with respect to cathode 125 max. volts

Typical Operation:
Pattern-Electrode Voltage ............ 1000 ....... volts
Grid-No.4 Voltage ................. 1050 ....... volts
Grid-No.3 Voltage for Focus at 0.5 μamp Grid-No.4 Current\▲ 300 approx. volts
Grid-No.2 Voltage ................. 1000 ....... volts
Grid-No.1 Voltage for Visual Cutoff on Monitor# -50 approx. volts
Internal Resistance between Grid No.4 and Pattern Electrode 125 max. volts
Grid-No.4 Current ................. Greater than 1 meg.

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

* Individual tubes may require between +20% and -20% of these values.
† Deflection must be maintained at all times. When scanned area does not cover entire pattern, the beam current should be reduced accordingly and time of operation limited to prevent damaging the pattern.
# Supply should be adjustable between +40% and -80% of this value.
** With full scanning.
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: 6 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.
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

**3AQPl**

**ELECTROSTATIC FOCUS**

**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 µf
- Cathode to all other electrodes ............................................................... 4.3 µf
- Deflecting electrode DJ₁ to deflecting electrode DJ₂ ................................ 5.2 µf
- Deflecting electrode DJ₃ to deflecting electrode DJ₄ .............................. 7 µf
- DJ₁ to all other electrodes ..................................................................... 10.1 µf
- DJ₂ to all other electrodes ..................................................................... 7.5 µf
- DJ₃ to all other electrodes ..................................................................... 8.1 µf
- DJ₄ to all other electrodes ..................................................................... 9.2 µf

**Faceplate, Spherical.** ........................................................................... Clear Glass

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

**Focusing Method.** ................................................................................ Electrostatic
**Deflection Method.** ............................................................................ Electrostatic

**Overall Length.** ................................................................................... 9-1/8" ± 1/4"

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

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

**Useful Scan (Centered with respect to tube face):**
- By deflecting electrodes DJ₁ & DJ₂ ...................................................... 2-3/4"
- By deflecting electrodes DJ₃ & DJ₄ ...................................................... 2-1/4"

**Operating Position.** ........................................................................... Any

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

**Base.** .................................................................................................... J24P1

**Basing Designation for BOTTOM VIEW.** ............................................ 12E

**Pin 1—Heater**
**Pin 2—Grid No.1**
**Pin 3—Cathode**
**Pin 4—Grid No.3**
**Pin 5—Internal Connection—Do Not Use**
**Pin 6—Deflecting Electrode DJ₃**
**Pin 7—Deflecting Electrode DJ₄**
**Pin 8—Ultor (Grid No.2, Collector)**
**Pin 9—Deflecting Electrode DJ₂**
**Pin 10—Deflecting Electrode DJ₁**
**Pin 11—Internal Connection—Do Not Use**
**Pin 12—Heater**

*DJ₁ and DJ₂ are nearer the screen*
*DJ₃ and DJ₄ are nearer the base*
Maximum and Minimum Ratings, Design-Center Values:

ULTOR VOLTAGE. .............................. 2750 max. volts
ULTOR INPUT (AVERAGE). .......................... 500 min. volts
GRID-No.3 VOLTAGE. .............................. 1100 max. volts
GRID-No.1 VOLTAGE:
  Negative-bias value. .............................. 200 max. volts
  Positive-bias value. .............................. 0 max. volts
  Positive-peak value. .............................. 2 max. volts
PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFLECTING ELECTRODE .............................. 550 max. volts
PEAK HEATER-CATHODE VOLTAGE:
  Heater negative with respect to cathode:
    During equipment warm-up period not exceeding 15 seconds .............................. 410 max. volts
    After equipment warm-up period .............................. 125 max. volts
  Heater positive with respect to cathode .............................. 125 max. volts

Equipment Design Ranges:

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

Grid-No.3 Voltage
  for focus .............................. 16.5% to 31% of $E_{c4}$ volts
Negative Grid-No.1 Voltage for visual extinction of undeflected spot .............................. 2.8% to 6.7% of $E_{c4}$ volts
Grid-No.3 Current
  for any operating condition .............................. -15 to +10 $\mu$A
Deflection Factors:
  DJ1 & DJ2 .............................. 73 to 99 v dc/in./kv of $E_{c4}$
  DJ3 & DJ4 .............................. 26 to 35 v dc/in./kv of $E_{c4}$
HIGH-VACUUM CATHODE-RAY TUBE

Supercedes Type 3BP1

General:

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

Direct Inter-electrode Capacitances (Approx.):
Grid No. 1 to All Other Electrodes: 8.5 µuf
Cathode to All Other Electrodes: 8.0 µuf
DJ1 to DJ2: 2.0 µuf
DJ3 to DJ4: 2.0 µuf
DJ1 to All Other Electrodes: 8.0 µuf
DJ3 to All Other Electrodes: 6.0 µuf
DJ1 to All Other Electrodes except DJ2: 6.0 µuf
DJ2 to All Other Electrodes except DJ1: 5.0 µuf
DJ3 to All Other Electrodes except DJ4: 4.0 µuf
DJ4 to All Other Electrodes except DJ3: 6.0 µuf

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.
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 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
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
HIGH-VACUUM CATHODE-RAY TUBE

(continued from preceding page)

GRID-No. 1 (CONTROL ELECTRODE) VOLTAGE:
- Negative Value: 200 max. volts
- Positive Value: 0 max. volts

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

PEAK HEATER-CATHODE VOLTAGE:
- Heater negative with respect to cathode: 125 max. volts
- Heater positive with respect to cathode: 10 max. volts

Typical Operation:

Anode-No. 2 & Grid-No. 2 Voltage: 1500 volts
Anode No. 1 Voltage for Focus: 430 volts
Grid-No. 1 Voltage, for Visual Cutoff: -45 volts
Max. Anode-No. 1 Current Range: Between -50 and +10 microamps.

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.

- Brilliancy 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

C1: 0.1 uf
C2: 1.0 uf
C3 C4 C5 C6: 0.05-uf Blocking Capacitors
R1 R2: 2 Megohms
R3: 5.5 Megohms
R4: 2-Megohm Potentiometer
R5: 1.5 Megohms
R6: 0.5-Megohm Potentiometer
R7 R8: Dual 5-Megohm Potentiometer
R9 R10: Dual 5-Megohm Potentiometer
R11 R12 R13 R14: 2 Megohms

*When cathode is grounded, capacitors should have high voltage rating; when anode No.2 is grounded, they may have low voltage rating. For dc amplifier service, deflecting electrodes should be connected 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

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
HIGH-VACUUM CATHODE-RAY TUBE

SCREEN RADIUS
1 3/8" MIN.

3 3/8"

10" ± 1/4"

9 1/4" ± 1/4"

2" ± 1/16"

MEDIUM SHELL
DIHEPTAL
12-PIN
BASE

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

DATA 2

JULY 1, 1945

3BPI-A

3BPI-A

3BPI-A

3BPI-A

3BPI-A

3BPI-A
### AVERAGE CHARACTERISTICS

**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**

![Graph showing grid and anode characteristics](image_url)
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" ± 1/4"
Greatest Diameter of Bulb ........ 3" ± 1/16"
Minimum Useful Screen Diameter .......... 2-3/4"

Mounting Position ........ Any
Cap ........ Recessed Small Ball (JETEC No.J1-22)
Base ........ Medium-Shell Diheptal 12-Pin (JETEC No.B12-37)
Basing Designation for BOTTOM VIEW .......... 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

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, 10⁰; Cap (on same side of tube as pin 5), 10⁰.

The angle between DJ1-DJ2 trace and DJ3-DJ4 trace is 90⁰ ± 3⁰.

AUG. 1, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
OSCILLOGRAPH TUBE

Maximum Ratings, Design-Center Values:

- **ANODE-No.3 VOLTAGE**: 4000 max. volts
- **ANODE-No.2 VOLTAGE**: 2000 max. volts
- **RATIO OF ANODE-No.3 VOLTAGE TO ANODE-No.2 VOLTAGE**: 2.3:1 max.
- **ANODE-No.1 VOLTAGE**: 1000 max. volts

**GRID-No.1 VOLTAGE:**
- Negative bias value: 200 max. volts
- Positive bias value: 0 max. volts
- Positive peak value: 2 max. volts

**PEAK VOLTAGE BETWEEN ANODE No.2 AND ANY DEFLECTING ELECTRODE**: 500 max. volts

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

Equipment Design Ranges:

For any anode-No.3 voltage (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:**

- **When Eb3 = 2 x Eb2**
  - DJ1 & DJ2: 85 to 115 v dc/in./kv of Eb2
  - DJ3 & DJ4: 62.5 to 85 v dc/in./kv of Eb2

- **When Eb3 = Eb2**
  - DJ1 & DJ2: 68 to 92 v dc/in./kv of Eb2
  - DJ3 & DJ4: 50 to 68 v dc/in./kv of Eb2

**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.

AUG. 1, 1951

TUBE DEPARTMENT

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

Examples of Use of Design Ranges:

<table>
<thead>
<tr>
<th>Voltage Range</th>
<th>Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>For anode-No. 3</td>
<td>2000</td>
</tr>
<tr>
<td>and anode-No. 2</td>
<td>2000</td>
</tr>
<tr>
<td>Anode-No.1 Volt.</td>
<td>400 to 690</td>
</tr>
<tr>
<td>Grid-No.1 Volt. †</td>
<td>-30 to -90</td>
</tr>
<tr>
<td>Deflection Factors:</td>
<td></td>
</tr>
<tr>
<td>DJ₁ &amp; DJ₂</td>
<td>136 to 184</td>
</tr>
<tr>
<td>DJ₃ &amp; DJ₄</td>
<td>100 to 136</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

† For visual extinction of undeflected focused spot.

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

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

SCREEN RADIUS
1 3/8" MIN.
1 3/4" ± 1/4"

ANODE NO. 3
RECESSED
SMALL BALL CAP

1/4" R.
12 7/16" R.
8" R.

2" ± 1/16" ± 1/4"
9 1/4" ± 1/4"
10" ± 1/4"
3 3/4" ± 3/16"
3.50"

MEDIUM-SHELL DIHEPTAL
12-PIN BASE

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
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-6583
CHARACTERISTICS

$E_C = 6.3 \text{ VOLTS}$

- Anode-no 1 volts adjusted for focus
- Anode-No 3 volts greater than anode-No 2 volts
- Grid-No 1 volts = 0

---

Typical fluorescent-screen current (anode-No 3)
Max. total current for any tube

<table>
<thead>
<tr>
<th>FLUORESCENT-SCREEN MICROAMPERES</th>
<th>TOTAL ANODE-NO 2 &amp; ANODE-NO 3 MICROAMPERES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>1000</td>
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<tr>
<td>800</td>
<td>2000</td>
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<tr>
<td>600</td>
<td>3000</td>
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<tr>
<td>400</td>
<td>1000</td>
</tr>
<tr>
<td>200</td>
<td>800</td>
</tr>
</tbody>
</table>

ANODE-NO 2 VOLTS

JUNE 22, 1951

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE CHARACTERISTICS

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

<table>
<thead>
<tr>
<th>CURVE</th>
<th>ELECTRODE</th>
<th>ANODE-N°2 VOLTS</th>
<th>ANODE-N°3 VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ANODE N°1</td>
<td>2000</td>
<td>4000</td>
</tr>
<tr>
<td>B</td>
<td>ANODE N°1</td>
<td>1500</td>
<td>3000</td>
</tr>
<tr>
<td>C</td>
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<td>4000</td>
</tr>
<tr>
<td>F</td>
<td>ANODE N°3</td>
<td>1500</td>
<td>3000</td>
</tr>
</tbody>
</table>

JUNE 22, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7870
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
OSCILLOGRAPH TUBE
ELECTROSTATIC FOCUS
ELECTROSTATIC DEFLECTION

DATA

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

Direct Interelectrode Capacitances (Approx.):
Grid No. 1 to all other electrodes ............ 8 μf
Deflecting electrode 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
Surb .................. Medium-Shell Magnal 11-Pin (JETEC No.B11-66)
Basing Designation for BOTTOM VIEW ........ 11M

Pin 1-Heater
Pin 2-Grid No.1
Pin 3-Cathode
Pin 4-Grid No.3
Pin 5-Deflecting
Electrode 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 DJ1
Pin 10-Internal
Connection-
Do Not Use
Pin 11-Heater

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

4-56
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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:

- **ULTOR VOLTAGE**: 2500 max. volts
- **ULTOR INPUT (AVERAGE)**: 6 max. watts
- **GRID-No.3 VOLTAGE**: 1000 max. volts
- **GRID-No.1 VOLTAGE**: Negative bias value 200 max. volts, Positive bias value 0 max. volts, Positive peak value 2 max. volts
- **PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFINING ELECTRODE**: 500 max. volts
- **PEAK HEATER-CATHODE VOLTAGE**: Heater negative with respect to cathode 125 max. volts, Heater positive with respect to cathode 125 max. volts

Equipment Design Ranges:

- For any ultor voltage ($E_{C4}$) between recommended minimum* and 2500 volts:
  - Grid-No.3 Voltage for Focus: 16% to 30% of $E_{C4}$ volts
  - Grid-No.1 Voltage for Visual Extinction of Undelected Focused Spot: 1.9% to 4.5% of $E_{C4}$ volts
  - Grid-No.3 Current for Any Operating Condition: -15 to +10 μamp

Deflection Factors:

- DJ₁ & DJ₂: 50 to 68 v dc/in./kv of $E_{C4}$
- DJ₃ & DJ₄: 38 to 52 v dc/in./kv of $E_{C4}$

Spot Position:

Examples of Use of Design Ranges:

- For ultor voltage of 1000, 2000 volts:
  - Grid-No.3 Voltage for Focus: 160 to 300, 320 to 600 volts

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

## Notes:

- Indicates a change.
OSCILLOGRAPH TUBE

For ultimate voltage of 1000 2000 volts

Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot
-19 to -45 -38 to -90 volts

Deflection Factors:
DJ1 & DJ2. 50 to 68 100 to 136 volts dc/in.
DJ3 & DJ4. 38 to 52 76 to 104 volts dc/in.

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

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

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

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
C7: 0.11 μF, 3000 Volts
e2: 0.5 μF, 100 Volts
C3: 0.05-pF 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 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 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.
$E_f = 6.3\ \text{VOLTS}$

GRID-$\#3$ VOLTS ADJUSTED FOR FOCUS

GRID-$\#1$ 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

<table>
<thead>
<tr>
<th>RELATIVE LINE BRIGHTNESS</th>
<th>UTLOR VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>90</td>
<td>500</td>
</tr>
<tr>
<td>80</td>
<td>1000</td>
</tr>
<tr>
<td>70</td>
<td>1500</td>
</tr>
<tr>
<td>60</td>
<td>2000</td>
</tr>
<tr>
<td>50</td>
<td>2500</td>
</tr>
</tbody>
</table>

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7191R2
MAXIMUM ULTOR-CURRENT REQUIREMENTS
FROM POWER SUPPLY

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

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

RECOMMENDED MAX. ULTOR CURRENT

ULTOR VOLTS
0 500 1000 1500 2000 2500
ULTOR MILLIAMPERES
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7192RI
AVERAGE CHARACTERISTIC

$E_f = 6.3$ VOLTS
GRID-N3 VOLTS ADJUSTED TO FOCUS
ULTOR VOLTS = 2000

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6658R2
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 ultraviolet 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.

---

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

**General:**

- Phosphor (for curves, see front of this section): P7—Purplish-Blue
- Fluorescence: Purplish-Blue
- Persistence: Medium-Short
- Phosphorescence: Yellowish-Green
- Persistence: Very Long

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

---

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

**General:**

- Phosphor (for curves, see front of this section): P11—Blue
- Fluorescence: Blue
- Phosphorescence: Blue
- Persistence: Medium-Short

In general, operation of the 3KP11 at an ultraviolet voltage less than 1500 volts is not recommended.
<table>
<thead>
<tr>
<th></th>
<th>ELECTROSTATIC FOCUS</th>
<th>ELECTROSTATIC DEFLECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3KP16</strong></td>
<td><strong>3KP16</strong></td>
<td></td>
</tr>
</tbody>
</table>

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

**General:**
Phosphor (For Curves, see front of this Section) .......... P16
   - Fluorescence—
     - Visible radiation .................. Violet
     - Invisible radiation ................. Near-Ultraviolet
   - Phosphorescence—
     - Persistence of visible radiation ... Very Short
     - Persistence of invisible radiation .. Very Short

In general, operation of the 3KP16 at an ultor voltage less than 1500 volts is not recommended.
The 3RP1 is the same as the 3RP1-A except for the following items:

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

**Diagram:**

- Screen Dia. 2 3/4" Min.
- 0.350" 1/4 R.
- 17" R.
- 8 R.
- 1 3/8" ± 1/16"
- 9 1/8" ± 1/4"
- SMALL-SHELL DUODECAL 10-PIN BASE JETEC #B10-75 OR SMALL-SHELL DUODECAL 12-PIN BASE JETEC #B12-43

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

**Data:**

Sept. 1, 1955

Tube Division
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
3RP-A
OSCILLOGRAPH TUBE
ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

DATA

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

Direct Interelectrode Capacitances (Approx.):
Grid No.1 to all other electrodes .... 8  μf
Deflecting electrode DJ1 to
deflecting electrode DJ2 ........ 2  μf
Deflecting electrode DJ3 to
deflecting electrode DJ4 ........ 2  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 ........ Flat Clear Glass
Phosphor [For Curves, see front of this Section] .......... P1
Fluorescence .......... Green
Phosphorescence .......... Green
Persistence .......... Medium
Focusing Method .......... Electrostatic
Deflection Method .......... Electrostatic
Overall Length ........ 9-1/8" ± 1/4"
Greatest Diameter of Bulb .......... 3" ± 1/16"
Minimum Useful Screen Diameter .......... 2-3/4"
Mounting Position .......... Any
Weight (Approx.) .......... 12 oz
Bulb .......... J-24S1
Base .......... Small-Shell Duodecal 10-Pin (JETEC No.B10-75), or Small-Shell Duodecal 12-Pin (JETEC No.B12-43)

Basing Designation for BOTTOM VIEW .......... 12E

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Cathode
Pin 4 - Grid No.3
Pin 5 - Internal Connection - Do Not Use
Pin 6 - Deflecting Electrode DJ3
Pin 7 - Deflecting Electrode DJ4
Pin 8 - Ultor (Grid No.2, Grid No.4, Collector)
Pin 9 - Deflecting Electrode DJ2
Pin 10 - Deflecting Electrode DJ1
Pin 11 - Internal Connection - Do Not Use
Pin 12 - Heater

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

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

JULY 1, 1955
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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>ULTOR⁰ VOLTAGE</th>
<th>2500 max. volts</th>
</tr>
</thead>
<tbody>
<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>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 ultor voltage \(E_c^4\) between 500* and 2500 volts

Grid-No.3 Voltage for Focus | 16.5% to 31% of \(E_c^4\) volts

Maximum Grid-No.1 Voltage for Visual Extinction of Un-deflected Focused Spot | -6.75% of \(E_c^4\) 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 \(E_c^4\) |
| DJ₃ & DJ₄ | 52 to 70 v dc/in./kv of \(E_c^4\) |

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.1. Since grid No.1, 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.

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.

---

* 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.
Examples of Use of Design Ranges:

<table>
<thead>
<tr>
<th></th>
<th>Grid-No. 3 Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>for Focus</td>
</tr>
<tr>
<td>Maximum Grid-No. 1</td>
<td>Voltage for Visual Extinction of Un-deflected Focused Spot</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

|                      |                      |
|                      | -67.5               |
|                      | -135                |

Deflection Factors:

- \( DJ_1 \) & \( DJ_2 \) .... 73 to 99 146 to 198 volts dc/in.
- \( DJ_3 \) & \( DJ_4 \) .... 52 to 70 104 to 140 volts dc/in.

Maximum Circuit Values:

<table>
<thead>
<tr>
<th></th>
<th>Grid-No. 1-Circuit Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.5 max. megohms</td>
</tr>
<tr>
<td>Resistance in Any Deflecting-Electrode Circuit</td>
<td>5 max. megohms</td>
</tr>
</tbody>
</table>

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

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

JULY 1, 1955

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

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

- **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 ultiot 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 ultiot be returned to a point in the amplifier system which will give the lowest possible potential difference between ultiot 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.

JULY 1, 1955

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-6777R1
3RP-1-A
CHARACTERISTICS

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

RECOMMENDED MAX. ULTOR CURRENT

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

CONSTANT LINE WIDTH 5000

CONSTANT LINE WIDTH 6000

ULTOR MILLIAMPERES

ULTOR VOLTS

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

92CM-7143R1
### General:

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

### Direct Interelectrode Capacitances:
- Grid No.1 to all other electrodes: 4.6 to 8.7 \( \mu F \)
- Cathode to all other electrodes: 3 to 5.7 \( \mu F \)
- Deflecting electrode DJ₁ to deflecting electrode DJ₂: 1.7 to 3.3 \( \mu F \)
- Deflecting electrode DJ₃ to deflecting electrode DJ₄: 1 to 2 \( \mu F \)
- DJ₁ to all other electrodes: 5.5 to 10.5 \( \mu F \)
- DJ₂ to all other electrodes: 5.5 to 10.5 \( \mu F \)
- DJ₃ to all other electrodes: 3.5 to 6.8 \( \mu F \)
- DJ₄ to all other electrodes: 3.5 to 6.8 \( \mu F \)

### 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
- 11-1/2" ± 1/8"

### Greatest Diameter of Bulb
- 3" ± 1/16"

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

### Minimum Useful Scan (Centered with respect to tube face):
- By deflecting electrodes DJ₁ & DJ₂: 2-1/2"
- By deflecting electrodes DJ₃ & DJ₄: 2-1/4"

### Weight (Approx.)
- 1 lb

### Mounting Position
- Any

### Bulb
- 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 Designation
- **Pin 1** - Heater
- **Pin 2** - Grid No.1
- **Pin 3** - Cathode
- **Pin 4** - Grid No.3
- **Pin 6** - Deflecting Electrode DJ₁
- **Pin 7** - Deflecting Electrode DJ₂
- **Pin 8** - Ultor
- **Pin 9** - Deflecting Electrode DJ₄
- **Pin 10** - Deflecting Electrode DJ₃
- **Pin 12** - Heater
OSCILLOGRAPH TUBE

Maximum Ratings, Design-Center Values:

ULTOR VOLTAGE: 2500 max. volts
ULTOR INPUT (AVERAGE): 6 max. watts
GRID-No.3 VOLTAGE: 1000 max. volts
GRID-No.1 VOLTAGE:
- Negative bias value: 200 max. volts
- Positive bias value: 0 max. volts
- Positive peak value: 0 max. volts

PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFLECTING ELECTRODE: 500 max. volts
PEAK HEATER–CATHODE VOLTAGE:
- Heater negative with respect to cathode: 180 max. volts
- Heater positive with respect to cathode: 180 max. volts

Equipment Design Ranges:

For any ultor voltage ($E_C$) 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 Undeflected Focused Spot: -3% to -5% of $E_C$
Grid-No.3 Current for Any Operating Condition: -15 to +10 $\mu$A

Deflection Factors:
- DJ1 & DJ2: 41.5 to 50.5 v dc/in./kv of $E_C$
- DJ3 & DJ4: 28.5 to 35 v dc/in./kv of $E_C$

Spot Position:

Examples of Use of Design Ranges:

For ultor voltage of 1000 1500 2000 volts

Grid-No.3 Voltage for Focus: 165 to 310 247 to 465 330 to 620 volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot: -30 to -50 -45 to -75 -60 to -100 volts

Deflection Factors:
- DJ1 & DJ2: 41.5 to 50.5 62.3 to 75.8 83 to 101 v dc/in.
- DJ3 & DJ4: 28.5 to 35 42.8 to 52.5 57 to 70 v dc/in.

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

** See next page.
3WPI

OSCILOGRAPH TUBE

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. meqohms</td>
</tr>
<tr>
<td>Resistance in Any Deflecting-Electrode</td>
<td>5 max. meqohms</td>
</tr>
</tbody>
</table>

SPECIAL PERFORMANCE DATA

For ultraviolet of 1500 volts

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line Width</td>
<td>0.026 max. inch</td>
</tr>
<tr>
<td>Peak Grid-No.1 Drive from Spot Cutoff</td>
<td>50 max. volts</td>
</tr>
<tr>
<td>Raster Shape</td>
<td>8</td>
</tr>
<tr>
<td>Deflection Factor Uniformity</td>
<td></td>
</tr>
</tbody>
</table>

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 1DJ2 direction and 1.688" in 3DJ4 direction, all points on the raster will lie within the area between the two rectangles also centered with respect to the tube face; the one, 1.920" in 1DJ2 direction by 1.730" in 3DJ4 direction; the other, 1.830" in 1DJ2 direction and 1.616" in 3DJ4 direction.

The deflection factor for either Dj1 and Dj2 electrodes or Dj3 and Dj4 electrodes for a deflection of less than 75 per cent of the respective useful scan will not differ from the deflection factor for the corresponding deflecting electrodes at 25 per cent of the useful scan by more than 2 per cent.

4-57

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CS-9130

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

THE PLANE THROUGH THE TUBE AXIS AND PIN 3 MAY VARY FROM THE TRACE PRODUCED BY 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° ± 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 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
T1: Transformer, with 6.3-volt/ampere secondary, insulated for at least 3000 volts, such as Thordarson T26F6S
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

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

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.

*LINE WIDTH MEASURED BETWEEN POINTS WHERE BRIGHTNESS WAS APPROX. 1/2 THAT AT CENTER OF LINE.*
CHARACTERISTICS

$E_e = 6.3$ VOLTS
GRID-N$\#$3 VOLTS ADJUSTED FOR FOCUS.
GRID-N$\&$I VOLTS = 0

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

--- MAX. ULTOR CURRENT FOR ANY TUBE
--- RECOMMENDED MAX. ULTOR CURRENT

ULTOR MILLIAMPERES

0 1.0 2.0 3.0 4.0 5.0

ULTOR VOLTS

1000 1500 2000 2500

FLUORESCENT-SCREEN MICROAMPERES

0 100 200 300

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9158
AVERAGE CHARACTERISTICS

\[ E_f = 6.3 \text{ VOLTS} \]
GRID-N=3 VOLTS ADJUSTED FOR FOCUS.

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

GRID-N VOLTS
ULTOR MILLIAMPERES
FLUORESCENT-SCREEN MICROAMPERES

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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.

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

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

Line width and drive values for the 3WP11 are the same as those shown for type 3WP1 under the heading SPECIAL PERFORMANCE DATA and are based upon operation at brightness values calculated from 3WP1 performance.
5ABPI

OSCILLOGRAPH TUBE

POST-ULTOR
RECESSED
SMALL BALL
CAP
JETEC №J1-22

MEDIUM-SHELL
DIHEPTAL
12-PIN
BASE
JETEC №BI2-37

92CM-7842

MAX. 10 9/32”

2” ± 1/16”

27 13/16” R.

16 3/4” ± 3/6”

5 1/4” ± 3/32”

SCREEN DIA.
4 9/16” MIN.

1/4” R.

.875”

6 1/4” ± 1/4”

² OF BULB WILL NOT DEVIATE MORE THAN 2⁰
IN ANY DIRECTION FROM PERPENDICULAR
ERECTED AT CENTER OF BOTTOM OF BASE

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

CE-7842
TYPICAL CHARACTERISTICS

$E_x = 6.3$ VOLTS
GRID-N = 3 VOLTS ADJUSTED FOR FOCUS
POST-ULTOR VOLTS = 2 x ULTOR VOLTS
CHARACTERISTICS

$E_f = 6.3$ VOLTS
GRID-N$^3$ VOLTS ADJUSTED FOR FOCUS
POST-ULTOR (GRID NO. 5 & COLLECTOR) VOLTS
GREATER THAN ULTOR (GRIDS NO. 2 & NO. 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**

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

**GRID-№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>
5ADPI
AVERAGE CHARACTERISTICS

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

<table>
<thead>
<tr>
<th>CURVE</th>
<th>ELECTRODE</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>

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9099
\[ E_p = 6.3 \text{ VOLTS} \]

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.

**CHARACTERISTICS**

![Graph](image-url)
5ADPI

TYPICAL CHARACTERISTICS

$E_p = 6.3$ VOLTS
GRID-$N=3$ VOLTS ADJUSTED FOR FOCUS.
POST-ULTOR VOLTS = $2 \times$ ULTOR VOLTS

RELATIVE LINE BRIGHNESS

ULTOR VOLTS

1500 1600 1700 1800 1900 2000

0 10 20 30 40 50 60 70 80 90 100

CONSTANT LINE WIDTH 0.012"
### 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**
- 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
<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater, for Unipotential Cathode</td>
<td>Voltage: 6.3 ac or dc volts, Current: 0.6 ± 10% amp</td>
</tr>
<tr>
<td>Direct Interelectrode Capacitances:</td>
<td>Grid No.1 to all other electrodes: 4.2 to 7.9 μμf, Cathode to all other electrodes: 3.1 to 5.8 μμf, Deflecting electrode DJ₁ to deflecting electrode DJ₂: 1.7 to 3.1 μμf, Deflecting electrode DJ₃ to deflecting electrode DJ₄: 0.7 to 1.3 μμf, DJ₁ to all other electrodes: 4.4 to 9.2 μμf, DJ₂ to all other electrodes: 4.4 to 9.2 μμf, DJ₃ to all other electrodes: 2.8 to 5.3 μμf, DJ₄ to all other electrodes: 2.8 to 6.3 μμf</td>
</tr>
<tr>
<td>Faceplate, Flat</td>
<td>Clear Glass</td>
</tr>
<tr>
<td>Phosphor (For Curves, see front of this Section)</td>
<td>P1 Fluorescence: Green, Phosphorescence: Green, Persistence: Medium</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>
<tr>
<td>Overall Length</td>
<td>16-3/4&quot; ± 3/16&quot;</td>
</tr>
<tr>
<td>Greatest Diameter of Bulb</td>
<td>5-1/4&quot; ± 3/32&quot;</td>
</tr>
<tr>
<td>Minimum Useful Screen Diameter</td>
<td>4-1/2&quot;</td>
</tr>
<tr>
<td>Weight (Approx.)</td>
<td>2-1/2 lbs</td>
</tr>
<tr>
<td>Mounting Position</td>
<td>Any</td>
</tr>
<tr>
<td>Cap.</td>
<td>Recessed Small Ball (JETEC No.J1-22)</td>
</tr>
<tr>
<td>Bulb</td>
<td>J42</td>
</tr>
<tr>
<td>Base</td>
<td>Medium-Shell Diheptal 12-Pin (JETEC No.B12-37)</td>
</tr>
<tr>
<td>Pin 1 - Heater</td>
<td>Pin 9 - Ultor (Grid No.2, Grid No.4)</td>
</tr>
<tr>
<td>Pin 2 - Cathode</td>
<td>Pin 10 - Deflecting Electrode</td>
</tr>
<tr>
<td>Pin 3 - Grid No.1</td>
<td>Not Use</td>
</tr>
<tr>
<td>Pin 4 - No Connection-Do</td>
<td>DJ₂</td>
</tr>
<tr>
<td>Pin 5 - Grid No.3</td>
<td>Pin 11 - Deflecting Electrode</td>
</tr>
<tr>
<td>Pin 6 - Deflecting Electrode</td>
<td>DJ₁</td>
</tr>
<tr>
<td>Pin 7 - Deflecting Electrode</td>
<td>Pin 12 - No Connection</td>
</tr>
<tr>
<td>Pin 8 - Deflecting Electrode</td>
<td>Pin 14 - Heater</td>
</tr>
<tr>
<td>Cap - Post-Ultor (Grid No.5, Collector)</td>
<td></td>
</tr>
</tbody>
</table>
### Maximum Ratings, Design-Center Values:

<table>
<thead>
<tr>
<th>Rating</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>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 post-ultor voltage ($E_C$) between 2000* and 6000 volts and any uktor voltage ($E_{du}$) between 1500** and 2600 volts

| Grid-No.3 Voltage for Focus   | 20% to 34.5% of $E_{C_4}$ volts |
| Grid-No.1 Voltage for Visual Extinction of Undelected Focused Spot | $-2.25\%$ to $-3.75\%$ of $E_{C_4}$ volts |
| Grid-No.3 Current for Any Operating Condition | $-15$ to $+10\mu$amp |

### Deflection Factors:

**When $E_C = 2 \times E_{C_4}$:**

- $DJ_1$ & $DJ_2$: $26.7$ to $33.3$ v dc/in./kv of $E_{C_4}$
- $DJ_3$ & $DJ_4$: $20.3$ to $25$ v dc/in./kv of $E_{C_4}$

**When $E_C = E_{C_4}$:**

- $DJ_1$ & $DJ_2$: $21.5$ to $26.5$ v dc/in./kv of $E_{C_4}$
- $DJ_3$ & $DJ_4$: $16$ to $20$ v dc/in./kv of $E_{C_4}$

### Spot Position

- At or near this rating, the effective resistance of the uktor supply should be adequate to limit the uktor input power to 6 watts.
- It is recommended that the post-ultor voltage be not less than 3000 volts for high-speed scanning.
- Recommended minimum value of uktor voltage.
- **With heater voltage of 6.3 volts, post-ultor voltage of 4000 volts, uktor 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 uktor, and the tube shielded from all extraneous fields, the center of the undeflected, focused spot will fall within a circle having an 8-mm radius concentric with the center of the tube face.**

### Note:

- See next page.
Examples of Use of Design Ranges:
With post-ulator voltage of 2000 3000 4000 volts
and ulator voltage of 2000 1500 2000 volts
Grid-No.3
Voltage for
Focus . . . . . . 400 to 690 300 to 515 400 to 690 volts
Grid-No.1
Voltage for
Visual Ex-
tinction of
Undelected
Focused Spot. . -45 to -75 -34 to -56 -45 to -75 volts
Deflection
Factors:#
DJ1 & DJ2 . . . . 43 to 53 40 to 50 53.4 to 66.6 v dc/in.
DJ3 & DJ4 . . . . 32 to 40 30.5 to 37.5 40.6 to 50 v dc/in.
Maximum Circuit Values:
Grid-No.1-Circuit Resistance. . . . . . . 1.5 max. megohms
Resistance in Any Deflecting-
Electrode Circuit . . . . . . . . . . . . 5.0 max. megohms

SPECIAL PERFORMANCE DATA
With post-ulator voltage of 3000 volts
and ulator voltage of 1500 volts
Line Width# . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.030 max. inch
Peak Grid-No.1 Drive from
Spot Cutoff§ . . . . . . . . . . . . . . . . . . . . . . . . . . . 45 max. volts
Raster Shape . . . . . . . . . . . . . . . . . . . . . . . . . . . §

# The deflecting electrodes in the SADPi 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, bright-
ness 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 con-
tracted until individual scanning lines are just barely distinguishable.
Line width is expressed as the quotient of the contracted raster height
measured at the center line of the tube face divided by the number of
scanning lines (49).

§ Under the following conditions: heater voltage of 6.3 volts, grid-No.3
voltage adjusted for focus, and grid-No.1 voltage adjusted to give
visible raster. With 49-line raster, the size of which is adjusted
so that the widest points on the raster just touch the sides of a
square 3.075" on a side, no point on the raster sides will lie within
an inscribed square 2.925" on a side having its sides parallel to
the sides of the 3.075" square and its center at the center of the
3.075" square.
OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE.

THE PLANE THROUGH TUBE AXIS AND EACH OF THE FOLLOWING ITEMS MAY VARY FROM THE TRACE PRODUCED BY 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.
5AHP7, 5AHP7-A
OSCILLOGRAPH TUBE
ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

DATA

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

Direct Interelectrode Capacitances (Approx.):
Grid No.1 to all other electrodes. 6 µf
Cathode to all other electrodes. 5 µf

Faceplate, Spherical. Clear Glass

Phosphor (for curves, see front of this section).
Type 5AHP7
Fluorescence. Blue
Phosphorescence. Greenish-Yellow
Persistence. Long

Type 5AHP7-A
Fluorescence. Blue
Phosphorescence. Greenish-Yellow
Persistence. Long

Focusing Method. Electrostatic
Deflection Method. Magnetic
Deflection Angle (Approx.) 53°

Overall Length. 11-1/8" ± 1/4"
Greatest Diameter of Bulb. 4-15/16" ± 1/32"
Minimum Useful Screen Diameter. 4-1/4"

Weight (Approx.) 1 lb 6 oz
Mounting Position. Any
Cap. Recessed Small Ball (JETEC No.J1-22)
Bulb. J39-1/2
Base. Medium-Shell Octal 8-Pin (JETEC No.B8-11),
or Long Medium-Shell Octal 8-Pin (JETEC No.B8-65)

Basing Designation for BOTTOM VIEW 8EF

Pin 1 - No Connection
Pin 2 - Heater
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 5 - Grid No.1
Pin 6 - No Connection
Pin 7 - Cathode
Pin 8 - Heater (Grid No.3, Collector)

Maximum Ratings, Design-Center Values:
ULTOR VOLTAGE. 10000 max. volts
GRID-No.4 VOLTAGE:
Positive value. 1000 max. volts
Negative value. 500 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. 0 max. volts
PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode. 180 max. volts
Heater positive with respect to cathode. 180 max. volts

*: See next page.

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TUBE DIVISION TENTATIVE DATA
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
5AHP7, 5AHP7-A

OSCILLOGRAPH TUBE

Equipment Design Ranges:

With any ultor voltage \( (E_{c5}) \) between 5000 and 10000 volts and grid-No.2 voltage \( (E_{c2}) \) between 300 and 700 volts:

- Grid-No.4 Voltage for Focus with Ultor Current of 100 \( \mu \)amp.
  - 0\% to 3.6\% of \( E_{c5} \) volts

- Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot
  - \(-11\% \) to \(-25.7\% \) of \( E_{c2} \) volts

- Grid-No.4 Current
  - \(-25 \) to \(+25 \) \( \mu \)amp

- Grid-No.2 Current
  - \(-15 \) to \(+15 \) \( \mu \)amp

- Spot Position
  - \#

Examples of Use of Design Ranges:

With ultor voltage of 7000 volts and grid-No.2 voltage of 300 volts:

- Grid-No.4 Voltage for Focus with Ultor Current of 100 \( \mu \)amp
  - 0 to 250 volts

- Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot
  - \(-33 \) to \(-77 \) volts

Maximum Circuit Values:

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

SPECIAL PERFORMANCE DATA

Line Width:

For ultor voltage of 7000 volts

- 0.013 max.\* inch

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

\# Brilliance and definition decrease with decreasing ultor voltage.

Recommended minimum ultor voltage for the 5AHP7 is 5000 volts; recommended minimum for the 5AHP7-A is 7000 volts.

## With the tube shielded from extraneous fields, the center of the undeflected, focused, low-intensity spot will fall within a circle having a 5/16-inch 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 100 microamperes, grid-No.2 voltage of 300 volts, and a 49-line raster. Raster width is adjusted to 11.4 cm and the grid-No.4 voltage 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: Ø OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.
5AHP7, 5AHP7-A

AVERAGE GRID-DRIVE CHARACTERISTICS

$E_p = 6.3$ VOLTS
ULTOR VOLTS = 5000-10000
GRID Nº1 BIASED TO CUTOFF OF UNDEFLECTED FOCUSED SPOT.

<table>
<thead>
<tr>
<th>PEAK GRID-Nº1 DRIVE FROM SPOT CUTOFF—VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>200</td>
</tr>
<tr>
<td>ULTOR MICROAMPERES</td>
</tr>
</tbody>
</table>

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

HIGH-RESOLUTION CAPABILITY
ALUMINIZED SCREEN
ELECTROSTATIC FOCUS
MAGNETIC DEFLECTION

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

DATA

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

Direct Interelectrode Capacitances:
Grid No.1 to all other electrodes. ... 8  μF
Cathode to all other electrodes. .... 5  μF
External conductive neck coating to ultor .... 1500 max.  μF

Faceplate, Flat. ................. Clear Glass
Phosphor ....................... P24
Fluorescence ................... Green
Phosphorescence ................. Green
Persistence ........................ Short
Focusing Method .......................... Electrostatic
Deflection Method .................... Magnetic
Deflection Angle (Approx.) 45°
Overall Length .............. 12-1/2" ± 3/8"
Greatest Diameter ........... 5" ± 1/8"
Minimum Useful Screen Diameter ... 4-1/4"
Operating Position ............ Any
Weight (Approx.) .................. 1.4 lbs
Cap. ......... Recessed Small Cavity (JETEC No.J1-21)
Socket .......................... See Operating Considerations
Base .......... Small-Shelf Duodecal 7-Pin (JETEC Group 4, No.B7-51)
Basing Designation for BOTTOM VIEW ......... 12C

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.3
Pin 7 - Internal Connection—Do Not Use
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater
Cap - Ulter
C - External Conductive Neck Coating

Maximum Ratings, Design-Center Values:
ULTOR VOLTAGE .............. 27000 max. volts
GRID-No.3 VOLTAGE .......... 6000 max. volts
GRID-No.2 VOLTAGE .......... 350 max. volts
GRID-No.1 VOLTAGE:
Negative-bias value ........... 150 max. volts
Positive-bias value .......... 0 max. volts
Positive-peak value .......... 2 max. volts

 Indicates a change.

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

PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period
not exceeding 15 seconds . . . . . 410 max. volts
After equipment warm-up period . . . 150 max. volts
Heater positive with respect to cathode. 150 max. volts

Characteristics Range Values for Equipment Design:

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

Grid-No.3 Voltage for focus
with ultor current of 200 \( \mu \)a . 17\% to 21.5\% of \( E_{C4} \) volts

Grid-No.2 Voltage when circuit
design utilizes fixed grid-
No.1 voltage \( (E_{C1}) \) for visual
extinction of undeflected fo-
cused spot . . . . . . . . . . . 2 to 5 times \( E_{C1} \) volts

Grid-No.1 Voltage for visual
extinction of undeflected fo-
cused spot when circuit design
utilizes grid-No.2 voltage
\( (E_{C2}) \) at fixed value . . . . . 20\% to 50\% of \( E_{C2} \) volts

Maximum Grid-No.3 Current for
ultor current of 200 \( \mu \)a . . . 170 \( \mu \)a

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 of 200 \( \mu \)a . 4600 to 5800 volts

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

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

Maximum Circuit Values:

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

* Brilliancy 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

\( \text{\textarrow indicates a change.} \)

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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.6-110 (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: ø OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.
AVERAGE CHARACTERISTICS

*E.F.* = 6.3 VOLTS
ULTOR (GRID-N°4 AND COLLECTOR) VOLTS = 27000
GRID-N°3 VOLTS ADJUSTED TO GIVE FOCUS.
GRID-N°2 VOLTS = 200
SCREEN BRIGHTNESS MEASURED ON BLANK TV RASTER 4" X 3"
**RCA**

### 5AYP4

**VIEW-FINDER KINESCOPE**

**METAL-BACKED SCREEN**

#### ELECTROSTATIC FOCUS  MAGNETIC DEFLECTION

#### DATA

**General:**

Heater, for Unipotential Cathode:

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

Direct Interelectrode Capacitances:

- Grid No. 1 to all other electrodes: 6 μuf
- Cathode to all other electrodes: 5 μuf
- External conductive coating to utor*: (750 max. μuf)
  - (500 min. μuf)

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: 11-9/16" ± 3/8"

Picture Size (within minimum-useful-screen area): 3-3/8" x 2-1/2"

Weight (Approx.): 1 lb 6 oz

Mounting Position: Any

Uutor* Terminal: Recessed Small Ball Cap (JETEC No. J1-22)

Bulb: J-39-1/2 (JETEC No. B8-65)

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

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

- UUTOR VOLTAGE*: 10000 max. volts
- GRID-No. 3 VOLTAGE: 1500 max. volts
- GRID-No. 2 VOLTAGE: 410 max. 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 5AYP4, the utor 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 "utor" for convenience in presenting data and curves.

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**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 \( E_{C4} \) 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 \( E_{C4} \) volts

Grid-No.1 Voltage for Visual Extinction of Focused Raster
8.5% to 23.5% of \( E_{C2} \) volts

Max. Grid-No.3 Current\(^**\) See Curves

-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 \( 7000 \) to \( 10000 \) volts
and grid-No.2 voltage of \( 200 \) to \( 300 \) 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_r = 6.3 VOLTS
ULTOR (GRID N° 4 AND COLLECTOR) VOLTS = 10000
GRID-N° 3 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS
GRID N° 1 BIASED TO CUTOFF OF FOCUSED RASTER
RASTER SIZE = 3 3/8" x 2 1/2"

FEB. 24, 1955
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
5AYP4

AVERAGE GRID-DRIVE CHARACTERISTICS

$E_f = 6.3 \text{ VOLTS}$

ULTOR (GRID N°4 AND COLLECTOR) VOLTS $= 10000$

GRID-N°3 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS

GRID N°1 BIASED TO CUTOFF OF FOCUSED RASTER

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FEB. 24, 1955

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_f = 6.3 \text{ VOLTS}$

ULTOR (GRID N°4 AND COLLECTOR) VOLTS = 10000

GRID-N°3 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS

GRID N°1 BIASED TO CUTOFF OF FOCUSED RASTER

<table>
<thead>
<tr>
<th>VIDEO SIGNAL VOLTS FROM RASTER CUTOFF</th>
<th>MAX. GRID-N°3 MICROAMPERES</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>30</td>
<td>40</td>
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<td>70</td>
<td>80</td>
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<tr>
<td>80</td>
<td>90</td>
</tr>
<tr>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td>100</td>
<td>110</td>
</tr>
</tbody>
</table>

FEB. 24, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM - 7799RI
# RCA 5AZP4

**PROJECTION KINESCOPE**

ALUMINIZED FLUORESCENT SCREEN  
FORCED-AIR COOLED AT MAXIMUM ULTOR INPUT  
ELECTROSTATIC FOCUS  
MAGNETIC DEFLECTION

## DATA

### General:
- **Heater, for Unipotential Cathode:**
  - Voltage: 6.3 V ac or dc volts
  - Current: 0.6 ± 10% amp
- **Direct Interelectrode Capacitances:**
  - Grid No.1 to all other electrodes: 8 max. μF
  - Cathode to all other electrodes: 5 μF
- **Faceplate, Spherical:** Non-browning Glass
- **Refractive index:** 1.519
- **Phosphor (for curves, see front of this Section): P4—Silicate Type Aluminized Fluorescence**
- **Phosphorescence:** White
- **Persistence:** Medium
- **Focusing Method:** Electrostatic
- **Deflection Method:** Magnetic
- **Deflection Angle (Approx.):** 50°
- **Overall Length:** 12-3/16" ± 3/8"
- **Greatest Diameter of Bulb:** 5" ± 1/8"
- **Minimum Useful Screen Diameter:** 4-1/2"
- **Minimum Optical-Quality-Circle Diameter:** 4-1/4"
- **Weight (Approx.):** 1-1/2 lbs
- **Mounting Position:** Any
- **Ultor Lead:** Molded-On Insulated Cable 48" Long
- **Bulb Base:** Small-Shell Duodecal 7-Pin (JETEC No.B7-51)
- **Basing Designation for BOTTOM VIEW:** 12AA

### Pin Connections:

<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>6</td>
<td>Grid No.3</td>
</tr>
<tr>
<td>7</td>
<td>Internal Connection—Flexible Cable—Ultor (Grid No.4, Collector) Do Not Use</td>
</tr>
<tr>
<td>10</td>
<td>Grid No.2</td>
</tr>
</tbody>
</table>

**NOTE:** Socket contacts for vacant pin positions 3, 4, 5, 8, and 9 should be removed so that maximum insulation is provided for pins 6 and 7.

### Air Flow to Face (When average ultor input exceeds 9 watts):
An adequate air flow sufficient to limit the faceplate temperature to the specified value should be delivered perpendicularly from a nozzle having a diameter of about 2 inches onto the face of the tube when it is in operation. The blower should have adequate capacity to provide for a total system pressure drop including that of the air filter.

**Face Temperature:** 100 max. °C
### Maximum Ratings, Absolute Values:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ULTOR VOLTAGE</strong></td>
<td>40000 max. volts</td>
</tr>
<tr>
<td><strong>ULTOR INPUT (AVERAGE):</strong></td>
<td></td>
</tr>
<tr>
<td>Without forced-air cooling of faceplate</td>
<td>9 max. watts</td>
</tr>
<tr>
<td>With forced-air cooling of faceplate</td>
<td>12 max. watts</td>
</tr>
<tr>
<td><strong>GRID-No.3 VOLTAGE</strong></td>
<td>9000 max. volts</td>
</tr>
<tr>
<td><strong>GRID-No.2 VOLTAGE</strong></td>
<td>400 max. volts</td>
</tr>
<tr>
<td><strong>GRID-No.1 VOLTAGE:</strong></td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>150 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 respect to cathode</td>
<td>175 max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>10 max. volts</td>
</tr>
</tbody>
</table>

### Equipment Design Ranges:

For any ultor voltage \(E_{c4}\) between 35000* and 40000 volts

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grid-No.3 (Focusing Electrode)</strong> Voltage for ultor current of 300 (\mu)amp.</td>
<td>18.5% to 22.5% of (E_{c4}) volts</td>
</tr>
<tr>
<td><strong>Grid-No.2 Voltage when circuit design utilizes grid-No.1 voltage (E_{c1}) at fixed value for raster cutoff</strong></td>
<td>2.15 to 5.4 times (E_{c1}) volts</td>
</tr>
<tr>
<td><strong>Grid-No.1 Voltage for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2 voltage (E_{c2}) at fixed value</strong></td>
<td>-18.5% to -46.5% of (E_{c2}) volts</td>
</tr>
<tr>
<td><strong>Maximum Grid-No.3 Current for ultor current of 300 (\mu)amp.</strong></td>
<td>100 (\mu)amp</td>
</tr>
<tr>
<td><strong>Grid-No.2 Current.</strong></td>
<td>-15 to +15 (\mu)amp</td>
</tr>
</tbody>
</table>

### Examples of Use of Design Ranges:

For ultor voltage of 36000 volts

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grid-No.3 (Focusing Electrode)</strong> Voltage for ultor current of 300 (\mu)amp.</td>
<td>6650 to 8100 volts</td>
</tr>
<tr>
<td><strong>Grid-No.2 Voltage when circuit design utilizes grid-No.1 voltage of -65 volts for raster cutoff.</strong></td>
<td>140 to 350 volts</td>
</tr>
<tr>
<td><strong>Grid-No.1 Voltage for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2 voltage of 200 volts.</strong></td>
<td>-37 to -93 volts</td>
</tr>
</tbody>
</table>

*See next page.*
### Maximum Circuit Values:

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

*Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 35000 volts.*

### OPERATING CONSIDERATIONS

**X-ray radiation** is produced at the face of the 5AZP4 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 shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section.

An **air-cooling system** is required to cool the face of the 5AZP4 when the tube is operated with an average ultor input in excess of 9 watts. The system consists of a suitable blower and 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 ultor power supply to prevent operation of the tube without cooling.
NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No. 3 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR-CABLE CONNECTION AT BULB WALL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ±20°. ULTOR-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: ULTOR 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.
AVERAGE DRIVE CHARACTERISTICS

\[ E_p = 6.3 \text{ VOLTS} \]
ULTOR VOLTS = 36000
GRID-N\# 3 VOLTS ADJUSTED TO GIVE FOCUS
GRID-N\# 2 VOLTS = 200
GRID N\# 1 BIASED TO CUTOFF OF FOCUSED RASTER
RASTER SIZE = 4" X 3"

GRID-N\# 3 OR ULTOR MICROAMPERES

ULTOR CURRENT

GRID-N\# 3 CURRENT

VIDEO SIGNAL VOLTS FROM RASTER CUTOFF

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY 92CM - 8549
HIGH-VACUUM CATHODE-RAY TUBE
Supersedes Type 5BP1

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

Direct Interelectrode Capacitances (Approx.):
- Grid No.1 to All Other Electrodes: 8.0 µf
- DJ1 to DJ2: 1.3 µf
- DJ2 to DJ4: 1.2 µf
- DJ1 to All Other Electrodes except DJ2: 8.0 µf
- DJ2 to All Other Electrodes except DJ4: 7.5 µf
- DJ3 to All Other Electrodes except DJ4: 10.0 µf
- DJ4 to All Other Electrodes except DJ3: 7.5 µf

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

Focusing Method: Electrostatic
Deflection Method: Electrostatic

Overall Length: 16-3/4" ± 3/8"
Greatest Diameter of Bulb: 5-1/4" + 1/16" - 3/32"
Minimum Useful Screen Diameter: 4-1/2"
Mounting Position: Any

Base: Medium Shell Magna 11-Pin
Basing Designation for BOTTOM VIEW: 11N
- Pin 1 - Heater
- Pin 2 - No Connection
- Pin 3 - Deflecting Electrode DJ1
- Pin 4 - Anode No.1
- Pin 5 - Internal Con.
- Pin 6 - Deflecting Electrode DJ4
- Pin 7 - Anode No.2
- Pin 8 - Deflecting Electrode DJ2
- Pin 9 - Deflecting Electrode DJ3
- Pin 10 - Grid No.1

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

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

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

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

JULY 1, 1945

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**HIGH-VACUUM CATHODE-RAY TUBE**

(continued from preceding page)

### Maximum Ratings, Absolute Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANODE-No.2 &amp; GRID-No.2 VOLTAGE</td>
<td>2200 max.</td>
</tr>
<tr>
<td>ANODE-No.1 VOLTAGE</td>
<td>1100 max.</td>
</tr>
<tr>
<td>GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Negative Value</td>
<td>125 max.</td>
</tr>
<tr>
<td>Positive Value</td>
<td>0 max.</td>
</tr>
<tr>
<td>PEAK VOLTAGE BETWEEN ANODE No.2 AND ANY DEFLECTING ELECTRODE</td>
<td>550 max.</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 μamp.

#### Deflection Sensitivity:

<table>
<thead>
<tr>
<th>Deflection 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>Deflection Electrode</th>
<th>Factor</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>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1 - Circuit Resistance</td>
<td>1.5 max. meghoms</td>
</tr>
<tr>
<td>Impedance of Any Deflecting-Electrode Circuit at Heater-Supply Frequency</td>
<td>1.0 max. meghohm</td>
</tr>
<tr>
<td>Resistance in Any Deflecting-Electrode Circuit**</td>
<td>5.0 max. meghohms</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
- DJ₂ to DJ₃: 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)***
- Fluorescence and Phosphorescence: Green
- Persistence of Phosphorescence: Medium

**Focusing Method:**
- Electrostatic Deflection Method

**Overall Length:**
- 16-3/4" ± 3/8"

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

**Minimum Useful Screen Diameter:**
- 4-1/2"

**Mounting Position:**
- Any

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

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

**Basing Designation for BOTTOM VIEW:**

- 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 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°.

**OCTOBER 1, 1951**

**RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY**
Maximum Ratings, Design-Center Values:

ANODE-No.3 VOLTAGE .................. 4000 max. volts
ANODE-No.2 VOLTAGE .................. 2000 max. volts
RATIO OF ANODE-No.3 VOLTAGE TO
ANODE-No.2 VOLTAGE .......... 2:3:1
ANODE-No.1 VOLTAGE ................. 1000 max. volts
GRID-No.1 VOLTAGE:
    Negative bias value ............... 200 max. volts
    Positive bias value* ............. 0 max. volts
    Positive peak value .............. 2 max. volts
PEAK VOLTAGE BETWEEN ANODE No.2 AND
    ANY DEFLECTING ELECTRODE ...... 500 max. volts
PEAK HEATER-CATHODE VOLTAGE:
    Heater negative with respect to cathode. 125 max. volts
    Heater positive with respect to cathode. 125 max. volts

Equipment Design Ranges:

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

Anode-No.1 Voltage .................. 18.7 to 34.5% of Eb2 .. volts
Grid-No.1 Voltage* .................. 1.5% to 4.5% of Eb2 .. volts
Anode-No.1 Current of any
    Operating Condition .......... -15 to +10 .. μamp

Deflection Factors:

When Eb3 = 2 x Eb2

DJ1 & DJ2 .................. 39 to 53 v dc/in./kv of Eb2
DJ3 & DJ4 .................. 33 to 45 v dc/in./kv of Eb2

When Eb3 = Eb2

DJ1 & DJ2 .................. 31 to 42 v dc/in./kv of Eb2
DJ3 & DJ4 .................. 27 to 37 v dc/in./kv of Eb2

Spot Position .................. **

Examples of Use of Design Ranges:

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

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

Deflection Factors:

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

Maximum Circuit Values:

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

** Indicates a change.
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.

With heater voltage of 6.3 volts, anode-No. 3 voltage of 4000 volts, anode-No. 2 voltage of 2000 volts, anode-No. 1 voltage adjusted to focus, grid-No. 1 voltage adjusted to give spot that is just visible, each deflecting electrode connected through 1-megohm resistor to anode No. 2, and tube shielded from all extraneous fields, the center of the undeflected, focused spot will fall within a circle having a 12.5-mm radius concentric with the center of the tube face.

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

TYPICAL OSCILLOGRAPH CIRCUIT

5.0001 μf, 2500 Volts

C3: 0.1 μf, 2500 Volts
C4: 0.5 μf, 2500 Volts
C5 C6 C7: 0.05-μf. Blocking Capacitors*
C8: 0.0001 μf, 2500 Volts
R1: 50 Megohms (Five 10-Meg-ohm, 1-Watt Resistors in Series)
R2 R3: 2 Megohms, 0.5 Watt
R4: 5.5 Megohms, 2 Watts

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

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

SCREW RADIUS
2 1/4" MIN.

ANODE NO. 3
RECESSED
SMALL BALL
CAP
JETEC NO. J1-22

MEDIUM-SHELL
DIHEPTAL
12-PIN
BASE
JETEC NO. BI2-37

\[ \frac{1}{2} R \times 10 \frac{3}{8} " \text{ MAX.} \]

16 \( \frac{3}{4} " \pm \frac{3}{8} " \]

2" ± 1/16"

\[ \frac{5}{4} " \pm \frac{3}{32} " \]

\[ \frac{27}{18} R \]

\[ \frac{8}{R} \]

\[ 0.808 " \]

\[ 5 1/4 " \]

\[ \frac{1}{4} " \]

\[ \frac{6}{4} " \]

\frac{1}{4} " ± \frac{1}{4} "

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\[ 92CM-6408R4 \]

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$E_f = 6.3$ VOLTS
ANODE - N°1 VOLTS ADJUSTED FOR FOCUS
ANODE - N°3 VOLTS = 2 x ANODE - N°2 VOLTS

RELATIVE LINE BRIGHTNESS

ANODE - N°2 VOLTS

DEC. 23, 1946
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8820
CHARACTERISTICS

$E_f = 6.3 \text{ VOLTS}$

ANODE-№ 1 VOLTS ADJUSTED FOR FOCUS
ANODE-№ 3 VOLTS GREATER THAN
ANODE-№ 2 VOLTS

GRID-№ 1 VOLTS = 0

- MAX. TOTAL CURRENT FOR ANY TUBE
- TYPICAL FLUORESCENT-SCREEN
  (ANODE № 3) CURRENT

DEC. 24, 1946

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ANODE-N2 VOLTS ADJUSTED TO GIVE FOCUS

<table>
<thead>
<tr>
<th>CURVE</th>
<th>ELECTRODE CURRENT</th>
<th>ANODE-N2 VOLTS</th>
<th>ANODE-N3 VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ANODE N21</td>
<td>2000</td>
<td>2000-4000</td>
</tr>
<tr>
<td>B</td>
<td>ANODE N21</td>
<td>1500</td>
<td>1500-3000</td>
</tr>
<tr>
<td>C</td>
<td>ANODE N22</td>
<td>2000</td>
<td>4000</td>
</tr>
<tr>
<td>D</td>
<td>ANODE N22</td>
<td>1500</td>
<td>3000</td>
</tr>
<tr>
<td>E</td>
<td>ANODE N23</td>
<td>2000</td>
<td>4000</td>
</tr>
<tr>
<td>F</td>
<td>ANODE N23</td>
<td>1500</td>
<td>3000</td>
</tr>
</tbody>
</table>

GRID-N1 VOLTS

ANODE-N2 VOLTS

ANODE-N3 VOLTS

GRID-N1 VOLTS

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

DEC. 26, 1946
92CM-6414 R2
The 5CP7-A is the same as the 5CP1-A, except that it has a screen of the greenish-yellow, long-persistence type, designated P7.

The SPECTRAL-ENERGY EMISSION CHARACTERISTIC, as well as PERSISTENCE CURVES of EUILDP and DECAY for the P7 PHOSPHOR are shown at the beginning of this Section.
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.
The 5CP12 is the same as the 5CP1-A except that it utilizes a medium-long-persistence screen which exhibits orange fluorescence and phosphorescence.

Because of its medium-long persistence, the 5CP12 is particularly useful where low- and medium-speed recurring phenomena are to be observed. However, it may also be used for observing low- and medium-speed, non-recurring phenomena but its efficiency is low. The persistence is such that the 5CP12 can be operated with scanning frequencies as low as 10 cycles per second without excessive flicker.

It will be noted that the phosphorescence decays exponentially with a time constant of about 120 milliseconds with the result that the low-level phosphorescence is of relatively short duration. Because of this characteristic, the 5CP12 provides high contrast between new and old information with change in target position. Therefore, the 5CP12 is suitable for short-range radar equipment involving medium-speed recurrent phenomena.

The P12 screen is more susceptible to burning than other phosphors. Therefore, the 5CP12 should be operated with the rated maximum anode-No.3 voltage and with the lowest anode-No.3 current which will give the desired brightness.

THE SPECTRAL-ENERGY EMISSION CHARACTERISTIC and the PERSISTENCE CHARACTERISTIC of the P12 Phosphor are shown at the front of this Section.
5FP7-A

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 µuf
Cathode to All Other Electrodes: 5 µuf
Phosphor (For Curves, see front of this Section): Greenish-Yellow
Fluorescence: Blue
Phosphorescence: Long
Persistence of Phosphorescence: Any
Focusing Method: Magnetic
Deflection Method: Magnetic
Deflection Angle (Approx.): 53°
Overall Length: 11-1/8" ± 3/8" 4-15/16" ± 3/32"
Greatest Diameter of Bulb: 4-1/4"
Minimum Useful Screen Diameter: Recessed Small Ball (JETEC No. J1-22)
Base: Long Medium-Shell Octal 8-Pin (JETEC No. B8-65)

Bottom View:
Pin 1 - No Connection
Pin 2 - Heater Connection
Pin 3 - Grid No. 2
Pin 4 - No Connection
Pin 5 - Grid No. 1
Pin 6 - No
Pin 7 - Cathode
Pin 8 - Heater
Cap - Above

Maximum Ratings, Design-Center Values:
ANODE VOLTAGE: 8000 max. volts
GRID-No.2 VOLTAGE: 700 max. volts
GRID-No.1 VOLTAGE:
  Negative bias value: 180 max. volts
  Positive bias value*: 0 max. volts
  Positive peak value: 2 max. volts
PEAK GRID-No.1 DRIVE FROM CUTOFF: 65 max. volts
PEAK HEATER-CATHODE VOLTAGE:
  Heater negative with respect to cathode: 125 max. volts
  Heater positive with respect to cathode: 125 max. volts

Typical Operation:
Anode Voltage**: 4000 7000 volts
Grid-No.2 Voltage: 250 250 volts

* At or near this rating, the effective resistance of the anode supply
  should be adequate to limit the anode input power to 6 watts.
** Brilliance and definition decrease with decreasing anode voltage. In
general, the anode voltage should not be less than 4000 volts.
5FP7-A

OSCILLOGRAPH TUBE

Grid-No.1 Voltage... -25 to -70 volts
Grid-No.2 Current... -15 to +15 μA

Focusing-Coil Current
(DC, approx.)#... 96 ± 15% ma

Spot Position... **

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

For visual extinction of undeflected focused spot.

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

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

OPERATING NOTES

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

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

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

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

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

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

AUG. 1, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
OSCILLOGRAPH TUBE
MAGNETIC FOCUS MAGNETIC DEFLECTION

DATA

General:
Heater, for Unipotential Cathode:
Voltage: 6.3 ac or dc volts
Current: 0.6 ± 10% amp
Direct Interelectrode Capacitances (Approx.):
Grid No.1 to all other electrodes: 8 μf
Cathode to all other electrodes: 5 μf
Faceplate, Spherical: Clear Glass
Phosphor (For curves, see front of this Section): P14 Purple
Fluorescence: Orange
Persistence: Medium Long
Focusing Method: Magnetic
Deflection Method: Magnetic
Deflection Angle (Approx.): 53°
Overall Length: 11-1/8" ± 3/8"
Greatest Diameter of Bulb: 4-15/16" ± 3/32"
Minimum Useful Screen Diameter: 4-1/4"
Weight (Approx.): 1 lb 2 oz
Mounting Position: Any
Cap.: Recessed Small Ball (JETEC No.J1-22)
Bulb: Medium-Shell Octal 8-Pin (JETEC No.B8-11)
Base: Medium-Shell Octal 8-Pin (JETEC No.B8-11)
Basing Designation for BOTTOM VIEW: 5AN

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 \( (E_3) \) 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
Undeflected Focused
Spot .......................... -10% to -28% of \( E_{c2} \) volts
Grid-No.2 Current ............................ -15 to +15 \( \mu \)amp
Focusing-Coil Current (DC) ............................ \([\sqrt{E_3/4000} \times 96] \pm 15\% \) 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
Undeflected Focused
Spot .......................... -25 to -70 -25 to -70 volts
Focusing-Coil Current (DC) ............................ 96 \pm 15\% 107 \pm 15\% ma

Maximum Circuit Values:

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

SPECIAL PERFORMANCE DATA

Line Width:

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

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

\* 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.

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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

$E_f = 6.3$ VOLTS
ULTOR VOLTS = 4000 - 8000
GRID N=1 BIASED TO CUTOFF OF UNDEFLECTED FOCUSED SPOT.
## 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): P15

Fluorescence—
- Visible radiation: Blue-Green
- Invisible radiation: Near-Ultraviolet

Phosphorescence—
- Persistence of visible radiation: Very Short
- Persistence of invisible radiation: Extremely Short

Focusing Method: Magnetic
Deflection Method: Magnetic
Deflection Angle (Approx.): 53°

Tube Dimensions:
- Overall length: 11-1/8" ± 3/8"
- Greatest diameter of bulb: 4-15/16" ± 3/32"
- Minimum Useful Screen Diameter: 4-1/4"
- Weight (Approx.): 1 lb 2 oz
- Mounting Position: Any
- Cap: Recessed Small Ball (JETEC No. J1-22)
- Bulb: J-39-1/2
- Base: Medium-Shell Octal 8-Pin (JETEC No. B8-11)

Basing Designation for BOTTOM VIEW: 5AN

### Pin Connections:

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

### Maximum Ratings, Design-Center Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultor Voltage</td>
<td>8000 max. volts</td>
</tr>
<tr>
<td>Grid-No. 2 Voltage</td>
<td>700 max. volts</td>
</tr>
<tr>
<td>Grid-No. 1 Voltage:</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>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>

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

For any ultor voltage \(E_{c3}\) between 4000\(^2\) and 8000 volts and grid-No. 2 voltage \(E_{c2}\) between 150 and 700 volts

Grid-No. 1 Voltage for Visual Extinction of Undeflected Focused Spot ....... -10\% to -28\% of \(E_{c2}\) volts

Grid-No. 2 Current ........ -15 to +15 \(\mu\)amp

Focusing-Coil Current (DC)\(\text{OO.} \left[\sqrt{E_{c3}/4000 \times 96}\right] \pm 15\%\) ma

Spot Position ........ #

Examples of Use of Design Ranges:

For ultor voltage of 4000 5000 volts

and grid-No. 2 voltage of 250 250 volts

Grid-No. 1 Voltage for Visual Extinction of Undeflected Focused Spot ........ -25 to -70 -25 to -70 volts

Focusing-Coil Current (DC) .... 82 to 110 91 to 123 ma

Maximum Circuit Values:

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

SPECIAL PERFORMANCE DATA

Line Width:

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

For Ultor Voltage of 5000 Volts .... 0.009 max.\(\text{\^}\) 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 centerline of the tube face divided by the number of scanning lines (49).
**NOTE 1:** THE PLANE THROUGH THE TUBE AXIS AND PIN 5 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 10°. ULTOR TERMINAL IS ON SAME SIDE OF TUBE AS PIN 5.

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

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

$E_F = 6.3$ VOLTS
ULTOR VOLTS = 4000 - 8000
GRID N=1 BIASED TO CUTOFF OF UNDEFLECTED FOCUSED SPOT

ULTOR MICROAMPERES

PEAK GRID-N=1 DRIVE FROM SPOT CUTOFF—VOLTS

GRID N=2 VOLTS = 250

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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. ...... 7.5 ........... \( \mu \)f
  Cathode to All Other Electrodes. ...... 5.0 ........... \( \mu \)f
  External Conductive Coating to Anode No.2 \( \{ \)
  500 max. \( \mu \)f
  100 min. \( \mu \)f
Phosphor (For curves, see front of this Section) .... No.4
  Fluorescence and Phosphorescence .......... White
  Persistence of Phosphorescence .......... Medium
Focusing Method ................ Electrostatic
Deflection Method ................ Magnetic
Deflection Angle (Approx.) ....... 50°
Overall Length .................. 11-3/4" ± 3/8"
Greatest Diameter of Bulb .......... 5" ± 1/8"
Minimum Useful Screen Diameter .... 4-1/2"
Minimum Optical-Quality-Circle Diameter ...... 4-1/4"
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 (CONTROL ELECTRODE) 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 .... 175 max. volts
  Heater positive with respect to cathode .... 10 max. volts

Typical Operation:
Anode-No.2 Voltage* .......... 27000 .. volts
Anode-No.1 Voltage for Focus
  when anode-No.2 current is 200 \( \mu \)a . 4320 to 5400 volts
* See next page. ← indicates a change.

MAR. 15, 1948 TUBE DEPARTMENT DATA
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Grid-No.2 Voltage**                      200 ... volts
→ Grid-No.1 Voltage for Visual CutoffO      -42 to -98 volts
Anode-No.2 Current                       200 ... μa
→ Max. Anode-No.1 Current.               65 ... μa
Max. Grid-No.2 Current                   ±15 ... μa

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:
Deflection Yoke                        ... RCA Type No. 201D2
Horizontal Output Transformer (for use with two 6BG6-G's) ... RCA Type No. 211T2
Vertical 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 20000 volts.
** Subject to variation of ±40% if it is desired to operate any tube at a grid-No.1 cutoff bias of -70 volts.
○ Visual extinction of undeflected focused spot.

→ Indicates a change.
PROJECTION KINESCOPE


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

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY.

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.
AVERAGE CHARACTERISTICS

E_f = 6.3 VOLS
ANODE-N2 2 VOLTS = 27,000
ANODE-N2 1 VOLTS ADJUSTED TO GIVE FOCUS
GRID-N9 2 VOLTS = 200
GRID-N9 1 BIASED TO CUTOFF
RASTER SIZE = 3" x 4"

GRID-N1 SIGNAL VOLTS

PEAK GRID-N1 SIGNAL VOLTS

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-6670
OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS  ELECTROSTATIC DEFLECTION

General:

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

Direct Interelectrode Capacitances (Approx.):
Grid No.1 to All Other Electrodes. 8.0 .... μf
DJ1 to DJ2 2.5 .... μf
DJ2 to DJ4 2.5 .... μf
DJ1 to All Other Electrodes 11.0 .... μf
DJ2 to All Other Electrodes 8.0 .... μf
DJ3 to All Other Electrodes 7.0 .... μf
DJ4 to All Other Electrodes 8.0 .... μf

Phosphor (For Curves, see front of this Section) No.1
Fluorescence........................ Medium
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 VIEWPin 1-Heater Pin 8-Anode No.2,
Pin 2-Grid No.1 Pin 9-Deflecting Electrode DJ2
Pin 3-Cathode Pin 10-Deflecting Electrode DJ1
Pin 4-Anode No.1 Pin 11-Internal Con. Do Not Use
Pin 5-Internal Con. Do Not Use
Pin 6-Deflecting Electrode DJ3 Pin 12-Heater
Pin 7-Deflecting Electrode DJ4

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

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

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

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

DEC. 20, 1946  TUBE DEPARTMENT
TENTATIVE DATA
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
OSCILLOGRAPH TUBE

Maximum Ratings, Design-Center Values:

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

Equipment Design Ranges:

- For any anode-No.2 voltage \( (E_{b2}) \) between 1000* and 2500 volts:
  - **Anode-No.1 Voltage**: 17% to 32% of \( E_{b2} \) volts
  - Max. **Grid-No.1 Voltage** for Visual Cutoff: 4.5% of \( E_{b2} \) volts
  - **Anode-No.1 Current for Any Operating Condition**: -15 to +10 microamp
  - **Deflection Factors**: DJ1 & DJ2: 28 to 38.5 v dc/in./kv of \( E_{b2} \)
  - DJ3 & DJ4: 23 to 31 v dc/in./kv of \( E_{b2} \)

Examples of Use of Design Ranges:

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

Maximum Circuit Values:

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

*Recommended minimum value.

- It is recommended that the deflecting-electrode-circuit resistances be approximately equal.
- Anode No.2 and grid No.2, which are connected together within tube, are referred to herein as anode No.2.

DEC. 20, 1946

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE DATA
5UPI
OSCILLOGRAPH TUBE

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 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
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5UPI
**SUPI OSCILLOGRAPH TUBE**

**SCREEN RADIUS**

- $2 \frac{1}{4}''$ MIN.
- $0.808''$
- $0.500''$ R.
- $1.71''$ R.
- $1.444''$
- $5.36''$ R.
- $0.576''$
- $20.16''$ R.

- $9 \frac{3}{8}''$ MAX.

- $5 \frac{1}{4}'' \pm \frac{3}{32}''$

- $14 \frac{1}{4}'' \pm \frac{3}{8}''$

- $14 \frac{3}{4}'' \pm \frac{3}{8}''$

- $15\frac{5}{8}'' \pm \frac{1}{16}''$

The bulb will not deviate more than $2^\circ$ in any direction from the perpendicular erected at the center of bottom of the base.

**NOTE 1:** This base may be superseded by an alternate base which will fit the same socket but which will have a flared shell indicated by the dashed lines and dimensioned approximately as follows:

- $A = 1.85''$ MAX., $B = 0.500''$, $C = 0.200''$ MIN., $D = 0.925''$.

92CM-6763

DEC. 20, 1946

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-6763
SUP 1

AVERAGE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ANODE-N° 1 VOLTS ADJUSTED
FOR FOCUS

---

NOV. 7, 1946
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6808
CHARACTERISTICS

E_f = 6.3 VOLTS
ANODE-N°1 VOLTS ADJUSTED FOR FOCUS
GRID-N°1 VOLTS = 0
--- TYPICAL FLUORESCENT-Screen Current
(See Text)

1500 2000
ANODE-N°2 VOLTS

2.5
2.0
1.5
1.0
0.5
0.0

140
120
100
80
60
40
20

92CM-6811RI
AVRRAGE CHARACTRRISTICS

E<sub>c</sub> = 6.3 VOLTS
ANODE-№1 VOLTS ADJUSTED FOR FOCUS
ANODE-№2 VOLTS = 2000
-- ANODE-№2 CURRENT
---- FLUORESCENT-SCREEN CURRENT (SEE TEXT)

NOV. 11, 1946
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
The 5UP7 is the same as the 5UP1, except that it has a screen of the greenish-yellow, long-persistence type, designated P7. Persistence of useable brightness can be obtained with an anode-No.2 voltage of as low as 1500 volts.

The SPECTRAL-ENERGY EMISSION CHARACTERISTIC, as well as PERSISTENCE CURVES of BUILDUP and DECAY for the P7 PHOSPHOR are shown at the beginning of this section.
The 5UP11 is the same as the 5UP1, 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 5UP11 particularly useful for photographic recording. Because its improved phosphor has exceptional brightness for a blue screen, the 5UP11 is also quite useful for visual observation of phenomena. Radiation of useable intensity can be obtained with anode-No.2 voltages as low as 1500 volts.

The SPECTRAL-ENERGY EMISSION CHARACTERISTIC of the P11 PHOSPHOR is shown at the beginning of this section.
TRANSCRIBER KINESCOPE

ELECTROSTATIC FOCUS

MAGNETIC DEJECTION

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 \( \mu \)f
Cathode to All Other Electrodes. 5 \( \mu \)f
External Conductive Coating to Anode No.2 (500 max. \( \mu \)f

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

Focusing Method. Electrostatic
Deflection Method. Magnetic
Deflection Angle (Approx.) 50°

Overall Length 11-7/16" ± 3/8"
Greatest Diameter of Bulb. 5" ± 1/8"
Minimum Useful Screen Diameter 4-1/4"
Raster Size (Approx.) 2-1/2" x 3-3/8"
Mounting Position. Any
Cap. Recessed Small Cavity
Base Small-Shell Duodecal 7-Pin

Basing Designation for BOTTOM VIEW 12C
Pin 1-Heater
Pin 2-Grid No.1
Pin 6-Anode No.1
Pin 7-Internal Con.-
Do Not Use
Pin 10-Grid No.2
Pin 11-Cathode
Pin 12-Heater
Cap - Anode No.2

Maximum Ratings, Design-Center Values:
ANODE-No.2 VOLTAGE 27000 max. volts
ANODE-No.1 VOLTAGE 6000 max. volts
GRID-No.2 VOLTAGE 350 max. volts
GRID-No.1 VOLTAGE:
Negative bias value. 150 max. volts
Positive bias value. 0 max. volts
Positive peak value. 2 max. volts
PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period not exceeding 15 seconds. 410 max. volts
After equipment warm-up period 125 max. volts
Heater positive with respect to cathode. 125 max. volts

Typical Operation:
Anode-No.2 Voltage* 27000 volts

*: See next page.

FEB. 1, 1949

TENTATIVE DATA 1
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 3183-GT/8016's ........................................ RCA Type No. 211T2
Ver. Deflection Output Transformer .. RCA Type No. 204T2

* Brilliance and definition decrease with decreasing anode voltages. In general, anode-No.2 voltage should not be less than 15000 volts.
** Subject variation of ± 10% when grid-No.1 voltage cutoff is desired at -70 volts.

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

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

AVERAGE CHARACTERISTICS

E_p = 6.3 VOLTS
ANODE-№ 2 VOLTS=27000
ANODE-№ 1 VOLTS ADJUSTED TO GIVE FOCUS
GRID-№ 2 VOLTS = 200
RASTER SIZE : 2 1/2 x 3 3/8"

OCTOBER 28, 1948
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7105
FLYING-SPOT CATHODE-RAY TUBE
ALUMINIZED SCREEN
ELECTROSTATIC FOCUS MAGNETIC DEFLECTION
For use as scanner in 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 μf
- Cathode to all other electrodes: 5 μf
- External conductive neck coating to ultor: {500 max. μf, 100 min. μf}

Faceplate, Flat: Clear Glass
Phosphor (for curves, see front of this section): Aluminized P15

Fluorescence—
- Visible radiation: Green
- Invisible radiation: Near Ultraviolet

Phosphorescence—
- Persistence of visible radiation: Short
- Persistence of invisible radiation: Very Short

Focusing Method: Electrostatic
Deflection Method: Magnetic
Deflection Angle (Approx.): 50°

**Tube Dimensions:**
- Overall length: 11-7/16" ± 3/8"
- Greatest diameter of bulb: 5" ± 1/8"
- Minimum Useful Screen Diameter: 4-1/4"
- Weight (Approx.): 1-1/2 lbs
- Operating Position: Any
- Cap: Recessed Small Cavity (JETEC No.J1-21)
- Socket: See Operating Considerations
- Base: Small-Shell Duodecal 7-Pin (JETEC No.B7-51)
- Basing Designation for BOTTOM VIEW: 12C

**Maximum Ratings, Design-Center Values:**
- ULTOR VOLTAGE: 27000 max. volts
- GRID-No.3 VOLTAGE: 6000 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 ultiot voltage (Ecq) between 15000* and 27000 volts
Grid-No.3 Voltage for focus with ultiot current of 150 µa or less ........ 15% to 19% of Ecq 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 Ec1 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 Ec2 volts
Maximum Grid-No.3 Current for ultiot current of 150 µa ........ 200 µa
Grid-No.2 Current ........ -15 to +15 µa

Examples of Use of Design Ranges:
For ultiot voltage of 20000 27000 volts
Grid-No.3 Voltage for focus with ultiot current as indicated 3000 to 3800 4000 to 5200 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 ........ 150 100 µa

Maximum Circuit Values:
Grid-No.1-Circuit Resistance ........ 1.5 max. megohms
*: See next page. Indicates a change.
FLYING-SPOT CATHODE-RAY TUBE

* Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 15,000 volts.

OPERATING CONSIDERATIONS

X-Ray Warning. X-ray radiation is produced at the face of the 5WPI5 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 5WPI5 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 800 lines at the center of the reproduced picture can be produced by the 5WPI5 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 screen of the 5WPI5 has radiation in the visible green region and in the invisible near-ultraviolet region. The frequency response of the ultraviolet radiation is substantially constant for a range of 3 megacycles and then decreases exponentially toward zero at approximately 100 megacycles.

The PI5 screen is more sensitive to heat than other standard types of phosphors. It shows a decrease in efficiency with increase in temperature. Use of forced air from a small blower directed against the face of the tube is, therefore, suggested to counteract the heating effect of the electron beam if optimum efficiency of the screen is desired at maximum ultor current.

Care should be taken to avoid under-scanning over a protracted period because such an underscanned area will be burned and thus give diminished radiation when the raster is scanned to full size and be apparent in the reproduced picture. Furthermore, it is inadvisable to permit a modulated stationary pattern to remain more than a few minutes on the face of the tube. If it remains for a longer time, the face will be burned unevenly over the pattern area. When a modulated stationary pattern is used, it is recommended that the ultor current be limited to an instantaneous value of about 150 microamperes.

indicates a change.
Because of the high peak energy in the beam, the screen will be seriously damaged if the beam is allowed to remain stationary, even momentarily. 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.

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

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

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE HINGED GAUGE 1.500" + 0.003" - 0.000" I.D. AND 2" LONG WILL REST ON BULB CONE.

NOTE 3: EXTERNAL CONDUCTIVE NECK COATING MUST BE GROUNDED.

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

$E_f = 6.3$ VOLTS
ULTOR VOLTS = 20000
GRID - No. 3 VOLTS ADJUSTED TO GIVE FOCUS.
GRID - No. 2 VOLTS = 200

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

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

ULTOR VOLTS = 27000
GRID - N\textsuperscript{2} VOLTS ADJUSTED TO FOCUS.
GRID - N\textsuperscript{1} VOLTS = 200

GRID-N\textsuperscript{3} VOLTS

ULTRA-VIOLET OUTPUT—ARBITRARY UNITS

GRID-N\textsuperscript{1} VOLTS
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 μf
  Cathode to all other electrodes ........ 5 μf
  External conductive neck coating to ultor. (500 max. μf)

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.J3-21)
Socket .................. See Operating Considerations
Base .................. Small-Shell Duodecal 7-Pin (JETEC No.B7-51)
Basing Designation for BOTTOM VIEW ........ 12C

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

Maximum Ratings, Design-Center Values:
ULTOR VOLTAGE .................. 27000 max. volts
GRID-No.3 VOLTAGE ............ 7000 max. volts
GRID-No.2 VOLTAGE ............ 350 max. volts

Indicates a change.

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ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
FLYING-SPOT CATHODE-RAY TUBE

GRID-No.1 VOLTAGE:
- Negative bias value: 150 max. volts
- Positive bias value: 0 max. volts
- Positive peak value: 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:
- Heater negative with respect to cathode:
  - During equipment warm-up period not exceeding 15 seconds: 410 max. volts
  - After equipment warm-up period: 150 max. volts
- Heater positive with respect to cathode: 150 max. volts

Equipment Design Ranges:
For any ultor voltage ($E_{C4}$) between 20000* and 27000 volts
- Grid-No.3 Voltage for focus with ultor current of 25 $\mu$A or less: 20.5% to 26.5% of $E_{C4}$ volts
- Grid-No.2 Voltage for visual extinction of undeflected focused spot when circuit design utilizes fixed grid-No.1 voltage: 2 to 5 times $E_{C1}$ volts
- Grid-No.1 Voltage for visual extinction of undeflected focused spot when circuit design utilizes fixed grid-No.2 voltage: -20% to -50% of $E_{C2}$ volts
- Grid-No.2 Current: -15 to +15 $\mu$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

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

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
OPERATING CONSIDERATIONS

X-Ray Warning. X-ray radiation is produced at the face of the 5ZP16 when it is operated at its normal ultor voltage. These rays can constitute a health hazard unless the tube is adequately shielded for X-ray radiation. Although relatively simple shielding should prove adequate, make sure that it provides the required protection against personal injury.

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

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

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

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

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

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

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


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

E.F. = 6.3 VOLTS
ULTOR VOLTS = 20,000
GRID N° 3 VOLTS ADJUSTED TO GIVE FOCUS.
GRID N° 2 VOLTS = 200

GRID N° 2 VOLTS

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

92CM-7575RI

ULTOR OR GRID-N°3 MICROAMPERES

-70 -60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60
AVERAGE CHARACTERISTICS

$E_f = 6.3 \text{ VOLTS}$

ULTOR VOLTS = 27000
GRID-N° 3 VOLTS ADJUSTED TO GIVE FOCUS.
GRID-N° 2 VOLTS = 200
RCA

7BP7-A

OSCILLOGRAPH TUBE

MAGNETIC FOCUS

MAGNETIC DEFLECTION

DATA

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

Direct Interelectrode Capacitances (Approx.):
- Grid No.1 to All Other Electrodes 8.5 μF
- Grid No.2 to All Other Electrodes 7 μF
- Cathode to All Other Electrodes 5 μF

Phosphor (For Curves, see front of this Section) No.7
- Fluorescence: Blue
- Phosphorescence: Greenish-Yellow
- Persistence of Phosphorescence: Long

Focusing Method: Magnetic
Deflection Method: Magnetic
Deflection Angle (Approx.): 53°

Overall Length: 13-1/4" ± 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

Maximum Ratings, Design-Center Values:
- ANODE VOLTAGE 8000 max. volts
- GRID-No.2 VOLTAGE 700 max. volts
- GRID-No.1 VOLTAGE:
  - Negative bias value 125 max. volts
  - Positive bias value 0 max. volts
  - Positive peak value 2 max. volts
- PEAK GRID-No.1 DRIVE FROM CUTOFF 65 max. volts
- PEAK HEATER-CATHODE VOLTAGE:
  - Heater negative with respect to cathode 125 max. volts
  - Heater positive with respect to cathode 125 max. volts

Typical Operation:
- Anode Voltage* 4000 7000 volts
- Grid-No.2 Voltage 250 250 volts
- Grid-No.1 Voltage Range° -25 to -70 -25 to -70 volts
- Focusing-Coil Current* 75 to 102 99 to 135 ma
- Spot Position: #

°, *: See next page.

JUNE 15, 1948
Maximum Circuit Values:
Grid-No. 1-Circuit Resistance . . . . . . . 1.5 max. megohms

Minimum Circuit Values:
When the output capacitor of the power supply is capable of storing more than 250 microcoulombs, and when the inherent regulation of the power supply permits the instantaneous short-circuit current to exceed 1 ampere, the effective resistance in circuit between indicated electrode and the output capacitor should be as follows:
Grid-No. 1-Circuit Resistance . . . . . . . 150 min. ohms
Grid-No. 2-Circuit Resistance . . . . . . . 820 min. ohms
Anode-Circuit Resistance . . . . . . . . . 9100 min. ohms

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

Components:
RCA Focusing Coil. . . . . . . . . . . . . . RCA Type No. 202D1

- Anode and grid No. 3, which are connected together within tube, are referred to herein as anode.
- At or near this rating, the effective resistance of the anode supply should be adequate to limit the anode input power to 6 watts.
- Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 11000 volts.
- For visual extinction of undeflected focused spot.
- For JETEC Focusing Coil No. 106, or equivalent, with center line of air gap approximately 2-3/4" from reference line (see Outline Drawing), and total anode current of 200 microamperes.
- The center of the undeflected, unfocused spot will fall within a circle having 12 mm radius concentric with the center of the tube face.
# RCA 7JP4 PICTURE TUBE
## ROUND GLASS TYPE
### ELECTROSTATIC FOCUS
#### ELECTROSTATIC DEFLECTION

#### DATA

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

Faceplate, Spherical: Clear Glass

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

#### Overall Length: 14-1/2" ± 3/8"
#### Greatest Diameter of Bulb: 7" ± 1/8"
#### Minimum Useful Screen Diameter: 6"

**Operating Position:** Any Base. Medium-Shell Dihetal 12-Pin (JETEC Group 5, No.B12-37) Basing Designation for BOTTOM VIEW. 14R

**Pin Layout:**
- 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
- Pin 9—Ultor
- Pin 10—Deflecting
- Pin 11—Deflecting
- Pin 12—Internal Connection—Do Not Use
- Pin 14—Heater

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

**Maximum Ratings, Design-Center Values:**
- **ULTOR VOLTAGE:** 6000 max. volts
- **GRID-No.3 (FOCUSING) VOLTAGE:** 2800 max. volts
- **GRID-No.1 VOLTAGE:**
  - Negative-bias value: 200 max. volts
  - Positive-bias value: 0 max. volts
  - Positive-peak value: 2 max. volts
- **PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFLECTING ELECTRODE:** 750 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

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9-58 ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
### Maximum Circuit Values:

<table>
<thead>
<tr>
<th>Circuit</th>
<th>Resistance</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 max. megohms</td>
</tr>
</tbody>
</table>

- It is recommended that the 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: 6 \(\mu\)f
- Cathode to All Other Electrodes: 5 \(\mu\)f

Phosphor (For Curves, see front of this Section): 7MP7

- Fluorescence: Blue
- Phosphorescence: Greenish-Yellow
- Persistence: Long

**Focusing Method:** Magnetic

**Deflection Method:** Magnetic

Deflection Angle (Approx.): 50°

Overall Length: 12-3/4" ± 3/8"

Greatest Diameter of Bulb: 7-3/16" ± 1/8"

Minimum Useful Screen Diameter: 6"

Mounting Position: Any

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

Base: Small-Shell Duodecal 5-Pin (JETEC No. B5-57)

**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.

OCTOBER 1, 1951

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Typical Operation:

Ultor Voltage* .................. 4000 7000 volts
Grid-No.2 Voltage ................ 250 250 volts
Grid-No.1 Voltage ° .................. -27 to -63 -27 to -63 volts
Grid-No.2 Current ................ -15 to +15 -15 to +15 μamp
Focusing-Coil Current (DC Approx.)** ........ 64 ± 15% 85 ± 15% ma
Spot Position ................. - ##

Maximum Circuit Values:

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

* Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 4000 volts.
° For visual extinction of undeflected, focused spot.
** For specimen focusing coil similar to JETEC Focusing Coil No. 109 positioned with air gap toward faceplate and center line of air gap 2-3/4" from Reference Line (see Outline Drawing) and ultor current of 200 microamperes.
## The center of the undeflected, unfocused spot will fall within a circle having 12-mm radius concentric with the center of the tube face.
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.
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_f = 6.3 \text{ VOLTS}$
ULTOR VOLTS = 7000
GRID N21 BIASED TO CUTOFF OF UNDEFLECTED FOCUSED SPOT
SCANNING AREA: 12 X 12 CM

--- ULTOR CURRENT
--- HIGHLIGHT BRIGHTNESS

HIGHLIGHT BRIGHTNESS - FOOT-LAMBERTS

ULTOR MICROAMPERES

VIDEO SIGNAL VOLTS FROM CUTOFF

JULY 18, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
PROJECTION KINESCOPE
20' x 15' PICTURES
FORCED-AIR COOLED
ELECTROSTATIC FOCUS
ALUMINIZED SCREEN
MAGNETIC DEFLECTION
For use in theater-television equipment

DATA

General:
Heater, for Unipotential Cathode:
Voltage .................. 6.6 ± 5% ...... ac or dc volts
Current .................. 0.62 ................ amp
Direct Inter-electrode Capacitances (Approx.):
Grid No.1 to all other electrodes. .... 12 µf
Cathode to all other electrodes. ...... 6 µf
Phosphor .................. P4—Silicate-Sulfide Type
Aluminized
Fluorescence .............. White
Phosphorescence ............ White
Persistence ................. Medium
Focusing Method ............ Electrostatic
Deflection Method .......... Magnetic
Deflection Angle (Approx.) ... 35°
Projection-Throw Distance for 20' x 15' Picture .... 60 feet
Overall Length ............ 19-1/2" ± 5/8"
Greatest Diameter of Bulb (Excluding side cap) .7" ± 3/16"
Maximum Radius of Tube (Including side cap) .... 4-11/32"
Quality Rectangle of Faceplate
(See Dimensional Outline) .... 5" x 3-3/4"
Refractive Index for Faceplate Glass .... 1.469
Weight (Approx.) .......... 15 lbs
Operating Position .......... Any
Cap. ..................... Medium (JETEC No.C1-5)
Socket .................... See Operating Considerations
Base ..................... Plastic-Filled, Small-Shell Diheptal 14-Pin
.......................... (JETEC Group 5, No.B14-45)

Basing Designation for BOTTOM VIEW .......... 14N

Pin 1—Heater
Pin 2—Cathode
Pin 3—Grid No.1
Pin 4—Grid No.2
Pin 5—No Connection
Pin 6—Same as Pin 5
Pin 7—Same as Pin 5
Pin 8—Same as Pin 5
Pin 9—Same as Pin 5
Pin 10—Same as Pin 5
Pin 11—Same as Pin 5
Pin 12—Same as Pin 5
Pin 13—Internal Connection—Do Not Use
Pin 14—Heater Cap—Ultor
(Grid No.4, Collector)

Indicates a change.
PROJECTION KINESCOPE

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. The blower should have adequate capacity to provide for a total system-pressure drop including that of the air filter.

Face Temperature.................. 100 max. °C

CATHODE-DRIVE® SERVICE

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

Maximum Ratings, Absolute Values:

ULTOR-TO-GRID-No.1 VOLTAGE*........ 80000 max. volts
GRID-No.3-TO-GRID-No.1 VOLTAGE........ 20000 max. volts
GRID-No.2-TO-GRID-No.1 VOLTAGE........ 850 max. volts
GRID-No.2-TO-CATHODE VOLTAGE........ 600 max. volts
CATHODE-TO-GRID-No.1 VOLTAGE:
    Positive-bias value ............ 250 max. volts
    Negative-bias value ............ 0 max. volts
    Peak-negative value ............ 2 max. volts
AVERAGE ULTOR CURRENT ............. 2 max. ma
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:

With any utor-to-grid-No.1 voltage (Ec4g1) between 70000* and 80000 volts and grid-No.2-to-grid-No.1 voltage (Ec2g1) between 400 and 850 volts

Grid-No.3-to-Grid-No.1 Voltage for focus ........ 20% to 22.6% of Ec4g1 volts
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 (Ekg1) .... 3.2 to 4.8 times Ekg1 volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level) to White-Level Value .... Same value as fixed cathode-to-grid-No.1 voltage except video drive is a negative voltage.

* # : See next page.

- Indicates a change.

11-58

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

Grid-No.3 Current........ 0 to +15 μA
Grid-No.2 Current........ -15 to +15 μA

Examples of Use of Design Ranges:

For ultor-to-grid-
No.1 voltage of 75000 volts
Grid-No.3-to-Grid-No.1 Voltage for focus. 15000 to 17000 volts
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 (Ek9) of
125 volts. 400 to 600 volts
Cathode-to-Grid-No.1 Video Drive from
Raster Cutoff
(Black Level) to
White-Level Value. -125 volts

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

GRID-DRIVE SERVICE

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

Maximum Ratings, Absolute Values:
ULTOR VOLTAGE........ 80000 max. volts
GRID-No.3 VOLTAGE........ 20000 max. volts
GRID-No.2 VOLTAGE........ 600 max. volts
GRID-No.1 VOLTAGE:
Negative-bias value........ 250 max. volts
Positive-bias value........ 0 max. volts
Peak-positive value........ 2 max. volts
AVERAGE ULTOR CURRENT........ 2 max. ma
PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period
not exceeding 15 seconds........ 410 max. volts
After equipment warm-up period........ 150 max. volts
Heater positive with respect to cathode........ 150 max. volts

See next page.
Equipment Design Ranges:

With any ultor voltage ($E_{c_{1}k}$) between 70000 and 80000 volts and grid-No.2 voltage ($E_{c_{2}k}$) between 400 and 600 volts.

Grid-No.3 Voltage
- for focus: 20% to 22.6% of $E_{c_{4}k}$ volts
- Grid-No.2 Voltage for visual extinction of focused raster when circuit design utilizes fixed grid-No.1 voltage ($E_{c_{1}k}$): 2.58 to 3.87 times $E_{c_{4}k}$ volts
- 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: 0 to +15 μA
- Grid-No.2 Current: -15 to +15 μA

Examples of Use of Design Ranges:

For ultor voltage of 75000 volts
- Grid-No.3 Voltage for focus: 15000 to 17000 volts
- Grid-No.2 Voltage for visual extinction of focused raster when circuit design utilizes fixed grid-No.1 voltage ($E_{c_{1}k}$): 400 to 600 volts
- Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level) to White-Level Value: 155 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.
- The product of ultor-to-grid-No.1 voltage, or ultor voltage, and average ultor current should be limited to 160 watts.
- Brilliance and definition decrease with decreasing ultor-to-grid-No.1 voltage or ultor voltage. In general, the ultor-to-grid-No.1 voltage or the ultor voltage should not be less than 70,000 volts.
- Grid-drive is the operating condition in which the video signal varies the grid-No.1 potential.

OPERATING CONSIDERATIONS

X-ray radiation is produced at the face of the 7NP4 when it is operated at its normal ultor voltage. These rays can constitute a health hazard unless the tube is adequately shielded.

Indicates a change.
shielded. Make sure that the shielding provides the required protection against personal injury.

The base pins fit a Diheptal 14-contact socket. It should be designed to prevent corona between pin 9 and pin 4, pin 13, and any adjacent socket-assembly bolt. The usual commercially available Diheptal sockets do not meet this requirement. Socket contacts for pins 5, 6, 7, 8, 10, 11, 12, and 13 should be removed so that maximum insulation is provided for pin 9. The socket should be made of high-grade, low-leakage, arc-resistant insulating material adequate to withstand 20,000 volts between the contact for pin 9 and the contacts for pins 4 and 13. The socket should not be rigidly mounted; it should have flexible leads and be allowed to move freely.

The ultor connection is made to the Medium cap on the side of the bulb. The ultor connector should have a ball-type corona shield with a diameter of about 1-1/2 inches in order to prevent the formation of corona.

An air-cooling system is required to cool the face of the 7NP4. The system consists of a blower, such as Pilot No. 50747 or No. 50748*, and an air duct, having an outlet diameter of about 2 inches, directed perpendicularly onto the face of the tube. An air flow of 40 cubic feet per minute at the tube face is required to provide adequate cooling. 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 ultor 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.

Failure of scanning while the 7NP4 draws beam current may permanently damage the screen. Provision should be made, therefore, for automatic, high-speed cutoff of the beam current in case of scanning failure.

Darkening of face occurs during normal operation of the tube with resulting decrease in the light transmitted by the face. The rate of darkening increases rapidly with increase in ultor 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.

* Made by F.A. Smith Mfg. Co., Inc., P.O. Box 509, Rochester 2, N.Y.

11-58 ELECTRON TUBE DIVISION RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
PRECAUTION

During storage of this Projection Kinescope, occluded gas may be released within the tube. When high voltage is applied, this gas may cause internal arcing with possible damage to the tube. To prevent such an occurrence, it is recommended that this kinescope be given the following treatment at intervals of about 2 months during storage, and at time of installation in equipment: With the beam cut off, apply normal ultor voltage to the tube. Gradually increase the ultor current in steps over a period of 15 minutes until one fourth of the operating ultor-current value is reached. Operate at this reduced value of current for 1 hour, and then increase the ultor current to full value for a few minutes before turning off the power.

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 ultor current gradually.

2. Never exceed the maximum average ultor-current rating 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.
**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 ULTOR 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 3:** INSIDE SURFACE OF FACEPLATE WITHIN THE QUALITY RECTANGLE MAY VARY ± 0.006" FROM THE SPHERICAL SURFACE HAVING A 20.3" RADIUS.

**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 9.

**NOTE 8:** EFFECTIVE DEFLECTING FIELD MUST BE WITHIN THIS SPACE.

**TYPICAL REFLECTIVE OPTICAL SYSTEM**

![Diagram of a reflective optical system](image)

**DIMENSIONS (APPROX.)**

<table>
<thead>
<tr>
<th>Dimension (Approx.)</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>26&quot;</td>
</tr>
<tr>
<td>D2</td>
<td>30&quot;</td>
</tr>
<tr>
<td>D3</td>
<td>15&quot;</td>
</tr>
<tr>
<td>D4</td>
<td>30&quot;</td>
</tr>
<tr>
<td>D5</td>
<td>21.5&quot;</td>
</tr>
<tr>
<td>D6</td>
<td>60&quot;</td>
</tr>
</tbody>
</table>

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 DRIVE CHARACTERISTICS**

**CATHODE-DRIVE SERVICE**

- $E_f = 6.6$ VOLTS
- ULTOR - TO - GRID-N1 VOLTS = 70000 - 80000
- GRID-N2 - TO - GRID-N1 VOLTS ADJUSTED TO GIVE FOCUS.
- GRID-N2 - TO - GRID-N1 VOLTS ADJUSTED TO GIVE RASTER CUTOFF.
- CATHODE - TO - GRID-N1 VOLTS = 125

**GRID-DRIVE SERVICE**

- $E_f = 6.6$ VOLTS
- ULTOR VOLTS = 70000 - 80000
- GRID-N3 VOLTS ADJUSTED TO GIVE FOCUS.
- GRID-N2 VOLTS ADJUSTED TO GIVE RASTER CUTOFF.
- GRID-N1 VOLTS = -155

---

**ELECTRON TUBE DIVISION**

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

**92CM-7514RI**
AVERAGE DRIVE CHARACTERISTICS

**CATHODE DRIVE SERVICE**

- $E_f = 6.6$ VOLTS
- ULTOR - TO - GRID-N°1 VOLTS = 75000
- GRID-N°3 - TO - GRID-N°1 VOLTS ADJUSTED TO GIVE FOCUS.
- GRID-N°2 - TO - GRID-N°1 VOLTS ADJUSTED TO GIVE RASTER CUTOFF.
- CATHODE - TO - GRID-N°1 VOLTS = 125
- RASTER SIZE = 5" x 3 3/4"

**GRID DRIVE SERVICE**

- $E_f = 6.6$ VOLTS
- ULTOR VOLTS = 75000
- GRID-N°3 VOLTS ADJUSTED TO GIVE FOCUS.
- GRID-N°2 VOLTS ADJUSTED TO GIVE RASTER CUTOFF.
- GRID-N°1 VOLTS = -155
- RASTER SIZE = 5" x 3 3/4"

**Graph**

- Highlight Brightness—Foot-Lamberts vs. Video Signal Volts from Raster Cutoff

**Electron Tube Division**

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7515RI
### Average Drive Characteristics

**Cathode-Drive Service**
- $E_\text{p} = 6.6$ Volts
- Ultor-to-Grid-$\#1$ Volts $= 75000$
- Grid-$\#3$ to Grid-$\#1$ Volts Adjusted to give focus.
- Grid-$\#2$ to Grid-$\#1$ Volts Adjusted to give raster cutoff.
- Cathode-to-Grid-$\#1$ Volts $= 125$
- Raster Size $= 5'' \times 3\frac{3}{4}''$

**Grid-Drive Service**
- $E_\text{p} = 6.6$ Volts
- Ultor Volts $= 75000$
- Grid-$\#3$ Volts adjusted to give focus.
- Grid-$\#2$ Volts adjusted to give raster cutoff.
- Grid-$\#1$ Volts $= -155$
- Raster Size $= 5'' \times 3\frac{3}{4}''$

---

**Transfer Characteristics**

- **Solid Line:** Transfer Characteristics
- **Dotted Line:** Transfer Characteristics on Basis on Contrast Ratio of 100:1

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**Video Signal Volts from Raster Cutoff**

**Electron Tube Division**

Radio Corporation of America, Harrison, New Jersey
7TP4
MONITOR KINESCOPE
METAL-BACKED SCREEN
ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

DATA

General:
Heater, for Unipotential Cathode:
Voltage .............. 6.3 ...... ac or dc volts
Current .............. 0.6 ...... amp
Direct Interelectrode Capacitances (Approx.):
Grid No.1 to All Other Electrodes ........ 6 µf
Cathode to All Other Electrodes ......... 5 µf
Faceplate ............. Clear Glass
Phosphor, Metal-Backed* ........ 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)

BOTTOM VIEW

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

Pin 12 — Heater
Cap — Grid No.4,
Collector
(Ultor)

Maximum Ratings, Design-Center Values:
ULTOR* VOLTAGE .................. 12000 max. volts
GRID-No.3 VOLTAGE .......... 2000 max. volts
GRID-No.2 VOLTAGE .......... 410 max. volts
GRID-No.1 VOLTAGE:
Negative bias value .......... 125 max. volts
Positive bias value .......... 0 max. volts
Positive peak value .......... 2 max. volts

* For curves, see front of this Section.

In the 7TP4, grid No. 4 which has the ultor function, and collector are connected together within the tube and are conveniently referred to collectively as "ultor." The "ultor" in a cathode-ray tube is the electrode, or the electrode in combination with one or more additional electrodes connected within the tube to it, to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection.

FEB. 1, 1952
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
TENTATIVE DATA
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 ulti or 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 Ultr Current of 100 $\mu$amp: 11.6% to 15.8% of $E_u$ volts
- Grid-No.1 Voltage for Visual Extinction of Undelected Focused Spot: 11% to 25.7% of $E_{c2}$ volts
- Grid-No.3 Current**: See Curves $\mu$amp
- 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 ulti or voltage of 10000 volts and grid-No.2 voltage of 200 volts:

- Grid-No.3 Voltage for Focus with Ultr Current of 100 $\mu$amp: 1160 to 1580 volts
- Grid-No.1 Voltage for Visual Extinction of Undelected Focused Spot: -22 to -52 volts

Maximum Circuit Values:

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

* Brilliance and definition decrease with decreasing ulti or voltage. In general, the ulti or voltage should not be less than 10000 volts.
** Grid-No.3 Current increases as the ulti or 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".

FEB. 1, 1952

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE GRID-DRIVE CHARACTERISTICS

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

OCT. 3, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-7687
AVERAGE GRID-DRIVE CHARACTERISTICS

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

ULTOR (GRID-N° 4 AND COLLECTOR) VOLTS = 10,000

GRID-N° 3 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS

GRID N° 1 BIASED TO CUTOFF OF UNDEFLECTED FOCUSED SPOT

--- = \( I_U \)

--- = \( I_{C_3} \)

ULTOR (\( I_U \)) OR GRID-N° 3 (\( I_{C_3} \)) MICROAMPERES

VIDEO SIGNAL VOLTS FROM CUTOFF

OCT. 3, 1951

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7688
7VPI
OSCILLOGRAPH TUBE
ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

**DATA**

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

Direct Interelectrode Capacitances (Approx.):
- Grid No.1 to All Other Electrodes: 6 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
- Fluorescence and Phosphorescence: Green
- Persistence of Phosphorescence: Medium

Focusing Method: Electrostatic
Deflection Method: Electrostatic
Overall Length: 14-1/2" ± 3/8"
Greatest Diameter of Bulb: 7" ± 1/8"
Minimum Useful Screen Diameter: 6"
Mounting Position: Any

Bulb: J56H

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

**Bottom View**

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid No.1
Pin 4 - No Connection
Pin 5 - Grid No.3
Pin 7 - Deflecting Electrode DJ3
Pin 8 - Deflecting Electrode DJ4
Pin 9 - Ultron (Grid No.2, Collector)
Pin 10 - Deflecting Electrode DJ2
Pin 11 - Deflecting Electrode DJ1
Pin 12 - Internal Connection—Do Not Use
Pin 14 - Heater DJ1 and DJ2 are nearer the screen.
DJ3 and DJ4 are nearer the base.

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

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

*: See next page.

NOV. 1, 1952
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
TENTATIVE DATA 1
### OSCILLOGRAPH TUBE

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ULTOR</strong> Voltage</td>
<td>4000 max. volts</td>
</tr>
<tr>
<td><strong>GRID-No.3 Voltage</strong></td>
<td>2000 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>750 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 ultor voltage ($E_u$) between 1000 and 4000 volts:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GRID-No.3 Voltage for Focus</strong></td>
<td>27% to 40% of $E_u$ volts</td>
</tr>
<tr>
<td>Maximum <strong>GRID-No.1 Voltage</strong> for Visual Extinction of Undeflected Focused Spot</td>
<td>2.8% of $E_u$ volts</td>
</tr>
<tr>
<td><strong>GRID-No.3 Current</strong></td>
<td>-15 to +10 µAmp</td>
</tr>
</tbody>
</table>

**Deflection Factors:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DJ1 &amp; DJ2</strong></td>
<td>31 to 41 V dc/in./kv of $E_u$</td>
</tr>
<tr>
<td><strong>DJ3 &amp; DJ4</strong></td>
<td>25 to 34 V dc/in./kv of $E_u$</td>
</tr>
</tbody>
</table>

**Spot Position:**

### Examples of Use of Design Ranges:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>For ultor voltage</strong></td>
<td>1500 3000 volts</td>
</tr>
<tr>
<td><strong>GRID-No.3 Voltage for Focus</strong></td>
<td>400 to 600 800 to 1200 volts</td>
</tr>
<tr>
<td>Maximum <strong>GRID-No.1 Voltage</strong> for Visual Extinction of Undeflected Focused Spot</td>
<td>-42 -84 volts</td>
</tr>
</tbody>
</table>

**Deflection Factors:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DJ1 &amp; DJ2</strong></td>
<td>47 to 62 93 to 123 volts dc/in.</td>
</tr>
<tr>
<td><strong>DJ3 &amp; DJ4</strong></td>
<td>38 to 51 75 to 102 volts dc/in.</td>
</tr>
</tbody>
</table>

**Maximum Circuit Values:**

<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. megohms</td>
</tr>
<tr>
<td><strong>Resistance in Any Deflecting-Electrode Circuit</strong></td>
<td>5.0 max. megohms</td>
</tr>
</tbody>
</table>

* In the 7VP1, grid No.4 which has the ultor function, grid No.2, and collector are connected together within the tube and are conveniently referred to collectively as ‘ultor.’ The ‘ultor’ in a cathode-ray tube is the electrode, or the electrode in combination with one or more additional electrodes connected within the tube to it, to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection.

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

---

#,#,##,0: See next page.
Brilliance and definition decrease with decreasing ultor voltage. A value as low as 1000 volts is recommended only for low-velocity deflection and low ambient-light levels.

With ultor voltage of 1500 volts, the center of the undeflected focused spot will fall within a circle having a 10-mm radius concentric with the center of the tube face.

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

The 7VPI 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.

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

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

<table>
<thead>
<tr>
<th>CURVE</th>
<th>CURRENT</th>
<th>ULTOR VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ULTOR</td>
<td>3000</td>
</tr>
<tr>
<td>B</td>
<td>ULTOR</td>
<td>1500</td>
</tr>
<tr>
<td>C</td>
<td>ULTOR</td>
<td>1000</td>
</tr>
<tr>
<td>D</td>
<td>FLUORESCENT SCREEN</td>
<td>3000</td>
</tr>
<tr>
<td>E</td>
<td>FLUORESCENT SCREEN</td>
<td>1500</td>
</tr>
<tr>
<td>F</td>
<td>FLUORESCENT SCREEN</td>
<td>1000</td>
</tr>
</tbody>
</table>

DEC. 17, 1951

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
PROJECTION KINESCOPE

20' x 15' PICTURES
FORCED-AIR COOLED
ALUMINIZED SCREEN
ELECTROSTATIC FOCUS
MAGNETIC DEFLECTION

For use in theater-television equipment

The 7WP4 is the same as the 7NP4 except for the following items:

General:
Projection Throw Distance for 20' x 15' Picture ... 80 feet
Overall Length .................... 19-7/16" ± 5/8"

REFERENCE LINE (NOTE 5) 5-1/4 ± 3-8 (NOTE 8)
EXTERNAL CONDUCTIVE COATING (NOTE 6)

ULTOR MEDIUM CAP JETEC N° CI-5 (NOTE 4)
EXTERNAL TRANSPARENT INSULATING COATING

SMALL-SHELL DIHEPTAL 14-PIN BASE JETEC GROUP 5, N° B14-45 (NOTE 7)

92CM-7731R2

11-58

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

NOTE 2: INSIDE SURFACE OF FACEPLATE WITHIN THE QUALITY RECTANGLE MAY VARY ± 0.006" FROM THE SPHERICAL SURFACE HAVING A 15.315" RADIUS.

NOTE 3: INSIDE SURFACE OF FACEPLATE WITHIN THE QUALITY RECTANGLE MAY VARY ± 0.006" FROM THE SPHERICAL SURFACE HAVING A 20.3" RADIUS.


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 9.

NOTE 8: EFFECTIVE DEFLECTING FIELD MUST BE WITHIN THIS SPACE.
7WP4
PROJECTION KINESCOPE

TYPICAL REFLECTIVE OPTICAL SYSTEM

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.
PICTURE TUBE
SMALL, COMPACT, RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

DATA

General:
Heater, for Unipotential Cathode:
Voltage: 6.3 ac or dc volts
Current: 0.6 ± 10% amp
Capacitance between External Conductive Coating and Ultor:
350 max. µF
250 min. µF
Faceplate, Spherical: Filterglass
Phosphor (For curves, see front of this Section): P4—Sulfide Type
Deflection Angles (Approx.):
Diagonal: 90°
Horizontal: 85°
Vertical: 68°
Electron Gun: Ion-Trap Type Requiring External Single-Field Magnet

Tube Dimensions:
Overall length: 10-7/16" ± 5/16"
Greatest width: 7-7/8" ± 1/16" - 1/32"
Greatest height: 6-1/16" ± 1/16" - 1/32"
Diagonal: 8-7/16" ± 1/16" - 1/32"
Neck length: 6-1/2" ± 3/16"
Radius of curvature of faceplate (External surface): 27"

Screen Dimensions (Minimum):
Greatest width: 7-3/16"
Greatest height: 5-3/8"
Diagonal: 7-13/16"
Projected area: 35.5 sq. in.
Operating Position: Any
Cap.: Recessed Small Cavity (JETEC No.J1-21)
Base: Dwarf-Shell Duodecal 6-Pin (JETEC Group 4, No.B6-158)
Basing Designation for BOTTOM VIEW: 12AB

Maximum Ratings, Design-Center Values:
ULTOR VOLTAGE: 8000 max. volts
GRID-No.4 (FOCUSING) VOLTAGE:
Positive value: 500 max. volts
Negative value: 500 max. volts
GRID-No.2 VOLTAGE: 300 max. volts

Indicates a change.
GRID-No.1 VOLTAGE:
  Negative-peak value. ................ 130 max. volts
  Negative-bias value. ................ 100 max. volts
  Positive-bias value. ................ 0 max. volts
  Positive-peak value. ................ 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:
  Heater negative with respect to cathode. 180 max. volts
  Heater positive with respect to cathode. 180 max. volts

Maximum Circuit Values:
  Grid-No.1-Circuit Resistance ........ 1.5 max. megohms
8HP4
MONITOR KINESCOPE
SMALL, COMPACT, RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
ALUMINIZED SCREEN
MAGNETIC DEFLECTION

DATA

General:
Heater, for Unipotential Cathode:
Voltage (AC or DC) ...................... 6.3 volts
Current ................................ 0.6 ± 10% amp
Direct Interelectrode Capacitances:
   Grid No.1 to all other electrodes .. 9 µf
   Cathode to all other electrodes ... 5 µf
External conductive coating to ultor. { 350 max. µf
                                           { 250 min. µf
Faceplate, Spherical. .................. Filterglass
Light transmission (Approx.) ......... 80%
Phosphor (for Curves, see front of this Section). P4—Sulfide Type
   Aluminized
Fluorescence. ................................ White
Phosphorescence .......................... White
   Persistence ................................ Short
Focusing Method .......................... Electrostatic
Deflection Method ........................ Magnetic
Deflection Angles (Approx.):
   Diagonal ................................ 90°
   Horizontal ............................. 85°
   Vertical ................................ 69°
Electron Gun. ............................. Type Requiring No Ion-Trap Magnet
Tube Dimensions:
   Overall length ....................... 9-15/16" ± 5/16"
   Greatest width ........................ 7-7/8" ± 1/16" - 1/32"
   Greatest height ...................... 6-1/16" ± 1/16" - 1/32"
   Diagonal .............................. 8-7/16" ± 1/16" - 1/32"
   Neck length ........................... 6" ± 3/16"
Screen Dimensions (Minimum):
   Greatest width ........................ 7-3/16"
   Greatest height ...................... 5-3/8"
   Diagonal .............................. 7-13/16"
   Projected area ....................... 35.5 sq. in.
Weight (Approx.) ....................... 2-1/2 lbs
Operating Position ..................... Any
Cap ...................................... Recessed Small Cavity (JEDEC No.J1-21)
Bulb ..................................... J67-1/2
Base. .................................... Small-Shell Duodecal 6-Pin, Arrangement 1
                                        (JEDEC Group 4, No.B6-63)
Basing Designation for BOTTOM VIEW. ........ 12L

8-59

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**Monitor Kinescope**

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR VOLTAGE</td>
<td>14000 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>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>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>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 ($EC_{ph}$) between 8000 and 14000 volts and grid-No.2 voltage ($EC_{ph}$) between 150 and 500 volts.

Grid-No.4 Voltage required for focus:
Changes inversely with ultor current at the rate of approximately 80 volts for each 100-µA change in ultor current. For typical values, see Examples of Use of Design Ranges.

Grid-No.1 Voltage ($EC_{ph}$) for visual extinction of focused raster. See Raster-Cutoff-Range Chart.

Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value (Peak positive) Same value as determined for $EC_{ph}$ except video drive is positive voltage.

**Examples of Use of Design Ranges:**

With ultor voltage of 11000 volts and grid-No.2 voltage of 300 volts.

Grid-No.4 Voltage for focus with average ultor current of 100 µA: 0 to 300 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 (Peak positive): 28 to 72 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 8000 volts.*
The grid-No.4 voltage required for focus of any individual tube will remain essentially constant for values of ultor voltage or grid-No.2 voltage within design ranges shown for these items.

Resolution for a given value of ultor voltage and a given value of grid-No.2 voltage decreases with increase in ultor current.

The indicated voltage is for condition with combined grid-No.1 bias voltage and video-signal voltage (generated by RCA-2F21 monoscope) adjusted to produce the average value of ultor current shown and to provide optimum focus of the Indian-Head Test Pattern from the 2F21.

SPECIAL PERFORMANCE DATA

Resolution:

For ultor voltage of 11,000 volts... 600 min. TV lines

Under the following conditions: heater volts = 6.3, grid-No.2 volts = 300, combined grid-No.1 bias voltage and video-signal voltage (generated by RCA-2F21 monoscope) adjusted to produce an average ultor current of 100 microamperes, and grid-No.4 voltage adjusted to give sharpest focus at center of tube face. Resolution is measured on the RCA-2F21 monoscope test pattern, or equivalent.

OPERATING CONSIDERATIONS

When operated at or below the maximum ratings shown in the tabulated data, the 8HP4 does not produce any harmful X-ray radiation.

The high voltages at which the 8HP4 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. Before any part of the circuit is touched, the power-supply switch should be turned off and both terminals of any capacitors should be grounded.
BULB-CONTOUR DIMENSIONS

TOP VIEW SHOWING MAXIMUM QUARTER-SECTION CONTOURS DEFINED BY PLANES AA', BB', CC', and DD'.

LONG-SIDE VIEW

CONTOURS (1), (2), (3), AND (4) DEFINE MAXIMUM BULB DIMENSIONS IN THE PLANES AA', BB', CC', AND DD'. THE PLANES ARE NORMAL TO THE TUBE AXIS AND AT FIXED LOCATIONS FROM THE REFERENCE LINE. WHEN DIMENSIONED FROM THE FACEPLATE, THE AXIAL POSITIONS OF PLANES AA', BB', CC', AND DD' WILL VARY BY ± 0.125".

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

FOR MAXIMUM SPACE REQUIREMENTS

SHORT-SIDE VIEW

REFERENCES LINE

3 1/2" R.

DIAGONAL VIEW

REFERENCES LINE

2 3/4" R.

92CM-8896

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

REFERENCE LINE
(NOTE 2)

ULTOR
RECESSED SMALL
CAVITY CAP
JEDEC No. J1-21
(NOTE 1)

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 AT THE REFERENCE LINE AND HAVING A DIAMETER OF 1-5/8 INCHES.

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: THE MAXIMUM RADIAL DISPLACEMENT OF THE PERIPHERY OF THE FACE PANEL (JUST ABOVE THE MOLD-MATCH LINE) FROM ITS EXACT CENTERED POSITION ON THE NECK AXIS IS 0.040".

NOTE 6: BULGE AT SPLICE-LINE SEAL WILL NOT PROTRUDE BEYOND THE MAXIMUM ENVELOPE DIMENSIONS AT THE MOLD-MATCH LINE.
**RASTER-CUTOFF-RANGE CHART**

- $E_c = 6.3$ VOLTS
- ULTOR VOLTS = 8000 TO 14000
- GRID-N\#4 VOLTS ADJUSTED FOR FOCUS.

**TYPICAL GRID-DRIVE CHARACTERISTIC**

- $E_c = 6.3$ VOLTS
- ULTOR VOLTS = 11000
- GRID N\#1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.
- RASTER FOCUSED AT AVERAGE BRIGHTNESS.
- RASTER SIZE = 6-1/4" x 4-11/16"
**Typical Grid-Drive Characteristic**

<table>
<thead>
<tr>
<th>Video Signal Volts from Raster Cutoff</th>
<th>Ultor Microamperes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>200</td>
</tr>
<tr>
<td>10</td>
<td>600</td>
</tr>
<tr>
<td>20</td>
<td>800</td>
</tr>
<tr>
<td>30</td>
<td>Grid 122 Volts 15500</td>
</tr>
<tr>
<td>40</td>
<td>92CS-9630</td>
</tr>
</tbody>
</table>

$E_g = 6.3$ Volts

Ultror Volts = 8000 to 14000

Grid #1 biased negative with respect to cathode to give focused raster cutoff.

Electron Tube Division
Radio Corporation of America, Harrison, New Jersey
I0BP4-A
PICTURE TUBE
ROUND GLASS TYPE

MAGNETIC FOCUS
MAGNETIC DEFLECTION

DATA

General:
Heater, for Unipotential Cathode:
Voltage: ac or dc volts
Current: amp
Capacitance between External Conductive Coating and Ultor: μf
Faceplate, Spherical: Filterglass
Phosphor (For Curves, see front of this section): P4—Sulfide Type
Electron Gun: Ion-Trap Type Requiring External Single-Field Magnet
Overall Length: 17-5/8" ± 3/8"
Greatest Diameter of Bulb: 10-1/2" ± 1/8"
Minimum Useful Screen Diameter: 9-1/8"
Operating Position: Any
Cap.: Recessed Small Cavity (JETEC No.J1-21)
Base: Small-Shell Duodecal 5-Pin (JETEC Group 4, No.B5-57)
Basing Designation for BOTTOM VIEW: 12N

Maximum Ratings, Design-Center Values:
ULTOR VOLTAGE: 12000 max. volts
GRID-No.2 VOLTAGE: 410 max. volts
GRID-No.1 VOLTAGE:
Negative-bias value: 125 max. volts
Positive-bias value: 0 max. volts
Positive-peak value: 2 max. volts
PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period not exceeding 15 seconds: 410 max. volts
After equipment warm-up period: 150 max. volts
Heater positive with respect to cathode: 150 max. volts

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

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

Indicates a change.

9-58
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
IOFP4-A
PICTURE TUBE

ROUND GLASS TYPE
MAGNETIC FOCUS
ALUMINIZED SCREEN
MAGNETIC DEFLECTION

DATA

General:
Heater, for Unipotential Cathode:
Voltage .................. 6.3 ................ ac or dc volts
Current .................. 0.6 ± 10% ................ amp
Capacitance between External Conductive Coating and Ultron
2500 max. μF
500 min. μF
Faceplate, Spherical .................. Filterglass
Phosphor (for curves, see front of this Section): P4–Sulfide Type Aluminized
Deflection Angle (Approx.) .................. 50°
Electron Gun .................. Type Requiring No Ion–Trap Magnet
Overall Length .................. 17-5/8" ± 3/8"
Greatest Diameter of Bulb .................. 10-1/2" ± 1/16"
Minimum Useful Screen Diameter .................. 9–1/8"
Operating Position .................. Any
Cap. .................. Recessed Small Cavity (JETEC No. J1-21)
Base .................. Small–Shell Duodecal 5–Pin (JETEC Group 4, No. B5-57)
Basing Designation for BOTTOM VIEW .................. 12N

Pin 1–Heater
Pin 2–Grid No.1
Pin 10–Grid No.2
Pin 11–Cathode
Pin 12–Heater
Cap–Ultror
(Grid No.3, Collector)
C–External Conductive Coating

Maximum Ratings, Design–Center Values:
ULTOR VOLTAGE .................. 12000 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 .................. 140 max. volts
Heater positive with respect to cathode .................. 140 max. volts

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

Cap may be aligned with either vacant pin position 6 or vacant pin position 3.
Indicates a change.

9-58
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
MONITOR KINESCOPE
ALUMINIZED SCREEN
ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

DATA

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

Direct Interelectrode Capacitances:
Grid No.1 to all other electrodes .................. 6 \mu f
Cathode to all other electrodes .................. 5 \mu f

Faceplate, Spherical .................. Filterglass
Light transmission (Approx.) .................. 76% 

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

Fluorescence .................. White
Phosphorescence .................. White
Persistence .................. Short

Focusing Method .................. Electrostatic
Deflection Method .................. Magnetic
Deflection Angle (Approx.) .................. 500

Overall Length .................. 16-5/8" \pm 3/8"
Greatest Diameter of Bulb .................. 10-1/2" \pm 1/16"
Minimum Useful Screen Diameter .................. 9-1/8"
Picture Size (Within minimum useful screen area) .................. 8" x 6"

Weight (Approx.) .................. 10 lbs
Operating Position .................. Any
Cap. .................. Recessed Small Cavity (JETEC No.J1-21)
Bulb .................. Small-Shell Duodeca 6-Pin (JETEC No.B6-63)
Base .................. Basing Designation for BOTTOM VIEW .................. 12Q

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

Pin 12—Heater Cap—Ultor
(Grid No.4, Collector)

Maximum Ratings, Design-Center Values:
ULTOR VOLTAGE .................. 20000 max. volts
GRID-No.3 VOLTAGE .................. 3000 max. volts
GRID-No.2 VOLTAGE .................. 410 max. volts
GRID-No.1 VOLTAGE:
Negative bias value .................. 125 max. volts
Positive bias value .................. 0 max. volts
Positive peak value .................. 2 max. volts

PEAK HEATER—CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period
not exceeding 15 seconds .................. 410 max. volts
After equipment warm-up period .................. 180 max. volts
Heater positive with respect to cathode: 

\textit{\textbf{indicates a change.}}
Equipment Design Ranges:

For any ultor voltage \((E_u)\) between 10000* and 20000 volts and grid-No.2 voltage \((E_{g2})\) between 150 and 410 volts

Grid-No.3 Voltage for focus with ultor current of 100 \(\mu A\) ....... 11.7% to 15.9% of \(E_u\) volts

Grid-No.1 Voltage for visual extinction of 8" x 6" raster ........ 9% to 24% of \(E_{g2}\) volts

Maximum Grid-No.3 Current** .... See Curves

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 14000 volts and grid-No.2 voltage of 200 200 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 X-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

$E_P = 6.3 \text{ VOLTS}$

ULTOR (GRID-Nº 4- AND-
COLLECTOR) VOLT $= 12000$

GRID-Nº 3 VOLTS ADJUSTED TO GIVE FOCUS
AT AVERAGE RASTER BRIGHTNESS.
GRID Nº 1 BIASED, TO RASTER CUTOFF.
RASTER SIZE $= 8'' \times 6''$

- VIDEO SIGNAL VOLTS FROM RASTER CUTOFF
- HIGHLIGHT BRIGHTNESS - FOOT-LAMBERTS

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

92CM-7774
E_{f} = 6.3 VOLTS
ULTOR (GRID-N° 4 AND
COLLECTOR) VOLTS = 12000
GRID-N° 3 VOLTS ADJUSTED TO GIVE FOCUS
AT AVERAGE RASTER BRIGHTNESS
GRID N° 1 BIASED TO CUTOFF OF RASTER
RASTER SIZE = 8" x 6"

MAR. 21, 1952
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**GRID-DRIVE CHARACTERISTICS**

- $E_f = 6.3$ VOLTS
- ULTOR (GRID-№ 4 AND COLLECTOR) VOLTS = 12000
- GRID-№ 3 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS
- GRID №1 BIASED TO CUTTOFF OF RASTER
- RASTER SIZE = $8'' x 6''$

### Video Signal Volts from Cutoff vs. Max. Grid-№3 Microamperes

<table>
<thead>
<tr>
<th>Video Signal Volts from Cutoff</th>
<th>Max. Grid-№3 Microamperes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>10</td>
<td>200</td>
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<tr>
<td>20</td>
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</tr>
<tr>
<td>70</td>
<td>800</td>
</tr>
<tr>
<td>80</td>
<td>900</td>
</tr>
<tr>
<td>90</td>
<td>1000</td>
</tr>
</tbody>
</table>

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MAR. 21, 1952

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7775
General:
Heater, for Unipotential Cathode:
Voltage: 6.3 ac or dc volts
Current: 0.6 ± 10% amperes
Capacitance between External Conductive Coating and Ultor: 2500 μf
Faceplate, Spherical: Filterglass
Phosphor (For Curves, see front of this Section): P4—Sulfide Type
Deflection Angle (Approx.): 54°
Electron Gun: Type Requiring No Ion-Trap Magnet
Overall Length: 17-5/8" ± 3/8"
Greatest Diameter of Bulb: 12-7/16" ± 1/16"
Minimum Useful Screen Diameter: 11-1/8"
Operating Position: Any
Cap: Recessed Small Cavity (JETEC No.J1-21)
Base: Small-Shell Duodecal 5-Pin (JETEC Group 4, No.B5-57)
Basing Designation for BOTTOM VIEW: 12N

Maximum Ratings, Design-Center Values:
ULTOR VOLTAGE: 12000 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: 140 max. volts
Heater positive with respect to cathode: 140 max. volts

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

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

Indicates a change.

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

#### General:

Heater, for Unipotential Cathode:
- Voltage: 8.4 ac or dc volts
- Current: 0.45 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 μf
- Cathode to all other electrodes: 5 μf
- External conductive coating to ultor: 1000 max. μf, 500 min. μf

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

#### Phosphor (for curves, see front of this Section):
- P4—Sulfide Type
- Aluminized
- Fluorescence: White
- Phosphorescence: White
- Persistence: Short

#### Focusing Method:
- Electrostatic

#### Deflection Method:
- Magnetic

#### Deflection Angles (Approx.):
- Diagonal: 90°
- Horizontal: 85°
- Vertical: 68°

#### Electron Gun:
- Type Requiring No Ion-Trap Magnet

#### Tube Dimensions:
- Overall length: 13–3/16" ± 5/16"
- Greatest width: 13–1/16" ± 1/8"
- Greatest height: 10–9/16" ± 1/8"
- Diagonal: 14" ± 1/8"
- Neck length: 5–1/2" ± 3/16"

#### Screen Dimensions (Minimum):
- Greatest width: 12–1/16"
- Greatest height: 9–1/2"
- Diagonal: 13"
- Projected area: 104 sq. in.
- Weight (Approx.): 8.5 lbs

#### Mounting Position:
- Any
- Recessed Small Cavity (JETEC No. J1-21)
- Bulb: J112 (90°)
- Base: Small-Shell Duodecal 6-Pin (JETEC No. B6-63)
Basing Designation for BOTTOM VIEW: 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater

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

GRID-DRIVE SERVICE

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

Maximum Ratings, Design-Center Values:

ULTOR VOLTAGE: 14000 max. volts
8000 min. volts

GRID-No.4 VOLTAGE:
Positive value: 1000 max. volts
Negative value: 500 max. volts

GRID-No.2 VOLTAGE:

GRID-No.1 VOLTAGE:
Negative peak value: 200 max. volts
Negative bias value: 140 max. volts
Positive bias value: 0 max. volts
Positive peak value: 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode: 180 max. volts
Heater positive with respect to cathode: 180 max. volts

Equipment Design Ranges:

With any ultor voltage ($E_{c,k}$) between 8000 and 14000 volts and grid-No.2 voltage ($E_{c,k}$) between 200 and 500 volts

Grid-No.4 Voltage for Focus:
0 to 400 volts

Grid-No.1 Voltage ($E_{c,k}$) for Visual Extinction of Focused Raster: See Raster-Cutoff-Range Chart for Grid-Drive Service

Grid-No.1 Video Drive from Raster Cutoff (Black Level):
White-level value (Peak positive): Same value as determined for $E_{c,k}$ except video drive is a positive voltage

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

* Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

§: see next page.
Examples of Use of Design Ranges:

With ultor voltage of 10000 volts and grid-No.2 voltage of 300 volts
Grid-No.4 Voltage for Focus 0 to 400 0 to 400 volts
Grid-No.1 Voltage for Visual Extinction of Focused Raster -25 to -69 -31 to -90 volts
Grid-No.1 Video Drive from Raster Cutoff (Black Level):
White-level value 25 to 69 31 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 Ratings, Design-Center Values:

ULTOR-TO-GRID-No.1 VOLTAGE 14000 max. volts
GRID-No.4-TO-GRID-No.1 VOLTAGE:
Positive value 1000 max. volts
Negative value 500 max. volts
GRID-No.2-TO-GRID-No.1 VOLTAGE 640 max. volts
GRID-No.2-TO-CATHODE VOLTAGE 500 max. volts
CATHODE-TO-GRID-No.1 VOLTAGE:
Positive peak value 200 max. volts
Positive bias value 140 max. volts
Negative bias value 0 max. volts
Negative peak value 2 max. volts
PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode 180 max. volts
Heater positive with respect to cathode 180 max. volts

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage \( E_{c1g1} \) between 8000 and 14000 volts
and grid-No.2-to-grid-No.1 voltage \( E_{c2g1} \) between 225 and 640 volts

Grid-No.4-to-Grid-No.1 Voltage for Focus:
0 to 400 volts

§ 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.

* 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 next page.
Cathode-to-Grid-No.1 Voltage (\(E_{kg1}\)) for Visual Extinction of Focused Raster... See Raster-Cutoff-Range Chart for Cathode-Drive Service

Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level): White-level value (Peak negative) ... Same value as determined for \(E_{kg1}\) except video drive is a negative voltage

Grid-No.4 Current ... -25 to +25 \(\mu\)A

Grid-No.2 Current ... -15 to +15 \(\mu\)A

Field Strength of Adjustable Centering Magnet* ... 0 to 8 gaussies

Examples of Use of Design Ranges:

With ultor-to-grid-No.1 voltage of 10000 14000 volts

and grid-No.2-to-grid-No.1 voltage of 300 400 volts

Grid-No.4-to-Grid-No.1 Voltage for Focus ... 0 to 400 0 to 400 volts

Cathode-to-Grid-No.1 Voltage for Visual Extinction of Focused Raster ... 25 to 58 31 to 75 volts

Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level): White-level value ... -25 to -58 -31 to -75 volts

Maximum Circuit Values:

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

* Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having 1/4-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 7/16-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
E_f = 8.4 VOLTS
ULTOR VOLTS = 8000 TO 14000
GRID-No. 4 VOLTS ADJUSTED FOR FOCUS.

GRID-No.1 VOLTS

GRID-No.2 VOLTS

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NOTE 2: WITH THE TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No. 116 (SHOWN AT FRONT OF THIS SECTION) AND WHEN TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4".

NOTE 4: 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 WILL NOT PROTRUDE BEYOND THE MAXIMUM INDICATED VALUE FOR ENVELOPE WIDTH, DIAGONAL, OR HEIGHT.

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.
E_f = 8.4 VOLTS
ULTOR-TO-GRID-No.1 VOLTS = 8000 TO 14000
GRID-No.4-TO-GRID-No.1 VOLTS
ADJUSTED FOR FOCUS.

GRID-No.2-TO-GRID-No.1 VOLTS

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY 92CS-9276
## Average Drive Characteristics

<table>
<thead>
<tr>
<th>Cathode-Drive Service</th>
<th>Grid-Drive Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E_f = 8.4$ Volts</td>
<td>$E_f = 8.4$ Volts</td>
</tr>
<tr>
<td>Ultor-To-Grid-No.1 Volts = 14000</td>
<td>Ultor Volts = 14000</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 = 11&quot; x 8-1/4&quot;</td>
<td>Raster size = 11&quot; x 8-1/4&quot;</td>
</tr>
</tbody>
</table>

### Diagram

- **Cathode Drive**
- **Grid Drive**

The graph shows the relationship between video signal volts from raster cutoff and highlight brightness in foot-lamberts. There are curves for both cathode and grid drive, indicating how the brightness changes with different voltages.
**AVERAGE DRIVE CHARACTERISTICS**

**CATHODE-DRIVE SERVICE**
- $E_f = 8.4$ Volts
- ULTOR-TO-GRID-No.1 VOLTS = 8000 TO 14000
- CATHODE BIASED POSITIVE WITH RESPECT TO GRID No.1 TO GIVE FOCUSED RASTER CUTOFF.

**GRID-DRIVE SERVICE**
- $E_f = 8.4$ Volts
- ULTOR VOLTS = 8000 TO 14000
- GRID No.1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.

---

**Graph:**
- **CATHODE DRIVE**
- **GRID DRIVE**

- **Video Signal Volts from Raster Cutoff:** 0 to 80
- **Ultor Milliamperes:** 0.5 to 2.5

---

**ELECTRON TUBE DIVISION**
**RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY**
14BAP4

Picture Tube

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

GENERAL DATA

Electrical:
Heater Current at 6.3 volts. 600 ± 10% ma
Direct Interelectrode Capacitances:
Grid No.1 to all other electrodes. 6.5 μμf
Cathode to all other electrodes. 5 μμf
External conductive coating to ultor. (1000 max. (600 min. μμf
Electron Gun Type Requiring No Ion-Trap Magnet

Optical:
Faceplate Filterglass
Light transmission (Approx.) 76%
Phosphor Type, P4—Sulfide Type, Aluminized

Mechanical:
Operating Position Any
Weight (Approx.) 10 lbs
Overall Length 16-25/32" ± 3/8"
Neck Length 7-1/2" ± 3/16"
Projected Area of Screen 96 sq. in.
External Conductive Coating:
Type Regular Band
Contact area for grounding Near Reference Line

For Additional Information on Coatings and Dimensions:
See Picture-Tube Dimensional-Outlines and Bulb J109-1/2 A/C sheets at the front of this section
Cap. Recessed Small Cavity (JEDEC No.J1-21)
Small-Shell Duodecal 6-Pin, Arrangement 1 (JEDEC Group 4, No.B6-63)
Basing Designation for BOTTOM VIEW 12L

ULTOR VOLTAGE 22000 max. volts
GRID-No.4 (FOCUSING) VOLTAGE:
Positive value 800 max. volts
GRID-No.2 VOLTAGE 700 max. volts

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

DATA 5-62
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

**MAGNETIC FOCUS**

**RECTANGULAR GLASS TYPE**

**70° MAGNETIC DEFLECTION**

**GENERAL DATA**

**Electrical:**

Direct Interelectrode Capacitances:
- Cathode to all other electrodes: 5 pf
- Grid No.1 to all other electrodes: 6 pf
- External conductive coating to anode: \{2000 max., 750 min.\} pf

Heater Current at 6.3 volts: 600 ± 30 ma

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

**Optical:**

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

Faceplate, Spherical: Filterglass

Light transmission (Approx.): 66%

**Mechanical:**

Weight (Approx.): 10 lbs

Overall Length: 16-15/32" ± 3/8"

Neck Length: 7-3/16" ± 3/16"

Projected Area of Screen: 96 sq. in.

External Conductive Coating:
- Type: Regular-Band
- Contact area for grounding: Near Reference Line

For Additional Information on Coatings and Dimensions:

See *Picture-Tube Dimensional-Outlines and Bulb J109-112 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

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
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<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>

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

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

- **ANODE VOLTAGE**: 15500 max. volts
- **GRID-No.2 VOLTAGE**: 450 max. volts

RADIO CORPORATION OF AMERICA

Electron Tube Division

Harrison, N. J.

DATA 4-63
GRID-No.1 VOLTAGE:
- Negative bias value: 140 max. volts
- Positive bias value: 0 max. volts
- Positive peak value: 2 max. volts

HEATER VOLTAGE:
- Peak heater-cathode voltage: 6.9 max. volts; 5.7 min. volts

PEAK HEATER-CATHODE VOLTAGE:
- Heater negative with respect to cathode:
  - During equipment warm-up period not exceeding 15 seconds: 450 max. volts
  - After equipment warm-up period: 165 max. volts
- Heater positive with respect to cathode:
  - Combined AC and DC voltage: 165 max. volts
  - DC component: 100 max. volts

Typical Operating Conditions for Grid-Drive Service:
- Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage: 12000 volts
Grid-No.2 Voltage: 300 volts
Grid-No.1 Voltage for visual extinction of focused raster: -28 to -72 volts

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

For X-radiation shielding considerations, see sheet X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section
14QP4-A
PICTURE TUBE
SHORT RECTANGULAR GLASS TYPE ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

DATA

General:
Heater, for Unipotential Cathode:
Voltage .................. 6.3 ............ ac or dc volts
Current ............. 0.6 ± 10% .............. amp
Capacitance between External Conductive Coating and Ultron .............. { 1000 max. \( \mu F \) 
600 min. \( \mu F \)
Faceplate, Spherical .............. Filterglass
Phosphor (For curves, see front of this section). P4—Sulfide Type Aluminized

Deflection Angles (Approx.):
Diagonal .................. 70°
Horizontal .................. 65°
Vertical .................. 50°
Electron Gun .............. Ion-Trap Type Requiring External Single-Field Magnet

Tube Dimensions:
Overall length .................. 16-5/32" ± 3/8"
Greatest width .................. 12-17/32" ± 1/8"
Greatest height .................. 9-23/32" ± 1/8"
Diagonal .................. 14-11/16" ± 1/8"
Neck length .................. 6-7/8" ± 3/16"
Radius of curvature of faceplate (External surface). 27"

Screen Dimensions (Minimum):
Greatest width .................. 11-1/2"
Greatest height .................. 8-5/8"
Diagonal .................. 12-3/4"
Projected area .................. 96 sq. in.
Operating Position .............. Any
Cap. .................. Recessed Small Cavity (JETEC No.J1-21)
Base .............. Small-Shell Duodecal 6-Pin (JETEC Group 4, No.B6-63)
Basing Designation for BOTTOM VIEW .............. 12L

Pin 1—Heater
Pin 2—Grid No.1
Pin 6—Grid No.4
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater

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

Maximum Ratings, Design-Center Values:
ULTOR VOLTAGE .................. 11000 max. volts
GRID-No.4 (FOCUSING) VOLTAGE:
Positive value .................. 1000 max. volts
Negative value .................. 500 max. volts
GRID-No.2 VOLTAGE .................. 500 max. volts

Indicates a change.
GRID-No.1 VOLTAGE:
- Negative-peak value: 160 max. volts
- 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:
  - 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
RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
90° MAGNETIC DEFLECTION
With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:
Direct Interelectrode Capacitances:
Cathode to all other electrodes ... 5 pf
Grid No.1 to all other electrodes ... 6 pf
External conductive coating to anode. \{ 1200 max. pf
\} 800 min. pf
Heater Current at 6.3 volts ... 600 ± 30 ma
Heater Warm-Up Time (Average) ... 11 seconds
Electron Gun ... Type Requiring No Ion-Trap Magnet

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

Mechanical:
Weight (Approx.) ... 8.5 lbs
Overall Length ... 13-3/16" ± 5/16"
Neck Length ... 5-1/2" ± 3/16"
Projected Area of Screen ... 104 sq. in.
External Conductive Coating:
Type ... Regular-Band
Contact area for grounding ... Near Reference Line

For Additional Information on Coatings and Dimensions:
See Picture-Tube Dimensional-Outlines and Bulb J112 A/B sheets at front of this section

Cap ... Recessed Small Cavity (JEDEC No.J1-21)
Bases (Alternates):
Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-63)
Short Small-Shell Duodecal 6-Pin (JEDEC No.B6-203)
Basing Designation for BOTTOM VIEW ... 12L

Pin 1—Heater
Pin 2—Grid No.1
Pin 6—Grid No.4
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater
Cap—Anode
(Grid No.3,
Grid No.5,
Screen,
Collector)
C—External
Conductive
Coating

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
Maximum and Minimum Ratings, Design-Maximum Values:

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

ANODE VOLTAGE: \( \{15500 \text{ max. volts} \) \cap 9000 \text{ min. volts} \)

GRID-No. 4 (FOCUSING) VOLTAGE:
- Positive value: 1100 max. volts
- Negative value: 550 max. volts

GRID-No. 2 VOLTAGE: 550 max. volts

GRID-No. 1 VOLTAGE:
- Negative peak value: 220 max. volts
- Negative bias value: 200 max. volts
- Positive bias value: 0 max. volts
- Positive peak value: 2 max. volts

HEATER VOLTAGE: \( \{6.9 \text{ max. volts} \) \cap 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 Grid-Drive Service:

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

Anode Voltage: 12000 volts
Grid-No.4 Voltage: -50 to +350 volts
Grid-No.2 Voltage: 300 volts
Grid-No.1 Voltage for visual extinction of focused raster: -28 to -72 volts

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

For X-radiation shielding considerations, see sheet X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES at front of this section.
15GP22

TRICOLOR KINESCOPE
THREE-GUN SHADOW-MASK TYPE ELECTROSTATIC FOCUS
ELECTROSTATIC CONVERGENCE MAGNETIC DEFLECTION

DATA

General:
Electron Guns, Three  Blue, Green, Red
Heater, for Unipotential Cathode of Each Gun,
    Paralleled with Each of the Other Two
Heaters within Tube:
Voltage (AC or DC)        6.3 volts
Current                  1.8 amp
Direct Interelectrode Capacitances (Approx.):
    Grid No.1 of Any Gun to All Other
    Electrodes Except the No.1 Grids
    of the Other Two Guns        7.5 μf
    Cathode of Blue Gun + Cathode of
    Green Gun + Cathode of Red Gun
    to All Other Electrodes      17.5 μf
    Grid No.3 (Of Each Gun Tied within
    Tube to No.3 Grids of Other Two
    Guns) to All Other Electrodes  12 μf
    Grid No.4 (Common to the Three
    Guns) to All Other Electrodes  7 μf
External Conductive Coating to Ultor:  (3000 max. 
                                      μf)
                                      (1500 min. μf)
Faceplate, Spherical                Clear Glass
Screen, Flat:
    Type                        Metal-Backed, Tricolor, Phosphor-Dot
    Plate                       Filterglass
    Light Transmission (Approx.) .70%
    Size (Rounded Sides—See Dimensional
    Outline)                    11-1/2" x 8-5/8"
Area                        88.5 sq. in.
Phosphor (Three Separate Phosphors, collectively)  P22
Fluorescence and Phosphorescence of
    Separate Phosphors, respectively  Blue, Green, Red
Persistence of Group Phosphorescence         Medium
Dot Arrangement       Approx. 195,000 triangular groups,
                      each consisting of blue dot, green dot,
                      and red dot (total of 585,000 dots)
Focusing Method           Electrostatic
Convergence Method         Electrostatic
Deflection Method          Magnetic
Deflection Angles (Approx.):
    Horizontal                  450°
    Vertical                    350°
Tube Dimensions:
    Maximum Overall Length      26-1/8"
    Greatest Diameter:
        At faceplate  14-5/8" ± 5/32"
        At metal flange  15-3/4" max.
Weight                       25 lbs

MARCH 1, 1954

TENTATIVE DATA 1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
TRICOLOR KINESCOPE

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

Bottom View

Pin 1: Heater
Pin 2: Cathode
Pin 3: Grid No.1
Pin 4: Grid No.2
Pin 5: No Connection
Pin 6: Grids No.3
Pin 7: Cathode
Pin 8: Grid No.1

Pin 9: Grid No.2 of Green Gun
Pin 10: Grid No.3 of Red Gun
Pin 11: Grid No.1 of Red Gun
Pin 12: Grid No.2 of Red Gun
Pin 13: Grid No.4
Pin 14: Grid No.1 of Blue Gun
Pin 15: Grid No.2 of Blue Gun
Pin 16: Grid No.1 of Blue Gun
Pin 17: Cathode of Blue Gun (Grid No.5, Grid No.6, Collector)
Pin 18: Heater Metal Flange: Ultor
Pin 19: Cathode of Blue Gun
Pin 20: Heater

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 ($E_c$) of 18000 to 20000 volts

Grid-No.4 (Converging Electrode) Voltage† .................. 42.5% to 51% of $E_c$ volts
Grid-No.3 (Focusing Electrode) Voltage ...................... 12% to 19% of $E_c$ volts

* The "ultor" in a cathode-ray tube is the electrode to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection. In the 15GP22, the ultor function is performed by grid No.5, since grid No.5, grid No.6, and collector are connected together within the tube, they are collectively referred to simply as "ultor", for convenience in presenting data and curves.
† This value is the product of ultor voltage and average current measured at the ultor terminal with a dc ammeter.

† See next page.
TRICOLOR KINESCOPE

Grid-No.2 Voltage (Each Gun)
when circuit design utilizes grid-No.1 Voltage
\( (E_{c1}) \) at fixed value for
raster cutoff (each gun) \( \ldots \) 2 to 4.5 times \( E_{c1} \) volts

Grid-No.1 Voltage for
Visual Extinction of Focused Raster (Each Gun)
when circuit design utilizes grid-No.2 voltage
\( (E_{c2}) \) at fixed value
(each gun) \( \ldots \) 22.5\% to 50\% of \( E_{c2} \) volts

Grid-No.4 Current \( \ldots \) \(-5\) to \(+5\) \( \mu \text{amp} \)
Max. Grid-No.3 Current \( \ldots \) 300 \( \mu \text{amp} \)
Grid-No.2 Current \( \ldots \) \(-15\) to \(+15\) \( \mu \text{amp} \)
Beam-Current Ratio to
Produce Illuminant-C White:
Red Gun to Green Gun \( \ldots \) 4:1 to 1:1
Blue Gun to Green Gun \( \ldots \) 1.5:1 to 0.5:1

Maximum Raster Shift in
Any Direction from
Screen Center \( \ldots \) \(1-1/4\) inches

Examples of Use of Design Ranges:
For ultimate voltage of 20000 volts

Grid-No.4 (Converging Electrode) Voltage\(^\dagger\) \( \ldots \) 8500 to 10200 volts
Grid-No.3 (Focusing Electrode) Voltage \( \ldots \) 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) \( \ldots \) 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) \( \ldots \) \(-45\) to \(-100\) volts

Circuit Values:

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

\( ^\dagger\) This range does not include the dc component of the dynamic converging voltage.

\( ^\star\) 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, purity, and concentricity.

\( ^\star\star\) 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.

MARCH 1, 1954
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
TRICOLOR KINESCOPE

SCREEN HEIGHT 6 5/8" Screen Mask

SCREEN WIDTH 11 1/2"

FACEPLATE SECTION 3 7/8" ± 3/32"

FACEPLATE (NOTE 5)

SUPPORT AREA 3 3/4" MIN. (NOTE 6)

4" SUPPORT AREA

26 1/8" MAX.

22 3/8" ± 3/8"

10 3/8" ± 1/4"

SMALL-SHELL BIDECAL 14-PIN BASE (NOTE 2)

JETEC NB B14-103 SEE DETAIL C

15 3/8" MAX.

1 3/4" MIN.

ULTOR METAL FLANGE (NOTE 4)

EXTERNAL INSULATING COATING (NOTE 7)

EXTERNAL CONDUCTIVE COATING (NOTE 3)

REFERENCE LINE (NOTE 1)

MARCH 1, 1954

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-8072R1A
ENLARGED SECTION A-A

ENLARGED SECTION B

BASE DETAIL C
BOTTOM VIEW
TRICOLOR KINESCOPE

NOTE 1: REFERENCE LINE IS DETERMINED BY POSITION WHERE A CYLINDRICAL GAUGE 2.400" ± 0.001" I.D. WHICH IS HELD CONCENTRIC WITH TUBE NECK AXIS WILL REST ON FUNNEL.

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

NOTE 3: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

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

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

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

NOTE 7: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.
### General:

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

- **Direct Interelectrode Capacitances (Approx.):**
  - Grid No.1 to All Other Electrodes: 6 μf
  - Cathode to All Other Electrodes: 5 μf

- **Faceplate, Spherical:** Filterglass
- **Light Transmission (Approx.):** 66%
- **Phosphor (For Curves, see front of this Section):** P7
  - Fluorescence: Blue
  - Persistence: Short
  - Phosphorescence: Greenish-Yellow
  - Persistence: Long

- **Focusing Method:** Magnetic
- **Deflection Method:** Magnetic
- **Deflection Angle (Approx.):** 53°

- **Maximum Overall Length:** 22".
- **Greatest Diameter at Lip:** 15-7/8" + 1/8".
- **Minimum Useful Screen Diameter:** 14-3/8".
- **Ultor* Terminal:** Metal-Shell Lip
- **Mounting Position:** Any

#### Bottom View

```
Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - No Connection
Pin 7 - No Connection
```

#### Pin Connections

- Pin 10 - Grid No.2
- Pin 11 - Cathode
- Pin 12 - Heater
- Cap - Ultor
  (Grid No.3, Collector)

### Maximum Ratings, Design-Center Values:

- **ULTOR VOLTAGE:** 14000 max. volts
- **GRID-No.2 VOLTAGE:**
  - Positive value (DC or Peak AC): 410 max. volts
  - Negative value (DC or Peak AC): 180 max. volts
- **GRID-No.1 VOLTAGE:**
  - Negative bias value: 180 max. volts
  - Positive bias value: 0 max. volts
  - Positive peak value: 2 max. volts
- **PEAK GRID-No.1 DRIVE FROM CUTOFF:** 65 max. volts

---

*In the 16ADP7, grid No.3 which has the ultor function, and collector are connected together within the tube and are conveniently referred to collectively as "ultor." The ultor in a cathode-ray tube is the electrode, or the electrode in combination with one or more additional electrodes connected within the tube to it, to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection.

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

---

FEB. 1, 1952

TUBE DEPARTMENT

TENTATIVE DATA

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**PEAK HEATER—CATHODE VOLTAGE:**
- Heater negative with respect to cathode: 125 max. volts
- Heater positive with respect to cathode: 125 max. volts

**Typical Operation:**
- **Ultor Voltage**: 12000 volts
- **Grid-No. 2 Voltage**: 250 volts
- **Grid-No. 1 Voltage for Visual Extinction of Undeflected Focused Spot**: -27 to -63 volts
- **Grid-No. 2 Current**
  - Voltage for Visual Extinction of Undeflected Focused Spot: -15 to +15 μamp
- **Focusing-Coil Current (DC)**: 95 ± 15% ma
- **Spot Position**: #

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

*Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 8000 volts.*

**For specimen focusing coil similar to JETEC Focusing Coil No. 109 positioned with air gap toward faceplate and center line of air gap 3-1/4" from Reference Line (see Outline Drawing) and ultor current of 200 microamperes.**

**# The center of the undeflected, unfocused spot will fall within a circle having 25-mm radius concentric with the center of the tube face.**
NOTE 1: 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 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 CIRCLE CONCENTRIC WITH METAL-SHELL AXIS AND HAVING 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 ULTORT VOLTAGE.

FEB. 1, 1952
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
CE-7690
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_g = 6.3 \text{ VOLTS}$

ULTOR (GRID- N° 3 AND COLLECTOR) VOLTS = 8000 TO 14000
GRID N° 1 BIASED TO CUTOFF OF UNDEFLICTED FOCUSED SPOT
**Picture Tube**

**16AYP4**

**RECTANGULAR GLASS TYPE**

**LOW-VOLTAGE ELECTROSTATIC FOCUS**

**ALUMINIZED SCREEN**

**114° 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: 1300 max. pf, 800 min. pf

Heater Current at 6.3 volts: 450 ± 20 ma
Heater Warm-Up Time (Average): 11 seconds

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

**Optical:**

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

**Mechanical:**

Weight (Approx.): 8-1/2 lbs
Overall Length: 10-1/4" ± 1/4"
Neck Length: 4-1/8" ± 1/8"
Projected Area of Screen: 125 sq. in.

**External Conducive 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 J125 C2 sheets at front of this section

Cap: Recessed Small Cavity (JEDEC No.J1-21)
Base: Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No. B7-20B)

Basing Designation for BOTTOM VIEW: 8HR

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

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

ANODE VOLTAGE: [20000 max. volts, 12000 min. volts]

**Cap-Anode**
- (Grid No.3, Grid No.5, Screen, Collector)
- C—External Conductive Coating

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

DATA 6-63
GRID-No.4 (FOCUSING) VOLTAGE:
Positive value: 1100 max. volts
Negative value: 550 max. volts

GRID-No.2 VOLTAGE:
{550 max. volts
200 min. volts

GRID-No.1 VOLTAGE:
Negative peak value: 220 max. volts
Negative bias value: 155 max. volts
Positive bias value: 0 max. volts
Positive peak value: 2 max. volts

HEATER VOLTAGE:
{6.9 max. volts
5.7 min. volts

PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period not exceeding 15 seconds: 450 max. volts
After equipment warm-up period: 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: 16000 volts
Grid-No.4 Voltage: 100 volts
Grid-No.2 Voltage: 300 volts
Cathode Voltage for visual extinction of focused raster: 28 to 60 volts
Field Strength of required adjustable Centering Magnet: 0 to 8 gauss

Maximum Circuit 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.
MAGNETIC FOCUS

Genera I:

PICTURE TUBE ROUND METAL-SHELL TYPE

MAGNETIC DEFLECTION

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

Faceplate, Spherical: Filterglass
Phosphor (For Curves, see front of this Section): P4—Sulfide Type
Deflection Angle (Approx.): 53°
Electron Gun: Ion-Trap Type Requiring External Single-Field Magnet

Maximum Overall Length: 22-5/16"
Greatest Diameter of Bulb: 15-7/8" ± 1/8"
Minimum Useful Screen Diameter: 14-3/8"
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: 14000 max. volts
GRID-No.2 VOLTAGE: 410 max. volts
GRID-No.1 VOLTAGE:
   Negative-bias value: 125 max. volts
   Positive-bias value: 0 max. volts
   Positive-peak value: 2 max. volts
PEAK HEATER-CATHODE VOLTAGE:
   Heater negative with respect to cathode:
      During equipment warm-up period not exceeding 15 seconds: 410 max. volts
      After equipment warm-up period: 150 max. volts
   Heater positive with respect to cathode: 150 max. volts

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

--- Indicates a change.

9-58

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
16DP4-A
PICTURE TUBE
ROUND GLASS TYPE

MAGNETIC FOCUS

MAGNETIC DEFLECTION

DATA

General:
Heater, for Unipotential Cathode:
Voltage ........................................ 6.3 ............... ac or dc volts
Current .......................................... 0.6 ± 10% ........... amp
Faceplate, Spherical.......................... Filterglass
Phosphor (For curves, see front of this Section). P4—Sulfide Type
Deflection Angle (Approx.) ......................... 60°
Electron Gun .......................... Ion-Trap Type Requiring
External Single-Field Magnet
Overall Length ...................................... 20-3/4" ± 1/4"
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 .................. 12D

Pin 1—Heater
Pin 2—Grid No.1
Pin 10—Grid No.2
Pin 11—Cathode

Pin 12—Heater Cap*—Uoltor (Grid No.3, Collector)

Maximum Ratings, Design-Center Values:
ULTOR VOLTAGE ...................... 15000 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

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

Indicates a change.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**16GP4-B**

**PICTURE TUBE**

**ROUND METAL-SHELL TYPE**

**MAGNETIC FOCUS**

**MAGNETIC DEFLECTION**

---

### DATA

**General:**
- Heater, for Unipotential Cathode:
  - Voltage: 6.3 ac or dc volts
  - Current: 0.6 ± 10% amp
- Faceplate, Spherical: Frosted Filterglass
- Phosphor (For curves, see front of this Section): P4—Sulfide Type
- Deflection Angle (Approx.): 70°
- Electron Gun: Ion-Trap Type Requiring External Single-Field Magnet

**Maximum Overall Length:** 17-11/16"
**Greatest Diameter of Bulb:** 15-7/8" ± 1/8"
**Minimum Useful Screen Diameter:** 14-3/8"
**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

---

**Electron Gun Diagram:**
- 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:** 14000 max. volts
- **GRID-No.2 VOLTAGE:** 410 max. volts
- **GRID-No.1 VOLTAGE:**
  - Negative-bias value: 125 max. volts
  - Positive-bias value: 0 max. volts
  - Positive-peak value: 2 max. volts
- **PEAK HEATER-CATHODE VOLTAGE:**
  - Heater negative with respect to cathode:
    - During equipment warm-up period not exceeding 15 seconds: 410 max. volts
    - After equipment warm-up period: 150 max. volts
  - Heater positive with respect to cathode: 150 max. volts

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

---

*Indicates a change.*

---

**RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY**
16LP4-A
PICTURE TUBE
ROUND GLASS TYPE

MAGNETIC FOCUS
MAGNETIC DEFLECTION

DATA

General:
Heater, for Unipotential Cathode:
  Voltage .................. 6.3 ac or dc volts
  Current .................. 0.6 ± 10% amp
Capacitance between External Conductive Coating and Ultron .................. 2000 max. µf
  750 min. µf
Faceplate, Spherical .................. Filterglass
Phosphor (For curves, see front of this Section) .................. P4—Sulfide Type
Deflection Angle (Approx.) .................. 520°
Electron Gun .................. Ion-Trap Type Requiring External Single-Field Magnet
Overall Length .................. 22-1/4" ± 3/8"
Greatest Diameter of Bulb .................. 15-7/8" ± 1/8"
Minimum Useful Screen Diameter .................. 14-1/2"
Operating Position .................. Any
Cap .................. Recessed Small Cavity (JETEC No. J1-21)
Base .................. Small-Shell Duodecal 5-Pin (JETEC Group 4, No. B5-57)
Basing Designation for BOTTOM VIEW .................. 12N

Pin 1—Heater
Pin 2—Grid No. 1
Pin 10—Grid No. 2
Pin 11—Cathode
Pin 12—Heater

Cap—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
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

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

Indicates a change.
Picture Tube

**16RP4A**

**Rectangular Glass Type**

**Magnetic Focus**

**Aluminized Screen**

**70° Magnetic Deflection**

**GENERAL DATA**

**Electrical:**

- Direct Interelectrode Capacitances:
  - Cathode to all other electrodes: 5 pf
  - Grid No.1 to all other electrodes: 6 pf
  - External conductive coating to anode: 1500 max. pf
  - 750 min. pf
  - Heater Current at 6.3 volts: 600 ± 30 ma

**Optical:**

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

**Mechanical:**

- Weight (Approx.): 16 lbs
- Overall Length: 18-3/4" ± 3/8"
- Neck Length: 7-1/2" ± 3/16"
- 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 J120 A/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

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

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

- **ANODE VOLTAGE**: 17500 max. volts
- **GRID-No.2 VOLTAGE**: 450 max. volts

**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**

Electron Tube Division  Harrison, N. J.
GRID-No.1 VOLTAGE:

Negative bias value .................. 140 max. volts
Positive bias value .................. 0 max. volts
Positive peak value .................. 2 max. volts

HEATER VOLTAGE .................. \{6.9 max. volts
\{5.7 min. volts

PEAK HEATER–CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period not exceeding 15 seconds .................. 450 max. volts
After equipment warm-up period .................. 165 max. volts
Heater positive with respect to cathode:
Combined AC and DC voltage .................. 165 max. volts
DC component .................. 100 max. volts

Typical Operating Conditions for Grid-Drive Service:

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

Anode Voltage .................. 12000 volts
Grid-No.2 Voltage .................. 300 volts
Grid-No.1 Voltage for visual extinction of focused raster .................. −28 to −72 volts

Maximum Circuit Value:

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

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

**General:**
- Heater, for Unipotential Cathode:
  - Voltage: 6.3 ac or dc volts
  - Current: 0.6 ± 10% amp
- Capacitance between External Conductive Coating and Ultor: 2000 max. µuf, 750 min. µuf
- Faceplate, Spherical: Filterglass
- Phosphor (for Curves, see front of this section): P4—Sulfide Type

**Deflection Angles (Approx.):**
- Diagonal: 70°
- Horizontal: 650°
- Vertical: 50°

**Electron Gun:** Ion-Trap Type Requiring External Single-Field Magnet

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

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

**Operating Position:** Any

**Cap.:** Small-Shell Duodecal 5-Pin (JETEC Group 4, No.B5-57)

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

**Pin 1—Heater**
- Cap—Ultor (Grid No.3, Collector)

**Pin 2—Grid No.1**
- C—External Conductive Coating

**Pin 10—Grid No.2**

**Pin 11—Cathode**

**Pin 12—Heater**

### Maximum Ratings, Design-Center Values:
- **ULTOR VOLTAGE:** 14000 max. volts
- **GRID-No.2 VOLTAGE:** 410 max. volts
- **GRID-No.1 VOLTAGE:**
  - Negative-bias value: 125 max. volts
  - Positive-bias value: 0 max. volts
  - Positive-peak value: 2 max. volts

*Indicates a change.*
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
16WP4-A

PICTURE TUBE

ROUND GLASS TYPE

MAGNETIC FOCUS

MAGNETIC DEFLECTION

DATA

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

Capacitance between External Conductive Coating and Ultor...........
(1500 max. 750 min. μF 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................... Small-Shell Duodecal 5-Pin (JETEC Group 4, No.B5-57)
Base...... 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 A—Ultor

C-External Conductive Coating

Pin 1—Heater
Pin 2—Grid No.1
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater
Cap A—Ultor

C-External Conductive Coating

Maximum Ratings, Design-Center Values:
ULTOR VOLTAGE.................. 16000 max. volts
GRID-No.2 VOLTAGE.................. 410 max. volts
GRID-No.1 VOLTAGE:
Negative-bias value.............. 125 max. volts
Positive-bias value............... 0 max. volts
Positive-peak value.............. 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period not exceeding 15 seconds........ 410 max. volts
After equipment warm-up period............................. 125 max. volts
Heater positive with respect to cathode. .................. 125 max. volts

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

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

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

Indicates a change.
17BJP4

Picture Tube

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

GENERAL DATA

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

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

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

For Additional Information on Coatings and Dimensions:
- See Picture-Tube Dimensional-Outlines and Bulb J133 F/G sheets at front of this section
- Cap. Recessed Small Cavity (JEDEC No.J1-21)
- Bases (Alternates):
  - Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-63)
  - Short Small-Shell Duodecal 6-Pin (JEDEC No.B6-203)
- Basing Designation for BOTTOM VIEW 12L

Pin 1—Heater
Pin 2—Grid No.1
Pin 6—Grid No.4
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater

Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)
C—External Conductive Coating

Indicates a change.
Maximum and Minimum Ratings, Design-Maximum Values:

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

ANODE VOLTAGE: \[17500 \text{ max. volts} \quad 11000 \text{ min. volts}\]

GRID-No.4 (FOCUSING) VOLTAGE:
- Positive value: 1100 max. volts
- Negative value: 550 max. volts

GRID-No.2 VOLTAGE: 550 max. volts

GRID-No.1 VOLTAGE:
- Negative peak value: 220 max. volts
- Negative bias value: 155 max. volts
- Positive bias value: 0 max. volts
- Positive peak value: 2 max. volts

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: 200 max. volts
- Heater positive with respect to cathode:
  - Combined AC and DC voltage: 200 max. volts
  - DC component: 100 max. volts

Typical Operating Conditions for Grid-Drive Service:

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

Anode Voltage: 14000 volts
Grid-No.4 Voltage: -55 to +300 volts
Grid-No.2 Voltage: 300 volts
Grid-No.1 Voltage for visual extinction of focused raster: -28 to -72 volts

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

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

17BP4B

RECTANGULAR GLASS TYPE
MAGNETIC FOCUS

ALUMINIZED SCREEN
70° MAGNETIC DEFLECTION

GENERAL DATA

Electrical:
Direct Interelectrode Capacitances:
  Cathode to all other electrodes ... 5 pf
  Grid No.1 to all other electrodes ... 6 pf
  External conductive coating to anode ... 750 min. pf
Heater Current at 6.3 volts ... 600 ± 60 ma
Electron Gun ... Ion-Trap Type Requiring
             External Single-Field Magnet

Optical:
Phosphor (For curves, see front of this Section). P4—Sulfide Type,
Aluminized
Faceplate, Spherical. Light transmission (Approx.) ... 74%
Mechanical:
Weight (Approx.) ... 18 lbs
Overall Length ... 19-3/16" ± 3/8"
Neck Length ... 7-1/2" ± 3/16"
Projected Area of Screen ... 149 sq.in.
External Conductive Coating:
  Type ... Regular-Band
  Contact area for grounding ... Near Reference Line
For Additional Information on Coatings and Dimensions:
  See Picture-Tube Dimensional-Outlines and Bulb J133 B/D sheets
  at front of this section
Cap ... Recessed Small Cavity (JEDEC No.J1-21)
Base ... Small-Shell Duodecal 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

ANODE

Cap—Anode
  (Grid No.3, 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.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANODE VOLTAGE</td>
<td>17600 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>HEATER VOLTAGE</td>
<td></td>
</tr>
<tr>
<td>PEAK</td>
<td>6.9 max. volts</td>
</tr>
<tr>
<td>HEATER-CATHODE VOLTAGE:</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... 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:

<table>
<thead>
<tr>
<th>Parameter</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 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.
**Picture Tube**

**17CDP4**

**Rectangular Glass Type**  
**Low-Voltage Electrostatic Focus**  
**110° 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: 1500 max. pf
  - Heater Current at 8.4 volts: 450 ± 45 ma
  - Heater Warm-Up Time (Average): 11 seconds
- Electron Gun: Type Requiring No Ion-Trap Magnet

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

**Mechanical:**
- Weight (Approx.): 10 lbs
- Overall Length: 12-9/16" + 1/4" - 9/16"
- Neck Length: 5-7/16" + 1/8" - 7/16"
- Projected Area of Screen: 155 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 J132 1/2 A/B sheets at front of this section
- Cap: Recessed Small Cavity (JEDEC No.J1-21)
- Bases (Alternates):
  - Small-Button Eightar 7-Pin, Arrangement 2 (JEDEC No.B7-183)
  - Small-Button Neoeightar 7-Pin, Arrangement 1 (JEDEC No.B7-208)

**Pin Designation:**
- 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, Screen, Collector)
- C - External Conductive Coating

→ Indicates a change.

RADIO CORPORATION OF AMERICA  
Electron Tube Division  
Harrison, N. J.
Maximum and Minimum Ratings, Design-Maximum Values:

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

ANODE VOLTAGE: \[\{17600 \text{ max. volts}\], \[11000 \text{ min. volts}\]

GRID-No.4 (FOCUSING) VOLTAGE:
- Positive value: 1100 max. volts
- Negative value: 550 max. volts

GRID-No.2 VOLTAGE: 550 max. volts

GRID-No.1 VOLTAGE:
- Negative peak value: 220 max. volts
- Negative bias value: 154 max. volts
- Positive bias value: 0 max. volts
- Positive peak value: 2 max. volts

HEATER VOLTAGE: \[\{6.9 \text{ max. volts}\], \[5.7 \text{ min. volts}\]

PEAK HEATER-CATHODE VOLTAGE:
- Heater negative with respect to cathode:
  - 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: 16000 volts
Grid-No.4 Voltage: 0 to 400 volts
Grid-No.2 Voltage: 400 volts

Grid-No.1 Voltage for visual extinction of focused raster: \[-96 \text{ to } -94 \text{ volts}\]

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

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

Indicates a change.
**PICTURE TUBE**

**RECTANGULAR METAL-SHELL TYPE**

**MAGNETIC FOCUS**

**MAGNETIC DEFLECTION**

**DATA**

**General:**

Heater, for Unipotential Cathode:

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

Faceplate, Spherical: Frosted Filterglass

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

**Deflection Angles (Approx.):**

- Diagonal: 70°
- Horizontal: 60°
- 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—Metal-Shell Lip—Metal-Shell Lip—Metal-Shell Lip—

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater

**Ultor Terminal:** Metal-Shell Lip—Metal-Shell Lip—Metal-Shell Lip—Metal-Shell Lip—

**Basing Designation for BOTTOM VIEW:** 12D

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

- ULTORIZ 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

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 рождение типа: 12D

**RCA**

**17CP4**

**PICTURE TUBE**

**RECTANGULAR METAL-SHELL TYPE**

**MAGNETIC FOCUS**

**MAGNETIC DEFLECTION**

**DATA**

**General:**

Heater, for Unipotential Cathode:

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

Faceplate, Spherical: Frosted Filterglass

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

**Deflection Angles (Approx.):**

- Diagonal: 70°
- Horizontal: 60°
- 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—Metal-Shell Lip—Metal-Shell Lip—Metal-Shell Lip—

- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater

**Ultor Terminal:** Metal-Shell Lip—Metal-Shell Lip—Metal-Shell Lip—Metal-Shell Lip—

**Basing Designation for BOTTOM VIEW:** 12D

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

- ULTORIZ 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

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**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
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 .. 1400 max. 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 . . . . . . . . . . . 12-5/16" ± 5/16"
Neck Length . . . . . . . . . . . . . 5-3/16" ± 3/16"
Projected Area of Screen . . . . . . . . . . . 155 sq. in
External Conductive Coating:
Type . . . . . . . Modified Band
Contact area for grounding . . . . . Near Reference Line

For Additional Information on Coatings and Dimensions:
See Picture-Tube Dimensional-Outlines and Bulb J132-112 A/B sheets at the front of this section

Cap . . . . . . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . . . . . . Special 6-Pin (JEDEC No.B6-185)
Basing Designation for BOTTOM VIEW . . . . . . . . . . . . . 7FA

Maximum Ratings, Design-Maximum Values:
ULTOR VOLTAGE . . . . . . . . . . 17600 max. volts
GRID-No.4 (FOCUSING) VOLTAGE:
Positive value . . . . . . . . . . . 1100 max. volts
Negative value . . . . . . . . . . . 550 max. volts
GRID-No.2 VOLTAGE .......................... 550 max. volts
GRID-No.1 VOLTAGE:
  Negative peak value ...................... 220 max. volts
  Negative bias value ..................... 154 max. volts
  Positive bias value ..................... 0 max. volts
  Positive peak value ..................... 2 max. volts
PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
  During equipment warm-up period not exceeding 15 seconds .......................... 450 max. volts
  After equipment warm-up period ................ 200 max. volts
Heater positive with respect to cathode ......................................................... 200 max. volts

Typical Operating Conditions:

  With anode voltage of ............................. 14000 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 ......................... -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
# RCA 17CFP4 PICTURE TUBE

**DATA**

## General:

- **Heater, for Unipotential Cathode:**
  - Voltage (AC or DC) ... 6.3 volts
  - Current ... 0.6 ± 10% amp

## Direct Interelectrode Capacitances:

- Grid No.1 to all other electrodes ... 6 µf
- Cathode to all other electrodes ... 5 µf
- External conductive coating to ultor (1500 max., 1200 min.) µf

## Faceplate, Spherical

- 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.**

## Deflection Angles (Approx.):

- Diagonal ... 90°
- Horizontal ... 85°
- Vertical ... 68°

## Tube Dimensions:

- **Overall length** ... 15" ± 3/8"
- **Greatest width** ... 15-5/8" ± 1/8"
- **Greatest height** ... 12-3/4" ± 1/8"
- **Diagonal** ... 16-9/16" ± 1/8"
- **Neck length** ... 5-1/2" ± 3/16"
- **Radius of curvature of faceplate (External surface)** 20-3/4"

## Screen Dimensions (Minimum):

- **Greatest width** ... 14-3/4"
- **Greatest height** ... 11-11/16"
- **Diagonal** ... 15-3/4"
- **Projected area** ... 155 sq. in.

## Weight (Approx.)

- 10 lbs

## Operating Position

- Any

## Cap.

- Recessed Small Cavity (JEDEC No. J1-21)

## Bulb

- J132-1/2 C1/D1

## Base

- Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-203)

## Basing Designation for BOTTOM VIEW

- 12L

---

**Pin 1—Heater**

**Pin 2—Grid No.1**

**Pin 6—Grid No.4**

**Pin 10—Grid No.2**

**Pin 11—Cathode**

**Pin 12—Heater**

---

**Cap—Ultor**

(Mesh No.3, Grid No.5, Collector, 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>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR VOLTAGE</td>
<td>16000 max. volts</td>
</tr>
<tr>
<td>Grid-No.4 (FOCUSBING) VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>1000 max. volts</td>
</tr>
<tr>
<td>Negative value</td>
<td>500 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></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</td>
<td></td>
</tr>
<tr>
<td>cathode:</td>
<td></td>
</tr>
<tr>
<td>During equipment warm-up period</td>
<td>410 max. volts</td>
</tr>
<tr>
<td>not exceeding 15 seconds</td>
<td></td>
</tr>
<tr>
<td>After equipment warm-up period</td>
<td>180 max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to</td>
<td>180 max. volts</td>
</tr>
<tr>
<td>cathode:</td>
<td></td>
</tr>
</tbody>
</table>

Equipment Design Ranges:

With any ultor voltage ($E_{ck}$) between 12000 and 16000 volts and grid-No.2 voltage ($E_{ck}$) between 200 and 500 volts:

Grid-No.4 Voltage for focus$^\dagger$: -50 to +350 volts

Grid-No.1 Voltage for visual extinction of focused raster: See Raster-Cutoff-Range Chart for Grid-Drive Service

Grid-No.1 Video Drive
From Raster Cutoff (Black level): White-level value (Peak positive): Same value as determined for $E_{ck}$ 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: -50 to +350 volts

Grid-No.1 Voltage for visual extinction of focused raster: -28 to -72 volts
17CFP4
PICTURE TUBE

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:

<table>
<thead>
<tr>
<th>Voltage Description</th>
<th>Minimum Value</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR-TO-GRID-No.1 Voltage</td>
<td>12000 min.</td>
<td>16000 max.</td>
</tr>
<tr>
<td>GRID-No.4 TO-GRID-No.1 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 TO-GRID-No.1 Voltage</td>
<td>640 max.</td>
<td>500 max.</td>
</tr>
<tr>
<td>GRID-No.2 TO-CATHODE Voltage</td>
<td>500 max.</td>
<td></td>
</tr>
<tr>
<td>CATHODE-TO-GRID-No.1 Voltage:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive-peak value</td>
<td>200 max.</td>
<td></td>
</tr>
<tr>
<td>Positive-bias value</td>
<td>140 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>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>410 max.</td>
<td></td>
</tr>
<tr>
<td>After equipment warm-up period</td>
<td>180 max.</td>
<td></td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>180 max.</td>
<td></td>
</tr>
</tbody>
</table>

Equipment Design Ranges:

*With any ultor-to-grid-No.1 voltage *(E<sub>cg1</sub>)* between 12000° and 16000 volts and grid-No.2-to-grid-No.1 voltage *(E<sub>cg2</sub>)* between 220 and 640 volts

<table>
<thead>
<tr>
<th>Voltage Description</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.4 to Grid-No.1 Voltage for focus§</td>
<td>0 to 400</td>
</tr>
<tr>
<td>Cathode-to-Grid-No.1 Voltage <em>(E&lt;sub&gt;k1&lt;/sub&gt;)</em> for visual extinction of focused raster</td>
<td>.See Raster-Cutoff-Range Chart for Cathode-Drive Service</td>
</tr>
<tr>
<td>Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value (Peak negative)</td>
<td>Same value as determined for E&lt;sub&gt;k1&lt;/sub&gt; except video drive is a negative voltage</td>
</tr>
<tr>
<td>Grid-No.4 Current</td>
<td>-25 to +25 μA</td>
</tr>
</tbody>
</table>
Grid-No.2 Current ........................ -15 to +15 μA
Field Strength of Adjust-
able Centering Magnet* ................ 0 to 8 gauss (s)

Examples of Use of Design Ranges:
- With ultor-to-grid-
  No.1 voltage of .................. 16,000 volts
  and grid-No.2-to-grid-
  No.1 voltage of .................. 300 volts

Grid-No.4-to-Grid-No.1 Voltage for focus ............... 0 to 400 volts
Cathode-to-Grid No.1 Voltage for visual 
  extinction of focused 
  raster .................................. 28 to 60 volts
Cathode-to-Grid-No.1 Video Drive from Raster 
  Cutoff (Black level):
  White-level value ................... -28 to -60 volts

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

A Grid drive is the operating condition in which the video signal varies 
the grid-No.1 potential with respect to cathode.

* This value is a working design-center minimum. The equivalent absolute 
minimum ultor- or ultor-to-grid-No.1 voltage is 10,800 volts, below 
which the serviceability of the 17CFP4 will be impaired. The equipment 
designer has the responsibility of determining a minimum design value 
such that under the worst probable operating conditions involving 
supply-voltage variation and equipment variation the absolute minimum 
ultor- or ultor-to-grid-No.1 voltage is never less than 10,800 volts.

$ The grid-No.4 voltage or grid-No.4-to-grid-No.1 voltage required for 
focus of any individual tube is independent of ultor current and will 
remain essentially constant for values of ultor voltage (or ultor-to-
grid-No.1 voltage) or grid-No.2 voltage (or grid-No.2-to-grid-No.1 
voltage) within design ranges shown for these items.

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

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

For X-ray shielding considerations, see sheet 
X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES 
at front of this Section
17CF P4
RAS TER-CUTOFF-RANGE CHARTS
GRID-DRIVE SERVICE

\[ E_F = 6.3 \text{ VOLTS} \]
ULTOR VOLTS = 12000 TO 16000
GRID-N\#4 VOLTS ADJUSTED FOR FOCUS.

<table>
<thead>
<tr>
<th>GRID-N#1 VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>-120</td>
</tr>
<tr>
<td>-100</td>
</tr>
<tr>
<td>-80</td>
</tr>
<tr>
<td>-60</td>
</tr>
<tr>
<td>-40</td>
</tr>
<tr>
<td>-20</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>40</td>
</tr>
<tr>
<td>60</td>
</tr>
<tr>
<td>80</td>
</tr>
<tr>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GRID-N#2 VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
</tr>
<tr>
<td>300</td>
</tr>
<tr>
<td>400</td>
</tr>
<tr>
<td>500</td>
</tr>
</tbody>
</table>

CATHODE-DRIVE SERVICE

\[ E_F = 6.3 \text{ VOLTS} \]
ULTOR-TO-GRID-N\#1 VOLTS = 12000 TO 16000
GRID-N\#4-TO-GRID-N\#1 VOLTS ADJUSTED FOR FOCUS.

<table>
<thead>
<tr>
<th>CATHODE-TO-GRID-N#1 VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>40</td>
</tr>
<tr>
<td>60</td>
</tr>
<tr>
<td>80</td>
</tr>
<tr>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GRID-N#2-TO-GRID-N#1 VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
</tr>
<tr>
<td>300</td>
</tr>
<tr>
<td>400</td>
</tr>
<tr>
<td>500</td>
</tr>
</tbody>
</table>

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
SCREEN DIAGONAL 15 3/4" MIN.

SCREEN HEIGHT
11 11/16" MIN.

SCREEN WIDTH
14 3/4" MIN.

15 5/8" ± 1/8"

3°

20 3/4" R.

2 3/4" R.

3.56" R.

REFERENCE LINE
(NOTE 2)

SHORT SMALL SHELL DUODECAL
6-PIN BASE
JEDEC GROUP 4
NO. 203
(NOTE 3)

17 1/16" ± 1/16"

15 27/32" R.

15 13/32" R.

3 1/6" R.

2 1/8" R.


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 WAFFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

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

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

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

NOTE 8: THE TUBE SHOULD BE SUPPORTED ON BOTH SIDES OF THE BULGE. THE MECHANISM USED SHOULD PROVIDE CLEARANCE FOR THE MAXIMUM DIMENSIONS OF THE BULGE.
**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-N1 VOLTS = 16000</td>
<td>ULTOR VOLTS = 16000</td>
</tr>
<tr>
<td>CATHODE BIASED POSITIVE WITH RESPECT TO GRID N1 TO GIVE FOCUSED RASTER CUTOFF.</td>
<td>GRID N1 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. CORDINATES OF SCREEN: $X=0.270, Y=0.300$

- CATHODE DRIVE
- GRID DRIVE

**Video Signal Volts from Raster Cutoff**

**Highlight Brightness—Foot-Lamberts**

**Electron Tube Division**

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE

E_f = 6.3 VOLTS
ULTOR-TO-GRID-N#1 VOLTS = 12000 TO 16000
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 16000
GRID N#1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.

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

92CM-9243
## 17CYP4 PICTURE TUBE

**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: (1500 max. μF) (1000 min. μF)

**Faceplate, Spherical.**
- Light transmission (Approx.): 77%

**Phosphor (for curves, see front of this section).**
- P4—Sulfide Type Aluminized
- Fluorescence: White
- Phosphorescence Persistence: White
- 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: 14" ± 3/8"
- Greatest width: 15-5/8" ± 1/8"
- Greatest height: 12-3/4" ± 1/8"
- Diagonal: 16-9/16" ± 1/8"
- Neck length: 4-1/2" ± 3/16"
- Radius of curvature of faceplate (External surface): 20-3/4"

**Screen Dimensions (Minimum):**
- Greatest width: 14-3/4"
- Greatest height: 11-11/16"
- Diagonal: 15-3/4"
- Projected area: 155 sq. in.
- Weight (Approx.): 10 lbs

**Operating Position.**
- Any

**Cap.**
- Recessed Small Cavity (JEDEC No.J1-21)

**Bulb.**
- J132-1/2 C1/D1

**Base.**
- Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-203)

**Basing Designation for BOTTOM VIEW.**
- 12L

---

**DATA**

**General:**

**Heater, for Unipotential Cathode:**
- Voltage (AC or DC)
- Current

**Direct Interelectrode Capacitances:**
- Grid No.1 to all other electrodes
- Cathode to all other electrodes
- External conductive coating to ultor

**Faceplate, Spherical.**
- Light transmission (Approx.)

**Phosphor (for curves, see front of this section).**
- P4—Sulfide Type Aluminized
- Fluorescence: White
- Phosphorescence Persistence: White
- 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
- Greatest width
- Greatest height
- Diagonal
- Neck length
- Radius of curvature of faceplate (External surface)

**Screen Dimensions (Minimum):**
- Greatest width
- Greatest height
- Diagonal
- Projected area
- Weight (Approx.)

**Operating Position.**
- Any

**Cap.**
- Recessed Small Cavity

**Bulb.**
- J132-1/2 C1/D1

**Base.**
- Short Small-Shell Duodecal 6-Pin

**Basing Designation for BOTTOM VIEW.**
- 12L

---

**DATA 1**

**RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY**
GRID-DRIVE® SERVICE

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

Maximum and Minimum Ratings, Design-Center Values:

ULTOR VOLTAGE: \[16000\] max. volts \[12000\] min. volts

GRID-No.4 (FOCUSING) VOLTAGE:
- Positive value \[1000\] max. volts
- Negative value \[500\] max. volts

GRID-No.2 VOLTAGE: \[500\] max. volts

GRID-No.1 VOLTAGE:
- Negative-peak value \[200\] max. volts
- Negative-bias value \[140\] max. volts
- Positive-bias value \[0\] max. volts
- Positive-peak value \[2\] max. volts

PEAK HEATER-CATHODE VOLTAGE:
- Heater negative with respect to cathode:
  - During equipment warm-up period not exceeding 15 seconds \[410\] max. volts
  - After equipment warm-up period \[180\] max. volts
- Heater positive with respect to cathode: \[180\] max. volts

Equipment Design Ranges:

With any ultor voltage \((E_{ck})\) between 12000 and 16000 volts and grid-No.2 voltage \((E_{ck2})\) between 200 and 500 volts

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

Grid-No.1 Voltage \((E_{ck1})\) for visual extinction of focused raster. \(\text{See Raster-Cutoff-Range Chart for Grid-Drive Service}\)

Grid-No.1 Video Drive from Raster Cutoff (Black level):
- White-level value
- Peak positive) \(\text{Same value as determined for } E_{ck1} \text{ except video drive is a positive voltage}\)

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: \[-50\] 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

**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>Voltage 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.1 Voltage</td>
<td>12000* min. volts</td>
</tr>
<tr>
<td>Grid-No.4-to-Grid-No.1 (Focusing) Voltage:</td>
<td>1000 max. volts</td>
</tr>
<tr>
<td>Positive value</td>
<td>500 max. volts</td>
</tr>
<tr>
<td>Negative value</td>
<td>640 max. volts</td>
</tr>
<tr>
<td>Grid-No.2-to-Grid-No.1 Voltage</td>
<td>500 max. volts</td>
</tr>
<tr>
<td>Cathode-to-Grid-No.1 Voltage</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Positive-peak value</td>
<td>140 max. volts</td>
</tr>
<tr>
<td>Positive-bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Negative-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</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 \( |E_{c_2g_1}| \) between 12000* and 16000 volts and grid-No.2-to-grid-No.1 voltage \( |E_{c_2g_1}| \) between 225 and 640 volts

<table>
<thead>
<tr>
<th>Voltage Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.4-To-Grid-No.1 Voltage</td>
<td>0 to 400 volts</td>
</tr>
<tr>
<td>Cathode-to-Grid-No.1 Voltage (( E_{c_1g} )) for visual extinction of focused raster.</td>
<td>See Raster-Cutoff-Range Chart for Cathode-Drive Service</td>
</tr>
<tr>
<td>Cathode-to-Grid-No.1 Video Drive from Raster Cutoff</td>
<td></td>
</tr>
<tr>
<td>(Black level): White-level value</td>
<td></td>
</tr>
<tr>
<td>(Peak negative): Same value as determined for ( E_{c_1g} ) except video drive is a negative value</td>
<td></td>
</tr>
<tr>
<td>Grid-No.4 Current.</td>
<td>-25 to +25 μA</td>
</tr>
<tr>
<td>Grid-No.2 Current.</td>
<td>-15 to +15 μA</td>
</tr>
<tr>
<td>Field Strength of Adjustable Centering Magnet*</td>
<td>0 to 8 gausses</td>
</tr>
</tbody>
</table>
Example of Use of Design Ranges:

With ultor-to-grid-
No. 1 voltage of 16000 volts
and grid-No. 2-to-grid-
No. 1 voltage of 300 volts

Grid-No. 4-to-Grid-No. 1 Voltage
for focus. . . . . . . . . . . . . . . . . 0 to 400 volts
Cathode-to-Grid-No. 1 Voltage
for visual extinction
of focused raster. . . . . . . . . . . 28 to 60 volts

Cathode-to-Grid-No. 1 Video
Drive from Raster Cutoff
(Black level):
White-level value. . . . . . . . . . . . . -28 to -60 volts

Maximum Circuit Values:

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

<table>
<thead>
<tr>
<th>Voltage Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>17CYP4</td>
</tr>
<tr>
<td>PICTURE TUBE</td>
</tr>
</tbody>
</table>

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 minimum. The equivalent absolute minimum ultor (or ultor-to-grid-No.1) voltage is 11,000 volts, below which the serviceability of the 17CYP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor (or ultor-to-grid-No.1) voltage is never less than 11,000 volts.

The grid-No. 4 voltage required for optimum focus of any individual tube will have a value between -50 and +350 volts independent of ultor current and will remain essentially constant for values of ultor voltage or grid-No. 2 voltage within design ranges shown for these items.

The 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-to-grid-No.1 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 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 17CYP4 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
**17CYP4**

**RASTER-CUTOFF-RANGE CHARTS**

**GRID-DRIVE SERVICE**

- \( E_p = 6.3 \) VOLTS
- ULTOR VOLTS = 12000 TO 16000
- GRID-\( \text{\#4} \) VOLTS ADJUSTED FOR FOCUS.

---

**CATHODE-DRIVE SERVICE**

- \( E_p = 6.3 \) VOLTS
- ULTOR-TO-GRID-\( \text{\#1} \) VOLTS = 12000 TO 16000
- GRID-\( \text{\#4} \)-TO-GRID-\( \text{\#1} \) VOLTS ADJUSTED FOR FOCUS.
PICTURE TUBE

SCREEN DIAGONAL 15.3/4" MIN.

SCREEN HEIGHT 11 1/16" MIN.

SCREEN WIDTH 14 3/4" MIN.

15 27/32" R.
15 13/32" R.
3 1/8" R.
2 5/8" R.

15 5/8" ± 1/8"

2 3/4" R.
2" MIN.

2" ± 1/4"

3 13/16" ± 1/4"

3.56" R.

REFERENCE LINE (NOTE 2)

SHORT SMALL-SHELL DUODECAL
6-PIN BASE
JEDEC GROUP 4, NRB6-203
(NOTE 3)
17CYP4

PICTURE TUBE

ULTOR RECESSED SMALL CAVITY CAP
JEDEC NO. J1-21 (NOTE 1)

REFERENCE LINE

CONTACT AREA OF ALTERNATE CONDUCTING COATING (NOTE 4)

TRANSPARENT INSULATING COATING (NOTE 5)

REFERENCE LINE

DIAGONAL VIEW

14" ± 3/8"
9 1/2" ± 3/16"
4 1/2" ± 3/16"

9 3/4" R.

2.06" R.

68°

12 3/4" ± 3/8"
1/2" R.

2" MIN.

92CL-10383

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4-60
NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 30^\circ$. ULTOR TERMINAL IS ON SAME SIDE AS PIN 6.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC NO. G-116 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE $CC'$ OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4".


NOTE 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.
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE

\[ E_f = 6.3 \text{ VOLTS} \]
ULTOR-TO-GRID-N°1 VOLTS = 16000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID N°1 TO GIVE
FOCUSED RASTER CUTOFF.
RASTER FOCUSED
AT AVERAGE BRIGHTNESS.
RASTER SIZE = 14”x10\(\frac{1}{2}\)”

GRID-DRIVE SERVICE

\[ E_f = 6.3 \text{ VOLTS} \]
ULTOR VOLTS = 16000
GRID N°1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE
FOCUSED RASTER CUTOFF.
RASTER FOCUSED
AT AVERAGE BRIGHTNESS.
RASTER SIZE = 14”x10\(\frac{1}{2}\)”

---

**Graph:**

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

**Axes:**
- **VIDEO SIGNAL VOLTS FROM RASTER CUTOFF**
- **HIGHLIGHT BRIGHTNESS — FOOT-LAMBERTS**

**Data Points:**
- 0 V: 100 F-L
- 20 V: 200 F-L
- 40 V: 300 F-L
- 60 V: 400 F-L
- 80 V: 500 F-L

**Note:**

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- RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
- 92CM-10386
**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$^\text{#1}$</td>
<td>ULTOR VOLTS = 12000 to 16000</td>
</tr>
<tr>
<td>VOLTS = 12000 to 16000</td>
<td>GRID N$^\text{#1}$ BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.</td>
</tr>
<tr>
<td>CATHODE BIASED POSITIVE WITH RESPECT TO GRID N$^\text{#1}$ TO GIVE FOCUSED RASTER CUTOFF.</td>
<td></td>
</tr>
</tbody>
</table>

**Graph:**
- **CATHODE DRIVE**
- **GRID DRIVE**

**Axes:**
- **Video Signal Volts from Raster Cutoff**
- **Ultor Milliamperes**

**Graph Legend:**
- Video Signal Volts from Raster Cutoff: 0, 20, 40, 60, 80
- Ultor Milliamperes: 0, 0.5, 1, 1.5, 2, 2.5

**Note:**
- U.S. Government work not protected by U.S. copyright.

** nine, New Jersey, New York, Chicago, Los Angeles, Philadelphia**
17DAP4
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 (AC or DC) .................. 2.68 ± 10% volts
  Current at 2.68 volts ............... 0.45 amp
  Warm-up time (Average) .......... 11 sec
Capacitance between External Conductive
  Coating and Ultor ................... 1400 max. μf
  Faceplate, Spherical ................ Filterglass
  Phosphor (For curves, see front of this section) : P4—Sulfide Type
  Deflection Angles (Approx.):
    Diagonal ......................... 110°
    Horizontal ....................... 105°
    Vertical ........................ 90°
Electron Gun. ............... Type Requiring No Ion-Trap Magnet
Tube Dimensions:
  Overall length ................... 10-11/16" ± 3/16"
  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" ± 1/16"
  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.
Operating Position ................ Any
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. .... BJK

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

Maximum Ratings, Design-Center Values:
ULTOR VOLTAGE .................. 16000 max. volts
GRID-No.4 (FOCUSING) VOLTAGE:
  Positive value .................. 850 max. volts
  Negative value ................. 630 max. volts
GRID-No.2 VOLTAGE ................ 500 max. volts

4-60  ELECTRON TUBE DIVISION  RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
## GRID-No.1 VOLTAGE:

<table>
<thead>
<tr>
<th>Voltage Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative-peak value</td>
<td>360 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:

<table>
<thead>
<tr>
<th>Circuit Type</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-ray shielding considerations, see sheet **X-RAY 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 .................. 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 \( \mu \text{f} \)
Cathode to all other electrodes ... 5 \( \mu \text{f} \)
External conductive coating to ultor \( \{ \) 1500 max. \( \mu \text{f} \)
\( \{ \) 1000 min. \( \mu \text{f} \)

Faceplate, Spherical .................. Filterglass
Light transmission (Approx.) ........ 76%
Phosphor (For curves, see front of this Section) \( \) P4—Sulfide Type
Aluminized
Fluorescence .................. White
Phosphorescence .................. White
Persistence .................. Short
Focusing Method ............... Electrostatic
Deflection Method ............. Magnetic

Deflection Angles (Approx.):
Diagonal .................. 110°
Horizontal .................. 105°
Vertical .................. 87°

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

Tube Dimensions:
Overall length .................. 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"

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
Base .................. Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

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ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Basing Designation for BOTTOM VIEW. 8JR

Basing Designation for BOTTOM VIEW. 8JR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.3
Pin 6 - Internal Connection Do Not Use
Pin 7 - Cathode

Pin 8 - Heater Cap - Ultor (Grid No.4, Collector) C - External Conductive Coating

GRID-DRIVE SERVICE

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

Maximum and Minimum Ratings, Design-Center Values:

ULTOR VOLTAGE 16000 max. volts
12000 min. volts

GRID-No.3 VOLTAGE 650 max. volts
GRID-No.2 VOLTAGE 550 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 16000 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
Grid-No.2 Current -15 to +15 μA
PICTURE TUBE

Field Strength of Adjustable Centering Magnet . . . . 0 to 12 gaussess

Examples of Use of Design Ranges:

<table>
<thead>
<tr>
<th>Design Ranges</th>
<th>Value 1</th>
<th>Value 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>With ultor voltage of</td>
<td>16000</td>
<td>16000</td>
</tr>
<tr>
<td>and grid-No.2 voltage of</td>
<td>400</td>
<td>500</td>
</tr>
<tr>
<td>Grid-No.3 Voltage for focus</td>
<td>0 to 400</td>
<td>0 to 400</td>
</tr>
<tr>
<td>Grid-No.1 Voltage for visual extinction of focused raster</td>
<td>-34 to -63</td>
<td>-43 to -78</td>
</tr>
<tr>
<td>Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value</td>
<td>34 to 63</td>
<td>43 to 78</td>
</tr>
</tbody>
</table>

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>Design Range</th>
<th>Value 1</th>
<th>Value 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR-TO-GRID-No.1 VOLTAGE</td>
<td>16000 max. volts</td>
<td>12000 min. volts</td>
</tr>
<tr>
<td>GRID-No.3-TO-GRID-No.1 VOLTAGE</td>
<td>650 max. volts</td>
<td></td>
</tr>
<tr>
<td>GRID-No.2-TO-GRID-No.1 VOLTAGE</td>
<td>690 max. volts</td>
<td></td>
</tr>
<tr>
<td>GRID-No.2-TO-CATHODE VOLTAGE</td>
<td>550 max. volts</td>
<td>300 min. volts</td>
</tr>
<tr>
<td>CATHODE-TO-GRID-No.1 VOLTAGE</td>
<td>200 max. volts</td>
<td></td>
</tr>
<tr>
<td>Positive-peak value</td>
<td>140 max. volts</td>
<td></td>
</tr>
<tr>
<td>Positive-bias value</td>
<td>0 max. volts</td>
<td></td>
</tr>
<tr>
<td>Negative-peak value</td>
<td>2 max. volts</td>
<td></td>
</tr>
<tr>
<td>PEAK HEATER-CATHODE VOLTAGE: Heater negative with respect to cathode: During equipment warm-up period not exceeding 15 seconds</td>
<td>410 max. volts</td>
<td></td>
</tr>
<tr>
<td>After equipment warm-up period</td>
<td>180 max. volts</td>
<td></td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>180 max. volts</td>
<td></td>
</tr>
</tbody>
</table>

Equipment Design Ranges:

<table>
<thead>
<tr>
<th>Design Range</th>
<th>Value 1</th>
<th>Value 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>With any ultor-to-grid-No.1 voltage ( (E_{c1g1}) ) between 12000 and 16000 volts and grid-No.2-to-grid-No.1 voltage ( (E_{c2g1}) ) between 400 and 690 volts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grid-No.3-to-Grid-No.1 Voltage for focus</td>
<td>0 to 400 volts</td>
<td></td>
</tr>
</tbody>
</table>
Cathode-to-Grid-No.1
Voltage \( (E_{k1}) \) 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:

With anode-to-grid- 

No.1 voltage of 16000 volts 
and grid-No.2-to-grid- 
No.1 voltage of 400 volts 

Grid-No.3-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. 

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 anode- or anode-to-grid-No.1 voltage is 11,000 volts, below which the serviceability of the 17DKP4 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 anode- or anode-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 1600 volts and is a function of the value of the anode voltage, anode current, and grid-No.2 voltage. It changes directly with the anode voltage at the rate of approximately 6 volts for each 1000-volt change in anode 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 anode current at the rate of about 60 volts for each 100-microampere change in anode current. Because the 17DKP4 has a narrow depth of focus, it is necessary to...
provide means such as a potentiometer or a 4-tap switch for adjusting the focusing voltage. In general, commercially acceptable focus is obtained if the focusing voltage is within 75 volts of the value required for optimum focus and if the focusing voltage is maintained to within 75 volts of the optimum value during line-voltage fluctuations.

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

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

**OPERATING CONSIDERATIONS**

*Shtatter-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 17DKP4 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*
PICTURE TUBE

SCREEN DIAGONAL 15 3/4" MIN.

SCREEN WIDTH 14 3/4" MIN.

SCREEN HEIGHT 11 1/16" MIN.

15 27/32" R.

15 1/32" R.

3 1/8" R.

2 5/8" R.

11 11/16" ± 1/8" (NOTE 6)

3°

2 1/2" R.

12" R.

105°

3 1/2" R.

1 1/8" ± 1/32" (NOTE 9)

SMALL-BUTTON NEOEIGHTAR 7-PIN BASE JEDEC M8B7-208 (NOTE 3)

REFERENCE LINE (NOTE 2)

X AXIS

y AXIS

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. 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.
Rasters-Cutoff-Range Charts

**GRID-DRIVE SERVICE**

- \( E_f = 6.3 \text{ VOLTS} \)
- ULTOR VOLTS = 12000 TO 16000
- GRID-№3 VOLTS ADJUSTED FOR FOCUS.

**CATHODE-DRIVE SERVICE**

- \( E_f = 6.3 \text{ VOLTS} \)
- ULTOR-TO-GRID-№1 VOLTS = 12000 TO 16000
- GRID-№3-TO-GRID-№1 VOLTS ADJUSTED FOR FOCUS.
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE

| E<sub>f</sub> = 6.3 VOLTS |
| ULTOR-TO-GRID-N<sub>1</sub> VOLTS = 16000 |
| CATHODE BIASED POSITIVE WITH RESPECT TO GRID N<sub>1</sub> TO GIVE FOCUSED RASTER CUTOFF. |
| RASTER FOCUSED AT AVERAGE BRIGHTNESS. |
| RASTER SIZE = 14" x 10 1/2" |

GRID-DRIVE SERVICE

| E<sub>f</sub> = 6.3 VOLTS |
| ULTOR VOLTS = 16000 |
| GRID N<sub>1</sub> BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF. |
| RASTER FOCUSED AT AVERAGE BRIGHTNESS. |
| RASTER SIZE = 14" x 10 1/2" |

I.C.I. COORDINATES OF SCREEN: X=0.270, Y=0.300

- CATHODE DRIVE
- GRID DRIVE
### Average Drive Characteristics

<table>
<thead>
<tr>
<th>Cathode-Drive Service</th>
<th>Grid-Drive Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E_C = 6.3 \text{ Volts}$</td>
<td>$E_C = 6.3 \text{ Volts}$</td>
</tr>
<tr>
<td>Ultor to Grid $\text{N}1$</td>
<td>Ultor Volts = 12000 to 16000</td>
</tr>
<tr>
<td>Volts = 12000 to 16000</td>
<td>Grid $\text{N}1$ biased negative with respect to cathode to give focused raster cutoff.</td>
</tr>
<tr>
<td>Cathode biased positive with respect to Grid $\text{N}1$ to give focused raster cutoff.</td>
<td></td>
</tr>
</tbody>
</table>

#### Video Signal Volts from Raster Cutoff

<table>
<thead>
<tr>
<th>Ultor Microamperes</th>
<th>Video Signal Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>600</td>
<td>600</td>
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<td>800</td>
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<tr>
<td>1200</td>
<td>1200</td>
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<tr>
<td>1400</td>
<td>1400</td>
</tr>
<tr>
<td>1600</td>
<td>1600</td>
</tr>
<tr>
<td>1800</td>
<td>1800</td>
</tr>
</tbody>
</table>

**Electron Tube Division**

Radio Corporation of America, Harrison, New Jersey

92CM-9932
17DQP4
Picture Tube

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: 450 ± 5% ma
- Heater Warm-Up Time (Average): 11 seconds
- Direct Interelectrode Capacitances:
  - Grid No.1 to all other electrodes: 6 µf
  - Cathode to all other electrodes: 5 µf
- External conductive coating to ultor: 1700 µf (max.), 1200 µf (min.)
- 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: Regular Band
- Contact area for grounding: Near Reference Line
- For Additional Information on Coatings and Dimensions: See Picture-Tube Dimensional-Outlines and Bulb J132-1/2 A/B sheets at the front of this section
- Cap: Recessed Small Cavity (JEDEC No.J1-21)
- Base: Special 6-Pin (JEDEC No.B6-214)
- Basing Designation for BOTTOM VIEW: 7FA

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

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

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

DATA
3-62
Maximum Ratings, Design-Maximum Values:

ULTOR-TO-GRID-No.1 VOLTAGE: 17600 max. volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:
  Positive value: 1100 max. volts
  Negative value: 550 max. volts
GRID-No.2-TO-GRID-No.1 VOLTAGE: 70 max. volts
CATHODE-TO-GRID-No.1 VOLTAGE:
  Positive bias value: 150 max. volts
  Negative peak value: 2 max. volts
PEAK HEATER-CATHODE VOLTAGE:
  Heater negative with respect to cathode:
    During equipment warm-up period not exceeding 15 seconds: 450 max. volts
    After equipment warm-up period: 200 max. volts
  Heater positive with respect to cathode: 200 max. volts

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage of 14500 volts
and grid-No.2-to-grid-No.1 voltage of 50 volts
Grid-No.4-to-Grid-No.1 Voltage for focus: -200 to +350 volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster: 31 to 49 volts

Maximum Circuit Values:

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

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

SHORT RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
110° MAGNETIC DEFLECTION
INTERNAL MAGNETIC SHIELD
With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:
Direct Interelectrode Capacitances:
- Cathode to all other electrodes: 3.65 pf
- Grid No.1 to all other electrodes: 4.15 pf
- External conductive coating to anode: 1400 max. pf, 900 min. pf
- Heater Current at 2.68 volts: 450 ± 45 ma
- Heater Warm-Up Time (Average): 11 seconds
- Electron Gun: Type Requiring No Ion-Trap Magnet

Optical:
- Phosphor (For curves, see front of this section): P4—Sulfide Type, Aluminized
- Faceplate, Spherical: Filterglass
- Light transmission (Approx.): 77%

Mechanical:
- Weight (Approx.): 10 lbs
- Overall Length: 10-13/16" ± 3/16"
- Neck Length: 3-11/16" ± 1/16"
- Projected Area of Screen: 155 sq. in.
- External Conductive Coating: Modified-Band
- Contact area for grounding: Near Reference Line

For Additional Information on Coatings and Dimensions:
See Picture-Tube Dimensional-Outlines and Bulb J192-1/2 A/B sheets at front of this section

Cap.: Recessed Small Cavity (JEDEC No.J1-21)
Base: Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW: 8JK

Pin 1 - Heater
Pin 2 - Grid No.2
Pin 3 - Grid No.1
Pin 4 - Grid No.4
Pin 5 - Grid No.2
Pin 7 - Cathode
Pin 8 - Heater

Cap - Anode
[Grid No.3, Screen, Collector]
C - External Conductive Coating

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

DATA 4-63
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>
</tr>
</thead>
<tbody>
<tr>
<td>ANODE VOLTAGE</td>
<td>17600 max. volts</td>
</tr>
<tr>
<td>GRID-No.4 (FOCUSING) VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>950 max. volts</td>
</tr>
<tr>
<td>Negative value</td>
<td>700 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>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>
<tr>
<td>HEATER VOLTAGE</td>
<td>2.9 max. volts</td>
</tr>
<tr>
<td></td>
<td>2.4 min. volts</td>
</tr>
</tbody>
</table>

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>14000 volts</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>100 to 500 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>-35 to -72 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
### 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 μf
- Cathode to all other electrodes: 5 μf
- External conductive coating to ultor: 1500 max. μf
  1000 min. μf

Faceplate, Spherical:
- Filterglass: 78%

Phosphor (for curves, see front of this section):
- P4—Sulfide Type
- Aluminized
- White
- Medium-Short
- ELECTRON TUBE DIVISION

### Focusing Method
- Type Requiring No Ion-Trap Magnet

### Deflection Method
- Electrostatic
- Magnetic

### Deflection Angles (Approx.)
- Diagonal: 110°
- Horizontal: 105°
- Vertical: 87°

### Tube Dimensions:
- Overall length: 11-1/4" ± 3/16"
- Greatest width: 15-5/8" ± 1/8"
- Greatest height: 12-3/4" ± 1/8"
- Diagonal: 16-9/16" ± 1/8"
- Neck length: 4-1/8" ± 1/8"
- Radius of curvature of faceplate (External surface): 20-3/4"

### Screen Dimensions (Minimum):
- Greatest width: 14-3/4"
- Greatest height: 11-11/16"
- Diagonal: 15-3/4"
- Projected area: 155 sq. in.
- Weight (Approx.): 10 lbs
- Operating Position: Any
- Cap: Recessed Small Cavity (JEDEC No.J1-21)
- Bulb: J132-1/2 A1/B1
- Socket: Ucinite Part No.115446, or equivalent

### Operating Position

---

RCA
I7DSP4
PICTURE TUBE
RECTANGULAR GLASS TYPE
ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS
MAGNETIC DEFLECTION

With heater having controlled warm-up time
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>voltage</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>U LTOR VOLTAGE</td>
<td>18000 max. volts</td>
</tr>
<tr>
<td>U LTOR VOLTAGE</td>
<td>12000 min. volts</td>
</tr>
<tr>
<td>GRID-No.4 (FOCUSBING) VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>1000 max. volts</td>
</tr>
<tr>
<td>Negative value</td>
<td>500 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></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></td>
</tr>
<tr>
<td>During equipment warm-up period</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 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 determined for Ec1k except video drive is a positive voltage.
PICTURE TUBE

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

Examples of Use of Design Ranges:

- With ultor voltage of 16000 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 (FOCUSING) VOLTAGE:
  - Positive value: 1000 max. volts
  - Negative value: 500 max. volts
- GRID-No.2-TO-GRID-No.1 VOLTAGE: 640 max. volts
- GRID-No.2-TO-CATHODE VOLTAGE: 500 max. volts
- CATHODE-TO-GRID-No.1 VOLTAGE:
  - Positive-peak value: 200 max. volts
  - Positive-bias value: 140 max. volts
  - Negative-bias value: 0 max. volts
  - Negative-peak value: 2 max. volts
- PEAK HEATER-CATHODE VOLTAGE:
  - Heater negative with respect to cathode:
    - During equipment warm-up period not exceeding 15 seconds: 410 max. volts
    - After equipment warm-up period: 180 max. volts
  - Heater positive with respect to cathode: 180 max. volts

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

DATA 2
Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage \((E_{c1})\) between 12000 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 \(^1\)...
\hspace{2cm} 0 \text{ to } 400 \text{ volts}

Cathode-to-Grid-No.1 Voltage
\((E_{k1})\) for visual extinction
of focused raster \(^1\)...
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) \(^1\)...
Same value as determined for
\(E_{k1}\) except video drive is a
negative value

Grid-No.4 Current \(^1\)...
\hspace{2cm} -25 \text{ to } +25 \mu\text{A}

Grid-No.2 Current \(^1\)...
\hspace{2cm} -15 \text{ to } +15 \mu\text{A}

Field Strength of Adjustable Centering Magnet* \(^1\)...
\hspace{2cm} 0 \text{ to } 8 \text{ 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...
\hspace{2cm} 0 \text{ to } 400 \text{ volts}

Cathode-to-Grid-No.1
Voltage for visual extinction of focused raster...
\hspace{2cm} 35 \text{ to } 63 \text{ volts}

Cathode-to-Grid-No.1 Video
Drive from Raster Cutoff
(Black level):
White-level value...
\hspace{2cm} -35 \text{ to } -63 \text{ volts}

Maximum Circuit Values:

Grid-No.1-Circuit Resistance...
\hspace{2cm} 1.5 \text{ max. megohms}

\(^1\) Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

\(^2\) 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.

\(^3\) 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 No.1 and the other electrodes.

OPERATING CONSIDERATIONS

Shatter-Proof Cover Over the Tube Face. Following conventional picture-tube practice, it is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of the 17DSP4 to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.

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


NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

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

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

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

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

GRID-DRIVE SERVICE

$E_f = 6.3$ VOLTS
ULTOR VOLTS = 12000 TO 18000
GRID-N\textsuperscript{4} VOLTS ADJUSTED FOR FOCUS.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{chart1}
\caption{GRID-DRIVE SERVICE}
\end{figure}

CATHODE-DRIVE SERVICE

$E_f = 6.3$ VOLTS
ULTOR-TO-GRID-N\textsuperscript{1} VOLTS = 12000 TO 18000
GRID-N\textsuperscript{4} TO GRID-N\textsuperscript{1} VOLTS ADJUSTED FOR FOCUS.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{chart2}
\caption{CATHODE-DRIVE SERVICE}
\end{figure}
# Average Drive Characteristics

## Cathode-Drive Service
- \( E_f = 6.3 \) Volts
- Ultor-to-Grid-N1 Volts = 16000
- Cathode biased positive with respect to Grid N1 to give focused raster cutoff.
- Raster focused at average brightness.
- Raster size = 14" x 10½"

## Grid-Drive Service
- \( E_f = 6.3 \) Volts
- Ultor Volts = 16000
- Grid N1 biased negative with respect to cathode to give focused raster cutoff.
- Raster focused at average brightness.
- Raster size = 14" x 10½"

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**Graph:**

- **Cathode Drive**
- **Grid Drive**

**Axes:**
- X-axis: Video Signal Volts from Raster Cutoff
- Y-axis: Brightness—Footlamberts

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Electron Tube Division
Radio Corporation of America, Harrison, New Jersey

92CM-10380
# Average Drive Characteristics

<table>
<thead>
<tr>
<th>Cathode-Drive Service</th>
<th>Grid-Drive Service</th>
</tr>
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<tbody>
<tr>
<td>$E_f = 6.3$ Volts</td>
<td>$E_f = 6.3$ Volts</td>
</tr>
<tr>
<td>Ultor-to-Grid $N01$</td>
<td>Ultor Volts $= 12000$ to $18000$</td>
</tr>
<tr>
<td>Volts $= 12000$ to $18000$</td>
<td>Grid $N01$ biased negative with respect to cathode to give focused raster cutoff.</td>
</tr>
<tr>
<td>Cathode biased positive with respect to grid $N01$ to give focused raster cutoff.</td>
<td></td>
</tr>
</tbody>
</table>

**Graph:**

- **Cathode Drive**
- **Grid Drive**

**Axes:**
- Video Signal Volts from Raster Cutoff
- Ultron Milliamperes

**Legend:**
- Video Signal Volts from Raster Cutoff: 0, 20, 40, 60, 80
- Ultron Milliamperes: 0.5, 1, 1.5, 2, 2.5

**Note:**
- Electron Tube Division
- Radio Corporation of America, Harrison, New Jersey

**Reference:** 92CM-10382
Picture Tube

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

GENERAL DATA

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

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

Mechanical:
Operating Position Any
Weight (Approx.) 18 lbs
Overall Length 19-3/16" ± 3/8"
Neck Length 7-1/2" ± 3/16"
Projected Area of Screen 149 sq. in.
External Conductive Coating Type Regular-Band Contact area for grounding Near Reference Line

For Additional Information on Coatings and Dimensions:
See Picture-Tube Dimensional-Outlines and Bulb J133 B/D sheets at the front of this section

Cap Recessed Small Cavity (JEDEC No.J1-21)
Base Small-Shell Duodecal 6-Pin, Arrangement 1, (JEDEC Group 4, No.B6-63)
Basing Designation for BOTTOM VIEW 12L

Pin 1—Heater
Pin 2—Grid No.1
Pin 6—Grid No.4
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater

Cap—Ultor
  (Grid No.3, Grid No.5, Collector)
C—External Conductive Coating
Maximum Ratings, Design-Maximum Values:

ULTOR VOLTAGE .......................... 22000 max. volts
GRID-No.4 (FOCUSING) VOLTAGE:
   Positive value .................................. 800 max. volts
GRID-No.2 VOLTAGE .......................... 700 max. volts
GRID-No.1 VOLTAGE:
   Negative bias value .............................. 180 max. volts
   Positive bias value .............................. 0 max. volts
   Positive peak value .............................. 2 max. volts

Typical Operating Conditions:

With ultor voltage of 18000 volts
and grid-No.2 voltage of 300 volts
Grid-No.4 Voltage for focus ............... 0 to 400 volts
Grid-No.1 Voltage for visual extinction of focused raster .......... -28 to -72 volts

For X-radiation shielding considerations, see sheet X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES at front of this section
SHORT RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
ALUMINIZED SCREEN
MAGNETIC DEFLECTION
With Heater Having Controlled Warm-Up Time

DATA

General:
Heater, for Unipotential Cathode:
Voltage (AC or DC) ..................................... 6.3 volts
Current at 6.3 volts ..................................... 0.45 amp
Warm-up time (Average) ................................ 11 sec
Direct Interelectrode Capacitances:
Grid No.1 to all other electrodes ................. 6 μμf
Cathode to all other electrodes ................. 5 μμf
External conductive coating to ultor. (1500 max. 1000 min. 1500 max.)

Faceplate, Spherical ................................ Filterglass
Light transmission (Approx.) ....................... 77%
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 ......................................... 10-11/16" ± 1/4"
Greatest width .......................................... 15-5/8" ± 1/8"
Greatest height ......................................... 12-3/4" ± 1/8"
Diagonal .................................................. 16-9/16" ± 1/8"
Neck length ............................................ 3-9/16" ± 1/8"
Radius of curvature of faceplate
(External surface) ..................................... 20-3/4"

Screen Dimensions (Minimum):
Greatest width ......................................... 14-3/4"
Greatest height ......................................... 11-11/16"
Diagonal .................................................. 15-3/4"
Projected area ......................................... 155 sq. in.
Weight (Approx.) ....................................... 10 lbs
Operating Position .................................... Any
Cap ...................................................... Recessed Small Cavity (JEDEC No.J1-21)
Bulb ....................................................... J132-1/2 A/B
Socket .................................................... Ucinite Part No.115446, or equivalent
Base ..................................................... Small-Button Neoeightar 7-Pin, Arrangement 1,
(JEDEC No.B7-208)
**GRID-DRIVE SERVICE**

_Unless otherwise specified, voltage values are positive with respect to cathode_

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

**ULTOR VOLTAGE:**

- Maximum: 16000 volts
- Minimum: 12000 volts

**GRID-No.3 (FOCUSING) VOLTAGE**

- Maximum: 650 volts
- Minimum: 550 volts

**GRID-No.2 VOLTAGE**

- Maximum: 300 volts

**GRID-No.1 VOLTAGE:**

- Negative-peak value: 200 volts
- Negative-bias value: 140 volts
- Positive-bias value: 0 volts
- Positive-peak value: 2 volts

**PEAK HEATER-CATHODE VOLTAGE:**

- Heater negative with respect to cathode:
  - During equipment warm-up period not exceeding 15 seconds: 410 volts
  - After equipment warm-up period: 180 volts
- Heater positive with respect to cathode: 180 volts

**Equipment Design Ranges:**

-With any ultor voltage ($E_{ck}$) between 12000 and 16000 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 ($E_{ck}$)**

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 $E_{ck}$ except video drive is a positive voltage

**Grid-No.3 Current**

- -25 to +25 µA

**Grid-No.2 Current**

- -15 to +15 µA
Field Strength of Adjustable Centering Magnet: 0 to 12 gausses

Examples of Use of Design Ranges:

<table>
<thead>
<tr>
<th>Description</th>
<th>Voltage Ranges</th>
<th>Grid-No.3 Voltage for focus</th>
<th>Grid-No.1 Voltage for visual extinction of focused raster</th>
<th>Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value</th>
</tr>
</thead>
<tbody>
<tr>
<td>With ultor voltage of 16000 volts and grid-No.2 voltage of 400 volts</td>
<td>0 to 400 volts</td>
<td>-34 to -63 volts</td>
<td>-43 to -78 volts</td>
<td>34 to 63 volts</td>
</tr>
</tbody>
</table>

Maximum Circuit Values:

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

**CATHODE-DRIVE® SERVICE**

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

<table>
<thead>
<tr>
<th>Description</th>
<th>Maximum and Minimum Ratings</th>
<th>Design-Center Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR-TO-GRID-No.1 VOLTAGE</td>
<td>16000 max. volts</td>
<td>12000 min. volts</td>
</tr>
<tr>
<td>GRID-No.3-TO-GRID-No.1 (FOCUSING) VOLTAGE</td>
<td>650 max. volts</td>
<td></td>
</tr>
<tr>
<td>GRID-No.2-TO-GRID-No.1 VOLTAGE</td>
<td>690 max. volts</td>
<td></td>
</tr>
<tr>
<td>GRID-No.2-TO-CATHODE VOLTAGE</td>
<td>550 max. volts</td>
<td>300 min. volts</td>
</tr>
<tr>
<td>CATHODE-TO-GRID-No.1 VOLTAGE: Positive-peak value</td>
<td>200 max. volts</td>
<td></td>
</tr>
<tr>
<td>Positive-bias value</td>
<td>140 max. volts</td>
<td></td>
</tr>
<tr>
<td>Negative-bias value</td>
<td>0 max. volts</td>
<td></td>
</tr>
<tr>
<td>Negative-peak value</td>
<td>2 max. volts</td>
<td></td>
</tr>
</tbody>
</table>

**PEAK HEATER-CATHODE VOLTAGE:**

Heater negative with respect to cathode:

<table>
<thead>
<tr>
<th>Description</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<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 \(E_{c_{ug1}}\) between 12000 and 16000 volts and grid-No.2-to-grid-No.1 voltage \(E_{c_{ug2}}\) between 400 and 690 volts

<table>
<thead>
<tr>
<th>Description</th>
<th>Voltage for focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.3-to-Grid-No.1</td>
<td>0 to 400 volts</td>
</tr>
</tbody>
</table>
Cathode-to-Grid-No.1 Voltage (Eg1) 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 Eg1 except video drive is a negative voltage.

Grid-No.3 Current -25 to +25 µa
Grid-No.2 Current -15 to +15 µa
Field Strength of Adjustable Centering Magnet 0 to 12 gausses

Examples of Use of Design Ranges:

With ultor-to-grid-
No.1 Voltage of 16000
and grid-No.2 to-grid-
No.1 Voltage of 400
Grid-No.3 to-Grid-
No.1 Voltage for focus 0 to 400 0 to 400 volts

Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster 34 to 56 41 to 69 volts

Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level):
White-level value -34 to -56 -41 to -69 volts

Maximum Circuit Values:

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

Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

This value is a working design-center minimum. The equivalent absolute minimum ultor- or ultor-to-grid-No.1 voltage is 11,000 volts, below which the serviceability of the 17DXP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor- or ultor-to-grid-No.1 voltage is never less than 11,000 volts.

The grid-No.3 voltage required for optimum focus of any individual tube may have a value anywhere between 0 and ±00 volts and is a function of the value of the ultor voltage, ultor current, and grid-No.2 voltage. It changes directly with the ultor voltage at the rate of approximately 46 volts for each 1000-volt change in ultor voltage; inversely with grid-No.2 voltage at the rate of about 60 volts for each 100-volt change in grid-No.2 voltage; and inversely with ultor current at the rate of about 60 volts for each 100-microampere change in ultor current. Because the 17DXP4 has a narrow depth of focus, it is necessary to provide means such as a potentiometer or a µ-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.

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
SCREEN DIAGONAL 15 3/4" MIN.

SCREEN HEIGHT 11 11/16" MIN.

SCREEN WIDTH 14 3/4" MIN.

15 27/32" R.
15 13/32" R.
3 1/8" R.
2 5/8" R.

15 5/6" ±1/8" (NOTE 6)

2 1/2" R.

20 3/4" R.

105°

12" R.

920°

11 3/16" ±1/8"

1 1/8" ±1/32"

3°

Y AXIS

REFERENCE LINE (NOTE 2)

X AXIS

SMALL-BUTTON NEOIGHTAR 7-PIN BASE ARRANGEMENT 1
JEDEC N#B7-208 (NOTE 3)


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

$E_p = 6.3$ Volts
Ultor Volts = 12000 to 16000
Grid-N23 Volts Adjusted for Focus.

Cathode-Drive Service

$E_p = 6.3$ Volts
Ultor-to-Grid-N81 Volts = 12000 to 16000
Grid-N83-to-Grid-N81 Volts Adjusted for Focus.
# 17GP4 Picture Tube

## Rectangular Metal-Shell Type

### Electrostatic Focus

### Magnetic Deflection

### General:
- **Heater**, for Unipotential Cathode:
  - Voltage: 6.3... ac or dc volts
  - Current: 0.6 ± 10%... amp
- **Faceplate**, Spherical: Frosted Filterglass
- **Phosphor** (for curves, see front of this Section): P4—Sulfide Type

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

### Electron Gun: Ion-Trap Type Requiring External Single-Field Magnet

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

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

### Operating Position: Any

### Ultor Terminal: Metal-Shell Lip Base.. Small-Shell Duodecal 6-Pin (JETEC Group 4, No.86-63)

### Basing Designation for BOTTOM VIEW: 12M

### Pin Map:

<table>
<thead>
<tr>
<th>Pin 1—Heater</th>
<th>Pin 2—Grid No.1</th>
<th>Pin 6—Grid No.4</th>
<th>Pin 10—Grid No.2</th>
<th>Pin 11—Cathode</th>
<th>Pin 12—Heater</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>4</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
</tbody>
</table>

### Maximum Ratings, Design-Center Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Minimum Value</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultor Voltage</td>
<td>16000 max. volts</td>
<td>16000 max. volts</td>
</tr>
<tr>
<td>Grid-No.4 (FOCUSING) Voltage</td>
<td>5000 max. volts</td>
<td>5000 max. volts</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>500 max. volts</td>
<td>500 max. volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td>125 max. volts</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>Negative-bias value</td>
<td>0 max. volts</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive-bias value</td>
<td>2 max. volts</td>
<td>2 max. volts</td>
</tr>
</tbody>
</table>

*Indicates a change.*

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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
## 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: Ion-Trap Type Requiring External Single-Field 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-OUT lines 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 (FOCUSBING) VOLTAGE:
  - Positive value: 1100 max. volts
  - Negative value: 550 max. volts

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RADIO CORPORATION OF AMERICA
Data 4-63
Electron Tube Division
Harrison, N. J.
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
17LP4A

Picture Tube

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

GENERAL DATA

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: 
    1500 max. pf
    750 min. pf
Heater Current at 6.3 volts: 600 ± 30 ma
Electron Gun: Ion-Trap Type Requiring External Single-Field Magnet

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

Mechanical:
Weight (Approx.): 19 lbs
Overall Length: 19-3/16" ± 3/8"
Neck Length: 7-1/2" ± 3/16"
Projected Area of Screen: 149 sq. in.
External Conductive Coating:
  Type: Regular-Band
  Contact area for grounding: Near Reference Line
For Additional Information on Coatings and Dimensions:
  See Picture-Tube Dimensional-Outlines and Bulb J133 C/E sheets at front of this section
Cap.: Recessed Small Cavity (JEDEC No.J1-21)
Base: Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-63)
Basing Designation for BOTTOM VIEW: 12L

Pin 1-Heater
Pin 2-Grid No.1
Pin 6-Grid No.4
Pin 10-Grid No.2
Pin 11-Cathode
Pin 12-Heater

Maximum and Minimum Ratings, Design-Maximum Values:
  Unless otherwise specified, voltage values are positive with respect to cathode
ANODE VOLTAGE: 17500 max. volts
GRID-No.4 (FOCUSING) VOLTAGE:
  Positive value: 1100 max. volts
  Negative value: 550 max. volts
GRID-No.2 VOLTAGE ..................... 550 max. volts
GRID-No.1 VOLTAGE:
   Negative peak value ................. 220 max. volts
   Negative bias value ............... 155 max. volts
   Positive bias value ............. 0 max. volts
   Positive peak value ............ 2 max. volts
HEATER VOLTAGE .................. 6.9 max. volts
                    \ 5.7 min. volts
PEAK HEATER–CATHODE VOLTAGE:
   Heater negative with respect to cathode:
       During equipment warm-up period not exceeding 15 seconds ... 450 max. volts
       After equipment warm-up period ... 200 max. volts
   Heater positive with respect to cathode:
       Combined AC and DC voltage ...... 200 max. volts
       DC component ................ 100 max. volts

Typical Operating Conditions for Grid-Drive Service:

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

Anode Voltage ..................... 14000 volts
Grid-No.4 Voltage .................. -56 to +310 volts
Grid-No.2 Voltage ................. 300 volts
Grid-No.1 Voltage for visual extinction of focused raster ...... -28 to -72 volts

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

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

RECTANGULAR GLASS TYPE
MAGNETIC FOCUS
ALUMINIZED SCREEN
MAGNETIC DEFLECTION

DATA

General:
Heater, for Unipotential Cathode:
Voltage: 6.3 ac or dc volts
Current: 0.6 ± 10% amp
Capacitance between External Conductive Coating and Ultor:
1500 max. μμf
750 min. μμf
Faceplate, Cylindrical: Filterglass
Phosphor (For Curves, see front of this Section): P4—Sulfide Type Aluminized
Deflection Angles (Approx.):
Diagonal: 70°
Horizontal: 65°
Vertical: 50°
Electron-Gun: Ion-Trap Type Requiring External Single-Field Magnet
Tube Dimensions:
Overall length: 19-3/16" ± 3/8"
Greatest width: 15-25/64" ± 1/8"
Greatest height: 12-9/32" ± 1/8"
Diagonal: 16-5/8" ± 1/8"
Neck length: 7-1/2" ± 3/16"
Radius of curvature of faceplate (External horizontal surface): 27"
Screen Dimensions (Minimum):
Greatest width: 14-1/4"
Greatest height: 10-3/4"
Diagonal: 15-5/16"
Projected area: 140 sq. in.
Operating Position: Any
Cap.: Recessed Small Cavity (JETEC No. J1-21)
Base: Small-Shell Duodecal 5-Pin (JETEC Group 4, No. B5-57)
Basing Designation for BOTTOM VIEW: 12N

Maximum Ratings, Design-Center Values:
ULTOR VOLTAGE: 18000 max. volts
GRID-No.2 VOLTAGE: 500 max. volts
GRID-No.1 VOLTAGE:
Negative-bias value: 125 max. volts
Positive-bias value: 0 max. volts
Positive-peak value: 2 max. volts

Indicates a change.
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

For X-ray shielding considerations, see sheet
X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section
PICTURE TUBE
RECTANGULAR METAL-SHELL TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

DATA

General:
Heater, for Unipotential Cathode:
Voltage: 6.3 ac or dc volts
Current: 0.6 ± 10% amp
Faceplate, Spherical: Frosted Filterglass
Phosphor (for curves, see front of this Section): P4—Sulfide Type
Deflection Angles (Approx.):
Diagonal: 70°
Horizontal: 66°
Vertical: 50°
Electron Gun: Ion-Trap Type Requiring External Single-Field Magnet

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

Screen Dimensions (Minimum):
Greatest width: 14-3/8"
Greatest height: 10-11/16"
Diagonal: 15-1/4"
Operating Position: Any
Ultor Terminal: Metal-Shell Lip
Base: Small-Shell Duodecal 6-Pin (JETEC Group 4, No.86-63)
Basing Designation for BOTTOM VIEW: .12M

Pin 1—Heater
Pin 2—Grid No.1
Pin 6—Grid No.4
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater

Metal-Shell Lip — Ultor
(Grid No.3, Collector)

Maximum Ratings, Design-Center Values:
ULTOR VOLTAGE: 16000 max. volts
GRID-No.4 (FOCUSING) VOLTAGE:
Positive value: 1000 max. volts
Negative value: 500 max. volts
GRID-No.2 VOLTAGE:
500 max. volts
GRID-No.1 VOLTAGE:
Negative-bias value: 125 max. volts
Positive-bias value: 0 max. volts
Positive-peak value: 2 max. volts

Indicates a change.
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
19ABP4

Picture Tube

SHORT RECTANGULAR GLASS TYPE
ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS
114° MAGNETIC DEFLECTION
INTERNAL MAGNETIC SHIELD

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Direct Interelectrode Capacitances:
- Cathode to all other electrodes ... 3.4 pf
- Grid No.1 to all other electrodes .. 3.4 pf
- External conductive coating to anode. \{1400 max. \ 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

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

DATA
4-63
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/Minimum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ANODE VOLTAGE</strong></td>
<td>20000 max. volts</td>
</tr>
<tr>
<td><strong>GRID-No.4 (FOCUSING) VOLTAGE:</strong></td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>950 max. volts</td>
</tr>
<tr>
<td>Negative value</td>
<td>700 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 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>
<tr>
<td><strong>HEATER VOLTAGE</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.9 max. volts</td>
</tr>
<tr>
<td></td>
<td>2.4 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... 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>16000 volts</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>100 to 500 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>-35 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
**BI-PANEL RECTANGULAR GLASS TYPE**

**ALUMINIZED SCREEN**

**LOW-VOLTAGE ELECTROSTATIC FOCUS**

**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
- Electron Gun: Type Requiring No Ion-Trap Magnet

**Optical:**
- Faceplate and Protective Panel: Filterglass
- Light transmission (Approx.): 44%
- Phosphor (For Curves, see front of this Section): P4—Sulfide Type, Aluminized

**Mechanical:**
- Operating Position: Any
- Weight (Approx.): 18-1/2 lbs
- Overall Length: 11-5/8" ± 5/16"
- Neck Length: 4-1/8" ± 1/8"
- Projected Area of Screen: 172 sq. in.
- External Conductive Coating:
  - Type: Regular Band
  - Contact area for grounding: Near Reference Line

For Additional Information on Coatings and Dimensions:
- See Picture-Tube Dimensional-Outlines and Bulb 149 C sheets at the front of this section
- Cap: Recessed Small Cavity (JEDEC No.J1-21)
- Base: Small-Button Neoeightar 7-Pin, Arrangement 1 (JEDEC No.B7-208)

Basing Designation for BOTTOM VIEW: 8HR

Pin 1—Heater
Pin 2—Grid No.1
Pin 3—Grid No.2
Pin 4—Grid No.4
Pin 6—Grid No.1
Pin 7—Cathode
Pin 8—Heater

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

**RADIO CORPORATION OF AMERICA**
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
and grid-No.2 voltage of
Grid-No.4 Voltage for focus. ........ 0 to 400 volts
Grid-No.1 Voltage for visual extinction
of focused raster. ........ -35 to -72 volts

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

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

SHORT RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
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: (1500 max. 1000 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: Filterglass
- Light transmission (Approx.): 78%

Mechanical:
- Weight (Approx.): 13-1/2 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 front of this section

Cap: Recessed Small Cavity (JEDEC No.J1-21)
Base: Small-Button Neonightar 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

<table>
<thead>
<tr>
<th>Component</th>
<th>Minimum Value</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANODE VOLTAGE</td>
<td>12000 min.</td>
<td>17600 max.</td>
</tr>
<tr>
<td>GRID-No.4 (FOCUSING) 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>GRID-No.2 VOLTAGE</td>
<td>650 max.</td>
<td></td>
</tr>
<tr>
<td>CATHODE VOLTAGE:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative peak value</td>
<td>2 max.</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>0 max.</td>
<td></td>
</tr>
<tr>
<td>Positive bias value</td>
<td>154 max.</td>
<td></td>
</tr>
<tr>
<td>Positive peak value</td>
<td>220 max.</td>
<td></td>
</tr>
<tr>
<td>PEAK HEATER-CATHODE VOLTAGE:</td>
<td>6.9 max.</td>
<td>5.7 min.</td>
</tr>
<tr>
<td>Heater negative with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>respect to cathode:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>During equipment warm-up period</td>
<td>450 max.</td>
<td>200 max.</td>
</tr>
<tr>
<td>After equipment warm-up period</td>
<td>200 max.</td>
<td></td>
</tr>
<tr>
<td>Heater positive with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>respect to cathode:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combined AC and DC voltage</td>
<td>200 max.</td>
<td>100 max.</td>
</tr>
<tr>
<td>DC component</td>
<td></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

Anode Voltage                 | 14000 volts |
Grid-No.4 Voltage              | 0 to 400 volts |
Grid-No.2 Voltage              | 500 volts |
Cathode Voltage for visual extinction of focused raster | 40 to 63 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
**19AJP4**

**Picture Tube**

**SHORT RECTANGULAR GLASS TYPE**  
**LOW-VOLTAGE ELECTROSTATIC FOCUS**  
**LOW GRID-No.2 VOLTAGE**  
**ALUMINIZED SCREEN**  
**114° MAGNETIC DEFLECTION**  
**CATHODE-DRIVE TYPE**  

With Heater Having Controlled Warm-Up Time

**GENERAL DATA**

**Electrical:**
- Heater Current at 6.3 volts .................. 450 ± 10% ma
- Heater Warm-Up Time (Average) ............. 11 seconds

Direct Interelectrode Capacitances:
- Grid No.1 to all other electrodes .......... 6 μf
- Cathode to all other electrodes .......... 5 μf
- External conductive coating to ultor. .... 1900 max. μf
- 1400 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 ............................ 11-3/8" ± 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

RADIO CORPORATION OF AMERICA  
Electron Tube Division  
Harrison, N. J.  
DATA 5-62
### Maximum and Minimum Ratings, Design-Maximum Values:

<table>
<thead>
<tr>
<th>Description</th>
<th>Positive Value</th>
<th>Negative Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR-TO-GRID-No.1 VOLTAGE.</td>
<td>1100 max. volts</td>
<td>500 max. volts</td>
</tr>
<tr>
<td>GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive value.</td>
<td>70 max. volts</td>
<td></td>
</tr>
<tr>
<td>Negative value.</td>
<td>40 min. volts</td>
<td></td>
</tr>
<tr>
<td>GRID-No.2-TO-GRID-No.1 VOLTAGE.</td>
<td>100 max. volts</td>
<td></td>
</tr>
<tr>
<td>CATHODE-TO-GRID-No.1 VOLTAGE.</td>
<td>7 max. volts</td>
<td></td>
</tr>
<tr>
<td>PEAK HEATER-CATHODE VOLTAGE:</td>
<td>5.8 min. volts</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>410 max. volts</td>
<td></td>
</tr>
<tr>
<td>After equipment warm-up period.</td>
<td>180 max. volts</td>
<td></td>
</tr>
<tr>
<td>Heater positive with respect to cathode.</td>
<td>180 max. volts</td>
<td></td>
</tr>
</tbody>
</table>

### 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
19ANP4

Picture Tube

SHORT RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
ALUMINIZED SCREEN
114° MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

The 19ANP4 is the same as the 19YP4 except for the following item:

Electrical:

Heater Current at 6.3 volts. . . . . . . . . . . . 450 ± 5% ma
MAGNETIC FOCUS MAGNETIC DEFLECTION

DATA

General:
Heater, for Unipotential Cathode:
  Voltage: 6.3 ac or dc volts
  Current: 0.6 ± 10% amp
Faceplate, Spherical: Frosted Filterglass
Phosphor (for curves, see front of this Section): P4—Sulphide Type
Deflection Angle (Approx.): 66°
Electron Gun: Ion-Trap Type Requiring External Single-Field Magnet

Overall Length: 21-1/2" ± 1/2"
Greatest Diameter of Bulb: 18-5/8" ± 1/8"
Minimum Useful Screen Diameter: 17-1/4"
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

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:
  Heater positive with respect to cathode: 150 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"

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Electron Tube Division
Radio Corporation of America, Harrison, New Jersey
BI-PANEL RECTANGULAR GLASS TYPE  ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS  114° MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

GENERAL DATA

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
- 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 and Protective Panel. . . . . Filterglass
- Light transmission (Approx.). . . . . . 44%
- Surface of Protective Panel . . . Treated to reduce specular reflection

Mechanical:
- Weight (Approx.). . . . . . . . . . 18-1/2 lbs
- Overall Length. . . . . . . . . 11-5/8" ± 5/16"
- Neck Length . . . . . . . . 4-1/8" ± 1/8"
- Projected Area of Screen . . . . . 174 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 J49 C sheets at front of this section
- Cap . . . . . . . Recessed Small Cavity (JEDEC No.J1-21)
- Base . . . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

Basing Designation for BOTTOM VIEW. . . . . . . . 8HR

Pin 1—Heater
Pin 2—Grid No.1
Pin 3—Grid No.2
Pin 4—Grid No.4
Pin 6—Grid No.1
Pin 7—Cathode
Pin 8—Heater

Cap—Anode
- (Grid No.3, Grid No.5, Screen, Collector)
- C—External Conductive Coating
Maximum and Minimum Ratings, Design-Maximum Values:

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

ANODE VOLTAGE ............. 20000 max. volts
GRID-No.4 (FOCUSING) VOLTAGE:
  Positive value .................. 1100 max. volts
  Negative value .................. 550 max. volts
GRID-No.2 VOLTAGE .......... 550 max. volts
GRID-No.1 VOLTAGE:
  Negative peak value ............. 220 max. volts
  Negative bias value ............ 155 max. volts
  Positive bias value ............. 0 max. volts
  Positive peak value ............. 2 max. volts
HEATER VOLTAGE ............. \{6.9 max. volts, 5.7 min. volts
PEAK HEATER–CATHODE VOLTAGE:
  Heater negative with respect to cathode:
    During equipment warm-up period not exceeding 15 seconds .................. 450 max. volts
    After equipment warm-up period .................. 200 max. volts
  Heater positive with respect to cathode:
    Combined AC and DC voltage .................. 200 max. volts
    DC component .................. 100 max. volts

Typical Operating Conditions for Grid-Drive Service:

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

Anode Voltage .................. 16000 volts
Grid-No.4 Voltage .................. 0 to 400 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
19AVP4

Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
With Heater Having Controlled Warm-Up Time

ALUMINIZED SCREEN
MAGNETIC DEFLECTION

GENERAL DATA

Electrical:
Heater Current at 6.3 volts ........ 600 ± 30 ma
Heater Warm-Up Time (Average) .... 11 seconds
Focusing Method .................. Electrostastic
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 ultor. 1500 max. 1000 min. μf

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

Optical:
Faceplate ................................ Filterglass
  Light transmission at center (Approx.) 78%
Phosphor (For curves, see front of this section) P4—Sulfide Type Aluminized
  Fluorescence ................................ .White
  Phosphorescence ............................. .White
  Persistence .................................. Medium Short

Mechanical:
Tube Dimensions:
  Overall length .................. 11-3/8" ± 1/4"
  Greatest width ............... 16-13/32" ± 1/8"
  Greatest height .............. 13-11/32" ± 1/8"
  Diagonal ................... 18-5/8" ± 1/8"
  Neck length .................. 4-1/8" ± 1/8"
Curvature of faceplate (External Radii):
  Center ....................... 48"
  Edge ......................... 21"

Screen Dimensions (Minimum):
  Greatest width ............... 15-1/8"
  Greatest height ............ 12"
  Diagonal ................... 17-9/16"
  Projected area ............ 172 sq. in.
Weight (Approx.) .................. 14 lbs
Operating Position ............... Any
Cap. ................................ Recessed Small Cavity (JEDEC No.J1-21)
Bulb ................................ J149A1

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DATA I
10–60
Base. ... Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

Basing Designation for BOTTOM VIEW. .......... BHR

Pin 1-Heater  Cap-Ultor
Pin 2-Grid No.1 (Grid No.3, Grid No.5, Collector)
Pin 3-Grid No.2
Pin 4-Grid No.4
Pin 6-Grid No.1  C-External Conductive
Pin 7-Cathode Coating
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 (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_{C5}) 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 gaussies

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

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

Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR-TO-GRID-No.1 VOLTAGE: {23000 max. volts, 15000 min. volts}

GRID-No.4-TO-GRID-No.1 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:
- Positive-peak value: 220 max. volts
- Positive-bias value: 154 max. volts
- Negative-bias value: 0 max. volts
- Negative-peak value: 2 max. volts

CATHODE-TO-GRID-No.1 VOLTAGE:
- Positive-peak value: 550 max. volts

PEAK HEATER-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 VOLTAGE:
- Positive with respect to cathode: 6.9 max. volts, 5.7 min. volts

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage \( E_{c\text{grid}1} \) of 20000 volts and grid-No.2-to-grid-No.1 voltage \( E_{c\text{grid}2} \) of 400 volts:

Grid-No.4-to-Grid-No.1 Voltage for focus*: 0 to 400 volts

Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster*: 36 to 78 volts

Field Strength of Adjustable Centering Magnet: 0 to 9 gausses

Maximum Circuit Values:

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

★ Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

★ The grid-No.4 (or grid-No.4-to-grid-No.1) voltage required for optimum focus of any individual tube will have a value anywhere between 0 and 400 volts, is independent of ultor current and will remain essentially constant for values of ultor (or ultor-to-grid-No.1) voltage or grid-No.2 (or grid-No.2-to-grid-No.1) voltage within design-maximum ratings shown for these items.

★ See Raster-Cutoff-Range Chart for Grid-Drive Service.

★ Distance from Reference Line for suitable PM centering magnet 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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DATA 2
10-60
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 ultimate 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

\[ E_c = 6.3 \text{ VOLTS} \]
ULTOR VOLTS = 15000 TO 23000
GRID-N04 VOLTS ADJUSTED FOR FOCUS.

\[ \begin{array}{c|c|c|c|c|c}
\hline
\text{GRID-N01 VOLTS} & -125 & -100 & -75 & -50 & -25 \\
\hline
\text{GRID-N02 VOLTS} & 200 & 300 & 400 & 500 & 600 \\
\hline
\end{array} \]

Cathode-Drive Service

\[ E_c = 6.3 \text{ VOLTS} \]
ULTOR-TO-GRID-N01 VOLTS = 15000 TO 23000
GRID-N04-TO-GRID-N01 VOLTS ADJUSTED FOR FOCUS.

\[ \begin{array}{c|c|c|c|c|c}
\hline
\text{CATHODE-TO-GRID-N01 VOLTS} & 125 & 100 & 75 & 50 & 25 \\
\hline
\text{GRID-N02-TO-GRID-N01 VOLTS} & 300 & 400 & 500 & 600 & 700 \\
\hline
\end{array} \]
SCREEN DIAGONAL
17 1/2 MIN.

SCREEN HEIGHT
12" MIN.

SCREEN WIDTH 15 1/8 MIN.

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NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

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

NOTE 6: MEASURED AT THE MOLD-MATCH LINE.

NOTE 7: BULGE AT SPlice-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/16" BEYOND THE ENVELOPE SURFACE AT THE MOLD-MATCH LINE.

NOTE 8: UNDISTURBED AREA BETWEEN MOLD-MATCH LINE AND SPlice LINE IS 3/8" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF THE TUBE SUPPORT BAND. TUBE MOUNTING AND YOKE SUPPORT CLAMPS MUST BE SPECED FROM THE TUBE BY USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.
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
19BDP4

Picture Tube

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 ± 10% ma
Heater Warm-Up Time (Average) ........ 11 seconds
Direct Interelectrode Capacitances:
  Grid No.1 to all other electrodes .... 6 µµf
  Cathode to all other electrodes .... 5 µµf
  External conductive coating to  ultor. ... {2000 max. µµf
                                      1500 min. µµf
Electron Gun ........ Type Requiring No Ion-Trap Magnet

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

Mechanical:
Operating Position .................. Any
Weight (Approx.) ................... 15 lbs
Overall Length .................... 15-1/4" ± 3/8"
Neck Length ....................... 5-1/2" ± 3/16"
Projected Area of Screen ............ 172 sq. in.
External Conductive Coating:
  Type ................................ Regular Band
  Contact area for grounding .......... Near Reference Line
For Additional Information on Coatings and Dimensions:
  See Picture-Tube Dimensional-Outlines and Bulb J149 B sheets
  at the front of this section
Cap ................ Recessed Small Cavity (JEDEC No.J1-21)
Bases (Alternates):
  Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-203)
  Small-Shell Duodecal 6-Pin, Arrangement 1
    (JEDEC Group 4, No.B6-63)
Basing Designation for BOTTOM VIEW .......... 12L

Pin 1—Heater
Pin 2—Grid No.1
Pin 6—Grid No.4
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater

Cap—Ultor
[Grid No.3, Grid No.5, Collector]
C—External Conductive Coating

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**19BDP4**

**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: \[70 \text{ max. volts} \]
\[40 \text{ min. volts} \]

CATHODE-TO-GRID-No.1 VOLTAGE: \[100 \text{ max. volts} \]

HEATER VOLTAGE:
- Positive: \[7 \text{ max. volts} \]
- Negative: \[5.8 \text{ min. volts} \]

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 to 500 volts
- Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster: 31 to 49 volts

**Maximum Circuit Values:**

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

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

**19BFP4**

**RECTANGULAR GLASS TYPE**

**LOW-VOLTAGE ELECTROSTATIC FOCUS**

**ALUMINIZED SCREEN**

**92° MAGNETIC DEFLECTION**

**GENERAL DATA**

**Electrical:**

Heater Current at 6.3 volts ............... 600 ± 5% ma

Direct Interelectrode Capacitances:

- Grid No.1 to all other electrodes ........ 6 µuf
- Cathode to all other electrodes .......... 5 µuf
- External conductive coating to ultor. .... 2000 max. µuf, 1500 min. µuf

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

**Optical:**

Faceplate .................................. Filterglass

Light transmission (Approx.) ............... 78%

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

**Mechanical:**

Operating Position. .......................... Any

Weight (Approx.). ............................ 14-3/4 lbs

Overall Length ............................. 15-1/4" ± 3/8"

Neck Length ................................. 5-1/2" ± 3/16"

Projected Area of Screen. .................... 172 sq. in.

External Conductive Coating:

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

For Additional Information on Coatings and Dimensions:

See Picture-Tube Dimensions—Outlines and Bulb J149 B sheets at the front of this section

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

Bases (Alternates):

- Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-203)
- Small-Shell Duodecal 6-Pin, Arrangement 1 (JEDEC Group 4, No.B6-63)

Basing Designation for BOTTOM VIEW. ........... 12L

Pin 1—Heater

Pin 2—Grid No.1

Pin 6—Grid No.4

Pin 10—Grid No.2

Pin 11—Cathode

Pin 12—Heater

Cap—Ultor

(Cap—Ultor, Grid No.3, Collector)

C—External

Conductive Coating
Maximum Ratings, Design-Maximum Values:

ULTOR VOLTAGE .................. 20000 max. volts
GRID-No.4 (FOCUSBING) VOLTAGE:
    Positive value .................. 1100 max. volts
    Negative value ................. 550 max. volts
GRID-No.2 VOLTAGE ............. 550 max. volts
GRID-No.1 VOLTAGE:
    Negative bias value ............ 154 max. volts
    Positive bias value ............ 0 max. volts
    Positive peak value ........... 2 max. volts
PEAK HEATER-CATHODE VOLTAGE:
    Heater negative with respect to cathode:
        During equipment warm-up period not exceeding 15 seconds .... 450 max. volts
        After equipment warm-up period . . . . 200 max. volts
    Heater positive with respect to cathode . . . . 200 max. volts

Typical Operating Conditions:

With ultor voltage of
    and grid-No.2 voltage of
    16000 volts
    400 volts
Grid-No.4 Voltage for focus . . . . 0 to 400 volts
Grid-No.1 Voltage for visual extinction of focused raster . . . . -36 to -94 volts

Maximum Circuit Values:

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

For X-radiation shielding considerations, see sheet X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES at front of this section
19BTP4
Picture Tube

SHORT RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
ALUMINIZED SCREEN
114° MAGNETIC DEFLECTION
With Heater Having Controlled Warm-Up Time

The 19BTP4 is the same as the 19YP4 except for the following item:

Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR VOLTAGE . . . . . . . . . . . . . (23000 max. volts
11000 min. volts

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**19CHP4**

**Picture Tube**

**SHORT RECTANGULAR GLASS TYPE**
**LOW-VOLTAGE ELECTROSTATIC FOCUS**
**LOW GRID-No.2 VOLTAGE**

**ALUMINIZED SCREEN**
**114° MAGNETIC DEFLECTION**
**CATHODE-DRIVE TYPE**

With Heater Having Controlled Warm-Up Time

**GENERAL DATA**

**Electrical:**
- Heater Current at 6.3 volts ............ 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. (1500 max. μF)
    - 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.
- External Conductive Coating:
  - Type ................................ Regular Band
  - Contact area for grounding ........ Near Reference Line

For Additional Information on Coatings and Dimensions:
- See Picture-Tube Dimensional-Outlines and Bulb J149 A sheets at the front of this section
- Cap ................ Recessed Small Cavity (JEDEC No.J1-21)
- Base ................ Small-Button Neoeightar 7-Pin, Arrangement 1 (JEDEC No.B7-20B)

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

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Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR-TO-GRID-No.1 VOLTAGE: \[20000 \text{ max. volts}\]
\[10000 \text{ min. volts}\]

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:
- \[70 \text{ max. volts}\]
- \[40 \text{ min. volts}\]

CATHODE-TO-GRID-No.1 VOLTAGE:
- Positive peak value: \[150 \text{ max. volts}\]
- Positive bias value: \[100 \text{ max. volts}\]
- 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 \[16000 \text{ volts}\]
- and grid-No.2-to-grid-No.1 voltage of \[50 \text{ volts}\]
- Grid-No.4-to-Grid-No.1 Voltage for focus: \[-50 \text{ to } +250 \text{ volts}\]
- Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster: \[32 \text{ to } 50 \text{ volts}\]

Maximum Circuit Values:

- Grid-No.1-Circuit Resistance: \[1.5 \text{ max. megohms}\]

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

19CKP4

SHORT RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
LOW-GRID-No.2 VOLTAGE

With Heater Having Controlled Warm-Up Time

ALUMINIZED SCREEN
114° MAGNETIC DEFLECTION
CATHODE-DRIVE TYPE

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
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.): 14 lbs
Overall Length: 11-3/4" ± 1/4"
Neck Length: 4-1/2" ± 1/8"
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 A sheets at front of this section
Cap: Recessed Small Cavity (JEDEC No. J1-21)

Bases (Alternates):
  Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No. B7-208)
  7-Pin (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

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DATA
4-63
Maximum and Minimum Ratings, Design-Maximum Values:

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

ANODE VOLTAGE. ........................................ 22000 max. volts
....................................................... 15000 min. volts

GRID-No.4 (FOCUSING) VOLTAGE:
  Positive value ....................................... 1100 max. volts
  Negative value ....................................... 550 max. volts

GRID-No.2 VOLTAGE. .................................... 100 max. volts
....................................................... 40 min. volts

CATHODE VOLTAGE:
  Negative peak value .................................. 2 max. volts
  Negative bias value ................................... 0 max. volts
  Positive bias value ................................... 100 max. volts
  Positive peak value ................................... 150 max. volts

HEATER VOLTAGE . ....................................... 6.9 max. volts
....................................................... 5.7 min. volts

PEAK HEATER-CATHODE VOLTAGE:
  Heater negative with respect to cathode:
  During equipment warm-up period not exceeding 15 seconds ........ 450 max. volts
  After equipment warm-up period ................................ 300 max. volts
  Heater positive with respect to cathode:
  Combined AC 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. ....................................... 0 to 500 volts
Grid-No.2 Voltage. ....................................... 50 volts
Cathode Voltage for visual extinction of focused raster ............. 31 to 49 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

**19XP4**

#### Rectangular Glass Type
- Low-voltage electrostatic focus
- Aluminized screen
- Magnetic deflection

With heater having controlled warm-up time

### General Data

**Electrical:**
- Heater current at 6.3 volts: 600 ± 30 ma
- Heater warm-up time (average): 11 seconds

**Direct Interelectrode Capacitances:**
- Grid No. 1 to all other electrodes: 6 μuf
- Cathode to all other electrodes: 5 μuf
- External conductive coating to ultor: 1500 max., 1000 min. μuf

**Focusing Method:** Electrostatic

**Deflection Method:** Magnetic

**Deflection Angles (Approx.):**
- Diagonal: 114°
- Horizontal: 102°
- Vertical: 85°

**Electron Gun:** Type requiring no ion-trap magnet

### Optical:
- Faceplate: Filterglass
- Light transmission at center (Approx.): 78%
- Phosphor (for curves, see front of this section): P4—Sulfide Type
  - Aluminized
- Fluorescence: White
- Phosphorescence: White
- Persistence: Medium Short

### Mechanical:

**Tube Dimensions:**
- Overall length: 11-3/8" ± 1/4"
- Greatest width: 16-13/32" ± 1/8"
- Greatest height: 13-11/32" ± 1/8"
- Diagonal: 18-5/8" ± 1/8"
- Neck length: 4-1/8" ± 1/8"

**Radius of curvature of faceplate:**
- Radius at center: 48" 21"
- Radius at edge: 30" 20"

**In plane of diagonal deflection:**
- In plane of horizontal deflection: 30" 20"
- In plane of vertical deflection: 30" 14"

**Screen Dimensions (Minimum):**
- Greatest width: 15-1/8"
- Greatest height: 12"
- Diagonal: 17-9/16"
- Projected area: 172 sq. in.
19XP4

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.B7-208)

Basing Designation for BOTTOM VIEW ..................................... 8HR
Pin 1 – Heater Cap – U1t0r
Pin 2 – Grid No.1 (Grid No.3,
Pin 3 – Grid No.2 Grid No.5,
Pin 4 – Grid No.4 Collector)
Pin 6 – Grid No.1 C – External
Pin 7 – Cathode Conductive
Pin 8 – Heater Coating

GRID-DRIVE SERVICE

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

Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR VOLTAGE .......................... \{20000 max. volts
11000 min. volts

GRID-No.4 (FOCUSING) VOLTAGE:
Positive value .................................. 1100 max. volts
Negative value .................................. 550 max. volts

GRID-No.2 VOLTAGE .......................... \{550 max. volts
200 min. volts

GRID-No.1 VOLTAGE:
Negative-peak value .................................. 220 max. volts
Negative-bias value .................................. 154 max. volts
Positive-bias value .................................. 0 max. volts
Positive-peak value .................................. 2 max. volts

HEATER VOLTAGE .......................... \{6.9 max. volts
5.7 min. volts

PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period:
not exceeding 15 seconds .................................. 450 max. volts
After equipment warm-up period .................................. 200 max. volts
Heater positive with respect to cathode .................................. 200 max. volts

Equipment Design Ranges:

With any ultor voltage ($E_{CA}$) between 11000 and 20000 volts
and grid-No.2 voltage ($E_{CB}$) between 220 and 550 volts

Grid-No.4 Voltage for focus* .................................. 0 to 400 volts
Grid-No.1 Voltage ($E_{C1K}$) for visual extinction of
focused raster .................................. See Raster-Cutoff-Range Chart
for Grid-Drive Service

RADIO CORPORATION OF AMERICA
Electron Tube Division Harrison, N. J.
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. \(-25 \text{ to } +25\) $\mu$A
Grid-No.2 Current. \(-15 \text{ to } +15\) $\mu$A

Field Strength of Adjustable Centering Magnet*. 0 to 8 gausses

Examples of Use of Design Ranges:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>With ultor voltage of Grid-No.2 voltage of</td>
<td>16000 volts</td>
</tr>
<tr>
<td>Grid-No.4 Voltage for focus</td>
<td>400 volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage for visual extinction of focused raster</td>
<td>-36 to -94 volts</td>
</tr>
<tr>
<td>Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value.</td>
<td>36 to 94 volts</td>
</tr>
</tbody>
</table>

Maximum Circuit Values:

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

**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>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR-TO-GRID-No.1 VOLTAGE</td>
<td>(20000 max. volts, 11000 min. volts)</td>
</tr>
<tr>
<td>GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:</td>
<td>Positive value 1250 max. volts, Negative value 400 max. volts</td>
</tr>
<tr>
<td>GRID-No.2-TO-GRID-No.1 VOLTAGE</td>
<td>(700 max. volts, 350 min. 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</td>
<td>Positive-peak value 220 max. volts, Positive-bias value 154 max. volts, Negative-bias value 0 max. volts, Negative-peak value 2 max. volts</td>
</tr>
<tr>
<td>HEATER VOLTAGE</td>
<td>(6.9 max. volts, 5.7 min. volts)</td>
</tr>
<tr>
<td>PEAK HEATER-CATHODE VOLTAGE</td>
<td>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</td>
</tr>
</tbody>
</table>
Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage \( (E_{c5g1}) \) between 11000 and 20000 volts and grid-No.2-to-grid-No.1 voltage \( (E_{c2g1}) \) between 225 and 700 volts

Grid-No.4-to-Grid-No.1 Voltage for focus\*.......................... 0 to 400 volts
Cathode-to-Grid-No.1 Voltage \( (E_{k1}) \) 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 \( \mu \)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-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 ....................... 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 with the combined bias voltage and video-signal voltage adjusted to produce an ultor current of 100 microamperes.

\* 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 3/16-inch deflection of the spot from the center of the tube face.

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

X-Ray Warning. When operated at 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 shatter-proof, 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.
19XP4

REFERENCE LINE
(NOTE 2)

SMALL-BUTTON
NEOEIGHTAR
7-PIN BASE
ARRANGEMENT 1
JEDEC Nº87-208
(NOTE 3)

SCREEN DIAGONAL
17.5 MIN.

SCREEN HEIGHT
12" MIN.

SCREEN WIDTH 15 1/8 MIN.

15" R.

48" R.

46.9" R.

32.6" R.

2.562"

1.5" R.

.97" R.

16 13/32 ± 1/8
(NOTE 6)

10"

48" R.

30" R.

20" R.

21" R.

.240"

102°

1.884"

1.884"

1.125" ±.031" DIA.

.025" DIA.


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 SPACED 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.
RASTER-CUTOFF-RANGE CHARTS
Grid-Drive Service

\[ E_c = 6.3 \text{ VOLTS} \]
\[ \text{ULTOR VOLTS} = 10000 \text{ TO } 20000 \]
\[ \text{GRID-N^2 VOLTS ADJUSTED FOR FOCUS.} \]

Cathode-Drive Service

\[ E_c = 6.3 \text{ VOLTS} \]
\[ \text{ULTOR-TO-GRID-N^2 VOLTS} = 11000 \text{ TO } 20000 \]
\[ \text{GRID-N^2 TO GRID-N^2 VOLTS ADJUSTED FOR FOCUS.} \]
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE
- $E_f = 6.3 \text{ VOLTS}$
- ULTOR-TO-GRID-NR1 VOLTS = 16000
- CATHODE BIASED POSITIVE WITH RESPECT TO GRID NR1 TO GIVE FOCUSED RASTER CUTOFF.
- RASTER FOCUSED AT AVERAGE BRIGHTNESS.
- RASTER SIZE = 14" x 10½"

GRID-DRIVE SERVICE
- $E_f = 6.3 \text{ VOLTS}$
- ULTOR VOLTS = 16000
- GRID NR1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.
- RASTER FOCUSED AT AVERAGE BRIGHTNESS.
- RASTER SIZE = 14" x 10½"

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-N1</td>
<td>ULTOR VOLTS = 11000 TO 20000</td>
</tr>
<tr>
<td>VOLTS = 11000 TO 20000</td>
<td>GRID N1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.</td>
</tr>
<tr>
<td>CATHODE BIASED POSITIVE WITH RESPECT TO GRID N1 TO GIVE FOCUSED RASTER CUTOFF.</td>
<td></td>
</tr>
</tbody>
</table>

### Graph

- **Legend:**
  - CATHODE DRIVE
  - GRID DRIVE

### Axes

- **Y-axis:** ULTRA MILLIAMPERES
  - 0
  - 0.5
  - 1
  - 1.5
  - 2
  - 2.5

- **X-axis:** VIDEO SIGNAL VOLTS FROM RASTER CUTOFF
  - 0
  - 20
  - 40
  - 60
  - 80
  - 100

### Reference

92CM-10643

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**Radio Corporation of America**

Electron Tube Division

Harrison, N. J.
PICTURE TUBE

SHORT RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
ALUMINIZED SCREEN
MAGNETIC DEFLECTION
With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:
Heater Current at 6.3 volts .......... 600 ± 30 ma
Heater Warm-Up Time (Average) ........ 11 seconds
Focusing Method .................. Electrostatic
Deflection Method ................ Magnetic
Deflection Angles (Approx.):
  Diagonal ................................ 114°
  Horizontal .......................... 102°
  Vertical ............................. 85°
Direct Interelectrode Capacitances:
  Grid No. 1 to all other electrodes .... 6 µµf
  Cathode to all other electrodes ...... 5 µµf
  External conductive coating toulator (1500 max. 1000 min. 1000 min.

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

DATA 1
RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
10-60
19YP4

Base. Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW. 8BJR
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 - Ulterior (Grid No.4, Collector)
C - External Conductive Coating

GRID-DRIVE® SERVICE

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

Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR VOLTAGE 20000 max. volts
11000 min. volts
GRID-No.3 (FOCUSING) VOLTAGE:
Positive value 700 max. volts
Negative value 350 max. volts
GRID-No.2 VOLTAGE 600 max. volts
300 min. volts
GRID-No.1 VOLTAGE:
Negative-peak value 220 max. volts
Negative-bias value 154 max. volts
Positive-bias value 0 max. volts
Positive-peak value 2 max. volts
HEATER VOLTAGE 6.9 max. volts
5.7 min. volts

PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period not exceeding 15 seconds. 450 max. volts
After equipment warm-up period 200 max. volts
Heater positive with respect to cathode 200 max. volts

Typical Operating Conditions:
With ulterior voltage \( E_{Chk} \) of 16000 volts
and grid-No.2 voltage \( E_{C2k} \) of 500 volts

Grid-No.3 Voltage for focus** 0 to 400 volts
Grid-No.1 Voltage for visual extinction of focused raster** -43 to -78 volts
Field Strength of Adjustable Centering Magnet** 0 to 10 gausses

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

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:

**Ultor-to-Grid-No. 1 Voltage**
- Maximum: 20000 max. volts
- Minimum: 11000 min. volts

**Grid-No. 3-to-Grid-No. 1 (Focusing) Voltage**
- Positive value: 850 max. volts
- Negative value: 200 max. volts

**Grid-No. 2-to-Grid-No. 1 Voltage**
- Maximum: 750 max. volts
- Minimum: 450 min. volts

**Grid-No. 2-to-Cathode Voltage**
- Maximum: 600 max. volts

**Cathode-to-Grid-No. 1 Voltage**
- Positive-peak value: 220 max. volts
- Positive-bias value: 154 max. volts
- Negative-bias value: 0 max. volts
- Negative-peak value: 2 max. volts

**Heater Voltage**
- Positive peak: 6.9 max. volts
- Positive bias: 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:**

- 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 40 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-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 an all-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.

**Maximum Circuit Values:**

- Grid-No. 1-Circuit Resistance: 1.5 max. megohms
required for optimum focus and if the focusing voltage is maintained to within 75 volts of the optimum value during line-voltage fluctuations.

★ See Raster-Cutoff-Range Chart for Grid-Drive Service.

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

$$\sqrt{\frac{E_{c4k} \text{ or } E_{c4g1} \text{ (volts)}}{16000 \text{ (volts)}}} \times 10 \text{ gausses}$$

The equipment manufacturer must determine and supply additional compensation for the effects of the earth's magnetic field and extraneous fields due to choice of circuitry and components. The additional compensation should preferably be applied as part of the magnetic field of the deflecting yoke.

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

★ See Raster-Cutoff-Range Chart for Cathode-Drive Service.

OPERATING CONSIDERATIONS

X-Ray Warning. When operated at ultor voltages up to 16 kilovolts, this picture tube does not produce any harmful X-ray radiation. However, because the rating of this type permits operation at voltages as high as 20 kilovolts (Design-maximum value), shielding of this picture tube for X-ray radiation may be needed to protect against possible injury from prolonged exposure at close range whenever the operating conditions involve voltages in excess of 16 kilovolts.

Shatter-Proof Cover Over the Tube Face. Following conventional picture-tube practice, it is recommended that the cabinet be provided with a shatterproof, glass cover over the face of this picture tube to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.
SMALL-BUTTON NEOEIGHTAR 7-PIN BASE ARRANGEMENT 1
JEDEC N87-208
(NOTE 3)

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.
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-N3 VOLTS ADJUSTED FOR FOCUS.

Cathode-Drive Service

$E_f = 6.3$ VOLTS
ULTOR-TO-GRID-N1 VOLTS = 11000 TO 20000
GRID-N2-GRID-N1 VOLTS ADJUSTED FOR FOCUS.
20DP4C

Picture Tube

RECTANGULAR GLASS TYPE
MAGNETIC FOCUS
ALUMINIZED SCREEN
70° MAGNETIC DEFLECTION

GENERAL DATA

Electrical:
Direct Interelectrode Capacitances:
  Cathode to all other electrodes .... 5 pf
  Grid No.1 to all other electrodes .... 6 pf
  External conductive coating to anode. \{1500 max. pf
  \{ 500 min. pf
Heater Current at 6.3 volts ........ 600 ± 30 ma
Electron Gun. ................. Ion-Trap Type Requiring
                      External Single-Field Magnet

Optical:
Phosphor (For curves, see front of this Section). P4—Sulfide Type,
                      Aluminized
Faceplate, Spherical. ................. Filterglass
  Light transmission (Approx.) ......... 75%

Mechanical:
Weight (Approx.). ...................... 30 lbs
Overall Length. ......................... 21-3/4" ± 3/8"
Neck Length ...................... 7-1/2" ± 3/16"
Projected Area of Screen. ........... 215 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 J161 C/D sheets
  at front of this section
Cap ......................... Recessed Small Cavity (JEDEC No.J1-21)
Base. .... Small-Shell Duodecal 5-Pin (JEDEC Group 4, No.B5-57)
   Basing Designation for BOTTOM VIEW ........ 12N

Pin 1—Heater
Pin 2—Grid No.1
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater

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

Maximum and Minimum Ratings, Design-Maximum Values:
  Unless otherwise specified, voltage values
  are positive with respect to cathode

ANODE VOLTAGE .................. 20000 max. volts
GRID-No.2 VOLTAGE ............... 450 max. volts

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

DATA 4-63
**GRID-No.1 VOLTAGE:**
- Negative bias value: 140 max. volts
- Positive bias value: 0 max. volts
- Positive peak value: 2 max. volts

**HEATER VOLTAGE:**
- 6.9 max. volts
- 5.7 min. volts

**PEAK HEATER-CATHODE VOLTAGE:**
- Heater negative with respect to cathode:
  - During equipment warm-up period not exceeding 15 seconds: 450 max. volts
  - After equipment warm-up period: 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
20HP4D

Picture Tube

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

**General Data**

**Electrical:**
- Heater: Current at 6.3 volts ....... 600 ± 30 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. (1500 max. pf) (500 min. pf)
- Electron Gun. ......... Ion-Trap Type Requiring External Single-Field Magnet

**Optical:**
- Phosphor (For curves, see front of this Section). P4—Sulfide Type, Aluminized
- Faceplate, Spherical. ......... Filterglass
- Light transmission (Approx.) ............. 75%

**Mechanical:**
- Weight (Approx.) ................. 30 lbs
- Overall Length ............. 21-3/4" ± 3/8"
- Neck Length ............... 7-1/2" ± 3/16"
- Projected Area of Screen. ........... 215 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 J161 C/D sheets* at front of this section

Cap .......... Recessed Small Cavity (JEDEC No.J1-21)
Base .......... Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-63)
Basing Designation for BOTTOM VIEW. .......... 12L

**Pin Numbers:**
- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 6—Grid No.4
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater
- Cap—Anode (Grid No.3, Grid No.5, Screen, Collector)
- C—External Conductive Coating

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

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

**ANODE VOLTAGE** ............... 17500 max. volts
**GRID—No.4 (FOCUSING) VOLTAGE:**
- Positive value. .......... 1100 max. volts
- Negative value. ........ 550 max. volts

---

**RCA**
Electron Tube Division
Harrison, N. J.
GRID-No.2 VOLTAGE: 550 max. volts
GRID-No.1 VOLTAGE:
  Negative bias value: 140 max. volts
  Positive bias value: 0 max. volts
  Positive peak value: 2 max. volts
HEATER VOLTAGE: 6.9 max. volts
                 5.7 min. volts
PEAK HEATER-CATHODE VOLTAGE:
  Heater negative with respect to cathode:
    During equipment warm-up period not exceeding 15 seconds: 450 max. volts
    After equipment warm-up period: 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
CATHODE-DRIVE SERVICE

- $E_f = 6.3$ VOLTS
- ULTOR-TO-GRID Nº1 VOLTS = 16000
- CATHODE BIASED POSITIVE WITH RESPECT TO GRID Nº1 TO GIVE FOCUSED RASTER CUTOFF.
- RASTER FOCUSED AT AVERAGE BRIGHTNESS.
- RASTER SIZE = 18"x 13½".

GRID-DRIVE SERVICE

- $E_f = 6.3$ VOLTS
- ULTOR VOLTS = 16000
- GRID Nº1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.
- RASTER FOCUSED AT AVERAGE BRIGHTNESS.
- RASTER SIZE = 18"x 13½".

I.C.I. COORDINATES OF SCREEN: $X=0.2890$, $Y=0.3260$
PICTURE TUBE

SCREEN DIAGONAL 20 1/4 MIN.

SCREEN WIDTH 19 1/16 MIN.

17 1/2 R.

17 R.

3 1/16 R.

30 25/32 R.

33 R.

4 R.

SCREEN HEIGHT 15 1/16 MIN.

20 1/4 ± 1/8

4 1/4 R.

33 R.

85°

6 3/16

2 MIN.

2 ± 1/4

1 7/16 ± 1/16

SMALL-SHELL DUODECAL
5-PIN BASE (NOTE 3)
JETEC No. B5-57

ULTOR RECEESED SMALL CAVITY CAP
JETEC No. J1-21
(NOTE 1)

REFERENCE LINE

(REFERENCE LINE)

(Radio Corporation of America, Harrison, New Jersey)

ELECTRON TUBE DIVISION

CE-8155R1A
21AMP4A

Picture Tube

RECTANGULAR GLASS TYPE
MAGNETIC FOCUS
ALUMINIZED SCREEN
90° MAGNETIC DEFLECTION

GENERAL DATA

Electrical:
Heater Current at 6.3 volts .............. 600 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. .................. Ion-Trap Type Requiring External Single-Field 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 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)
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—Ultor
   (Grid No.3, Collector)
C—External
   Conductive Coating

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
Maximum Ratings, Design-Maximum Values:

ULTOR VOLTAGE ............ 20000 max. volts
GRID-No.2 VOLTAGE .......... 550 max. volts
GRID-No.1 VOLTAGE:
  Negative peak value ......... 220 max. volts
  Negative bias value .......... 155 max. volts
  Positive bias value .......... 0 max. volts
  Positive peak value .......... 2 max. volts

PEAK HEATER–CATHODE VOLTAGE:
  Heater negative with
  respect to cathode:
    During equipment warm-up period
      not exceeding 15 seconds .... 450 max. volts
    After equipment warm-up period . 200 max. volts
  Heater positive with
  respect to cathode ............ 200 max. volts

Typical Operating Conditions:

  With ultor voltage of
  and grid-No.2 voltage of
  Grid-No.1 Voltage for visual
  extinction of focused raster .... -28 to -72 volts

  16000 volts
  300 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

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

**21AP4**

**PICTURE TUBE**

**RECTANGULAR METAL-SHELL TYPE**

**DATA**

**MAGNETIC FOCUS**

**MAGNETIC DEFLECTION**

**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 Metal-Shell Lip

**Ultor Terminal 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: 18000 max. volts
- GRID-No.2 VOLTAGE: 500 max. volts
- GRID-No.1 VOLTAGE:
  - Negative-bias value: 125 max. volts
  - Positive-bias value: 0 max. volts
  - Positive-peak value: 2 max. volts
- 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.
21AP4 PICTURE TUBE

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
21AVP4B

Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
ALUMINIZED SCREEN
72° MAGNETIC DEFLECTION

GENERAL DATA

Electrical:
Heater Current at 6.3 volts ........ 600 ma
Direct Interelectrode Capacitances:
Grid No.1 to all other electrodes .... 6 µµf
Cathode to all other electrodes .... 5 µµf
External conductive coating to ultor. {2500 max. µµf
{2000 min. µµf
Electron Gun. ........ ion-Trap Type Requiring External
Single-Field Magnet

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

Mechanical:
Operating Position. ........ Any
Weight (Approx.). ........ 24 lbs
Overall Length ......... 23-1/32" ± 3/8"
Neck Length ......... 7-1/2" ± 3/16"
Projected Area of Screen. ........ 262 sq. in.
External Conductive Coating:
Type. ........ Special
Contact area for grounding. ........ Near Reference Line
For Additional Information on Coatings and Dimensions:
See Picture-Tube Dimensional-Outlines and Bulb J171 B/F sheets at the front of this section
Cap ........ Recessed Small Cavity (JEDEC No.J1-21)
Base. ........ Small-Shell Duodecal 6-Pin, Arrangement 1, (JEDEC Group 4, No.B6-63)
Basing Designation for BOTTOM VIEW. ........ 12L

Pin 1—Heater
Pin 2—Grid No.1
Pin 6—Grid No.4
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater

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

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
DATA
1-63
Maximum Ratings, Design-Maximum Values:

ULTOR VOLTAGE .................. 22000 max. volts
GRID-No.4 (FOCUSING) VOLTAGE:
    Positive value ................. 1100 max. volts
    Negative value ............... 550 max. volts
GRID-No.2 VOLTAGE ................ 550 max. volts
GRID-No.1 VOLTAGE:
    Negative 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 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
RECTANGULAR GLASS TYPE
ALUMINIZED SCREEN
MAGNETIC FOCUS
MAGNETIC DEFLECTION

DATA

General:
Heater, for Unipotential Cathode:
Voltage: 6.3 ac or dc volts
Current: 0.6 ± 10% amp
Capacitance between External Conductive Coating and Ultor:
\[2500 \text{ max.} \mu\text{F}\]
\[2000 \text{ min.} \mu\text{F}\]
Faceplate, Spherical: Filterglass
Phosphor (for Curves, see front of this Section): P4—Sulfide Type Aluminized

Deflection Angles (Approx.):
Diagonal: 72°
Horizontal: 67°
Vertical: 53°

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: 16-3/8" ± 1/8"
Diagonal: 21-3/8" ± 1/8"
Neck length: 7-1/2" ± 3/16"
Radius of curvature of faceplate (External surface): 33" Screen Dimensions (Minimum):
Greatest width: 19-1/16" Screen Dimensions (Minimum):
Greatest height: 15-1/16"
Diagonal: 20-1/4" Projected area: 262 sq. in.

Pin 1—Heater
Pin 2—Grid No.1
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater
Cap—Ultor (Grid No.3, Collector)
C—External Conductive Coating

Maximum Ratings, Design-Center Values:
ULTOR VOLTAGE: 18000 max. volts
GRID-No.2 VOLTAGE: 500 max. volts
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

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
# 21AXP22-A

**COLOR KINESCOPE**

**THREE-GUN SHADOW-MASK TYPE**

**ELECTROSTATIC FOCUS**

**MAGNETIC CONVERGENCE**

**MAGNETIC DEFLECTION**

**ALUMINIZED TRICOLOR PHOSPHOR-DOT SCREEN**

Supersedes Type 21AXP22

## DATA

**General:**

Electron Guns, Three with Axes Tilted Toward Tube Axis .......... Blue, Green, Red

Heater, for Unipotential Cathode of Each Gun, Paralleled with Each of the Other Two Heaters within Tube:

Voltage .......... 6.3 ac or dc volts

Current .......... 1.8 ± 10% amp

Direct Interelectrode Capacitances (Approx.):

- Grid No.1 of any gun to all other electrodes except the No.1 grids of the other two guns .......... 7 μf
- Cathode of blue gun + cathode of green gun + cathode of red gun to all other electrodes .......... 16 μf
- Grid No.3 (Of each gun tied within tube to No.3 grids of other two guns) to all other electrodes .......... 9 μf

Faceplate, Spherical ........ Filterglass

Light transmission (Approx.) .......... 77%

Screen, on Inner Surface of Faceplate:

Type .......... Aluminized, Tricolor, Phosphor-Dot Phosphor (Three separate phosphors, collectively) .......... P22

Fluorescence and phosphorescence of separate phosphors, respectively. .. Blue, Green, Red

Persistence of group phosphorescence .......... Medium

Dot arrangement .......... Triangular group consisting of blue dot, green dot, and red dot

Spacing between centers of adjacent dot trios (Approx.) 0.029" Size (Minimum):

- Greatest width .......... 19-1/16"
- Height .......... 15-1/4"
- Projected area .......... 255 sq. in.

Focusing Method .......... Electrostatic

Convergence Method .......... Magnetic

Deflection Method .......... Magnetic

Deflection Angles (Approx.):

- Horizontal .......... 70°
- Vertical .......... 55°

Tube Dimensions:

- Maximum overall length .......... 25-5/16"

Diameter:

- At lip .......... 20-9/16" ± 1/8"
- At flange .......... 20-15/16" ± 5/16"

Weight (Approx.) .......... 28 lbs

Mounting Position .......... Tube axis horizontal (base pin 12 on top)

---

8-56

**TUBE DIVISION**

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

Ultor Terminal .......... Metal Shell
Base ........ Small-Shell Neodihexal 12-Pin (JETEC No.B12-131)
Socket ........ Alden Nos.214NIHSEC (Radial leads),
214NIHSEC (Axial leads), or equivalent

Basing Designation for BOTTOM VIEW .......... 14AH

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Heater</td>
<td>9</td>
<td>Grids No.3</td>
</tr>
<tr>
<td>2</td>
<td>Grid No.1, of Red Gun</td>
<td>11</td>
<td>Grid No.2, of Blue Gun</td>
</tr>
<tr>
<td>3</td>
<td>Grid No.2, of Red Gun</td>
<td>12</td>
<td>Grid No.1, of Blue Gun</td>
</tr>
<tr>
<td>4</td>
<td>Cathode, of Red Gun</td>
<td>13</td>
<td>Cathode, of Blue Gun</td>
</tr>
<tr>
<td>5</td>
<td>Cathode, of Green Gun</td>
<td>14</td>
<td>Heater</td>
</tr>
<tr>
<td>6</td>
<td>Grid No.1, of Green Gun</td>
<td></td>
<td>METAL SHELL:</td>
</tr>
<tr>
<td>7</td>
<td>Grid No.2, of Green Gun</td>
<td></td>
<td>Ultor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Grid No.4, Grid No.5, Collector)</td>
</tr>
</tbody>
</table>

Maximum Ratings, Design-Center Values:

<table>
<thead>
<tr>
<th>Rating Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultor-to-Cathode (of each gun) voltage</td>
<td>25000 max. volts</td>
</tr>
<tr>
<td>Ultor current, (Average, each gun)</td>
<td>500 max. μamp</td>
</tr>
<tr>
<td>Grid-No.3-to-Cathode (of each gun) voltage</td>
<td>5000 max. volts</td>
</tr>
<tr>
<td>Grid-No.2-to-Cathode voltage (Each gun)</td>
<td>8000 max. volts</td>
</tr>
<tr>
<td>Grid-No.1-to-Cathode voltage (Each gun):</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>400 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 (Each gun):</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>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 voltage ($E_{C4k}$ of each gun) between 20000 and 25000 volts
- Grid-No.3 (Focusing electrode)-to-Cathode voltage (of each gun) 15.2% to 21.2% of $E_{C4k}$ of each gun volts
- Grid-No.2-to-Cathode voltage (Each gun) when circuit design utilizes grid-No.1-to-cathode voltage ($E_{C4k}$) at fixed voltage for raster cutoff. See Cutoff Design Chart

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

Variation in Raster Cutoff Between Guns in Any Tube. \(\pm 21\%\) of average of highest and lowest cutoff values.

Grid-No.3 Current for ultron current of 800 \(\mu\)amp.

Grid-No.2 Current (Each gun)...

Percentage of Total Ultron Current Supplied by Each Gun:

To produce Illuminant-C White (I.C.I. Coordinates \(x=0.310, y=0.316\)):

- Red gun: 47 to 67 per cent
- Blue gun: 11 to 24 per cent
- Green gun: 20 to 33 per cent

To produce White of 8500°K + 27 M.P.C.D. (I.C.I. Coordinates \(x=0.287, y=0.316\)):

- Red gun: 42 to 60 per cent
- Blue gun: 12 to 27 per cent
- Green gun: 23 to 38 per cent

Maximum Raster Shift in Any Direction from Screen Center: 1 inch

Adjustment to be Provided by the Following Components:

- Purifying magnet: Raster shift of 1" max. in any direction from screen center
- Magnetic-field equalizer: Beam displacement with respect to phosphor dot at position of max. displacement (i.e., edge of screen)
- Tangential: \(\pm 0.0005\"\) to \(\pm 0.007\"
- Radial: \(\pm 0.0005\"\) to \(\pm 0.007\"

*A value of average ultron current per gun higher than 500 microamperes will increase picture brightness but may impair resolution and shorten cathode life.

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

Brilliance and definition decrease with decreasing ultron voltage. In general, the ultron voltage should not be less than 20000 volts.
COLOR KINESCOPE

Lateral-Converging Magnet:

After adjustment has been made for color purity and dynamic convergence—
Max. shift of blue beam: ±1/4"
Max. shift of red and green beams: ±1/8" to ±3/8"
Average of max. shift of red and green beams: ±7/32" to ±9/32"

Radial-Converging Magnet Assembly:

For static convergence—
After adjustment has been made for optimum color purity and dynamic convergence (Each beam): Shift of ±5/8"

For dynamic convergence:
Effected by magnetomotive force of parabolic and/or sawtooth waveshape synchronized with scanning.

Horizontal:
Blue pattern—
Parabola amplitude to provide: Shift of 1/4" to 9/16"
Sawtooth amplitude to provide: Shift of ±50% of the shift caused by parabola amplitude

Red pattern & green pattern—
Parabola:
Amplitude to provide: Shift of 1/8" to 3/8"
Ratio of red-pattern shift to green-pattern shift: 1/2 to 2
Sawtooth:
Amplitude for red pattern to provide: Shift of -35% to +85% of the shift caused by parabola amplitude
Amplitude for green pattern to provide: Shift of -85% to +35% of the shift caused by parabola amplitude

Difference between red-pattern shift and green-pattern shift (Shift_R - Shift_G): 0 to +100%

Vertical:
Blue pattern—
Parabola amplitude to provide: Shift of 0 to 1/8"

See next page.
For dynamic convergence† (Cont'd):

**Vertical:**
- Sawtooth amplitude to provide 0° to 1/4" 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 0° Shift of -1/8" to +3/16"
- Difference between red-pattern shift and green-pattern shift (\(\text{Shift}_R - \text{Shift}_G\)) 0 to +100%

**Examples of Use of Design Ranges:**

For ultor voltage of 20000 25000 volts
- Grid-No.3 (Focusing Electrode) to Cathode (Of Each Gun) Voltage: 3040 to 4240 3800 to 5300 volts
- Grid-No.2-to-Cathode Voltage (Each Gun) when circuit design utilizes grid-No.1-to-cathode voltage of -70 volts for raster cutoff. 130 to 370 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 intube 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 megarohms.

†, ‡: 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 (A) and (oo).
★ The direction of movement of the red and green beam is opposite to that of the blue beam.
† Indicated values apply when RCA test yoke is used with the 21AXP22-A.
▲ The parabola amplitude is determined by the average value of the shifts at the extremities of the respective horizontal and vertical axes of the screen with convergence of the three beams maintained at the center of the screen. An increase in amplitude should move the blue beam toward the top of the screen; the red beam toward the lower left of the screen; and the green beam toward the lower right of the screen.
oo The sawtooth amplitude is determined by the difference between the shifts at the extremities of the respective horizontal and vertical axes of the screen. Positive amplitude indicates that the shift at the right or bottom of the screen is greater than the shift at the left or top of the screen.

X-RAY WARNING

X-ray radiation is produced by the 21AXP22-A when it is operated at its normal ultor voltage. The radiation is through the faceplate, and is sufficient to require the adoption of safety measures in TV receivers. Shielding such as that provided by a 1/4-inch thickness of safety glass (lime) in front of the faceplate, should prove adequate to provide protection against personal injury from prolonged exposure at close range when the tube is operated at its maximum ultor voltage rating.

When this tube is being serviced outside of the TV receiver cabinet, it should never be operated without providing adequate X-ray shielding in front of faceplate. Because the ultor voltage may rise above its maximum rated value for short periods during adjustment with increase in the amount of X-ray radiation, provision should be made for placing a 3/8-inch thickness of safety glass in front of the faceplate to avoid the hazard of X-ray radiation.
21AXP22-A
CUTOFF DESIGN CHART

\( E_f = 6.3 \) VOLTS
ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 20000 TO 25000
GRID-N\#3-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8565RI
**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 ULTRAVOLTAGE.

---

**REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE**

![Diagram of the reference-line and neck-funnel contour gauge with dimensions and tolerances.]

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

<table>
<thead>
<tr>
<th>y</th>
<th>x</th>
<th>y</th>
<th>x</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000&quot;</td>
<td>2.062&quot; + 0.001&quot; - 0.000&quot;</td>
<td>0.385&quot;</td>
<td>2.062&quot; + 0.001&quot; - 0.000&quot;</td>
</tr>
<tr>
<td>0.125&quot;</td>
<td>2.062&quot; + 0.001&quot; - 0.000&quot;</td>
<td>0.500&quot;</td>
<td>2.084&quot; ± 0.001&quot;</td>
</tr>
<tr>
<td>0.250&quot;</td>
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<td>0.625&quot;</td>
<td>2.122&quot; ± 0.001&quot;</td>
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<tr>
<td>0.375&quot;</td>
<td>2.062&quot; + 0.001&quot; - 0.000&quot;</td>
<td>0.750&quot;</td>
<td>2.182&quot; ± 0.001&quot;</td>
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---

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
<table>
<thead>
<tr>
<th>y</th>
<th>x</th>
<th>y</th>
<th>x</th>
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</thead>
<tbody>
<tr>
<td>0.875&quot;</td>
<td>2.258&quot; ± 0.001&quot;</td>
<td>1.625&quot;</td>
<td>3.216&quot; ± 0.001&quot;</td>
</tr>
<tr>
<td>1.000&quot;</td>
<td>2.352&quot; ± 0.001&quot;</td>
<td>1.750&quot;</td>
<td>3.440&quot; ± 0.001&quot;</td>
</tr>
<tr>
<td>1.125&quot;</td>
<td>2.465&quot; ± 0.001&quot;</td>
<td>1.875&quot;</td>
<td>3.678&quot; ± 0.001&quot;</td>
</tr>
<tr>
<td>1.250&quot;</td>
<td>2.604&quot; ± 0.001&quot;</td>
<td>2.000&quot;</td>
<td>3.958&quot; ± 0.001&quot;</td>
</tr>
<tr>
<td>1.375&quot;</td>
<td>2.778&quot; ± 0.001&quot;</td>
<td>2.125&quot;</td>
<td>4.332&quot; ± 0.001&quot;</td>
</tr>
<tr>
<td>1.500&quot;</td>
<td>2.990&quot; ± 0.001&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TYPICAL DRIVE CHARACTERISTICS

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

ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = \{20000 TO 25000\}

GRID-N°2-TO-CATHODE (OF EACH GUN) VOLTS = EC₂K

<table>
<thead>
<tr>
<th>CURVES</th>
<th>DRIVE</th>
<th>EC₂K</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRID N°1</td>
<td>MEASURED WITH ZERO VIDEO DRIVE</td>
<td></td>
</tr>
<tr>
<td>CATHODE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

VIDEO SIGNAL VOLTS FROM ULTOR - CURRENT CUTOFF PER GUN

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8566RI
E_f = 6.3 VOLTS
GRID-NA3-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 1/8" x 14 1/2"
### DATA

<table>
<thead>
<tr>
<th>General:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electron Guns, Three with Axes Tilted</td>
</tr>
<tr>
<td>Toward Tube Axis. ........... Red, Blue, Green</td>
</tr>
<tr>
<td>Heater, for Unipotential Cathode of</td>
</tr>
<tr>
<td>Each Gun, Paralleled with Each of</td>
</tr>
<tr>
<td>the Other Two Heaters within Tube:</td>
</tr>
<tr>
<td>Voltage ................ 6.3 ........ ac or dc volts</td>
</tr>
<tr>
<td>Current ............. 1.8 ± 10% ........ amp</td>
</tr>
<tr>
<td>Faceplate, Spherical. .......... Filterglass</td>
</tr>
<tr>
<td>Light transmission (Approx.) .. 77%</td>
</tr>
</tbody>
</table>

| 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 Method. ........ Tube axis horizontal (Base pin 12 on top) |
| Uiltor Terminal .......... Metal Shell |
| Socket. .......... Alden Nos. 214NMINSC (Radial leads), 214NMINC (Axial leads), or equivalent |

For Curves, see front of this Section.
COLOR PICTURE TUBE

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

- Pin 1-Heater
- Pin 2-Grid No.1
  of Red Gun
- Pin 3-Grid No.2
  of Red Gun
- Pin 4-Cathode
  of Red Gun
- Pin 5-Cathode
  of Green Gun
- Pin 6-Grid No.1
  of Green Gun
- Pin 7-Grid No.2
  of Green Gun
- Pin 9-Grids No.3
- Pin 10-Grid No.3
  of Blue Gun
- Pin 11-Grid No.2
  of Blue Gun
- Pin 12-Grid No.1
  of Blue Gun
- Pin 13-Cathode
  of Blue Gun
- Pin 14-Heater
  METAL SHELL-
  ULTOR
  (Grid No.4,
  Collector)

Maximum Ratings, Design-Center Values:
ULTOR-TO-CATHODE (Of each gun) VOLTAGE... 25000 max. volts
GRID-No.3-TO-CATHODE (Of each gun) VOLTAGE... 6000 max. volts
GRID-No.2-TO-CATHODE VOLTAGE (Each gun).... 800 max. volts
GRID-No.1-TO-CATHODE VOLTAGE (Each gun):
  Negative-bias value.................. 400 max. volts
  Positive-bias value.................. 0 max. volts
  Positive-peak value.................. 2 max. volts
PEAK HEATER-CATHODE VOLTAGE (Each gun):
  Heater negative with respect to cathode:
    During equipment warm-up period
       not exceeding 15 seconds........... 410 max. volts
    After equipment warm-up period..... 180 max. volts
  Heater positive with respect to cathode, 180 max. volts

Limiting Circuit Values:
High-Voltage Circuits:

In order to minimize the possibility of damage to the
tube caused by a momentary internal arc, it is recommended
that the ultor power supply and the grid-No.3 power supply
be of the limited-energy type with inherent regulation to
limit the continuous short-circuit current to 50 milliamperes.
In addition, to prevent cathode damage with resultant decrease
in tube life, the effective resistance between grid-No.3 power-
supply output capacitor and the grid-No.3 electrode should be
not less than 50,000 ohms. This resistance should be capable
of withstanding the maximum instantaneous current and voltage
in the grid-No.3 circuit.

In equipment utilizing a well-regulated ultor power supply,
the grid-No.3-circuit resistance should be limited to 7.5
megohms.

Low-Voltage Circuits:
Grid-No.1-Circuit Resistance (Each gun)...... 1.5 max. megohms
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 (lume) 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.
21CBP4A

Picture Tube

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

GENERAL DATA

Electrical:
Heater Current at 6.3 volts .............. 600 ± 10% ma
Direct Interelectrode Capacitances:
  Grid No.1 to all other electrodes ....... 6 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.J-1-21)

Bases (Alternates):
  Short Small-Shell Duodecal 6-Pin
    (JEDEC Group 4, No.B6-203)
  Small-Shell Duodecal 6-Pin, Arrangement 1
    (JEDEC Group 4, No.B6-63)
  Basing Designation for BOTTOM VIEW ........ 12L

Pin 1—Heater
Pin 2—Grid No.1
Pin 6—Grid No.4
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater

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

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
**Maximum and Minimum Ratings, Design-Maximum Values:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR VOLTAGE</td>
<td>22000 max. volts</td>
</tr>
<tr>
<td>GRID-No.4 (FOCUSING) VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>1000 max. volts</td>
</tr>
<tr>
<td>Negative value</td>
<td>500 max. volts</td>
</tr>
<tr>
<td>GRID-No.2 VOLTAGE</td>
<td>550 max. volts</td>
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<tr>
<td>GRID-No.1 VOLTAGE:</td>
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<tr>
<td>Negative peak value</td>
<td>220 max. volts</td>
</tr>
<tr>
<td>Negative bias value</td>
<td>155 max. volts</td>
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<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>HEATER VOLTAGE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.9 max. volts</td>
</tr>
<tr>
<td></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: 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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.4 Voltage for focus</td>
<td>0 to 450 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 Values:**

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

---

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

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

With heater having controlled warm-up time

<table>
<thead>
<tr>
<th>DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General:</strong></td>
</tr>
</tbody>
</table>

Heater, for Unipotential Cathode:

<table>
<thead>
<tr>
<th>Voltage (AC or DC)</th>
<th>6.3 volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>0.6 ± 5% amp</td>
</tr>
<tr>
<td>Warm-up time (Average)</td>
<td>11 sec</td>
</tr>
</tbody>
</table>

Capacitance between External Conductive Coating and Ultor:

- 2500 max. µf
- 2000 min. µf

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

Deflection Angles (Approx.):

- Diagonal: 110°
- Horizontal: 105°
- Vertical: 87°

Electron Gun: Type Requiring No Ion-Trap Magnet

Tube Dimensions:

- Overall length: 14-7/16" ± 3/8"
- Greatest width: 20-1/4" ± 1/8"
- Greatest height: 16-3/8" ± 1/8"
- Diagonal: 21-3/8" ± 1/8"
- Neck length: 5-3/16" ± 3/16"
- Radius of curvature of faceplate (External surface): 28-1/2"

Screen Dimensions (Minimum):

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

Operating Position: Any

Cap: Recessed Small Cavity (JEDEC No.J1-21)
Base: Special (JEDEC No.B6-185)

Basing Designation for BOTTOM VIEW: 7FA

Maximum Ratings, Design-Center Values:

- ULTOR VOLTAGE: 18000 max. volts
- GRID-No.4 (FOCUSING) VOLTAGE:
  - Positive value: 1000 max. volts
  - Negative value: 500 max. volts
- GRID-No.2 VOLTAGE: 500 max. volts

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
(CGrid No.3, Collector)
C—External Conductive Coating
GRID-No.1 VOLTAGE:
- Negative-peak value: 200 max. volts
- Negative-bias value: 140 max. volts
- Positive-bias value: 0 max. volts
- Positive-peak value: 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:
- Heater negative with respect to cathode:
  - During equipment warm-up period not exceeding 15 seconds: 410 max. volts
  - After equipment warm-up period: 180 max. volts
- Heater positive with respect to cathode: 180 max. volts

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

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section
COLOR PICTURE TUBE
THREE-GUN, GRADED-HOLE, SHADOW-MASK TYPE
ALUMINIZED TRICOLOR PHOSPHOR-DOT SCREEN
ALL-GLASS ENVELOPE ELECTROSTATIC FOCUS
MAGNETIC CONVERGENCE MAGNETIC DEFLECTION

DATA

General:
Electron Guns, Three with Axes Tilted
Toward Tube Axis ...................................... Blue, Green, Red
Heater, for Unipotential Cathode of
Each Gun, Paralleled with Each of
the Other Two Heaters within Tube:
Voltage ........................................ 6.3 ac or dc volts
Current ........................................ 1.8 ± 10% amp
Direct Interelectrode Capacitances (Approx.):
Grid No.1 of any gun to all other
electrodes except the No.1 grids
of the other two guns ......................... 7 μf
Cathode of blue gun + cathode of green
gun + cathode of red gun to all
other electrodes ............................. 16 μf
Grid No.3 (of each gun tied within
tube to No.3 grids of other two
guns) to all other electrodes ............ 9 μf
External conductive coating to grid No.6. {2500 max. μf
{2000 min. μf

Faceplate, Spherical .................................. Filterglass
Light transmission (Approx.) .................. 72%

Screen, on Inner Surface of Faceplate:
Type ............................................ Aluminized, Tricolor, Phosphor-Dot
Phosphor (Three separate phosphors, collectively) ... P22
Fluorescence and phosphorescence of
separate phosphors, respectively .... Blue, Green, Red
Persistence of group phosphorescence .......... Medium
Dot arrangement .................................. Triangular group consisting of
blue dot, green dot, and red dot
Spacing between centers of adjacent dot trios (Approx.) 0.029"

Size (Minimum):
Greatest width .................................... 19-1/4"
Height ........................................... 15-1/2"
Projected area ................................... 261 sq. in.

Focusing Method .................................. Electrostatic
Convergence Method .......................... Magnetic
Deflection Method .......................... Magnetic

Deflection Angles (Approx.):
Horizontal ..................................... 70°
Vertical ......................................... 55°

Tube Dimensions:
Overall length .................................. 25-1/32" ± 3/8"
Diameter ........................................ 20-13/16" ± 1/8"
Weight (Approx.) ................................ 36-1/2 lbs
Operating Position .......................... Tube Axis Horizontal
(Base pin 12 and V-grooved panel pad on top)
COLOR PICTURE TUBE

Cass (Two)............... Recessed Small Cavity (JETEC No.J1-21)
Socket. .................. Alden Nos.214NMINS (Radial leads),
                       214NMINS (Axial leads), or equivalent
Base. .................. Small-Shell Neodheetal 12-Pin (JETEC No.B12-131)
Basing Designation for BOTTOM VIEW. .................. 14AL

Pin 1-Heater           Pin 13-Cathode
Pin 2-Grid No.1        of Blue Gun
                      of Red Gun
Pin 3-Grid No.2        Pin 14-Heater
                      Cap Over
Pin 4-Cathode         Pin 1-Ulterior
                      of Red Gun
PIN 5-Cathode         Cap Over (Grid No.4,
                      of Green Gun Grid No.5)
Pin 6-Grid No.1       Pin 2-Grid No.6,
                      Collector,
Pin 7-Grid No.2       Voltage-
                      of Green Gun Supply
Pin 9-Grid No.3       Pin 11-Grid No.2
                      of Blue Gun C-External
Pin 11-Grid No.2      of Blue Gun Conductive
Pin 12-Grid No.1
                      of Blue Gun

Maximum Ratings, Design-Center Values:
ULTOR-TO-CATHODE (Of each gun) VOLTAGE ... 25000 max. volts
Between the Ultror Terminal and the High-Voltage-Supply
Terminal (See Dimensional Outline), it is necessary to
connect a resistor of 50,000 ohms as described under
Limiting Circuit Values. The high voltage must be connec-
ted to the High-Voltage-Supply Terminal—never directly
to the Ultror Terminal.
GRID-No.3-TO-CATHODE (Of each gun) VOLTAGE. 6000 max. volts
GRID-No.2-TO-CATHODE VOLTAGE (Each gun) .. 600 max. volts
GRID-No.1-TO-CATHODE VOLTAGE (Each gun):
Negative bias value ............... 400 max. volts
Positive bias value .............. 0 max. volts
Positive peak value .............. 2 max. volts
PEAK HEATER-CATHODE VOLTAGE (Each gun):
Heater negative with respect to cathode:
During equipment warm-up period
not exceeding 15 seconds. ........ 410 max. volts
After equipment warm-up period. .... 180 max. volts
Heater positive with respect to cathode. 180 max. volts

Equipment Design Ranges:

With ultor voltage (E_{c_1}^{k_1}each gun) between 20000* and
25000 volts

Grid-No.3 (Focusing
Electrode)-to-Cathode
(One each gun) Voltage. 16.8% to 20% of E_{c_1}^{k_1}each gun

*: see next page.
COLOR PICTURE TUBE

Grid-No.2-to-Cathode
Voltage (Each gun)
when circuit design
utilizes grid-No.1-
to-cathode voltage
(Ec1k) 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
(Ec2k) 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
Grid-No.2 Current (Each gun)
Percentage of Total Ultor
Current Supplied by Each Gun:
To Produce White of
8500° K + 27 M.P.C.D.
(I.C.I. Coordinates
x = 0.287, y = 0.316):
Red gun .................................. 50 %
Blue gun .................................. 19 %
Green gun .................................. 31 %

Ratios of Cathode Currents:
To Produce White of
8500° K + 27 M.P.C.D.
(I.C.I. Coordinates
x = 0.287, y = 0.316):
Red cathode to green cathode 1 1.6 2
Red cathode to blue cathode 1.5 2.7 4

Maximum Raster Shift in Any
Direction from Screen Center
Maximum Required Displacements
of Beam Trios with Respect to
Associated Phosphor-Dot Trios:
Uniform in any direction over
entire screen area 0.005"

* Connect high-voltage supply to this cap and also connect 50,000-ohm
resistor between this cap and cap over pin 1 (Ultor cap).
# Brilliance and definition decrease with decreasing ultor voltage. In
general, the ultor voltage should not be less than 20,000 volts.
* 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".

See next page.
COLOR PICTURE TUBE

Localized around edge of screen—
  Tangential. ................................. 0.002" 
  Radial. .................................... 0.003"

Adjustment to be Provided by
the Following Components:

Lateral-Converging Magnet:
  Maximum lateral shift of blue beam. .... ±1/4" 
  Maximum lateral shift of red beam and
green beam. ................................ ±1/8" to ±3/8" 
  Average of maximum lateral shift 
of red beam and green beam. ............ ±7/32" to ±9/32"

Radial-Converging Magnet Assembly:
  For static convergence including
  compensation for dc component
  of dynamic convergence
  (Each beam) ................................... "Shift of ±5/8"
  For dynamic convergence†—
  Effected by magnetomotive force
  of parabolic and/or sawtooth
  waveshape synchronized with
  scanning.

Horizontal:
  Blue pattern—
    Parabola amplitude to
    provide. .................................. "Shift of 3/16" to 1/2"
    Sawtooth amplitude to
    provide. .................................. "Shift of ±50% of the
                                       shift caused by parabola amplitude"

Red pattern & green pattern—
  Parabola:
    Amplitude to provide. .................. "Shift of 1/16" to 5/16"
    Ratio of red-pattern shift
to green-pattern shift. ............... 2/3 to 3/2
  Sawtooth:
    Amplitude to provide. ................. "Shift of -60% to +60% 
                                       of the shift caused by
                                       parabola amplitude"

Difference between red-pattern
  shift and green-pattern shift
  (Shiftₐ - Shift₆) ......................... -75% to +75%

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.

† Shift is the movement of the regions of dot/crosshatch-generator pattern
  indicated in notes (a) and (b).

↓ 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 21CYP22.

【a, b】: See next page.
COLOR PICTURE TUBE

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
Sawtooth:
Amplitude to provide
Shift of -1/8" to +3/16"
Difference between red-pattern shift and green-pattern shift
(Shift_R - Shift_G)

Examples of Use of Design Ranges:

For voltages of 20000 25000 volts
Grid-No. 3 (Focusing Electrode)—Cathode Voltage (Each gun) Voltage.
Grid-No. 2—Cathode Voltage (Each gun) when circuit design utilizes grid-No. 1—cathode voltage of -70 volts for raster cutoff.
Grid-No. 1—Cathode Voltage (Each gun) for Visual Extinction of Focused Raster when circuit design utilizes grid-No. 2—cathode voltage of 200 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 mA.

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.
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 ultor power supply, the grid-No.3-circuit resistance should be limited to 7.5 megohms.

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.

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 the 21CYP22 is designed to be operated at ultor voltages as high as 25 kilovolts (design-center maximum value), shielding of the 21CYP22 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 the 21CYP22 to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.

High Voltages. The high voltages at which cathode-ray tubes are operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Precautions include the 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.

REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE for Type 21CYP22 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

$E_F = 6.3 \text{ Volts}$

ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 20000 TO 25000
GRID-No. 3-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS

GRID-No. 2-TO-CATHODE VOLTS

GRID-No. 1-TO-CATHODE VOLTS

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
TYPICAL DRIVE CHARACTERISTICS

**CATHODE-DRIVE SERVICE**

- $E_f = 6.3$ VOLTS
- ULTOR-TO-GRID-\#1 (OF EACH GUN) VOLTS = 20000 TO 25000
- GRID-\#2-TO-GRID-\#1 (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS
- ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 20000 TO 25000
- GRID-\#2-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS

**GRID-DRIVE SERVICE**

- $E_f = 6.3$ VOLTS
- ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 20000 TO 25000
- GRID-\#2-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS
- ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS
- GRID-\#2-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS

**Ultor-to-Grid and Grid-to-Ultor Voltages**

- ULTOR-TO-GRID-\#1 (EACH GUN) $= V_{ULTOR} - V_{GRID1}$
- GRID-\#1-TO-CATHODE (EACH GUN) $= V_{GRID1} - V_{CATHODE}$
- ULTOR-TO-GRID-\#2 (EACH GUN) $= V_{ULTOR} - V_{GRID2}$
- GRID-\#2-TO-CATHODE (EACH GUN) $= V_{GRID2} - V_{CATHODE}$

**Video Signal Volts from Ultor-CURRENT Cutoff**

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

92CL-9421
TYPICAL LIGHT-OUTPUT CHARACTERISTICS

$E_F = 6.3$ VOLTS
GRID-N° 3 - TO-CATHODE (OF EACH GUN) VOLTS=ADJUSTED FOR FOCUS
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ULTOR CURRENT TO PRODUCE 8500° K+27 M.P.C.D. WHITE LIGHT OUTPUT.
PERCENTAGE OF TOTAL ULTOR CURRENT SUPPLIED BY EACH GUN TO PRODUCE 8500° K+27 M.P.C.D. WHITE:
RED GUN: 50%
BLUE GUN: 19%
GREEN GUN: 31%
RASTER SIZE: $19\frac{1}{4}'' \times 14\frac{1}{4}''$ CENTERED ON TUBE FACE.
*MEASURED WITHIN 5'' DIAMETER AREA CENTERED ON TUBE FACE.
21CYP22-A

Color Picture Tube

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

ALL-GLASS ENVELOPE
MAGNETIC CONVERGENCE
ELECTROSTATIC FOCUS
MAGNETIC DEFLECTION

Supersedes Type 21CYP22

DATA

General:

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

- Voltage (AC or DC) 6.3 volts
- Current at 6.3 volts 1.6 amp

Direct Interelectrode Capacitances (Approx.):

- Grid No. 1 of any gun to all other electrodes except the No. 1 grids of the other two guns: 7 μf
- Cathode of blue gun + cathode of green gun + cathode of red gun to all other electrodes: 16 μf
- Grid No. 3 (of each gun tied within tube to No. 3 grids of other two guns) to all other electrodes: 9 μf

External conductive coating to grid No. 6 Faceplate, Spherical: Filterglass

Light transmission (Approx.) Screen, on inner surface of Faceplate: Type: Aluminized, Tricolor, Phosphor-Dot Phosphor (three separate phosphors, collectively) P22 Fluorescence and phosphorescence of separate phosphors, respectively: Blue, Green, Red Persistence of group phosphorescence: Medium Dot arrangement: Triangular group consisting of blue dot, green dot, and red dot Spacing between centers of adjacent dot trios (Approx.) 0.029" Size (Minimum):

- Greatest width: 19-1/4"
- Height: 15-1/2"
- Projected area: 261 sq. in.

Focusing Method: Electrostatic
Convergence Method: Magnetic
Deflection Method: Magnetic
Deflection Angles (Approx.):

- Horizontal: 70°
- Vertical: 55°

Tube Dimensions:

- Overall length: 25-1/32" ± 3/8"
- Diameter: 20-13/16" ± 1/8"
- Weight (Approx.): 36-1/2 lbs
21CYP22-A

Operating Position .......... Tube Axis Horizontal
(Base pin 12 and V-grooved panel pad on top)
Caps (Two) .......... Recessed Small Cavity (JEDEC No.J1-21)
Socket ............... Alden Nos.214NMINS (Radial leads),
214NMINC (Axial leads), or equivalent
Base .......... Small-Shelf Neodischeal 12-Pin (JEDEC No.B12-131)
Basing Designation for BOTTOM VIEW ........ 14AL

Pin 1-Heater
Pin 2-Grid No.1 of Red Gun
Pin 3-Grid No.2 of Red Gun
Pin 4-Cathode of Red Gun
Pin 5-Cathode of Green Gun
Pin 6-Grid No.1
of Green Gun
Pin 7-Grid No.2
of Green Gun
Pin 9-Grid No.3
Pin 11-Grid No.2
of Blue Gun
Pin 12-Grid No.1
of Blue Gun
Pin 13-Cathode of Blue Gun
Pin 14-Heater
Cap Over
Pin 1-Ultor (Grid No.4,
Grid No.5)

Cap* Over
Pin 2-Grid No.6,
Collector, High-
Voltage-Supply
Terminal
Pin 3-Grid No.6
Collector, High-
Voltage-Supply
Terminal
C-External
Conductive
Coating

Maximum Ratings, Design-Center Values:
ULTOR-TO-CATHODE (of each gun) VOLTAGE .... 25000 max. volts
Between the Ultor Terminal and the High-Voltage-Supply
Terminal (See Dimensional Outline), it is necessary to
connect a resistor of 50,000 ohms as described under
Limiting Circuit Values. The high voltage must be connec-
ted to the High-Voltage-Supply Terminal—never directly
to the Ultor Terminal.
GRID-No.3-TO-CATHODE (of each gun)
VOLTAGE ........ 6000 max. volts
GRID-No.2-TO-CATHODE VOLTAGE (Each gun) .... 600 max. volts
GRID-No.1-TO-CATHODE VOLTAGE (Each gun):
Negative-bias value .......... 400 max. volts
Positive-bias value .......... 0 max. volts
Positive-peak value .......... 2 max. volts
PEAK HEATER-CATHODE VOLTAGE (Each gun):
Heater negative with respect to cathode:
During equipment warm-up period
not exceeding 15 seconds .......... 410 max. volts
After equipment warm-up period .......... 180 max. volts
Heater positive with respect to cathode .......... 180 max. volts

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
Equipment Design Ranges:

With ultor voltage ($E_{c4}$ each gun) between 20000 and 25000 volts.

Grid-No.3 (Focusing Electrode)-to-Cathode Voltage (Of each gun) is 16.8% to 20% of $E_{c4}$ each gun volts.

Grid-No.2-to-Cathode Voltage (Each gun) when circuit design utilizes grid-No.1-to-cathode voltage ($E_{c1}$) at fixed value.

Grid-No.1-to-Cathode Voltage (Each gun) for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2-to-cathode voltage ($E_{c2}$) at fixed value.

See Cutoff Design Chart.

Variation in Raster Cutoff Between Guns in Any Tube.

Grid-No.3 Current (Each gun) is -45 to +45 µA.

Grid-No.2 Current (Each gun) is -5 to +5 µA.

Percentage of Total Ultor Current Supplied by Each Gun:

To Produce White of $8500\degree K + 27\ M.P.C.D.$

(CIE Coordinates $x = 0.287, y = 0.316$):

Red gun: 49 %

Blue gun: 18 %

Green gun: 33 %

Ratios of Cathode Currents:

To Produce White of $8500\degree K + 27\ M.P.C.D.$

(CIE Coordinates $x = 0.287, y = 0.316$):

Red cathode to green cathode: 1.2 Min. 1.5 Typical 1.8 Max.

Red cathode to blue cathode: 2.1 Min. 2.7 Typical 3.3 Max.

Maximum Raster Shift in Any Direction from Screen Center: 7/8 inch.
Maximum Required Displacements of Beam Trios with Respect to Associated Phosphor-Dot Trios: Uniform in any direction over entire screen area .................. 0.005".

Adjustment to be Provided by the Following Components:

Lateral-Converging Magnet:
- Maximum lateral shift of blue beam ........... ±1/4"
- Maximum lateral shift of red beam and green beam .......................... ±1/8" to ±3/8"
- Average of maximum lateral shift of red beam and green beam ........... ±7/32" to ±9/32"

Radial-Converging Magnet Assembly:
- For static convergence including compensation for dc component of dynamic convergence (Each beam) .................. Shift of ±5/8"
- For dynamic convergence—
  Effected by magnetomotive force of parabolic and/or sawtooth waveshape synchronized with scanning.

Horizontal:
- Blue pattern—Parabola amplitude to provide* .......... Shift of 3/16" to 1/2"
  Sawtooth amplitude to provide* .................. Shift of ±50% of the shift caused by parabola amplitude

Red pattern & green pattern—
- Parabola: Amplitude to provide* .................. Shift of 1/16" to 5/16"
  Ratio of red-pattern shift to green-pattern shift ............ 2/3 to 3/2
- Sawtooth: Amplitude to provide* .................. Shift of -60% to +60% of the shift caused by parabola amplitude

Difference between red-pattern shift and green-pattern shift (Shift \( R \) - Shift \( G \)) .................. -75% to +75%

Vertical:
- Blue pattern—Parabola amplitude to provide* .................. Shift of -1/8" to +1/16"
  Sawtooth amplitude to provide* .................. Shift of -1/16" to +3/16"
Red pattern & green pattern—

Parabola:
Amplitude to provide* . . . Shift of 1/8" to 5/16"
Ratio of red-pattern shift to green-pattern shift . . . . . . . 2/3 to 3/2

Sawtooth:
Amplitude to provide*. . . Shift of -1/8" to +3/16"
Difference between red-pattern shift and green-pattern shift (Shift_R - Shift_G) . . . . . . . . . -100% to +100%

Examples of Use of Design Ranges:

<table>
<thead>
<tr>
<th>For ultor voltage of</th>
<th>20000</th>
<th>25000</th>
<th>volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.3 (Focusing Electrode)-to-Cathode (Of each gun) Voltage.</td>
<td>3360 to 4000</td>
<td>4200 to 5000</td>
<td>volts</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>
<td>volts</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>
<td>volts</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 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 1.5 amperes with variations not exceeding ± 3% under normal line-voltage variations. When voltage regulation is employed, the regulator should be designed to provide a heater voltage of 5.5 volts with variations not exceeding ± 6% under normal line-voltage variations.

* For curves, see front of this Section.

**Connect high-voltage supply to this cap and also connect 50,000-ohm resistor between this cap and cap over pin 1 (ultor cap).**

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

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

* If this displacement is accomplished by means of a purifying magnet located on the neck of the tube, the equivalent raster movement is about 3/4".

* Shift is the movement of the regions of dot/crosshatch-generator pattern indicated in notes (*) and (†).

* The direction of movement of the red and green beam is opposite to that of the blue beam.

* 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 associated phosphor-dot trios.

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

GENERAL CONSIDERATIONS

X-Ray-Warning. Because this color picture tube is designed to be operated at ultra voltages as high as 25 kilovolts (Design-center maximum value), shielding of this color picture tube for X-ray radiation may be needed to protect against possible injury from prolonged exposure at close range.

Shatter-Proof Cover Over the Tube Face. Following conventional picture-tube practice, it is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of this color picture tube to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.

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

REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE
for Type 2ICYP22-A is the same as that shown for Type 2IAXP22-A
LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS

LOCATION OF LATERAL-CONVERGING POLE PIECES WITH RESPECT TO GUNS

HORIZONTAL £ OF SCREEN

GREEN GUN

RED GUN

PLANE THROUGH £ OF PIN NR 2 AND TUBE AXIS

BASE

BOTTOM VIEW

MOLD-MATCH LINE

1 1/16" MIN.
UNDISTURBED WIDTH EXCLUDING PADS

1/8"

5/32" (NOTE 5)

SEAL AREA

SEAL LINE

DETAIL

92CL-9340R2

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

DATA 5
10-60

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

$E_c = 6.3$ VOLTS
ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 20000 TO 25000
GRID-N°3-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS

GRID-N°1-TO-CATHODE VOLTS

GRID-N°2-TO-CATHODE VOLTS

MAXIMUM RASTER CUT-OFF OF ANY TUBE

MINIMUM RASTER CUT-OFF OF ANY TUBE

RASTER CUT-OFF OF TYPICAL TUBE

92CM-8565R1

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
## TYPICAL DRIVE CHARACTERISTICS

### Cathode-Drive Service

- \( E_F = 6.3 \text{ Volts} \)
- \( \text{Volts} = 20000 \text{ to } 25000 \)
- Grid-N93-to-Grid-N91 (of each gun) Volts = Adjusted for Focus
- Grid-N92-to-Grid-N91 Volts (each gun) = Adjusted to provide Ultor-Current Cut-Off for desired fixed Cathode-to-Grid-N91 (each gun) Voltage (\( E_{k0} \))

### Grid-Drive Service

- \( E_F = 6.3 \text{ Volts} \)
- \( \text{Volts} = 20000 \text{ to } 25000 \)
- Grid-N93-to-Cathode (of each gun) Volts = Adjusted for Focus
- Grid-N92-to-Cathode Volts (each gun) = Adjusted to provide Ultor-Current Cut-Off for desired fixed Grid-N91-to-Cathode (each gun) Voltage (\( E_{c,k} \))

<table>
<thead>
<tr>
<th>Voltage (Volts)</th>
<th>10000</th>
<th>9</th>
<th>8</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cathode Drive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zero-Bias Point</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Graph:**

- Video Signal Volts from Ultor-Current Cutoff per Gun
- Ultron Microamperes per Gun

92CL-9421

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
TYPICAL LIGHT-OUTPUT CHARACTERISTICS

$E_p = 6.3$ VOLTS

GRID-NO. 3-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS

DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ULTOR CURRENT TO PRODUCE 8500° K±27 M.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" X 14¼" CENTERED ON TUBE FACE.

*MEASURED WITHIN 5/8 INCH DIAMETER AREA CENTERED ON TUBE FACE.
PICTURE TUBE

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

With heater having controlled warm-up time

DATA

General:
Heater, for Unipotential Cathode:
Voltage (AC or DC) ................. 6.3 volts
Current ................................ 0.6 amp
Warm-up time (Average) .......... 11 sec

Direct Interelectrode Capacitances:
Grid No.1 to all other electrodes ... 6 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 ............................ 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 ...................... 14-11/16" ± 5/16"
Greatest width ....................... 20-1/4" ± 1/8"
Greatest height ...................... 16-3/8" ± 1/8"
Diagonal ............................. 21-3/8" ± 1/8"
Neck length .......................... 5-7/16" ± 3/16" − 1/8"
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.
Weight (Approx.) .................... 22 lbs
Operating Position ..................... Any
Cap ................................ Recessed Small Cavity (JEDEC No.J1-21)
Bulb ................................ J171G1/K1
Base ................................ Small-Button Eightar 7-Pin,
                                          Arrangement 2, (JEDEC No.B7-183)
Basing Designation for 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-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 ($E_{C_{5K}}$) between 15000 and 20000 volts and grid-No.2 voltage ($E_{C_{2k}}$) between 200 and 500 volts

Grid-No.4 Voltage for focus $S$ ........................ 0 to 500 volts

Grid-No.1 Voltage ($E_{C_{1k}}$)
for visual extinction of focused raster ........................................
See Raster-Cutoff-Range Chart for Grid-Drive Service

Grid No.1 Video Drive
from Raster Cutoff
(Black level):
White-level value
(Peak positive) ........................................
Same value as determined for $E_{C_{1k}}$ except video drive is a positive voltage

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

Field Strength of Adjust-
able Centering Magnet* ......................... 0 to 8 gausses

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ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Examples of Use of Design Ranges:

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

Grid-No.4 Voltage for focus... 0 to 500 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 Ratings, Design-Center Values:

ULTOR-TO-GRID-No.1 VOLTAGE ........ 20000 max. volts

GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:
Positive value........ 1000 max. volts
Negative value........ 500 max. volts

GRID-No.2-TO-GRID-No.1 VOLTAGE........ 640 max. volts

GRID-No.2-TO-CATHODE VOLTAGE........ 500 max. volts

CATHODE-TO-GRID-No.1 VOLTAGE:
Positive-peak value........ 200 max. volts
Positive-bias value........ 140 max. volts
Negative-bias value........ 0 max. volts
Negative-peak value........ 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period not exceeding 15 seconds........ 410 max. volts
After equipment warm-up period........ 180 max. volts
Heater positive with respect to cathode........ 180 max. volts

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage \(E_{C2g_1}\) between 15000 and 20000 volts and grid-No.2-to-grid-No.1 voltage \(E_{C2g_1}\) between 225 and 540 volts

Grid-No.4-to-Grid-No.1 Voltage for focus........ 0 to 500 volts

Cathode-to-Grid-No.1 Voltage \(E_{k91}\) for visual extinction of focused raster........ See Raster-Cutoff-Range Chart for Cathode-Drive Service
Cathode-to-Grid-No.1
Video Drive from Raster
Cutoff (Black level):
White-level value
(Peak negative) ........ Same value as determined for
E_{kg1} except video drive is a
negative voltage
Grid-No.4 Current ........ -25 to +25 \( \mu A \)
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:

\begin{align*}
\text{With ultor-to-grid-} & \text{ No.1 voltage of} \\
\text{and grid-No.2-to-grid-} & \text{No.1 voltage of} \\
\text{Grid-No.4-to-Grid-No.1} & \text{Voltage for focus.} \\
\text{Cathode-to-Grid-No.1} & \text{Voltage for visual} \\
\text{extinction of focused} & \text{raster} \\
\text{Cathode-to-Grid-No.1} & \text{Video Drive from Raster} \\
\text{Cutoff (Black level):} & \text{White-level value.} \\
\end{align*}

\begin{align*}
16000 & \text{volts} \\
400 & \text{volts} \\
0 \text{ to } 500 & \text{volts} \\
36 \text{ to } 78 & \text{volts} \\
-36 \text{ to } -78 & \text{volts}
\end{align*}

Maximum Circuit Values:

\begin{align*}
\text{Grid-No.1-Circuit Resistance} & \text{ 1.5 max. megohms}
\end{align*}

* Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.
* Brightness and focus quality decrease with decreasing ultor voltage.
* In general, the ultor voltage should not be less than 15,000 volts.
* The grid-No.4 voltage or grid-No.4-to-grid-No.1 voltage required for focus of any individual tube is independent of ultor current and will remain essentially constant for values of ultor voltage (or ultor-to-grid-No.1 voltage) or grid-No.2 voltage (or grid-No.2-to-grid-No.1 voltage) within design ranges shown for these items.
* Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 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
DETAIL SHOWING EXTERNAL CONDUCTIVE COATING

92CL-10323


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 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 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.
GRID-DRIVE SERVICE

E_f = 6.3 VOLTS
ULTOR VOLTS = 15000 TO 20000
GRID-N°4 VOLTS ADJUSTED FOR FOCUS.

CATHODE-DRIVE SERVICE

E_f = 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_f = 6.3 \text{ VOLTS} )</td>
<td>( E_f = 6.3 \text{ VOLTS} )</td>
</tr>
<tr>
<td>Ultor-to-Grid-№1 Volts = 16000</td>
<td>Ultor 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>
<tr>
<td>Raster size = 18&quot; x 13( \frac{1}{2} )&quot;</td>
<td>Raster size = 18&quot; x 13( \frac{1}{2} )&quot;</td>
</tr>
</tbody>
</table>

I.C.I. Coordinates of Screen: \( x = 0.270, y = 0.300 \)

Electron Tube Division
Radio Corporation of America, Harrison, New Jersey
92CM-10326
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-$N_1$ VOLTS = 15000 TO 20000</td>
<td>ULTOR VOLTS = 15000 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>

**Diagram:**
- **Axes:**
  - Y-axis: ULTR MILLIAMPERES
  - X-axis: VIDEO SIGNAL VOLTS FROM RASTER CUTOFF
- **Curves:**
  - CATHODE DRIVE
  - GRID DRIVE

**Notes:**
- ELECTRON TUBE DIVISION
- RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
- 92CM-10328
**21DFP4**  
**PICTURE TUBE**  
RECTANGULAR GLASS TYPE  
LOW-VOLTAGE FOCUS  
ALUMINIZED SCREEN  
MAGNETIC DEFLECTION  

**DATA**

**General:**

Heater, for Unipotential Cathode:
- Voltage: 6.3 ac or dc volts
- Current: 0.6 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: [2200 max] μf

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

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

Focus i'ng Method:
- Electrostatic

Deflection Method:
- Magnetic

Deflection Angles (Approx.):
- Diagonal: 110°
- Horizontal: 105°
- Vertical: 87°

Electron Gun:
- Type Requiring No Ion-Trap Magnet

**Tube Dimensions:**

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

**Screen Dimensions (Minimum):**

- Greatest width: 19-1/16"
- Greatest height: 15-1/6"
- Diagonal: 20-1/4"
- Projected area: 262 sq. in.

**Weight (Approx.):**

- Any

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

**Bulb:** J171 (110°)

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

**Base:** Small-Button Eightar 7-Pin, Arrangement 2, (JETEC No.B7-1B3)

**Basing Designation:**

- 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
- Conductive Coating

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ELECTRON TUBE DIVISION  
RADIO 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, 12000 min. volts</td>
</tr>
<tr>
<td>GRID-No.4 VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>1000 max. volts</td>
</tr>
<tr>
<td>Negative value</td>
<td>500 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></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 ($E_{c5k}$) between 12000 and 18000 volts and grid-No. 2 voltage ($E_{c2k}$) between 200 and 500 volts:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.4-Voltage for focus</td>
<td>0 to 400 volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage ($E_{c1k}$)</td>
<td></td>
</tr>
<tr>
<td>for visual extinction of focused raster</td>
<td>See Raster-Cutoff-Range Chart for Grid-Drive Service</td>
</tr>
<tr>
<td>Grid-No.1 Video Drive from Raster Cutoff (Black Level):</td>
<td>Same value as determined for $E_{c1k}$ except video drive is a positive voltage</td>
</tr>
<tr>
<td>White-level value (Peak positive)</td>
<td></td>
</tr>
<tr>
<td>Grid-No.4 Current</td>
<td>-25 to +25 μA</td>
</tr>
<tr>
<td>Grid-No.2 Current</td>
<td>-15 to +15 μA</td>
</tr>
<tr>
<td>Field Strength of Adjustable Centering Magnet</td>
<td>0 to 8 gausses</td>
</tr>
</tbody>
</table>

### Examples of Use of Design Ranges:

With ultor voltage of 14000 volts and grid-No. 2 voltage of 300 volts:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.4 Voltage for focus</td>
<td>0 to 400 volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage for visual extinction of focused raster</td>
<td>-28 to -72 volts, -36 to -94 volts</td>
</tr>
</tbody>
</table>

*: See next page.
GRID-NO.1 VIDEO DRIVE
from Raster Cutoff
(Black Level):
White-level value. ....  28 to 72  36 to 94 volts

MAXIMUM CIRCUIT VALUES:
Grid-No.1-Circuit Resistance. .... 1.5 max. megohms

CATHODE-DRIVE® SERVICE

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

MAXIMUM RATINGS, Design-Center Values:
ULTOR-TO-GRID-No.1 VOLTAGE .... (18000 max. volts
GRID-No.4-TO-GRID-No.1 VOLTAGE:
Positive value .... 1000 max. volts
Negative value .... 500 max. volts
GRID-No.2-TO-GRID-No.1 VOLTAGE .... 640 max. volts
GRID-No.2-TO-CATHODE VOLTAGE .... 500 max. volts
CATHODE-TO-GRID-No.1 VOLTAGE:
Positive peak value .... 200 max. volts
Positive bias value .... 140 max. volts
Negative bias value .... 0 max. volts
Negative peak value .... 2 max. volts
PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode. 180 max. volts
Heater positive with respect to cathode. 180 max. volts

EQUIPMENT DESIGN RANGES:
With any ultor-to-grid-No.1 voltage (Ec5g1) between 12000
and 18000 volts and grid-No.2-to-grid-No.1 voltage (Ec2g1)
between 225 and 640 volts

Grid-No.4-to-Grid-No.1
Voltage for focusS .... 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.4 Current .... -25 to +25 µA

@ see next page.
21DFP4

PICTURE TUBE

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

Examples of Use of Design Ranges:

With ultor-to-grid-
No.1 voltage of
14000 16000 volts
and grid-No.2-to-grid-
No.1 voltage of
300 400 volts

Grid-No.4-to-Grid-
No.1 Voltage
for focus  0 to 400 0 to 400 volts

Cathode-to-Grid-No.1
Voltage for
vision 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

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 21DFP4 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 voltage or grid-No.4-to-grid-No.1 voltage required for focus of any individual tube is independent of ultor current and will remain essentially constant for values of ultor voltage (or ultor-to-grid-No.1 voltage) or grid-No.2 voltage (or grid-No.2-to-grid-No.1 voltage) within design ranges shown for these items.

Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 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

Curves and Charts shown under Type 21CEP4 also apply to the 21DFP4
DETAIL SHOWING EXTERNAL CONDUCTIVE COATING

45°
45°

5 11/16" ± 1/4"

3 1/4" ± 1/4"

ULTOR TERMINAL

EXTERNAL CONDUCTIVE COATING

REFERENCE LINE

1 1/8" ± 1/16"

4 7/8" ± 1/8"

5 7/16"

7 3/16"

1/2"

± 1/4" R.

92CL-9354

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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 3/4" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF TUBE SUPPORT BAND.
RECTANGULAR GLASS TYPE  
LOW-VOLTAGE ELECTROSTATIC FOCUS  
110° MAGNETIC DEFLECTION  
With Heater Having Controlled Warm-Up Time

**GENERAL DATA**

**Electrical:**
- Heater Current at 6.3 volts: 450 ± 5% ma
- Heater Warm-Up Time (Average): 11 seconds
- Direct Interelectrode Capacitances:
  - Grid No.1 to all other electrodes: 6 μf
  - Cathode to all other electrodes: 5 μf
  - External conductive coating to ultor: (2500 max. μf, 1700 min. μf)
- Electron Gun: Type Requiring No Ion-Trap Magnet

Optical:
- Faceplate: Filterglass
- 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: Regular Band
- Contact area for grounding: Near Reference Line

For Additional Information on Coatings and Dimensions:
- See Picture-Tube Dimensional-Outlines and Bulb J171 O/K sheets at the front of this section
- Cap: Recessed Small Cavity (JEDEC No.J1-21)

**Bases (Alternates):**
- Small-Button Eightar 7-Pin, Arrangement 2, (JEDEC No.B7-183)
- Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

**Basing Designation for BOTTOM VIEW:** 8HR

Pin 1—Heater  
Pin 2—Grid No.1  
Pin 3—Grid No.2  
Pin 4—Grid No.4  
Pin 6—Grid No.1  
Pin 7—Cathode  
Pin 8—Heater

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

RADIO CORPORATION OF AMERICA  
Electron Tube Division  
Harrison, N. J.  
DATA 3-62
Maximum Ratings, Design-Maximum Values:

ULTOR VOLTAGE: 19800 max. volts
GRID-No.4 (FOCUSING) VOLTAGE:
- Positive value: 1100 max. volts
- Negative value: 550 max. volts
GRID-No.2 VOLTAGE: 550 max. volts
GRID-No.1 VOLTAGE:
- Negative peak value: 220 max. volts
- Negative bias value: 154 max. volts
- Positive bias value: 0 max. volts
- Positive peak value: 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:
- Heater negative with respect to cathode:
  - During equipment warm-up period not exceeding 15 seconds: 450 max. volts
  - After equipment warm-up period: 200 max. volts
- Heater positive with respect to cathode: 200 max. volts

Typical Operating Conditions:

With ultor voltage of 16000 volts
and grid-No.2 voltage of 300 volts
Grid-No.4 Voltage for focus: 0 to 400 volts
Grid-No.1 Voltage for visual extinction of focused raster: -35 to -72 volts

Maximum Circuit Values:

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

For X-radiation shielding considerations, see sheet X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES at front of this section.
**21DLP4 DATA**

**General:**
Heater, for Unipotential Cathode:

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

**Direct Interelectrode Capacitances:**
- Grid No. 1 to all other electrodes: 6 µµf
- Cathode to all other electrodes: 5 µµf
- External conductive coating to ultor: (2500 max.) µµf

**Faceplate, Spherical:**
Filterglass

**Light transmission (Approx.):** 74%

**Phosphor (For curves, see front of this section):**
- Type: P4—Sulfide Type
- Aluminized
- White
- White
- White
- Short
- Aluminized
- White

**Fluorescence:**

**Persistence:**

**Focusing Method:**
Electrostatic

**Deflection Method:**
Magnetic

**Deflection Angles (Approx.):**
- Diagonal: 90°
- Horizontal: 85°
- Vertical: 68°

**Electron Gun:**
Type Requiring No Ion-Trap Magnet

**Tube Dimensions:**
- Overall length: 17" ± 3/8"
- Greatest width: 20-1/4" ± 1/8"
- Greatest height: 16-3/8" ± 1/8"
- Diagonal: 21-3/8" ± 1/8"
- Neck length: 4-1/2" ± 3/16"

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

**Weight (Approx.):** 24 lbs

**Operating Position:** Any

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

**Bulb:** J171D2/E1

**Base:** Short Small-Shell Duodecal 6-Pin (JETEC Group 4, No.B6-203), or Small-Shell Duodecal 6-Pin (JETEC Group 4, No.B6-63)

**Basing Designation for BOTTOM VIEW:** 12L

**Pin 1—Heater**
**Pin 2—Grid No. 1**
**Pin 6—Grid No. 4**
**Pin 10—Grid No. 2**
**Pin 11—Cathode**
**Pin 12—Heater**

**Cap—Ultor**
**Grid No. 3, Grid No. 5, Collector**
**C—External Conductive Coating**

**RECTANGULAR GLASS TYPE  LOW-VOLTAGE ELECTROSTATIC FOCUS  MAGNETIC DEFLECTION**
GRID-DRIVE\textsuperscript{a} SERVICE

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

Maximum and Minimum Ratings, Design-Center Values:

ULTOR VOLTAGE: \( \left\{ \begin{array}{ll} 20000 \text{ max. volts} \\ 12000 \text{ min. volts} \end{array} \right. \\

GRID-No.4 (FOCUSING) VOLTAGE:
Positive value \( 1000 \text{ max. volts} \\
Negative value \( 500 \text{ max. volts} \\
GRID-No.2 VOLTAGE: \( 500 \text{ max. volts} \\
GRID-No.1 VOLTAGE:
Negative-peak value \( 200 \text{ max. volts} \\
Negative-bias value \( 140 \text{ max. volts} \\
Positive-bias value \( 0 \text{ max. volts} \\
Positive-peak value \( ? \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 any ultor voltage \( (E_{C1k}) \) between 12000 and 20000 volts and grid-No.2 voltage \( (E_{C2k}) \) between 200 and 500 volts

Grid-No.4 Voltage for focus\$ \( -50 \text{ to } +400 \text{ volts} \\
Grid-No.1 Voltage \( (E_{C1k}) \)
for visual extinction of focused raster. \( \text{See Raster-Cutoff-Range Chart for Grid-Drive Service} \\
Grid-No.1 Video Drive from Raster Cutoff (Black Level):
White-level value (Peak positive). \( \text{Same value as determined for } E_{C1k} \text{ except video drive is a positive voltage} \\
Grid-No.4 Current. \( -25 \text{ to } +25 \mu\text{a} \\
Grid-No.2 Current. \( -15 \text{ to } +15 \mu\text{a} \\
Field Strength of Adjustable Centering Magnet* \( 0 \text{ to } 8 \text{ gauss} \\

Examples of Use of Design Ranges:

With ultor voltage of \( 16000 \text{ volts} \) and grid-No.2 voltage of \( 300 \text{ volts} \\
Grid-No.4 Voltage for focus. \( 0 \text{ to } 400 \text{ volts} \\

\( \text{\textsuperscript{a}}\text{\textsuperscript{b}}\text{\textsuperscript{c}}\text{\textsuperscript{d}}\text{: See next page.} \)
Grid-No.1 Voltage for
target 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:
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_{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§ . . . . . 0 to 450 volts
Cathode-to-Grid-No.1 Voltage (E_{CG1}) for
visual extinction
of focused raster . . . . . See Raster-Cutoff-Range Chart
for Cathode-Drive Service

See next page.
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 Adjustable Centering Magnet*........ 0 to 8 gausses

Examples of Use of Design Ranges:
With ultor-to-grid-
No.1 voltage of 16000 volts
and grid-No.2-to-grid-
No.1 voltage of 900 volts

Grid-No.4-to-Grid-No.1 Voltage for focus ........ 0 to 400 volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster ........ 28 to 60 volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level):
White-level value ........ -28 to -60 volts

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

Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

This value is a working design-center minimum. The equivalent absolute minimum ultor- or ultor-to-grid-No.1 voltage is 11,000 volts, below which the serviceability of the 21DLP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor- or ultor-to-grid-No.1 voltage is never less than 11,000 volts.

The grid-No.4 voltage or grid-No.4-to-grid-No.1 voltage required for focus of any individual tube is independent of ultor current and will remain essentially constant for values of ultor voltage (or ultor-to-grid-No.1 voltage) or grid-No.2 voltage (or grid-No.2-to-grid-No.1 voltage) within design ranges shown for these items.

Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/8". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 7/16-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

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

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section
21DLP4
RASTER-CUTOFF-RANGE CHARTS
GRID-DRIVE SERVICE

E_F = 6.3 VOLTS
ULTOR VOLTS = 12000 TO 20000
GRID-N2 VOLTS ADJUSTED FOR FOCUS.

GRID-N2 VOLTS
-125
-100
-75
-50
-25
0
100 200 300 400 500
GRID-N2 VOLTS

92CS-9349V

CATHODE-DRIVE SERVICE

E_F = 6.3 VOLTS
ULTOR-TO-GRID-N81 VOLTS = 12000 TO 20000
GRID-N81-TO-GRID-N81 VOLTS ADJUSTED FOR FOCUS.

CATHODE-TO-GRID-N81 VOLTS
100
75
50
25
0
100 200 300 400 500
GRID-N81-TO-GRID-N81 VOLTS

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92CS-9350V
2IDLP4
PICTURE TUBE

SCREEN DIAGONAL 20 1/4" MIN.

SCREEN HEIGHT 15 1/16"

SCREEN WIDTH 19 1/16" MIN.

ULTOR RECESSED SMALL CAVITY CAP JETEC N26-21 (NOTE 1)

REFERENCE LINE

SHORT SMALL-SHELL DUODECAL 6-PIN BASE JETEC GROUP 4, N2B6-203 OR SMALL-SHELL DUODECAL 6-PIN BASE JETEC GROUP 4, N2B6-63 (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.
AVERAGE DRIVE CHARACTERISTICS

**CATHODE-DRIVE SERVICE**

- $E_f = 6.3$ VOLTS
- ULTOR-TO-GRID-NO.1 VOLTS = 16000
- CATHODE BIASED POSITIVE WITH RESPECT TO GRID NO.1 TO GIVE FOCUSED RASTER CUTOFF.
- RASTER FOCUSED AT AVERAGE BRIGHTNESS.
- RASTER SIZE = 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"

---

**Video Signal Volts from Raster Cutoff**

- **Cathode Drive**
- **Grid Drive**

---

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CS-9143R1
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.

---

**Graph**

- Dashed line: CATHODE DRIVE
- Solid line: GRID DRIVE

**Axes**

- Y-axis: ULTR MILLIAMPERES (0.5 to 2.5)
- X-axis: VIDEO SIGNAL VOLTS FROM RASTER CUTOFF (0 to 80)

---

ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CS-9351
**DATA**

**General:**

Heater, for Unipotential Cathode:

- Voltage (AC or DC): 6.3 volts
- Current: 0.6 amp

Direct Interelectrode Capacitances:

- Grid No.1 to all other electrodes: 6 \( \mu \text{f} \)
- Cathode to all other electrodes: 5 \( \mu \text{f} \)
- External conductive coating to ultor: 2500 max. \( \mu \text{f} \), 2000 min. \( \mu \text{f} \)

Faceplate, Spherical: Filterglass

- Light transmission (Approx.): 74%

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

- Aluminized Sulfide Type
- White
- Medium-Short Persistence

Focusing Method:

- 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" (15-1/16"
- Greatest height: 16-3/8" ± 1/8"
- Diagonal: 21-3/8" ± 1/8"
- Neck length: 5-1/2" ± 3/16"
- Radius of curvature of faceplate (External surface): 33"

**Screen Dimensions (Minimum):**

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

**Weight (Approx.):** 24 lbs

**Operating Position:** Any

**Cap:** Recessed Small Cavity (JEDEC No.J1-21)

**Bulb:** J171 D2/E1 (JEDEC Group 4, No.B6-63), or Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-203)

---

**RECTANGULAR GLASS TYPE**  **ALUMINIZED SCREEN**  **LOW-VOLTAGE ELECTROSTATIC FOCUS**  **LOW GRID-No.2 VOLTAGE**  **MAGNETIC DEFLECTION**  **CATHODE-DRIVE TYPE**
Basing Designation for BOTTOM VIEW. . . . . . . . . . . . . 12L

<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>6</td>
<td>Grid No.4</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

**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>Voltage Description</th>
<th>Minimum Value</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR-TO-GRID-No.1 VOLTAGE.</td>
<td>12000 volts</td>
<td>20000 volts</td>
</tr>
<tr>
<td>GRID-No.4-TO-GRID-No.1 VOLTAGE:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>500 volts</td>
<td>1000 volts</td>
</tr>
<tr>
<td>Negative value</td>
<td>64 volts</td>
<td>64 volts</td>
</tr>
<tr>
<td>GRID-No.2-TO-GRID-No.1 VOLTAGE.</td>
<td>64 volts</td>
<td>64 volts</td>
</tr>
<tr>
<td>GRID-No.2-TO-CATHODE VOLTAGE.</td>
<td>64 volts</td>
<td>64 volts</td>
</tr>
<tr>
<td>CATHODE-TO-GRID-No.1 VOLTAGE:</td>
<td>2 volts</td>
<td>2 volts</td>
</tr>
<tr>
<td>Positive-peak value</td>
<td>200 volts</td>
<td>200 volts</td>
</tr>
<tr>
<td>Positive-bias value</td>
<td>140 volts</td>
<td>140 volts</td>
</tr>
<tr>
<td>Negative-bias value</td>
<td>0 volts</td>
<td>0 volts</td>
</tr>
<tr>
<td>Negative-peak value</td>
<td>2 volts</td>
<td>2 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 volts
- After equipment warm-up period: 180 volts

Heater positive with respect to cathode: 180 volts

**Equipment Design Ranges:**

With any ultor-to-grid-No.1 voltage (Ec\(_{58}\)) between 12000 and 20000 volts and grid-No.2-to-grid-No.1 voltage (Ec\(_{28}\)) between 40 and 64 volts

- Grid-No.4-to-Grid-No. Voltage for focus\(\$: 0\) to 400 volts
- Cathode-to-Grid-No.1 Voltage (Ek\(_{41}\)) 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 Ek\(_{41}\) except video drive is a negative 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
t

Examples of Use of Design Ranges:

- **With ultor-to-grid-**
  - No.1 voltage of 18000 volts
- **and grid-No.2-to-grid-**
  - No.1 voltage of 50 volts

Grid-No.4-to-Grid-No.1 Voltage for focus ................ 0 to 350 volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster ................ 32 to 47 volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level):
  - White-level value ................ -32 to -47 volts

**Maximum Circuit Values:**

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

- Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.
- Operation below this value is not recommended.
- The grid-No.4 voltage or grid-No.4-to-grid-No.1 voltage required for focus of any individual tube is independent of ultor current and will remain essentially constant for values of ultor-to-grid-No.1 voltage or grid-No.2-to-grid-No.1 voltage within design ranges shown for these items.
- Distance from Reference Line for suitable PM centering magnet should not exceed 7-1/4". 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 \( (E_{ka1}) \) 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 \( \text{X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES} \) at front of this Section


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.
RCA

2IDSP4

RASTER-CUTOFF-RANGE CHART

$E_C = 6.3 \text{ VOLTS}$

$\text{ULTOR-TO-GRID-N}_1 \text{ VOLTS} = 18000$

$\text{GRID-N}_2 \text{ TO-GRID-N}_1 \text{ VOLTAGE ADJUSTED FOR FOCUS.}$

$\text{*INCREASES OR DECREASES DIRECTLY BY APPROX. 2\% FOR EVERY 1000-VOLT CHANGE IN ULTOR-TO-GRID-N}_1 \text{ VOLTAGE.}$

$21\text{DSP4}$

92CS-9911

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
CATHODE-DRIVE CHARACTERISTICS

$E_p = 6.3$ VOLTS
ULTOR-TO-GRID-$N^2_1$ VOLTS=18000
GRID-$N^2_2$-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” x 13-1/2”

HIGH CUTOFF
LOW CUTOFF

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
CATHODE-DRIVE CHARACTERISTICS

E_f = 6.3 VOLTS
ULTOR-TO-GRID-N²I VOLTS = 18000
GRID-N²2-TO-GRID-N²I VOLTS = 50
CATHODE BIASED POSITIVE WITH RESPECT TO GRID N²I TO GIVE FOCUSED RASTER CUTOFF.

ULTOR MICROAMPERES

VIDEO SIGNAL VOLTS FROM RASTER CUTOFF
Picture Tube

21EP4B

**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: (750 max. pf) or (500 min. pf)
- Heater Current at 6.3 volts: 600 ± 60 ma
- Electron Gun: Ion-Trap Type Requiring External Single-Field Magnet

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

**Mechanical:**
- Weight (Approx.): 29 lbs
- Overall Length: 23-1/32" ± 3/8"
- Neck Length: 7-1/2" ± 3/16"
- Projected Area of Screen: 248 sq. in.
- External Conductive Coating:
  - Type: Regular-Band
  - Contact area for grounding: Near Reference Line

For additional information on coatings and dimensions:
- See Picture-Tube Dimensional-Outlines and Bulb J170 A/C sheets at front of this section
- Cap: Recessed Small Cavity (JEDEC No.J1-21)
- Base: Small-Shell Duodecal 5-Pin (JEDEC Group 4, No.B5-57)

Basing Designation for BOTTOM VIEW: 12N

Pin 1 - Heater
Pin 2 - Grid No. 1
Pin 10 - Grid No. 2
Pin 11 - Cathode
Pin 12 - Heater

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

← Indicates a change.
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>19800 max.</td>
</tr>
<tr>
<td>GRID-No.2 VOLTAGE</td>
<td>550 max.</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>154 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>
<tr>
<td>HEATER VOLTAGE</td>
<td>(6.9 max.</td>
</tr>
<tr>
<td>PEAK HEATER-CATHODE VOLTAGE:</td>
<td>5.7 min.</td>
</tr>
<tr>
<td>Heater negative with</td>
<td></td>
</tr>
<tr>
<td>respect to cathode:</td>
<td></td>
</tr>
<tr>
<td>During equipment</td>
<td></td>
</tr>
<tr>
<td>warm-up period</td>
<td>450 max.</td>
</tr>
<tr>
<td>After equipment warm-up</td>
<td>200 max.</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></td>
</tr>
<tr>
<td>Combined AC and DC</td>
<td>200 max.</td>
</tr>
<tr>
<td>voltage.</td>
<td>100 max.</td>
</tr>
</tbody>
</table>

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</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</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.</td>
</tr>
</tbody>
</table>

For X-radiation shielding considerations, see sheet

X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section

Indicates a change.
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 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.):** 73%

**Phosphor (For Curves, see front of this Section):** P4—Sulfide Type Aluminized
  - Fluorescence: White
  - Phosphorescence: White
  - Persistence: Short
  - Focusing Method: Electrostatic
  - Deflection Method: Magnetic

**Deflection Angles (Approx.):**
- Diagonal: 110°
- Horizontal: 105°
- Vertical: 87°

**Electron Gun:** Type Requiring No Ion-Trap Magnet

**Tube Dimensions:**
- Overall length: 12-9/16" ± 5/16"
- Greatest width: 20-1/4" ± 1/8"
- Greatest height: 16-3/8" ± 1/8"
- Diagonal: 21-3/8" ± 1/8"
- Neck length: 3-9/16" ± 1/8"

**Screen Dimensions (Minimum):**
- Greatest width: 19-1/16"
- Greatest height: 15-1/16"
- Diagonal: 20-1/4"
- Projected area: 262 sq. in.
- Weight (Approx.): 23 lbs

**Operating Position:** Any Cap.
- Recessed Small Cavity (JEDEC No.J1-21)
- Bulb: J171 H1/J1
- Socket: Ucinite Part No.115446, or equivalent
- Base: Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

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ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
2IEQP4

PICTURE TUBE

Basing Designation for BOTTOM VIEW: 8JR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.3
Pin 6 - Internal Connection—Do Not Use
Pin 7 - Cathode
Pin 8 - Heater Cap-Ulter (Grid No. 4, Collector) C-External Conductive Coating

GRID-DRIVE SERVICE

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

Maximum and Minimum Ratings, Design-Center Values:

ULTOR VOLTAGE: [18000 max. volts, 12000 min. volts]
GRID-No.3 VOLTAGE: 650 max. volts
GRID-No.2 VOLTAGE: 550 max. volts
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 ulter voltage (E_{C4k}) 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
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**Grid-No.2 Current** ....... -15 to +15 μa

Field Strength of Adjustable Centering Magnet...... 0 to 10 gauss

**Examples of Use of Design Ranges:**

<table>
<thead>
<tr>
<th>With ultor voltage of</th>
<th>16000</th>
<th>18000</th>
</tr>
</thead>
<tbody>
<tr>
<td>and grid-No.2 voltage of</td>
<td>400</td>
<td>500</td>
</tr>
</tbody>
</table>

**Grid-No.3 Voltage for**

<table>
<thead>
<tr>
<th>focus</th>
<th>0 to 400</th>
<th>0 to 400</th>
</tr>
</thead>
</table>

**Grid-No.1 Voltage for**

<table>
<thead>
<tr>
<th>visual extinction of focused raster</th>
<th>-34 to -63</th>
<th>-43 to -78</th>
</tr>
</thead>
</table>

**Grid-No.1 Video Drive from Raster Cutoff (Black level):**

<table>
<thead>
<tr>
<th>White-level value</th>
<th>34 to 63</th>
<th>43 to 78</th>
</tr>
</thead>
</table>

**Maximum Circuit Values:**

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

**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>ULTOR-TO-GRID-No.1 VOLTAGE...</th>
<th>18000 max. volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRID-No.3-TO-GRID-No.1 VOLTAGE.</td>
<td>12000∞ min. volts</td>
</tr>
<tr>
<td>GRID-No.2-TO-GRID-No.1 VOLTAGE..</td>
<td>650 max. volts</td>
</tr>
<tr>
<td>GRID-No.2-TO-CATHODE VOLTAGE...</td>
<td>300 min. volts</td>
</tr>
<tr>
<td>CATHODE-TO-GRID-No.1 VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Positive-peak value</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Positive-bias value</td>
<td>140 max. volts</td>
</tr>
<tr>
<td>Negative-bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Negative-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>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 \(^{(E_{cg1})}\) between 12000 and 18000 volts and grid-No.2-to-grid-No.1 voltage \(^{(E_{cg2})}\) 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 (Ek9) 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 Ek9 except video drive is a negative voltage

Grid-No.3 Current ........ -25 to +25 μA
Grid-No.2 Current ........ -15 to +15 μA
Field Strength of Adjustable Centering Magnet .... 0 to 10 gausses

Examples of Use of Design Ranges:

With ultor-to-grid-No.1 voltage of 16000 18000 volts
and grid-No.2-to-grid-No.1 voltage of 400 500 volts

Grid-No.3-to-Grid-No.1 Voltage for focus ........ 0 to 400 0 to 400 volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster ........ 34 to 56 41 to 69 volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level):
White-level value ........ -34 to -56 -41 to -69 volts

Maximum Circuit Values:

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

▲ Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

Φ This value is a working design-center minimum. The equivalent absolute maximum ultor- or ultor-to-grid-No.1 voltage is 11,000 volts, below which the serviceability of the 21EQP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor- or ultor-to-grid-No.1 voltage is never less than 11,000 volts.

The grid-No.3 voltage required for optimum focus of any individual tube may have a value anywhere between 0 and 400 volts and is a function of the value of the ultor voltage, ultor current, and grid-No.2 voltage. It changes directly with the ultor voltage at the rate of approximately 46 volts for each 1000-volt change in ultor voltage; inversely with grid-No.2 voltage at the rate of about 60 volts for each 100-volt change in grid-No.2 voltage; and inversely with ultor current at the rate of about 60 volts for each 100-microampere change in ultor current. Because the 21EQP4 has a narrow depth of focus, it is necessary to provide means such as a potentiometer or a w-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 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
PICTURE TUBE

EXTERNAL CONDUCTIVE COATING

ULTOR RECESSSED SMALL CAVITY CAP
JEDEC NR J1-21
(NOTE 1)

TRANSPARENT INSULATING COATING
(NOTE 5)

SEE NOTES 7&8

FOR THIS CONTOUR
Y = 5A X 2 + 0.5X
(X/Y IN INCHES)

DIAGONAL VIEW

NOTE 4

92CL-9936R1

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.
E\textsubscript{F} = 6.3 \text{ VOLTS}
ULTOR VOLTS = 12000 TO 18000
GRID-N\textsubscript{23} VOLTS ADJUSTED FOR FOCUS.

CATHODE-DRIVE SERVICE
E\textsubscript{F} = 6.3 \text{ VOLTS}
ULTOR-TO-GRID-N\textsubscript{21} VOLTS = 12000 TO 18000
GRID-N\textsubscript{23}-TO-GRID-N\textsubscript{21} VOLTS ADJUSTED FOR FOCUS.
AVERAGE DRIVE CHARACTERISTICS

**CATHODE-DRIVE SERVICE**

- $E_F = 6.3$ VOLTS
- ULTOR-TO-GRID-N01 VOLTS = 16000
- CATHODE BIASED POSITIVE WITH RESPECT TO GRID N01 TO GIVE FOCUSED RASTER CUTOFF.
- RASTER FOCUSED AT AVERAGE BRIGHTNESS.
- RASTER SIZE = 18” x 13½”

**GRID-DRIVE SERVICE**

- $E_f = 6.3$ VOLTS
- ULTOR VOLTS = 16000
- GRID N01 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.
- RASTER FOCUSED AT AVERAGE BRIGHTNESS.
- RASTER SIZE = 18” x 13½”

I.C.I. COORDINATES OF SCREEN: X=0.270, Y=0.300

---

**Electron Tube Division**

Radio Corporation of America, Harrison, New Jersey

92CM-9942
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE

$E_f = 6.3 \text{ VOLTS}$

ULTOR-TO-GRID-$N^{31}$

VOLTS = 12000 TO 18000

CATHODE BIASED POSITIVE WITH RESPECT TO GRID $N^{31}$ TO GIVE FOCUSED RASTER CUTOFF.

GRID-DRIVE SERVICE

$E_f = 6.3 \text{ VOLTS}$

ULTOR VOLTS = 12000 TO 18000

GRID $N^{31}$ BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.

---

**Diagram:**

- **Cathode Drive**
- **Grid Drive**

**Axes:**

- ULTOR MICROAMPERES
- VIDEO SIGNAL VOLTS FROM RASTER CUTOFF

**Range:**

- ULTOR MICROAMPERES: 0 to 1800
- VIDEO SIGNAL VOLTS: 0 to 60

---

**Electron Tube Division**

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9935
Short Rectangular Glass Type
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: 2000 max. pf
    1500 min. pf
- Heater Current at 2.68 volts: 450 ± 45 ma
- Heater Warm-Up Time (Average): 11 seconds
- Electron Gun: Type Requiring No Ion-Trap Magnet

Optical:
- Phosphor (For curves, see front of this section): P4—Sulfide Type, Aluminized
- Faceplate, Spherical: Filterglass
- Light transmission (Approx.): 75.5%

Mechanical:
- Weight (Approx.): 20 lbs
- Overall Length: 12-15/16" ± 1/4"
- Neck Length: 3-11/16" ± 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 front of this section

Cap: Recessed Small Cavity (JEDEC No.J1-21)
Base: Small-Button Neeightar 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

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

21FAP4

SHORT 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 ... 600 ± 5% ma
Heater Warm-Up Time (Average) ... 11 seconds
Direct Interelectrode Capacitances:
   Grid No.1 to all other electrodes ... 6 µµf
   Cathode to all other electrodes ... 5 µµf
   External conductive coating to ultor ... 2500 max. µµf
   2000 min. µµf
Electron Gun ... Type Requiring No Ion-Trap Magnet

Optical:
Faceplate ... Filterglass
   Light transmission (Approx.) ... 76%
Phosphor (For curves, see front of this Section) ... P4—Sulfide Type, Aluminized

Mechanical:
Operating Position ... Any
Weight (Approx.) ... 20 lbs
Overall Length ... 12-13/16" ± 5/16"
Neck Length ... 3-9/16" ± 1/8"
Projected Area of Screen ... 262 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 J471 G/K sheets at the front of this section
Cap ... Recessed Small Cavity (JEDEC No.J1-21)
Base ... Small-Button Neoeightar 7-Pin, Arrangement 1 (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW ... 8JR

Pin 1—Heater
Pin 2—Grid No.1
Pin 3—Grid No.2
Pin 4—Grid No.3
Pin 6—IC — Do Not Use
Pin 7—Cathode
Pin 8—Heater Cap—Ultor (Grid No.4, Collector)
C—External Conductive Coating
Maximum Ratings, Design-Maximum Values:

ULTOR VOLTAGE ...................... 22000 max. volts
GRID-No.3 (FOCUSING) VOLTAGE:
   Positive value ..................... 700 max. volts
GRID-No.2 VOLTAGE ................... 600 max. volts
GRID-No.1 VOLTAGE:
   Negative peak value ................ 220 max. volts
   Negative bias value ................ 154 max. volts
   Positive bias value ................ 0 max. volts
   Positive peak value ................ 2 max. volts
PEAK HEATER-CATHODE VOLTAGE:
   Heater negative with respect to cathode:
      During equipment warm-up period not exceeding 15 seconds .... 450 max. volts
      After equipment warm-up period .... 200 max. volts
   Heater positive with respect to cathode .......... 200 max. volts

Typical Operating Conditions:

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

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
With Heater Having Controlled Warm-Up Time

ALUMINIZED SCREEN
110° MAGNETIC DEFLECTION

GENERAL DATA

Electrical:
Heater Current at 6.3 volts ........ 600 ± 5% ma
Heater Warm-Up Time (Average) ........ 11 seconds
Direct Interelectrode Capacitances:
  Grid No.1 to all other electrodes ........ 6 μμf
  Cathode to all other electrodes ........ 5 μμf
External conductive coating to ultor 2000 max. μμf
  1500 min. μμf
Electron Gun ........ Type Requiring No Ion-Trap Magnet

Optical:
Faceplate .................... Filterglass
Light transmission (Approx.) ............. 76%
Phosphor (For Curves, see front of this Section) . P4—Sulfide Type, Aluminized

Mechanical:
Operating Position .................... Any
Weight (Approx.) .................... 20 lbs
Overall Length .................... 13-1/8" ± 1/4"
Neck Length .................... 3-7/8" ± 1/16"
Projected Area of Screen ............ 262 sq. in.
External Conductive Coating:
  Type .................... Regular Band
  Contact area for grounding ........ Near Reference Line

For Additional Information on Coatings and Dimensions:
  See Picture-Tube Dimensional-OUTLINES and Bulb J171 G/K sheets at the front of this section

Cap. .................... Recessed Small Cavity (JEDEC No.J1-21)
Base .................... Small-Button Neoeightar 7-Pin, Arrangement 1 (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW ............ .BKW

Pin 1—Heater
Pin 3—Grid No.1
Pin 4—Grid No.4
Pin 6—Grid No.2
Pin 7—Cathode
Pin 8—Heater
  Cap—Ultor (Grid No.3, Grid No.5, Collector)
  C—External Conductive Coating
Maximum Ratings, Design-Maximum Values:

ULTOR VOLTAGE: 20000 max. volts
GRID-No.4 (FOCUSING) VOLTAGE:
  Positive value 1100 max. volts
  Negative value 550 max. volts
GRID-No.2 VOLTAGE: 550 max. volts
GRID-No.1 VOLTAGE:
  Negative peak value 400 max. volts
  Negative bias value 155 max. volts
  Positive bias value 0 max. volts
  Positive peak value 2 max. volts
PEAK HEATER-CATHODE VOLTAGE:
  Heater negative with respect to cathode:
    During equipment warm-up period not exceeding 15 seconds 450 max. volts
    After equipment warm-up period 200 max. volts
  Heater positive with respect to cathode 200 max. volts

Typical Operating Conditions:

With ultor voltage of 16000 volts
and grid-No.2 voltage of 300 volts
Grid-No.4 Voltage for focus: +100 to +500 volts
Grid-No.1 Voltage for visual extinction of focused raster: -35 to -72 volts

Maximum Circuit Values:

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

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

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

GENERAL DATA

Electrical:
Direct Interelectrode Capacitances:
- Cathode to all other electrodes .... 5 pf
- Grid No. 1 to all other electrodes .... 6 pf
- External conductive coating to anode .... 750 max. pf
- 500 min. pf

Heater Current at 6.3 volts .... 600 ± 60 ma
Electron Gun .... Ion-Trap Type Requiring External Single-Field Magnet

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

Mechanical:
- Weight (Approx.) .... 29 lbs
- Overall Length .... 23-1/32" ± 3/8"
- Neck Length .... 7-1/2" ± 3/16"
- Projected Area of Screen .... 248 sq. in.
- External Conductive Coating:
  - Type .......... Regular-Band
  - Contact area for grounding .......... Near Reference Line
- For Additional Information on Coatings and Dimensions:
  - See Picture-Tube Dimensional-Outlines and Bulb J170 A/C sheets at front of this section

Cap .... Recessed Small Cavity (JEDEC No.J1-21)
Base .... Small-Shell Duodecal (JEDEC Group 4, No.B6-63)
Basing Designation for BOTTOM VIEW .......... 12L

Pin 1—Heater
Pin 2—Grid No.1
Pin 6—Grid No.4
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater

ANODE VOLTAGE .... 19800 max. volts
GRID—No.4 (FOCUSING) VOLTAGE:
- Positive value .... 1100 max. volts
- Negative value .... 550 max. volts

Maximum and Minimum Ratings, Design-Maximum Values:
- Unless otherwise specified, voltage values are positive with respect to cathode

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Electron Tube Division
Harrison, N. J.
DATA 4-63
GRID-No.2 VOLTAGE .......................... 550 max. volts
GRID-No.1 VOLTAGE:
  Negative peak value .......................... 220 max. volts
  Negative bias value .......................... 154 max. volts
  Positive bias value .......................... 0 max. volts
  Positive peak value .......................... 2 max. volts
HEATER VOLTAGE .............................. 6.9 max. volts
  5.7 min. volts
PEAK HEATER–CATHODE VOLTAGE:
  Heater negative with
    respect to cathode:
      During equipment warm-up period not exceeding 15 seconds. ... 450 max. volts
      After equipment warm-up period. ... 200 max. volts
  Heater positive with
    respect to cathode:
    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
General:
Heater, for Unipotential Cathode:
  Voltage: 6.3 ac or dc volts
  Current: 0.6 ± 10% amp
Faceplate, Spherical: Frosted Filterglass
Phosphor (for curves, see front of this section): P4—Sulfide Type
Deflection Angles (Approx.):
  Diagonal: 70°
  Horizontal: 66°
  Vertical: 50°
Electron Gun: Ion-Trap Type Requiring External Single-Field Magnet
Tube Dimensions:
  Maximum overall length: 22-5/8"
  Greatest width at lip: 19-23/32" ± 1/8"
  Greatest height at lip: 15-5/16" ± 1/8"
  Diagonal at lip: 20-3/4" ± 1/4"
  Neck length: 7-1/2" ± 3/16"
  Radius of curvature of faceplate (external surface): 33"
Screen Dimensions (Minimum):
  Greatest width: 18-1/8"
  Greatest height: 13-11/16"
  Diagonal: 19-1/8"
Operating Position: Any
Ultor Terminal: Metal-Shell Lip
Base: Small-Shell Duodecal 6-Pin (JETEC Group 4, No.B6-63)
Basing Designation for BOTTOM VIEW: .12M

Maximum Ratings, Design-Center Values:
ULTOR VOLTAGE: 16000 max. volts
GRID-No.4 (FOCUSING) VOLTAGE:
  Positive value: 1000 max. volts
  Negative value: 500 max. volts
GRID-No.2 VOLTAGE: 500 max. volts
GRID-No.1 VOLTAGE:
  Negative-bias value: 125 max. volts
  Positive-bias value: 0 max. volts
  Positive-peak value: 2 max. volts

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RCA
2IMP4
PICTURE TUBE
RECTANGULAR METAL-SHELL TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

DATA

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

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Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater

Metal-Shell Lip - Ultor (Grid No.3, Grid No.5, Collector)
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
MAGNETIC FOCUS
ALUMINIZED SCREEN
70° MAGNETIC DEFLECTION

GENERAL DATA

Electrical:
Direct Interelectrode Capacitances:
  Cathode to all other electrodes .... 5 pf
  Grid No.1 to all other electrodes ... 6 pf
  External conductive coating to anode... \{750 max. pf
                                           \{500 min. pf
Heater Current at 6.3 volts ........ 600 ± 60 ma
Electron Gun ....................... Ion-Trap Type Requiring
                                External Single-Field Magnet

Optical:
Phosphor (for curves, see front of this section) . P4—Sulfide Type,
Aluminized
Faceplate, Spherical ................ Filterglass
Light transmission (Approx.) .......... 73%

Mechanical:
Weight (Approx.) .................. 24 lbs
Overall Length ..................... 22-7/16" ± 3/8"
Neck Length ........................ 7-1/2" ± 3/16"
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 J165Z 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

Max 10—Anode
C—External

Maximum and Minimum Ratings, Design-Maximum Values:

  Unless otherwise specified, voltage values are positive with respect to cathode
ANODE VOLTAGE .................. 19800 max. volts

  Indicates a change.

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Electron Tube Division
Harrison, N. J.
GRID-No.2 VOLTAGE ............... 550 max. volts
GRID-No.1 VOLTAGE:
    Negative peak value ........... 220 max. volts
    Negative bias value ........... 154 max. volts
    Positive bias value ........... 0 max. volts
    Positive peak value ........... 2 max. volts
HEATER VOLTAGE ................... 6.9 max. volts
                                  5.7 min. volts
PEAK HEATER-CATHODE VOLTAGE:
    Heater negative with respect to cathode:
        During equipment warm-up period not exceeding 15 seconds .... 450 max. volts
        After equipment warm-up period ....................... 200 max. volts
    Heater positive with respect to cathode:
        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.
**DATA**

**General:**
- Heater, for Unipotential Cathode:
  - Voltage: 6.3 ac or dc volts
  - Current: 0.6 ± 10% amp
- Capacitance between External Conductive Coating and Ultor: 2500 max. μF
  - 2000 min. μF
- Faceplate, Spherical Filterglass
- Phosphor (For curves, see front of this section): P4—Sulfide Type Aluminized
- Deflection Angles (Approx.):
  - Diagonal: 70°
  - Horizontal: 66°
  - Vertical: 50°
- Electron Gun: Ion-Trap Type Requiring External Single-Field Magnet

**Tube Dimensions:**
- Overall length: 22-7/16" ± 3/8"
- Greatest width: 18-11/16" ± 1/8"
- Greatest height: 14-15/16" ± 1/8"
- Diagonal: 20-5/8" ± 3/16"
- Neck length: 7-1/2" ± 3/16"
- Radius of curvature of faceplate (External surface): 40"

**Screen Dimensions (Minimum):**
- Greatest width: 17-3/8"
- Greatest height: 13-5/8"
- Diagonal: 19-1/2"
- Projected area: 224 sq. in.
- Operating Position: Any

**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 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>Negative-bias value</th>
<th>125 max. volts</th>
</tr>
</thead>
<tbody>
<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

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*For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE–RAY TUBES at front of this Section*
### Picture Tube

**21YP4A**

**RECTANGULAR GLASS TYPE**

**ALUMINIZED SCREEN**

**LOW-VOLTAGE ELECTROSTATIC FOCUS**

**70° MAGNETIC DEFLECTION**

### GENERAL DATA

#### Electrical:
- **Direct Interelectrode Capacitances:**
  - Cathode to all other electrodes: 5 pf
  - Grid No.1 to all other electrodes: 6 pf
  - External conductive coating to anode: 750 max. pf, 500 min. pf
- **Heater Current at 6.3 volts:** 600 ± 60 ma
- **Electron Gun:** Ion-Trap Type Requiring External Single-Field 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:** Regular-Band
- **Contact area for grounding:** Near Reference Line

For Additional Information on Coatings and Dimensions:
- See Picture-Tube Dimensional-Outlines and Bulb J170 B/D sheets at front of this section

**Cap:** Recessed Small Cavity (JEDEC No.J1-21)

**Base:** Small-Shell Duodecal 6-Pin (JEDEC Group 4, No. B6-63)

**Basing Designation for BOTTOM VIEW:** 12L

#### Pin Assignment:
- **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:

- **ANODE VOLTAGE:** 19800 max. volts

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Electron Tube Division
Harrison, N. J.

DATA 4-63
### 21YP4A

**GRID-No.4 (FOCUSING) VOLTAGE:**
- Positive value: **1100** max. volts
- Negative value: **550** max. volts

**GRID-No.2 VOLTAGE:**
- 550 max. volts

**GRID-No.1 VOLTAGE:**
- Negative peak value: **220** max. volts
- Negative bias value: **154** max. volts
- Positive bias value: **0** max. volts
- Positive peak value: **2** max. volts

**HEATER VOLTAGE:**
- **6.9** max. volts
- **5.7** min. volts

**PEAK HEATER-CATHODE VOLTAGE:**
- Heater negative with respect to cathode:
  - During equipment warm-up period (not exceeding 15 seconds): **450** max. volts
  - After equipment warm-up period: **200** max. volts
- Heater positive with respect to cathode:
  - 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 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
21ZP4B

Picture Tube

**RECTANGULAR GLASS TYPE**  **ALUMINIZED SCREEN**

**MAGNETIC FOCUS**  **70° MAGNETIC DEFLECTION**

**GENERAL DATA**

**Electrical:**
Direct Interelectrode Capacitances:
- Cathode to all other electrodes: 5 pf
- Grid No.1 to all other electrodes: 6 pf
- External conductive coating to anode: (750 max. pf 500 min. pf)

Heater Current at 6.3 volts: 600 ± 60 ma
Electron Gun: Ion-Trap Type Requiring External Single-Field Magnet

**Optical:**
- Phosphor (For curves, see front of this section): P4—Sulfide Type, Aluminized
- Faceplate, Spherical: Filterglass
- Light transmission (Approx.): 75%

**Mechanical:**
- Weight (Approx.): 24 lbs
- Overall Length: 23-1/32" ± 3/8"
- Neck Length: 7-1/2" ± 3/16"
- Projected Area of Screen: 248 sq. in.

**External Conductive Coating:**
- Type: Regular-Band
- Contact area for grounding: Near Reference Line

For Additional Information on Coatings and Dimensions:
See Picture-Tube Dimensional-Outlines and Bulb J170 B/D sheets at front of this section

Cap: Recessed Small Cavity (JEDEC No.J1-21)
Base: Small-Shell Duodecal 5-Pin (JEDEC Group 4, No. B5-57)

Basing Designation for BOTTOM VIEW: 12N

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
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</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>
<tr>
<td>Cap</td>
<td>Anode</td>
</tr>
<tr>
<td></td>
<td>(Grid No.3, Screen,</td>
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<tr>
<td></td>
<td>Collector)</td>
</tr>
<tr>
<td>C</td>
<td>External Conductive</td>
</tr>
<tr>
<td></td>
<td>Coating</td>
</tr>
</tbody>
</table>

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

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

- **ANODE VOLTAGE** 19800 max. volts
- **GRID-No.2 VOLTAGE** 550 max. volts

Indicates a change.
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 .............. \[6.9 \text{ max. volts}\]
\[5.7 \text{ min. volts}\]

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 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
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: 18-13/16" ± 7/16"
- Neck Length: 6" ± 3/16"
- Projected Area of Screen: 282 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 J187 D/G sheets at the front of this section

Cap: Recessed Small Cavity (JEDEC No.J1-21)
Base: Short Small-Shel Duodecal 6-Pin (JEDEC Group 4, No.B6-203)

Basing Designation for BOTTOM VIEW: 12L

Pin 1—Heater
Pin 2—Grid No.1
Pin 6—Grid No.4
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater

Cap—Ultor
(Grid No.3, Collector)
C—External Conductive Coating
Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR VOLTAGE ........................................... 25000 max. volts
                          12000 min. volts

GRID-No.4 (FOCUSING) VOLTAGE:
  Positive value ............................................. 1100 max. volts
  Negative value ............................................ 550 max. volts

GRID-No.2 VOLTAGE ........................................ 550 max. volts

GRID-No.1 VOLTAGE:
  Negative peak value ................................... 220 max. volts
  Negative bias value ...................................... 155 max. volts
  Positive bias value ....................................... 0 max. volts
  Positive peak value ...................................... 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:
  Heater negative with respect to cathode:
    During equipment warm-up period not exceeding 15 seconds .... 450 max. volts
    After equipment warm-up period ................................ 200 max. volts
  Heater positive with respect to cathode ...................... 200 max. volts

Typical Operating Conditions:
With ultor voltage of 20000 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.
**23ALP4**

**Picture Tube**

- SHORT RECTANGULAR GLASS TYPE
- LOW-VOLTAGE ELECTROSTATIC FOCUS
- ALUMINIZED SCREEN
- 114° MAGNETIC DEFLECTION
- With Heater Having Controlled Warm-Up Time

The 23ALP4 is the same as the 23NP4 except for the following item:

**Electrical:**

Heater Current at 6.3 volts . . . . . . . . . . 450 ± 20 ma
The 23AVP4 is the same as the 23CP4 except for the following item:

Optical:
Surface of Protective Panel...Treated to reduce specular reflection
The 23BDP4 is the same as the 23YP4 except for the following item:

Optical:
Surface of Protective Panel ............ Treated to reduce specular reflection
23BJP4

Picture Tube

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. 1700 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.) .................. 25 lbs
Overall Length .................. 18-1/8' ± 3/8'
Neck Length .................. 5-5/8' ± 3/16'
Projected Area of Screen ................. 282 sq. in.
External Conductive Coating:
Type .................. Regular Band
Contact area for grounding .................. Near Reference Line

For Additional Information on Coatings and Dimensions:
See Picture-Tube Dimensional-Outlines and Bulb J187 C/F sheets at the front of this section
Cap .................. Recessed Small Cavity (JEDEC No.J1-21)
Base .................. Short Small-Shell Duodecal 6-Pin
(JEDEC Group 4, No.B6-203)
Basing Designation for BOTTOM VIEW ............ .12L

Pin 1—Heater
Pin 2—Grid No.1
Pin 6—Grid No.4
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater

ULTOR Cap—Ultor (Grid No.3, Grid No.5, Collector)
G4 C—External Conductive Coating
G3 G5

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Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR-TO-GRID-No.1 VOLTAGE:  [25000 max. volts]
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:
  Positive value:  1250 max. volts
  Negative value:  450 max. volts
GRID-No.2 TO-GRID-No.1 VOLTAGE:
  Positive value:  225 max. volts
  Negative value:  40 min. volts
GRID-No.2-TO-CATHODE VOLTAGE:  70 max. volts
CATHODE-TO-GRID-No.1 VOLTAGE:
  Positive peak value:  220 max. volts
  Positive bias value:  154 max. volts
  Negative bias value:  0 max. volts
  Negative peak value:  2 max. volts
HEATER VOLTAGE:  [6.9 max. volts]
PEAK HEATER-CATHODE VOLTAGE:
  Heater negative with respect to cathode:
    During equipment warm-up period not exceeding 15 seconds:  450 max. volts
    After equipment warm-up period:  200 max. volts
  Heater positive with respect to cathode:  200 max. volts

Typical Operating Conditions:

  With ultor-to-grid No.1 voltage of 20000 volts
  and grid-No.2-to-grid-No.1 voltage of 50 volts
Grid-No.4-to-Grid-No.1 Voltage for focus: 0 to 400 volts
Cathode-to-GRID-No.1 Voltage for visual extinction of focused raster: 36 to 54 volts

Maximum Circuit Values:

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

For X-radiation shielding considerations, see sheet X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES at front of this section.
**23BKP4**

**Picture Tube**

**BI-PANEL RECTANGULAR GLASS TYPE**

**LOW-VOLTAGE ELECTROSTATIC FOCUS**

**LOW GRID-No.2 VOLTAGE**

**ALUMINIZED SCREEN**

**92° MAGNETIC DEFLECTION**

**CATHODE-DRIVE TYPE**

**With Heater Having Controlled Warm-Up Time**

**GENERAL DATA**

**Electrical:**

- Heater Current at 6.3 volts: 600 ± 30 ma
- Heater Warm-Up Time (Average): 11 seconds

**Direct Interelectrode Capacitances:**

- Grid No.1 to all other electrodes: 6 μf
- Cathode to all other electrodes: 5 μf
- External conductive coating to ультор: \[ \{2500 \text{ max.} \; \mu f \] \[ \{1700 \text{ min.} \; \mu f \]

**Electron Gun:** Type Requiring No Ion-Trap Magnet

**Optical:**

- Faceplate and Protective Panel: Filterglass
- Light transmission (Approx.): 40%
- Phosphor (For Curves, see front of this section): P4—Sulfide Type, Aluminized

**Mechanical:**

- Operating Position: Any
- Weight (Approx.): 35 lbs
- Overall Length: 18-7/16" ± 7/16"
- Neck Length: 5-5/8" ± 3/16"
- Projected Area of Screen: 282 sq. in.

**External Conductive Coating:**

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

For Additional Information on Coatings and Dimensions:

- See Picture-Tube Dimensional-Outlines and Bulb J187 D/G sheets at the front of this section

**Cap:** Recessed Small Cavity (JEDEC No.J1-21)

**Base:** Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-209)

**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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Electron Tube Division

Harrison, N. J.

**DATA**

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Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR-TO-GRID-No.1 VOLTAGE:  
\[
\begin{align*}
&\text{25000 max. volts} \\
&\text{15000 min. volts}
\end{align*}
\]

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:
\[
\begin{align*}
&\text{225 max. volts} \\
&\text{40 min. volts}
\end{align*}
\]

GRID-No.2-TO-CATHODE VOLTAGE: 
\[
\begin{align*}
&\text{225 max. volts} \\
&\text{40 min. volts}
\end{align*}
\]

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:
\[
\begin{align*}
&\text{6.9 max. volts} \\
&\text{5.7 min. volts}
\end{align*}
\]

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: 200 max. volts

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage of 20000 volts
and grid-No.2-to-grid-No.1 voltage of 50 volts
Grid-No.4-to-Grid-No.1 Voltage for focus: 0 to 400 volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster: 36 to 54 volts

Maximum Circuit Values:

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

For X-radiation shielding considerations, see sheet X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES at front of this section
23BLP4

Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
LOW-GRID-No.2 VOLTAGE

ALUMINIZED SCREEN
92° MAGNETIC DEFLECTION
CATHODE-DRIVE TYPE

With Heater Having Controlled Warm-Up Time

The 23BLP4 is the same as the 23BKP4 except for the following item:

Optical:
Surface of Protective Panel........... Treated to reduce specular reflection
**BI-PANEL RECTANGULAR GLASS TYPE**

**LOW-VOLTAGE ELECTROSTATIC FOCUS**

**ALUMINIZED SCREEN**

**110° MAGNETIC DEFLECTION**

With Heater Having Controlled Warm-Up Time

### GENERAL DATA

#### Electrical:
- Heater Current at 6.3 volts: 450 ± 5% ma
- Heater Warm-Up Time (Average): 11 seconds
- Direct Interelectrode Capacitances:
  - Grid No. 1 to all other electrodes: 6 μμf
  - Cathode to all other electrodes: 5 μμf
  - External conductive coating to ultor: \{2500 max. \[2000 min. \μμf
- Electron Gun: Type Requiring No Ion-Trap Magnet

#### Optical:
- Faceplate and Protective Panel: Filterglass
- Light transmission (Approx.): 40%
- Phosphor (For Curves, see front of this Section): P4—Sulfide Type, Aluminized

#### Mechanical:
- Operating Position: Any
- Weight (Approx.): 32-1/2 lbs
- Overall Length: 15-3/16" ± 3/8"
- Neck Length: 5-1/8" ± 1/8"
- Projected Area of Screen: 282 sq. in.
- External Conductive Coating:
  - Type: Regular Band
  - Contact area for grounding: Near Reference Line

For Additional Information on Coatings and Dimensions:
- See Picture-Tube Dimensional-Outlines and Bulb J187 A sheets at the front of this section
- Cap: Recessed Small Cavity (JEDEC No. J1-21)
- Base: Small-Button Neoeightar 7-Pin, Arrangement 1 (JEDEC No. B7-20B)

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 5—Grid No.1**
**Pin 6—Cathode**
**Pin 7—Heater**

**Cap—Ultor**
(Grid No. 3, Grid No. 5, Collector)
**C—External Conductive Coating**
Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR VOLTAGE . . . . . . . . . . . . 23000 max. volts
                12000 min. volts

GRID-No.4 (FOCUSING) VOLTAGE:
    Positive value .................. 1100 max. volts
    Negative value ..................  550 max. volts

GRID-No.2 VOLTAGE .................  550 max. volts

GRID-No.1 VOLTAGE:
    Negative peak value ............. 220 max. volts
    Negative bias value .............  154 max. volts
    Positive bias value .............  0 max. volts
    Positive peak value .............  2 max. volts

PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
    During equipment warm-up period not exceeding 15 seconds . . . 450 max. volts
    After equipment warm-up period ................................ 200 max. volts
Heater positive with respect to cathode ................................ 200 max. volts

Typical Operating Conditions:

    With ultor voltage of 16000 volts
    and grid-No.2 voltage of  300 volts
Grid-No.4 Voltage for focus .................. 0 to 400 volts
Grid-No.1 Voltage for visual extinction of focused raster .......... -35 to -72 volts

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

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

23BTP4

BI-PANEL RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
ALUMINIZED SCREEN
With Heater Having Controlled Warm-Up Time
92° MAGNETIC DEFLECTION

The 23BTP4 is the same as the 23YP4 except for the following item:
Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR VOLTAGE ..............

{(25000 max. volts

15000 min. volts

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The 23CBP4 is the same as the 23UP4 except for the following items:

**Optical:**  
Surface of Protective Panel . . . . . . . Treated to reduce specular reflection

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

ULTOR VOLTAGE . . . . . . . . . . . . . (23000 max. volts

12000 min. volts
Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
With Heater Having Controlled Warm-Up Time

ALUMINIZED SCREEN
MAGNETIC DEFLECTION

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 ultor [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 .............. 90°
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></th>
<th>Radius at center</th>
<th>Radius at edge</th>
</tr>
</thead>
<tbody>
<tr>
<td>In plane of diag-</td>
<td>50-1/4&quot;</td>
<td>See Dimen-</td>
</tr>
<tr>
<td>onal deflection</td>
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<td>sional Outline</td>
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<tr>
<td>In plane of hori-</td>
<td>50-1/4&quot;</td>
<td>35-1/4&quot;</td>
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<td>45-1/2&quot;</td>
<td>35&quot;</td>
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<td>cal deflection</td>
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<td></td>
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</tbody>
</table>

Radius of curvature of faceplate (Internal surface):

<table>
<thead>
<tr>
<th></th>
<th>Radius at center</th>
<th>Radius at edge</th>
</tr>
</thead>
<tbody>
<tr>
<td>In plane of diag-</td>
<td>39-1/2&quot;</td>
<td>31-1/2&quot;</td>
</tr>
<tr>
<td>onal deflection</td>
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<td></td>
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<tr>
<td>In plane of hori-</td>
<td>39-3/4&quot;</td>
<td>26-1/2&quot;</td>
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<td>zontal deflection</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**23CP4**

**Radius at center**

| In plane of vertical deflection | 36-3/4" |
| Radius at edge                  | 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

**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>ULTOR VOLTAGE</th>
<th>20000 max. volts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12000 min. volts</td>
</tr>
</tbody>
</table>

**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 \( (E_{C\text{ultor}}) \) between 12000* and 20000 volts and grid-No.2 voltage \( (E_{C\text{grid}}) \) between 200 and 500 volts

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

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Grid-No.1 Voltage ($E_{c1k}$) for visual extinction of focused raster. 
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. 
Grid-No.2 Current. 
Field Strength of Adjustable Centering Magnet:
0 to 8 gaussess

Examples of Use of Design Ranges:

With ulti or voltage of 18000 volts and grid-No. 2 voltage of 400 volts

Grid-No.4 Voltage for focus. 0 to 400 volts
Grid-No.1 Voltage for visual extinction of focused raster. -44 to -94 volts
Grid-No.1 Video Drive from Raster Cutoff (Black level):
White-level value. 44 to 94 volts

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

CATHODE-DRIVE SERVICE

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

Maximum and Minimum Ratings, Design-Center Values:

ULTOR-TO-GRID-No.1 VOLTAGE. 20000 max. volts
12000 min. volts

GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:
Positive value. 1000 max. volts
Negative value. 500 max. volts
GRID-No.2-TO-GRID-No.1 VOLTAGE. 640 max. volts
GRID-No.2-TO-CATHODE VOLTAGE. 500 max. volts
CATHODE-TO-GRID-No.1 VOLTAGE:
Positive-peak value. 200 max. volts
Positive-bias value. 140 max. volts
Negative-bias value. 0 max. volts
Negative-peak value. 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period not exceeding 15 seconds. 410 max. volts
After equipment warm-up period... 180 max. volts
Heater positive with respect to cathode... 180 max. volts

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage \((E_{c2g1})\) between 12000 and 20000 volts and grid-No.2-to-grid-No.1 voltage \((E_{c2g1})\) between 225 and 640 volts

Grid-No.4-to-Grid-No.1 Voltage for focus\*: 0 to 400 volts
Cathode-to-Grid-No.1 Voltage \((E_{kg1})\) for visual extinction of focused raster. See Raster-Cutoff-Range Chart for Cathode-Drive Service

Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level):
White-level value \(11000\) volts
(Peak negative) \((-42\) to \(-78\) volts)

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-to-grid-No.1 voltage \(18000\) volts
and grid-No.2-to-grid-No.1 voltage \(400\) volts
Grid-No.4-to-Grid-No.1 Voltage for focus\*: 0 to 400 volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster. 42 to 78 volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level):
White-level value \(-42\) to \(-78\) volts

Maximum Circuit Values:

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

\* Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

\* This value is a working design-center minimum. The equivalent absolute minimum ultor (or ultor-to-grid-No.1) voltage is 11,000 volts below which the serviceability of the 23CP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor (or ultor-to-grid-No.1) voltage is never less than 11,000 volts.

\* The grid-No.4 (or grid-No.4-to-grid-No.1) voltage required for optimum focus of any individual tube may have a value anywhere between 0 and 400 volts; is independent of ultor current; and will remain essentially constant for values of ultor (or ultor-to-grid-No.1) voltage, or grid-No.2 (or grid-No.2-to-grid-No.1) voltage, within design ranges shown for these items.
Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/4". 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.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC NO. G-126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS OF THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

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

\[ E_f = 6.3 \text{ VOLTS} \]
\[ \text{ULTOR VOLTS} = 12000 \text{ TO 20000} \]
\[ \text{GRID-N\#4 VOLTS ADJUSTED FOR FOCUS.} \]

Cathode-Drive Service

\[ E_f = 6.3 \text{ VOLTS} \]
\[ \text{ULTOR-TO-GRID-N\#1 VOLTS} = 12000 \text{ TO 20000} \]
\[ \text{GRID-N\#4-TO-GRID-N\#1 VOLTS ADJUSTED FOR FOCUS.} \]
**AVERAGE DRIVE CHARACTERISTICS**

<table>
<thead>
<tr>
<th>CATHODE-DRIVE SERVICE</th>
<th>GRID-DRIVE SERVICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>( E_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>ULTOR 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 = 18&quot; x 13 1/2&quot;</td>
<td>RASTER SIZE = 18&quot; x 13 1/2&quot;</td>
</tr>
</tbody>
</table>

**I.C.I. COORDINATES OF SCREEN: X=0.287, Y=0.315**

**Graph:**
- **CATHODE DRIVE**
- **GRID DRIVE**

**Axes:**
- **HIGHLIGHT BRIGHTNESS — FOOTLAMBERTS**
- **VIDEO SIGNAL VOLTS FROM RASTER CUTOFF**

**Values:**
- Highlight brightness values range from 0 to 400 footlamberts.
- Video signal voltages range from 0 to 90 volts from raster cutoff.

---

**RADIO CORPORATION OF AMERICA**
Electron Tube Division
Harrison, N. J.
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE
- $E_f = 6.3 \text{ VOLTS}$
- ULTOR-TO-GRID-N21 VOLTS = 12000 TO 20000
- CATHODE BIASED POSITIVE WITH RESPECT TO GRID N21 TO GIVE FOCUSED RASTER CUTOFF.

GRID-DRIVE SERVICE
- $E_f = 6.3 \text{ VOLTS}$
- ULTOR VOLTS = 12000 TO 20000
- GRID N21 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.

DATA 6
RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
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:
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 and Protective Panel: Filterglass
- Light transmission (Approx.): 40%

Mechanical:
- Weight (Approx.): 33 lbs
- Overall Length: 15-3/16" ± 3/8"
- Neck Length: 5-1/8" ± 1/8"
- Projected Area of Screen: 282 sq. in.
- External Conductive Coating: 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. 87-208)
Basing Designation for BOTTOM VIEW: 8HR

Pin 1—Heater
Pin 2—Grid No.1
Pin 3—Grid No.2
Pin 4—Grid No.4
Pin 6—Grid No.1
Pin 7—Cathode
Pin 8—Heater

Cap—Anode
  (Grid No.3,
  Grid No.5,
  Screen,
  Collector)

C—External Conductive Coating
Maximum and Minimum Ratings, Design-Maximum Values:

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

**ANODE VOLTAGE**

- Maximum: 23500 max. volts
- Minimum: 14000 min. volts

**GRID-No.4 (FOCUSING) VOLTAGE:**
- Positive value: 1100 max. volts
- Negative value: 550 max. volts

**GRID-No.2 VOLTAGE:**
- Maximum: 550 max. volts

**GRID-No.1 VOLTAGE:**
- Negative peak value: 220 max. volts
- Negative bias value: 154 max. volts
- Positive bias value: 0 max. volts
- Positive peak value: 2 max. volts

**HEATER VOLTAGE:**
- Maximum: 6.9 max. volts
- Minimum: 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 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:** 400 volts
- **Grid-No.1 Voltage for visual extinction of focused raster:** -44 to -94 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
BI-PANEL RECTANGULAR GLASS TYPE ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS MAGNETIC DEFLECTION
LOW GRID-No.2 VOLTAGE CATHODE-DRIVE TYPE
With Heater Having Controlled Warm-Up Time

DATA

General:
Heater, for Unipotential Cathode:
Voltage (AC or DC) .............. 6.3 ± 10% volts
Current at 6.3 volts .......... 0.6 amp
Warm-up time (Average) .... 11 sec

Direct Interelectrode Capacitances:
Grid No.1 to all other electrodes .... 6 μμf
Cathode to all other electrodes .... 5 μμf

External conductive coating to ultor .... \{2500 max. \μμf
\{1700 min. \μμf

Faceplate and Protective Panel ................ Filterglass
Total light transmission (Approx.) ........ 40%

Phosphor (for curves, see front or 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 .............. 90°
Vertical .............. 80°

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></th>
<th>Radius at center</th>
<th>Radius at edge</th>
</tr>
</thead>
<tbody>
<tr>
<td>In plane of diagonal deflection</td>
<td>50-1/4&quot;</td>
<td>See Dimensional Outline</td>
</tr>
<tr>
<td>In plane of horizontal deflection</td>
<td>50-1/4&quot;</td>
<td>35-1/4&quot;</td>
</tr>
<tr>
<td>In plane of vertical deflection</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></th>
<th>Radius at center</th>
<th>Radius at edge</th>
</tr>
</thead>
<tbody>
<tr>
<td>In plane of diagonal deflection</td>
<td>39-1/2&quot;</td>
<td>31-1/2&quot;</td>
</tr>
</tbody>
</table>
Radius at center  |  Radius at edge  
---|---
In plane of horizontal deflection... 39-3/4"  |  26-1/2"
In plane of vertical deflection... 36-3/4"  |  18-1/2"

Screen Dimensions (Minimum):
- Greatest width: 19-5/16"
- Greatest height: 15-1/4"
- Diagonal: 22-5/16"
- Projected area: 282 sq. in.
- Weight (Approx.): 33 lbs

Operating Position: Any

Cap: Recessed Small Cavity (JEDEC No.J1-21)
Bulb: J187 Fitted with Protective Panel FP198
Base: Small-Button Neoeightar 7-Pin Arrangement 2, (JEDEC No.B7-219)

Basing Designation for BOTTOM VIEW: 8KP

Pin 2 - Internal Connection— Do Not Use Cap — Ultor (Grid No.3, Grid No.5, Collector)
Pin 3 - Cathode Pin 4 - Heater Pin 5 - Heater Pin 6 - Grid No.1 Pin 7 - Grid No.2 C - External Conductive Coating

CATHODE-DRIVE® SERVICE

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

Maximum and Minimum Ratings, Design-Center Values:

ULTOR-TO-GRID-No.1 VOLTAGE: 
- 20000 max. volts
- 12000 min. volts

GRID-No.4 TO GRID-No.1 (FOCUSING)VOLTAGE:
- Positive value: 1000 max. volts
- Negative value: 500 max. volts

GRID-No.2 TO GRID-No.1 VOLTAGE: 64 max. volts

CATHODE-TO-GRID-No.1 VOLTAGE:
- Positive-peak value: 200 max. volts
- Positive-bias value: 140 max. volts
- Negative-bias value: 0 max. volts
- Negative-peak value: 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:
- Heater negative with respect to cathode:
  - During equipment warm-up period not exceeding 15 seconds: 410 max. volts
  - After equipment warm-up period: 180 max. volts
- Heater positive with respect to cathode: 180 max. volts
Equipment Design Ranges:

With any ultor-to-grid-No. 1 voltage (EC_g1) between 12000 and 20000 volts and grid-No.2-to-grid No.1 voltage (EC_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
(EG1) 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 EG1 except video drive is a negative voltage
Grid-No.4 Current. . . . . . . . . . -25 to +25 µa
Grid-No.2 Current. . . . . . . . . . -15 to +15 µa
Field Strength of Adjustable Centering Magnet
. . . . . . . . . . . . . . . . . . . . . 0 to 8 gausses

Examples of Use of Design Ranges:

With ultor-to-grid-
No.1 voltage of 16000 18000 volts
and grid-No.2-to-grid-
No.1 voltage of 50 50 volts

Grid-No.4-to-Grid-No.1 Voltage for focus* . . . . . . . . . . . . 0 to 400 0 to 400 volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster . . . . . . . . . . . . 32 to 47 34 to 49 volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level):
White-level value. . . . . -32 to -47 -34 to -49 volts

Maximum Circuit Values:

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

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

This value is a working design-center minimum. The equivalent absolute minimum ultor-to-grid-No.1 voltage is 11,000 volts below which the serviceability of the 23EP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor-to-grid-No.1 voltage is never less than 11,000 volts.

The grid-No.2-to-grid-No.1 voltage required for focus of any individual tube may have a value anywhere between 0 and 400 volts.

Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 3/8-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.
For X-ray shielding considerations, see sheet
X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section
Raster-Cutoff-Range Chart
Cathode-Drive Service

Ep = 6.3 Volts
Ultor-To-Grid-N#1 Volts = 16000
Grid-N#2-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.

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Radio Corporation of America
Electron Tube Division
Harrison, N. J.
DATA 3
8-60


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 LINTLESS CLOTH.

NOTE 6: REFERENCE POINTS A, B, AND C ARE PROVIDED FOR USE IN DESIGN OF A MASK CONTOURED FOR CLOSE FIT TO THE PROTECTIVE PANEL.

NOTE 7: THE CENTER OF THE PROTECTIVE PANEL MAY BE ECCENTRIC WITH RESPECT TO THE AXIS OF THE TUBE ENVELOPE. ASSOCIATED SHIFT OF THE PROTECTIVE PANEL ALONG ITS MINOR AND/OR MAJOR AXIS WILL NOT EXCEED 1/16".

NOTE 8: KEEP THIS CIRCUMFERENTIAL AREA FREE OF MOUNTING HARDWARE.

NOTE 9: ADEQUATE TUBE SUPPORT IS OBTAINED BY CLAMPING TO THE MOUNTING LUGS PROVIDED AT EACH CORNER OF THE PROTECTIVE PANEL. TUBE MOUNTING AND YOKE SUPPORT CLAMPS MUST BE SPACED FROM THE TUBE BY USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.
CATHODE-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ULTOR-TO-GRID-N2 VOLTS=16000
GRID-N2-TO-GRID-N1 VOLTS=50
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"

I.C.I. COORDINATES OF SCREEN: X=0.287, Y=0.315

LOW-CUTOFF TUBE
HIGH-CUTOFF TUBE
CATHODE-DRIVE CHARACTERISTICS

CATHODE BIASED POSITIVE WITH RESPECT TO GRID NO. 1 TO GIVE FOCUSED RASTER CUTOFF.
23FP4A

Picture Tube

SHORT RECTANGULAR GLASS TYPE
ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS
114° MAGNETIC DEFLECTION
With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:
Direct Interelectrode Capacitances:
- Cathode to all other electrodes: 5 pf
- Grid No. 1 to all other electrodes: 6 pf
- External conductive coating to anode: \{2500 max. pf
\{1700 min. pf

Heater Current at 6.3 volts: 600 ± 60 mA
Heater Warm-Up Time (Average): 11 seconds

Electron Gun: Type Requiring No Ion-Trap Magnet

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

Mechanical:
Weight (Approx.): 24 lbs
Overall Length: 13-11/16" + 5/16" - 1/4"
Neck Length: 4-3/8" ± 1/8"
Projected Area of Screen: 282 sq. in.

External Conductive Coating:
Type: Regular-Band
Contact area for grounding: Near Reference Line

For Additional Information on Coatings and Dimensions:
See Picture-Tube Dimensional-Outlines and Bulb J187 B sheets at front of this section

Cap: Recessed Small Cavity (JEDEC No.J1-21)
Base: Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

Basing Designation for BOTTOM VIEW: 8HR

Pin 1—Heater
Pin 2—Grid No. 1
Pin 3—Grid No. 2
Pin 4—Grid No. 4
Pin 6—Grid No. 1
Pin 7—Cathode
Pin 8—Heater
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 (FOCUSBNG) 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

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
23JP4
Picture Tube
ALUMINIZED SCREEN
BI-PANEL RECTANGULAR GLASS TYPE
1100 MAGNETIC DEFLECTION
LOW-VOLTAGE ELECTROSTATIC FOCUS
CATHODE-DRIVE
TYPE
LOW-GRID-NO.2 VOLTAGE
With Heater Having Controlled Warm-Up Time
GENERAL DATA
Electrical:
Direct Interelectrode Capacitances:
Cathode to all other electrodes.
Grid No.1 to all other electrodes
External conductive coating to anode.

5

pf
pf
max.
pf
{ 25DO
2000 min.
pf
450 ± 25ma
Heater Current at 6.3 volts . . . . . .
11
seconds
Heater Warm-Up Time (Average) . . . . . .
Electron Gun . . . . . . . . Type Requiring No lon-Trap Magnet
Optical:
Phosphor (For curves, see front of this section). P4--Sulfide Type,
Al umin ized
F i lterg I ass
Faceplate and Protective Panel . . . . . . .
40%
Light transmission (Approx.) . . . . . . .
6

Meehan i ca I:
Weight (Approx.) . . . . .
32-1/2 lbs
15-7/16" ± 7/16"
Overall Length . . . . . .
5-3/8" ± 3/16"
Neck Length . . . . . . .
• . . 282 sq. in.
Projected Area of Screen. •
External Conductive Coating:
Type. . . . . . . . . . . .
. . . . Regu I ar-Band
Contact area for grounding . . . . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
See Pictu..-e-Tube Dimensional-Outlines and Bulb Jz87 A sheets
at front of this section
Cap . . . . . . . . . . Recessed Small Cavity (JEDEC No.Jl-21)
Base . . . . . . . . . . . . . . . "
. . JEDEC No. B6-214
Basing Designation for BODOM VIEW.
. . . . . . . . 7FA
Pi n 2 -Cathode
Pi n 3 - Heater
Pi n 4 - Heater
Pin 5 -Grid No.1
Pin 6 -Grid No.4
Pin 7 -Grid No.2

•

H

Cap -Anode
(Grid No.3,
Grid No.5,
Screen,
Collector)
C -External
Conductive
Coating

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

DATA

4-63

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

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

**ANODE VOLTAGE**

\[
\begin{align*}
22000 \text{ max.} \quad \text{volts} \\
15000 \text{ min.} \quad \text{volts}
\end{align*}
\]

**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: 44 min. volts

**CATHODE VOLTAGE:**
- Negative peak value: 2 max. volts
- Negative bias value: 0 max. volts
- Positive bias value: 100 max. volts
- Positive peak value: 150 max. volts

**HEATER VOLTAGE**
- Positive value: 6.9 max. volts
- Negative value: 5.7 min. volts

**PEAK HEATER-CATHODE VOLTAGE:**
- Heater negative with respect to cathode:
  - During equipment warm-up period, not exceeding 15 seconds: 450 max. volts
  - After equipment warm-up period: 200 max. volts
- Heater positive with respect to cathode:
  - Combined AC and DC voltage: 200 max. volts
  - DC component: 100 max. volts

**Typical Operating Conditions for Cathode-Drive Service:**

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

**Anode Voltage**
- 16000 volts

**Grid-No.4 Voltage**
- 0 to 500 volts

**Grid-No.2 Voltage**
- 50 volts

**Cathode Voltage for visual extinction of focused raster**
- 35 to 50 volts

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

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section.
RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:
- Heater Current at 6.3 volts: 600 ± 30 ma
- Heater Warm-Up Time (Average): 11 seconds
- Direct Interelectrode Capacitances:
  - Grid No.1 to all other electrodes: 6 µµf
  - Cathode to all other electrodes: 5 µµf
- External conductive coating to ultor: 2500 max. 1700 min. µµf
- Focusing Method: Electrostatic
- Deflection Method: Magnetic
- Deflection Angles (Approx.):
  - Diagonal: 114°
  - Horizontal: 102°
  - Vertical: 84°

Optical:
- Faceplate: Filterglass
- Light transmission at center (Approx.): 78%
- Phosphor (For curves, see front of this Section): P4—Sulfide Type Aluminized
- Fluorescence: White
- Phosphorescence: White
- Persistence: Medium Short

Mechanical:
- Tube Dimensions:
  - Overall length: 14-3/8" ± 5/16"
  - Greatest width: 20-1/2" + 1/16" - 1/8"
  - Greatest height: 16-1/2" ± 1/8"
  - Diagonal: 23-25/64" + 3/32" - 1/8"
  - Neck length: 5-1/8" ± 1/8"
- Curvature of faceplate (Radii):
  - Center: 50" - 36-3/4"
  - Intermediate: 30" - 48"
  - Edge: 24"
- Screen Dimensions (Minimum):
  - Greatest width: 19-1/4"
  - Greatest height: 15-1/8"
  - Diagonal: 22-5/16"
  - Projected area: 282 sq. in.
  - Weight (Approx.): 24 lbs
  - Operating Position: Any
  - Cap.: Recessed Small Cavity (JEDEC No. J1-21)
  - Bulb: J187 (114°)
 Base. Small-Button Neoeightar 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-Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

GRID-DRIVE\(^{\dagger}\) SERVICE

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

Maximum and Minimum Ratings, Design-Maximum Values:

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Max.</th>
<th>Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR VOLTAGE</td>
<td>22000</td>
<td>11000</td>
</tr>
<tr>
<td>GRID-No.4 (FOCUSING) VOLTAGE:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>1100</td>
<td></td>
</tr>
<tr>
<td>Negative value</td>
<td>550</td>
<td></td>
</tr>
<tr>
<td>GRID-No.2 VOLTAGE</td>
<td>550</td>
<td>200</td>
</tr>
<tr>
<td>GRID-No.1 VOLTAGE</td>
<td>220</td>
<td>154</td>
</tr>
<tr>
<td>Negative-peak value</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Positive-peak value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEATER VOLTAGE</td>
<td>6.9</td>
<td>5.7</td>
</tr>
<tr>
<td>PEAK HEATER-CATHODE VOLTAGE:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heater negative with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>respect to cathode:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>During equipment warm-up</td>
<td>450</td>
<td>200</td>
</tr>
<tr>
<td>period not exceeding 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>seconds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After equipment warm-up</td>
<td></td>
<td></td>
</tr>
<tr>
<td>period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heater positive with</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>respect to cathode.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Equipment Design Ranges:

With any ultor voltage \(E_{C5k}\) between 11000 and 22000 volts and grid-No.2 voltage \(E_{C2k}\) between 220 and 550 volts

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.4 Voltage</td>
<td></td>
<td>400</td>
</tr>
<tr>
<td>Grid-No.1 Voltage (E_{C1k})</td>
<td></td>
<td>550</td>
</tr>
<tr>
<td>Grid-No.1 Video Drive from</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raster Cutoff (Black level):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White level value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Peak positive)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>for (E_{C1k}) except video</td>
<td></td>
<td></td>
</tr>
<tr>
<td>drive is a positive voltage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
Grid-No.4 Current. .............. -25 to +25 μa
Grid-No.2 Current. .............. -15 to +15 μa
Field Strength of Adjustable Centering Magnet*............. 0 to 8 gausses

Examples of Use of Design Ranges:

- With ultor voltage of 18000 volts and grid-No.2 voltage of 400 volts
- Grid-No.4 Voltage for focus*............. 0 to 400 volts
- Grid-No.1 Voltage for visual extinction of focused raster............. -36 to -94 volts
- Grid-No.1 Video Drive from Raster Cutoff (Black level):
  White-level value............. 36 to 94 volts

Maximum Circuit Values:

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

CATODE-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
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 ........ \{350 min. 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
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 11000 and 22000 volts and grid-No.2-to-grid-No.1 voltage \(E_{C581}\) 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
\( E_{g1} \) 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 \( E_{g1} \) except video drive is a negative voltage

<table>
<thead>
<tr>
<th>Grid-No.4 Current</th>
<th>-25 to +25 ( \mu A )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.2 Current</td>
<td>-15 to +15 ( \mu A )</td>
</tr>
</tbody>
</table>

Field Strength of Adjustable Centering Magnet* 0 to 8 gauss

Examples of Use of Design Ranges:

\[ \text{With ultor-to-grid-} \]
\[ \text{No.1 voltage of} \]
\[ \text{and grid-No.2-to-} \]
\[ \text{grid-No.1 voltage of} \]
\[ \text{Grid-No.4-to-Grid-No.1} \]
\[ \text{Voltage for focus}^* \]
\[ \text{Cathode-to-Grid-No.1 Voltage} \]
\[ \text{for visual extinction} \]
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

\( \star \) Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

\( \bullet \) 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.

\( \star \) 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.

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

OPERATING CONSIDERATIONS

\( X \)-Ray Warning. When operated at ultor voltages up to 16 kilovolts, this picture tube does not produce any harmful \( X \)-ray radiation. However, because the rating of this type permits operation at voltages as high as 22 kilovolts (Design-maximum value), shielding of this picture tube for \( X \)-ray radiation may be needed to protect against possible injury from prolonged
exposure at close range whenever the operating conditions involve voltages in excess of 16 kilovolts.

Shatter-Proof Cover Over the Tube Face. Following conventional picture-tube practice, it is recommended that the cabinet be provided with a shatterproof, glass cover over the face of this picture tube to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.
SCREEN DIAGONAL 22-5/16 MIN.

SCREEN HEIGHT 15-1/8 MIN.

SCREEN WIDTH 19-1/4 MIN.

.20 1/2 + 1/16 (NOTE 6)

48" R.

30" R.

24" R.

.250"

102°

REFERENCE LINE (NOTE 2)

SMALL-BUTTON NEOEIGHTAR
7-PIN BASE
ARRANGEMENT I
JEDEC NO. B7-208
(NOTE 3)

TRANSPARENT PROTECTIVE,
COATING (OPTIONAL)

3.109"

1.125" + .031" - .025"

2.16"

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC NO.G-126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUITRY CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

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

NOTE 6: MEASURED AT THE MOLD-MATCH LINE.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/16" BEYOND THE ENVELOPE SURFACE AT THE LOCATION SPECIFIED FOR DIMENSIONING THE ENVELOPE WIDTH, DIAGONAL, AND HEIGHT.

NOTE 8: AREA BETWEEN MOLD-MATCH LINE AND SEAL BULGE IS 1/2" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF TUBE SUPPORT BAND. SUPPORTS MUST BE SPACED FROM THE TUBE BY THE USE OF CUSHIONING PADS MADE OF ASPHALT, IMPREGNATED FELT OR EQUIVALENT.
BULB-CONTOUR DIMENSIONS

SHORT-SIDE VIEW

LONG-SIDE VIEW

REFERENCE LINE

Y AXIS

NOTE: PLANES A THRU G ARE NORMAL TO THE TUBE AXIS AND AT FIXED LOCATIONS FROM THE Y AXIS. THESE COORDINATES DESCRIBE THE BOGIE-BULB EXTERNAL CONTOUR IN PLANES THROUGH THE TUBE AXIS AND THE RESPECTIVE FACEPLATE AXES.
RASTER-CUTOFF-RANGE CHARTS
Grid-Drive Service

Cathode-Drive Service

RADIO CORPORATION OF AMERICA
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 VOLTS</td>
<td>E_f = 6.3 VOLTS</td>
</tr>
<tr>
<td>ULTOR-TO-GRID-N1 VOLTS = 16000</td>
<td>ULTOR VOLTS = 16000</td>
</tr>
<tr>
<td>CATHODE BIASED POSITIVE WITH RESPECT TO GRID N1 TO GIVE FOCUSED RASTER CUTOFF.</td>
<td>GRID N1 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 = 18” x 13½”</td>
<td>RASTER SIZE = 18” x 13½”</td>
</tr>
</tbody>
</table>

CIE COORDINATES OF SCREEN: X = 0.287, Y = 0.315

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[Graph showing video signal volts from raster cutoff]
### 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-N2 VOLTS=10000 TO 22000</td>
<td>ULTOR VOLTS=11000 TO 22000</td>
</tr>
<tr>
<td>CATHODE BIASED POSITIVE WITH RESPECT TO GRID N2 TO GIVE FOCUSED RASTER CUTOFF.</td>
<td>GRID N2 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.</td>
</tr>
</tbody>
</table>

#### Diagram

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

#### Graph

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

- **VIDEO SIGNAL VOLTS FROM RASTER CUTOFF**
  - 0
  - 20
  - 40
  - 60
  - 80
  - 100

- **ULTOR VOLTS**
  - 300
  - 500

- **GRID DRIVE VOLTS**
  - 500

**92CM-10618**

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RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
BI-PANEL RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
110° MAGNETIC DEFLECTION
With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:
Heater Current at 6.3 volts .......... 450 ± 5% ma
Heater Warm-Up Time (Average) .......... 11 seconds
Direct Interelectrode Capacitances:
  Grid No.1 to all other electrodes .......... 6 µµf
  Cathode to all other electrodes .......... 5 µµf
  External conductive coating to ultor .......... (2500 max. 2000 min. 11 µµf)
Electron Gun .......... Type Requiring No Ion-Trap Magnet

Optical:
Faceplate and Protective Panel .......... Filterglass
Light transmission (Approx.) .......... 40%
Phosphor (For curves, see front of this Section) .......... P4—Sulfide Type, Aluminized

Mechanical:
Operating Position .......... Any
Weight (Approx.) .......... 32-1/2 lbs
Overall Length .......... 15-3/16" ± 3/8"
Neck Length .......... 5-1/8" ± 1/8"
Projected Area of Screen .......... 282 sq. in.
External Conductive Coating:
  Type .......... Regular Band
  Contact area for grounding .......... Near Reference Line
For Additional Information on Coatings and Dimensions:
See Picture-Tube Dimensional-Outlines and Bulb J187 A sheets at the front of this section
Cap .......... Recessed Small Cavity (JEDEC No.J1-21)
Base .......... Small-Button Neonightar 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

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR VOLTAGE ... ... ... ... ... ... ... ... ... ... ... 18000 max. volts
... ... ... ... ... ... ... ... ... ... ... 10000 min. volts

GRID-No.4 (FOCUSING) VOLTAGE:
  Positive value. ... ... ... ... ... ... ... ... ... ... ... 1100 max. volts
  Negative value. ... ... ... ... ... ... ... ... ... ... ... 550 max. volts

GRID-No.2 VOLTAGE ... ... ... ... ... ... ... ... ... ... ... 550 max. volts

GRID-No.1 VOLTAGE:
  Negative peak value ... ... ... ... ... ... ... ... ... ... ... 220 max. volts
  Negative bias value ... ... ... ... ... ... ... ... ... ... ... 154 max. volts
  Positive bias value ... ... ... ... ... ... ... ... ... ... ... 0 max. volts
  Positive peak value ... ... ... ... ... ... ... ... ... ... ... 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:
  Heater negative with
  respect to cathode:
    During equipment warm-up period
    not exceeding 15 seconds. ... ... 450 max. volts
    After equipment warm-up period. ... ... 200 max. volts
  Heater positive with
  respect to cathode. ... ... ... ... ... ... ... ... ... ... ... 200 max. volts

Typical Operating Conditions:

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

Grid-No.4 Voltage for focus ... 0 to 400 volts
Grid-No.1 Voltage for visual extinction of focused raster. ... -35 to -72 volts

Maximum Circuit Values:

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

For X-radiation shielding considerations, see sheet X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES at front of this section
**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 μuf
  - Cathode to all other electrodes: 5 μuf
- External conductive coating to ultor: 2500 max. μuf
- Electron Gun: Type Requiring No Ion-Trap Magnet

**Optical:**
- Faceplate and Protective Panel: Filterglass
  - Light transmission (Approx.): 40%
- Phosphor (For Curves, see front of this section): P4—Sulfide Type, Aluminized

**Mechanical:**
- Operating Position: Any
- Weight (Approx.): 34-1/2 lbs
- Overall Length: 18-5/16" ± 7/16"
- Neck Length: 5-1/2" ± 3/16"
- Projected Area of Screen: 282 sq. in.
- External Conductive Coating Type: Regular Band
- Contact area for grounding: Near Reference Line

For Additional Information on Coatings and Dimensions:
- See Picture-Tube Dimensional-Outlines and Bulb J187 D/G sheets at the front of this section
- Cap: Recessed Small Cavity (JEDEC No.J1-21)
- Base: Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-203)

Basing Designation for BOTTOM VIEW: 12L
Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR VOLTAGE \( \begin{cases} 22000 \text{ max.} & \text{volts} \\ 12000 \text{ min.} & \text{volts} \end{cases} \)

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 uthor voltage of 16000 volts and grid-No.2 voltage of 300 volts

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

Grid-No.1 Voltage for visual extinction of focused raster: -35 to -72 volts

Maximum Circuit Values:

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

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

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
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
1200 min. μf
Electron Gun. ........ Type Requiring No lon-Trap Magnet

Optical:
Faceplate, Spherical. ........ Filterglass
Light transmission (Approx.) .......... 75%
Phosphor (For Curves, see front of this Section). P4—Sulfide Type, Aluminized

Mechanical:
Operating Position. ................ Any
Weight (Approx.) .................. 35 lbs
Overall Length .................. 19-1/8" ± 3/8"
Neck Length .................. 5-1/2" ± 3/16"
Projected Area of Screen .......... 332 sq. in.
External Conductive Coating:
Type. ................ Special
Contact area for grounding. .......... Near Reference Line

For Additional Information on Coatings and Dimensions:
See Picture-Tube Dimensional-Outlines and Bulb J192 A/B sheets at the front of this section

Cap. ................ Recessed Small Cavity (JEDEC No.J1-12)

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

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

RADIO CORPORATION OF AMERICA
Electron Tube Division Harrison, N. J.
DATA
1-63
Maximum Ratings, Design-Maximum Values:

ULTOR VOLTAGE .................. 22000 max. volts
GRID-No.4 (FOCUSING) VOLTAGE:
   Positive value .................. 1100 max. volts
   Negative value .................. 550 max. volts
GRID-No.2 VOLTAGE ................ 550 max. volts
GRID-No.1 VOLTAGE:
   Negative bias value ............... 155 max. volts
   Positive bias value .............. 0 max. volts
   Positive peak value ............. 2 max. volts
PEAK HEATER-CATHODE VOLTAGE:
   Heater negative with
      respect to cathode:
         During equipment warm-up period
            not exceeding 15 seconds .......... 450 max. volts
         After equipment warm-up period.... 200 max. volts
   Heater positive with
      respect to cathode ............... 200 max. volts

Typical Operating Conditions:

With ultor voltage of 18000 volts
and grid-No.2 voltage of 300 volts
Grid-No.4 Voltage for focus ....... -50 to +350 volts
Grid-No.1 Voltage for visual extinction of focused raster .... -28 to -72 volts

Maximum Circuit Values:

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

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section
24AHP4
PICTURE TUBE
RECTANGULAR GLASS TYPE
LOW-VOLTAGE FOCUS
ALUMINIZED SCREEN
MAGNETIC DEFLECTION

DATA

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

Direct Interelectrode Capacitances:
Grid No. 1 to all other electrodes ..... 6 ....... \( \mu \text{F} \)
Cathode to all other electrodes ..... 5 ....... \( \mu \text{F} \)
External conductive coating to ultor. ..... \{2500 max. \( \mu \text{F} \}
\{2000 min. \( \mu \text{F} \}

Faceplate, Spherical. ...... Filterglass
Light transmission (Approx.) ....... 76%
Phosphor (For curves, see front of this Section). \( \text{P}-4-\text{Sulfide Type} \)
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
Cap. ...... Recessed Small Cavity (JETEC No.J1-21)
Bulb. ...... J192 (110°)
Base. ...... Small-Button Eightar 7-Pin, Arrangement 2, (JETEC No.B7-183)

Basing Designation for BOTTOM VIEW. ...... 8HR

Pin 1 - Heater
Pin 2 - Grid No. 1
Pin 3 - Grid No. 2
Pin 4 - Grid No. 4
Pin 6 - Grid No. 1
Pin 7 - Cathode
Pin 8 - Heater

Cap - Ultor
[Grid No. 3, Grid No. 5, Collector]
C - External
Conductive Coating
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>20000 max., 12000 min.</td>
</tr>
<tr>
<td>GRID-No. 4 VOLTAGE</td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>1000 max. volts</td>
</tr>
<tr>
<td>Negative value</td>
<td>500 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></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>
</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 \( E_{clk} \) 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 \( E_{clk} \) 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 \( E_{clk} \) 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 14000 volts and grid-No. 2 voltage of 16000 volts.

Example:
- Grid-No. 4 Voltage for Focus: -50 to +350

- 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:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR-TO-GRID-No.1 VOLTAGE</td>
<td>20000 max. volts</td>
</tr>
<tr>
<td>GRID-No.4-TO-GRID-No.1 VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>1000 max. volts</td>
</tr>
<tr>
<td>Negative value</td>
<td>500 max. volts</td>
</tr>
<tr>
<td>GRID-No.2-TO-GRID-No.1 VOLTAGE</td>
<td>640 max. volts</td>
</tr>
<tr>
<td>GRID-No.2-TO-CATHODE VOLTAGE</td>
<td>500 max. volts</td>
</tr>
<tr>
<td>CATHODE-TO-GRID-No.1 VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Positive peak value</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>140 max. volts</td>
</tr>
<tr>
<td>Negative bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Negative 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>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 \( (E_{c1}g_1) \) between 12000 and 20000 volts and grid-No.2-to-grid-No.1 voltage \( (E_{c2}g_1) \) between 225 and 640 volts

Grid-No.4-to-Grid-No.1 Voltage for Focus§ . . . . . . . -50 to +350 volts

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

*This value is a working design-center minimum. The equivalent absolute minimum ultor or ultor-to-grid-No.1 voltage is 11000 volts, below which the serviceability of the 24AHP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor or ultor-to-grid-No.1 voltage is never less than 11000 volts.

*§: See next page.
### Cathode-to-Grid-No.1 Voltage (Ek1) 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 Ek1 except video drive is a negative voltage

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.4 Current</td>
<td>-25 to +25 µa</td>
</tr>
<tr>
<td>Grid-No.2 Current</td>
<td>-15 to +15 µa</td>
</tr>
<tr>
<td>Field Strength of Adjustable Centering Magnet</td>
<td>0 to 8 gauss</td>
</tr>
</tbody>
</table>

### Examples of Use of Design Ranges:

**With ultor-to-grid-No.1 voltage of**

- 14000 volts
- 16000 volts

**and grid-No.2-to-grid-No.1 voltage of**

- 300 volts
- 400 volts

**Grid-No.4-to-Grid-No.1 Voltage for Focus**

- -50 to +350 volts
- -50 to +350 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):**

White-level value

- -28 to -60 volts
- -36 to -78 volts

### Maximum Circuit Values:

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

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

The grid-No.4 voltage or grid-No.4-to-grid-No.1 voltage required for focus of any individual tube is independent of ultor current and will remain essentially constant for values of ultor voltage (or ultor-to-grid-No.1 voltage) or grid-No.2 voltage (or grid-No.2-to-grid-No.1 voltage) within design ranges shown for these items.

For X-ray shielding considerations, see sheet *X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section*
$E_f = 6.3$ VOLTS
ULTOR VOLTS = 12000 TO 20000
GRID-NO.4 VOLTS ADJUSTED FOR FOCUS.
24AHP4

PICTURE TUBE

SCREEN DIAGONAL 22 13/16

SCREEN HEIGHT 16 7/8

SCREEN WIDTH 21 7/16

22 1/16 ± 1/8

4"R.

32"R.

16 1/4"R.

Y AXIS

1 1/8" ± 1/32"

X AXIS

REFERENCE LINE (NOTE 2)

0.920"

105°

SMALL-BUTTON EIGHTAR

7-PIN BASE

ARRANGEMENT 2

JETEC N°B7-183

(NOTE 3)

ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6-57

CE-9345A
24AHP4
PICTURE TUBE

TRANSPARENT INSULATING COATING (NOTE 5)

SEE NOTE 7

ULTRASONIC RECESSED CAVITY NO. 21 (NOTE 1)

FOR THIS CONTOUR Y = 0.58 x 2 x 0.576

DIAGONAL VIEW

EXTERNAL CONDUCTIVE COATING (NOTE 4)

92CL-9345

RCA
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No. 126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

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

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

NOTE 7: UNDISTURBED AREA BETWEEN MOLD-MATCH LINE AND SPLICELINE IS 1" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF TUBE SUPPORT BAND.
$E_f = 6.3$ 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"

---

**Graph:**

- Video signal volts from raster cutoff vs. highlight brightness—foot-lamberts.
- Two lines represent cathode drive and grid drive, respectively.

---

**Electron Tube Division**

Radio Corporation of America, Harrison, New Jersey

92CS-9352
**AVERAGE DRIVE CHARACTERISTICS**

**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.

---

**Graph**

- **Cathode Drive**
- **Grid Drive**

**Axes**

- **ULTOR MILLIAMPERES**
  - 0.5
  - 1.0
  - 1.5
  - 2.0
  - 2.5
- **VIDEO SIGNAL VOLTS FROM RASTER CUTOFF**
  - 0
  - 20
  - 40
  - 60
  - 80

**Notes**

- VIDEO SIGNAL VOLTS FROM RASTER CUTOFF
- ELECTRON TUBE DIVISION
- RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
- 92CS-9351
### General:

Heater, for Unipotential Cathode:
- Voltage (AC or DC): \( 6.3 \) volts
- Current at 6.3 volts: 0.6 amp
- Warm-up time (Average): 11 sec

Direct Inter electrode Capacitances:
- Grid No.1 to all other electrodes: \( 6 \) \( \mu \)f
- Cathode to all other electrodes: \( 5 \) \( \mu \)f
- External conductive coating to ultor: \( \{ 2500 \text{ max.} \} \) \( \mu \)f \((2000 \text{ min.} \) \( \mu \)f

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

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: \( 19-1/8" \pm 3/8" \)
- Greatest width: \( 22-11/16" \pm 1/8" \)
- Greatest height: \( 18-7/16" \pm 1/8" \)
- Diagonal: \( 24" \pm 1/8" \)
- Neck length: \( 5-1/2" \pm 3/16" \)
- 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.):
- 35 lbs

### Operating Position:
- Any

Cap: Recessed Small Cavity (JEDEC No.J1-21)
Bulb: J192 A2/B2
Socket: Cinch Part No.9464-12, or equivalent
Base: Small-Shell Duodecal 6-Pin, Arrangement 1, (JEDEC Group 4, No.B6-63)
Basing Designation for BOTTOM VIEW. .......................... 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater

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

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 (FOCUSBING) VOLTAGE:
Positive value. .......................... 1000 max. volts
Negative value. ......................... 500 max. volts

GRID-No.2-TO-GRID-No.1 VOLTAGE. .......... 68 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 ..................... 0 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 (Ec281) between 40 and 68 volts

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

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
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 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): 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. 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 24ATP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that 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 optimum focus of any individual tube may have a value anywhere between 0 and 400 volts and 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.

The cathode-to-grid-No.1 voltage (Ekgl) 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.

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

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 24ATP4 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
SMALL-SHELL DUODECAL
6-PIN BASE,
ARRANGEMENT I,
JEDEC GROUP 4, N0B6-63
(NOTE 3)

NOTE 2: WITH TUBE NECK INSERTED THROUGH 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. 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.
RASTER-CUTOFF-RANGE CHART
Cathode-Drive Service

$E_c = 6.3 \text{ VOLTS}$
ULTOR-TO-GRID-$N^1$ VOLTS=16000
GRID-$N^4$-TO-GRID-$N^1$ VOLTAGE ADJUSTED FOR FOCUS.
*INCREASES OR DECREASES DIRECTLY BY APPROX. 2% FOR EVERY 1000-VOLT CHANGE IN ULTOR-TO-GRID-$N^1$ VOLTAGE.

<table>
<thead>
<tr>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
</tr>
</thead>
<tbody>
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<td>70</td>
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</tbody>
</table>

GRID-$N^2$-TO-GRID-$N^1$ VOLTS

92CS-10765
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 μF
Cathode to all other electrodes: 5 μF
External conductive coating to ultor: (2500 max. μF)
(1700 min. μF)

Faceplate, Spherical: Filterglass
Light transmission (Approx.): 74%
Phosphor (for curves, see front of this Section): P4—Sulfide Type
Aluminized
Fluorescence: White
Phosphorescence: White
Persistence: Short

Focusing Method: Electrostatic
Deflection Method: Magnetic

Deflection Angles (Approx.):
Diagonal: 90°
Horizontal: 85°
Vertical: 68°

Electron Gun: Type Requiring No Ion-Trap Magnet

Tube Dimensions:
Overall length: 18-1/8" ± 3/8"
Greatest width: 22-11/16" ± 1/8"
Greatest height: 18-7/16" ± 1/8"
Diagonal: 24" ± 1/8"
Neck length: 4-1/2" ± 3/16"
Radius of curvature of faceplate (External surface): 40"

Screen Dimensions (Minimum):
Greatest width: 21-7/16"
Greatest height: 16-7/8"
Diagonal: 22-13/16"
Projected area: 332 sq. in.

Weight (Approx.): 32-1/2 lbs

Operating Position: Any
Cap. Recessed Small Cavity (JEDEC No.J1-21)
Bulb: J192A/B

Base: Short Small-Shell Duodecal 6-Pin
(JEDEC Group 4, No.B6-203), or Small-Shell Duodecal 6-Pin, Arrangement 1
(JEDEC Group 4, No.B6-63)

4-59
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, Collector)

C - External Conductive Coating

GRID-DRIVE SERVICE

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

Maximum Ratings, Design-Center Values:

ULTOR VOLTAGE: 20000 max. volts
12000 min. volts

GRID-No.4 (FOCUSED) 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 (Ee)k) between 12000 and 20000 volts
and grid-No.2 voltage (Ee)k) between 200 and 500 volts

Grid-No.4 Voltage for focus § -75 to +400 volts

Grid-No.1 Voltage (Ee)k) for visual extinction of focused raster See Raster-Cutoff-Range Chart for Grid-Drive Service

Grid-No.1 Video Drive from Raster Cutoff (Black Level):
White-level value Same value as determined for Ee)k
(Peak positive) a positive voltage

Grid-No.4 Current -25 to +25 µA

§§: see next page.
Grid-No.2 Current: ............. -15 to +15 μA
Field Strength of Adjustable Centering Magnet: ............. 0 to 8 gausses

Examples of Use of Design Ranges:

With ultor voltage of and grid-No.2 voltage of

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
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 (Ec581) between 12000 and 20000 volts and grid-No.2-to-grid-No.1 voltage (Ec2581) 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 (Ek91) for visual extinction of focused raster: ............. See Raster-Cutoff-Range Chart for Cathode-Drive Service

See next page.
Cathode-to-Grid-No.1 Video
Drive from Raster Cutoff (Black Level):
White-level value
(Peak negative) .......... Same value as determined for $E_{kg1}$ except video drive is a negative voltage

Grid-No.4 Current ............. -25 to +25 $\mu$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:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Range 1</th>
<th>Range 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>With ultor-to-grid- No.1 voltage of</td>
<td>18000 volts</td>
<td>300 volts</td>
</tr>
<tr>
<td>and grid-No.2-to-grid- No.1 voltage of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grid-No.4-to-Grid-No.1 Voltage for focus</td>
<td>-75 to +40C volts</td>
<td></td>
</tr>
<tr>
<td>Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster</td>
<td>33 to 60 volts</td>
<td></td>
</tr>
<tr>
<td>Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level): White-level value</td>
<td>-33 to -60 volts</td>
<td></td>
</tr>
</tbody>
</table>

Maximum Circuit Values:

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

* Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

This value is a working design-center minimum. The equivalent absolute minimum ultor-or ultor-to-grid-No.1 voltage is 11,000 volts, below which the serviceability of the 24AUP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor-or ultor-to-grid-No.1 voltage is never less than 11,000 volts.

§ The grid-No.4 voltage or grid-No.4-to-grid-No.1 voltage required for focus of any individual tube is independent of ultor current and will remain essentially constant for values of ultor voltage (or ultor-to-grid-No.1 voltage) or grid-No.2 voltage (or grid-No.2-to-grid-No.1 voltage) within design ranges shown for these items.

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

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

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

\[ E_f = 6.3 \text{ VOLTS} \]
ULTOR VOLTS = 12,000 TO 20,000
GRID-N\#4 VOLTS ADJUSTED FOR FOCUS.

**CATHODE-DRIVE SERVICE**

\[ E_f = 6.3 \text{ VOLTS} \]
ULTOR-TO-GRID-N\#1 VOLTS = 12,000 TO 20,000
GRID-N\#4-TO-GRID-N\#1 VOLTS ADJUSTED FOR FOCUS.
24AUP4
PICTURE TUBE

SCREEN DIAGONAL 22 7/16 MIN.

SCREEN WIDTH 21 7/16 MIN.

SCREEN HEIGHT 16 7/8 MIN.

22" R.

22" R.

35° R.

38° R.

4 13/16° R.

2 7/16° R.

6 3/4" R.

3 3/4" R.

22 1/16" ± 3/16"

REFERENCE LINE

SHORT SMALL-SHELL DUODECAL 6-PIN BASE
JEDEC GROUP 4, N886-203
OR
SMALL-SHELL DUODECAL 6-PIN BASE,
ARRANGEMENT 1
JEDEC GROUP 4, N886-63
(NOTE 3)

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC NO. G-116 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

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

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

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

NOTE 6: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/16" BEYOND THE ENVELOPE SURFACE AT THE MOLD-MATCH LINE.
**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-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 = 21&quot; x 16&quot;</td>
<td>RASTER SIZE = 21&quot; x 16&quot;</td>
</tr>
</tbody>
</table>

---

**Graph**

- **Axes**:
  - **X-axis**: VIDEO SIGNAL VOLTS FROM RASTER CUTOFF
  - **Y-axis**: HIGHLIGHT BRIGHNESS — FOOT-LAMBERTS

- **Lines**:
  - **CATHODE DRIVE**
  - **GRID DRIVE**

---

**Notes**

- **Video Signal Voltages**:
  - 0 to 80 volts

- **Highlight Brightness**:
  - 0 to 300 foot-lamberts

---

**Electron Tube Division**

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

**Document Code**

92CM-9352
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE
$E_f = 6.3$ VOLTS
ULTOR-TO-GRID-N7 VOLTS = 12000 TO 20000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID N7 TO GIVE FOCUSED RASTER CUTOFF.

GRID-DRIVE SERVICE
$E_f = 6.3$ VOLTS
ULTOR VOLTS = 12000 TO 20000
GRID N7 BIASED NEGATIVE, WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.

---

**Electron Tube Division:**

Radio Corporation of America, Harrison, New Jersey
### Data 1

#### General:
- **Heater, for Unipotential Cathode:**
  - Voltage (AC or DC) ....... 6.3 volts
  - Current ........... 0.6 amp

#### Direct Interelectrode Capacitances:
- Grid No.1 to all other electrodes .... 6 \( \mu \text{f} \)
- Cathode to all other electrodes .... 5 \( \mu \text{f} \)
- External conductive coating to ultor .... 2500 max. \( \mu \text{f} \)
- 1700 min. \( \mu \text{f} \)

#### Faceplate, Spherical
- Filterglass
- Light transmission (Approx.) .... 76%

#### Phosphor (for curves, see front of this section)
- Aluminized Screen
  - 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"
- Radius of curvature of faceplate (External surface) .... 32"

#### 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

#### Operating Position
- Any

#### Cap
- Recessed Small Cavity (JEDEC No. J1-21)
- J192 C1/D1

#### Bulb
- Uncle Part No. 11546, or equivalent

#### Socket
- Small-Button Eightar 7-Pin, Arrangement 2. (JEDEC No. B7-183)

---

*Indicates a change.*

---

4-60
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 - Uitor (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 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
- 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 (\(E_{c91}\)) between 12000 and 20000 volts and grid-No.2-to-grid-No.1 voltage (\(E_{c92}\)) between 40 and 64 volts

- Grid-No.4-to-Grid-No.1 voltage: 0 to 400 volts

- Cathode-to-Grid-No.1 Voltage (\(E_{k91}\)) 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 \(E_{k91}\) except video drive is a negative 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

4-60 ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**Examples of Use of Design Ranges:**

<table>
<thead>
<tr>
<th>With ultor-to-grid-</th>
<th>Voltage Range</th>
<th>No. 1 voltage of</th>
<th>Grid-No. 4-to-Grid-No. 1 Voltage for focus</th>
<th>Cathode-to-Grid-No. 1 Voltage for visual extinction of focused raster</th>
<th>Cathode-to-Grid-No. 1 Video Drive From Raster Cutoff (Black level): White-level value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1 voltage of</td>
<td>16000</td>
<td>20000 volts</td>
<td>0 to 400 volts</td>
<td>32 to 47 volts</td>
<td>-32 to -47 volts</td>
</tr>
<tr>
<td>and grid-No. 2-to-grid-</td>
<td>50</td>
<td>64 volts</td>
<td>0 to 400 volts</td>
<td>42 to 58 volts</td>
<td>-42 to -58 volts</td>
</tr>
</tbody>
</table>

**Maximum Circuit Values:**

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

- Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No. 1 and the other electrodes.
- This value is a working design-center minimum. The equivalent absolute minimum ultor-to-grid-No. 1 voltage is 11,000 volts below which the serviceability of the 24BAP4 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 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-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 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.

**OPERATING CONSIDERATIONS**

**X-Ray Warning.** When operated at ultor voltages up to 16 kilovolts, the 24BAP4 does not produce any harmful X-ray radiation. However, because the rating of this type permits operation at voltages as high as 22 kilovolts (Absolute-maximum value), shielding of the 24BAP4 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 shatter-proof, glass cover over the face of the 24BAP4 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.
PICTURE TUBE

SCREEN DIAGONAL 22 1/16 MIN.

SCREEN HEIGHT 16 7/8 MIN.

SCREEN WIDTH 21 7/16 MIN.

22 11/16 ± 1/8

REFERENCE LINE (NOTE 2)

SMALL-BUTTON EIGHTAR
7-PIN BASE
ARRANGEMENT 2
JEDEC N887-183
(NOTE 3)


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 1" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF TUBE SUPPORT BAND.
**24BAP4**

**RASTER-CUTOFF-RANGE CHART**

**E_F=6.3 VOLTS**

**ULTOR-TO-GRID-N2 VOLTS=16000**

**GRID-N2-TO-GRID-N1 VOLTS ADJUSTED FOR FOCUS.**

*CATHODE-TO-GRID-N1 VOLTAGE FOR VISUAL EXTINCTION OF FOCUSED RASTER INCREASES OR DECREASES DIRECTLY BY APPROX. 2% FOR EVERY 1000-VOLT CHANGE IN ULTOR-TO-GRID-N1 VOLTAGE.*

---

**GRID-N2-TO-GRID-N1 VOLTS**

<table>
<thead>
<tr>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
</tr>
<tr>
<td>30</td>
</tr>
<tr>
<td>40</td>
</tr>
<tr>
<td>50</td>
</tr>
<tr>
<td>60</td>
</tr>
<tr>
<td>70</td>
</tr>
</tbody>
</table>

**CATHODE-TO-GRID-N1 VOLTS**

<table>
<thead>
<tr>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
</tr>
<tr>
<td>40</td>
</tr>
<tr>
<td>50</td>
</tr>
<tr>
<td>60</td>
</tr>
<tr>
<td>70</td>
</tr>
</tbody>
</table>

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92CS-9945R1

**ELECTRON TUBE DIVISION**

**RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY**
CATHODE-DRIVE CHARACTERISTICS

\( E_f = 6.3 \text{ VOLTS} \)
ULTOR-TO-GRID-N1 VOLTS = 16000
GRID-N2 TO-GRID-N1 VOLTS = 50
CATHODE BIASED POSITIVE WITH RESPECT TO
GRID N1 TO GIVE FOCUSED RASTER CUTOFF.
RASTER FOCUSED AT AVERAGE BRIGHTNESS.
RASTER SIZE = 21" x 16"

I.C.I. COORDINATES OF SCREEN: X = 0.270, Y = 0.300

ELECTRON TUBE DIVISION
92CM-10075R1
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
CATHODE-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ULTOR-TO-GRID-N1 VOLTS = 16000
GRID-N2-TO-GRID-N1 VOLTS = 50
CATHODE BIASED POSITIVE WITH RESPECT TO GRID N1 TO GIVE FOCUSED RASTER CUTOFF.

ELECIIION TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
### 24CP4-A

#### Average Drive Characteristics

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<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-#1 Volts = 16000 to 20000</td>
<td>Ultor Volts = 16000 to 20000</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>
</tbody>
</table>

---

**Graph:**

- **Graph Title:**
- **Graph Axes:**
  - **X-axis:** Video Signal Volts from Raster Cutoff
  - **Y-axis:** Ultor Milliamperes

---

**Footnote:**

- **Date:** May 24, 1955
- **Division:** Tube Division
- **Company:** Radio Corporation of America, Harrison, New Jersey

**Model Number:** 24CM-8626
24CP4A

Picture Tube

RECTANGULAR GLASS TYPE
MAGNETIC FOCUS
ALUMINIZED SCREEN
RECTANGULAR GLASS TYPE
MAGNETIC FOCUS
ALUMINIZED SCREEN

GENERAL DATA

Electrical:
Heater Current at 6.3 volts ............ 600 ±10% ma
Direct Interelectrode Capacitances:
- Grid No.1 to all other electrodes .... 6 μμf
- Cathode to all other electrodes .... 5 μμf
- External conductive coating to ultor .... 2500 max., 2000 min. μμf
Electron Gun. ................. Ion-Trap Type Requiring External Single-Field 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.
Type. ................ Regular-Band Contact area for grounding. .... Near Reference Line
External Conductive Coating:
See Picture-Tube Dimensional-Outlines and Bulb Jig 2 A/B sheets at the front of this section
Cap .......... Recessed Small Cavity (JEDEC No.J1-21)
Base. .......... Small-Shell Duodecal 5-Pin (JEDEC Group 4, No.B5-57)
Basing Designation for BOTTOM VIEW ........ 12N

Maximum Ratings, Design-Maximum Values:
ULTOR VOLTAGE .................. 22000 max. volts
GRID-No.2 VOLTAGE ............. 550 max. volts

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
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 uttor voltage of
and grid-No.2 voltage of
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
27MP4
PICTURE TUBE
RECTANGULAR METAL-SHELL TYPE ALUMINIZED SCREEN
MAGNETIC FOCUS MAGNETIC DEFLECTION

DATA

General:
Heater, for Unipotential Cathode:
Voltage: 6.3 (ac or dc volts)
Current: 0.6 ± 10% amp
Faceplate, Compound Spherical. Frosted Filterglass Phosphor (for curves, see front of this section) P4—Sulfide Type Aluminized

Deflection Angles (Approx.):
Diagonal: 90°
Horizontal: 85°
Vertical: 69°

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

Tube Dimensions:
Maximum overall length: 22-3/16"
Greatest width at lip: 25-1/4" ± 3/16"
Greatest height at lip: 19-15/16" ± 3/16"
Diagonal at lip: 26-7/8" ± 1/4"
Neck length: 7-1/2" ± 3/16"

Radius of curvature of faceplate (External surface):

Screen Dimensions (Minimum):
Greatest width: 23-7/16"
Greatest height: 19-1/8"
Diagonal: 25-1/16"
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: 18000 max. volts
GRID-No.2 VOLTAGE: 500 max. volts
GRID-No.1 VOLTAGE:
Negative-bias value: 125 max. volts
Positive-bias value: 0 max. volts
Positive-peak value: 2 max. volts

*: See next page. Indicates a change.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, 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 . . . 180 max. volts
Heater positive with respect to cathode. 180 max. volts

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

Within major area, the radius of curvature is 40°. The curvature of
the surface at the boundary of this area blends into the rim and has a
perimetrical shape conforming to the surface of a sphere having a
50° radius.

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

#### General:
- **Heater, for Unipotential Cathode:**
  - Voltage (AC or DC): 6.3 volts
  - Current: 0.6 ± 10% amp

#### Capacitance between External Conductive Coating and Ultor:
- 2500 max. µf
- 500 min. µf

#### Faceplate, Spherical:
- Filterglass
- Phosphor (For curves, see front of this section): P4—Sulfide Type Aluminized

#### Deflection Angles (Approx.):
- Diagonal: 90°
- Horizontal: 85°
- Vertical: 69°

#### Electron Gun:
- Ion-Trap Type Requiring External Single-Field Magnet

#### Tube Dimensions:
- Overall length: 23-1/16" ± 3/8"
- Greatest width: 25-9/32" ± 3/16"
- Greatest height: 20-7/32" ± 3/16"
- Diagonal: 26-13/16" ± 3/16"
- Neck length: 7-1/2" ± 3/16"
- Radius of curvature of faceplate (External surface): 40"

#### Screen Dimensions (Minimum):
- Greatest width: 24-1/4"
- Greatest height: 18-5/8"
- Diagonal: 25-3/4"
- Projected area: 425 sq. in.

#### Operating Position:
- Any

#### Cap Base Designation for BOTTOM VIEW:
- Recessed Small Cavity (JEDEC No. J1-21)
- Small-Shell Duodecal 5-Pin (JEDEC Group 4, No. B5-57)

#### Basing Designation:
- 12N Cap - Ultor (Grid No. 3, Collector)
- C - External Conductive Coating

### Maximum Ratings, Design-Center Values:
- **ULTOR VOLTAGE**: 20000 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

---

**ELECTRON TUBE DIVISION**

**RADIO CORPORATION OF AMERICA, HARRISON, 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... 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

27VP4

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

GENERAL DATA

Electrical:
Heater Current at 6.3 volts ............. 600 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 .................................. Filterglass
  Light transmission (Approx.) .......... 72%
Phosphor (For curves, see front of this section): P4—Sulfide Type, Aluminized

Mechanical:
Operating Position. ....................... Any
Weight (Approx.) ......................... 44 lbs
Overall Length ......................... 21-1/16" ± 3/8"
Neck Length ......................... 5-1/2" ± 3/16"
Projected Area of Screen ............. 425 sq. in.
External Conductive Coating:
  Type .................................. Regular Band
  Contact area for grounding ............ Near Reference Line
For Additional Information on Coatings and Dimensions:
See Picture-Tube Dimensional-Outlines and Bulb J214-112 A sheets at the front of this section

Cap ......................... Recessed Small Cavity (JEDEC No. J1-21)
Base ......................... Small-Shell Duodecal 6-Pin,
  Arrangement 1 (JEDEC Group 4, No. B6-63)
Basing Designation for BOTTOM VIEW. ....... 12L

Pin 1—Heater
Pin 2—Grid No.1
Pin 6—Grid No.4
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater

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

Minimum 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

RADIO CORPORATION OF AMERICA
Electron Tube Division Harrison, N. J. DATA 5-62
GRID-No.1 VOLTAGE:
- Negative peak value: 220 max. volts
- Negative bias value: 155 max. volts
- Positive bias value: 0 max. volts
- Positive peak value: 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:
- Heater negative with respect to cathode:
  During equipment warm-up period not exceeding 15 seconds: 450 max. volts
  After equipment warm-up period: 200 max. volts
- Heater positive with respect to cathode: 200 max. volts

Typical Operating Conditions:
- With ultor voltage of 16000 volts
- and grid-No.2 voltage of 300 volts
- Grid-No.4 Voltage for focus: -72 to +396 volts
- Grid-No.1 Voltage for visual extinction of focused raster: -28 to -72 volts

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

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

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:

Anode No. 2 & Grid No. 2 Voltage* .. 400 600 ... volts
Anode No. 1 Voltage for Focus
at 75% of Grid-No. 1 Voltage for Cutoff • 100 150 ... volts
Grid-No. 1 Volt. for Visual Cutoff# • -40 -60 ... volts
Max. Anode-No. 1 Current
Range Between -50 and +10 μamp.

Deflection Sensitivity:
DJ1 and DJ2 0.273 0.183 ... mm/v dc
DJ3 and DJ4 0.326 0.217 ... mm/v dc

Deflection Factor:**
DJ1 and DJ2 93 139 ... v dc/in.
DJ3 and DJ4 78 117 ... v dc/in.

* Brilliance and definition decrease with decreasing anode-No. 2 voltage. In general, anode-No. 2 voltage should not be less than 400 volts.
• Individual tubes may require between +20% and -35% of the values shown with grid-No. 1 voltages between zero and cutoff.
# Visual extinction of stationary focused spot. Supply should be adjustable to ± 50% of these values.
A Individual tubes may vary from these values by ± 20%.

Spot Position:

The undeflected focused spot will fall within a 10-mm square centered at the geometric center of the tube face and having one side parallel to the trace produced by DJ1 and DJ2. Suitable test conditions are: anode-No. 2 voltage, 600 volts; anode-No. 1 voltage, adjusted for focus; deflecting-electrode resistors, 1 megohm each for DJ1 and DJ4, connected to anode No. 2; the tube shielded from all extraneous fields. To avoid damage to the tube, grid-No. 1 voltage should be near cutoff before application of anode voltages.

Maximum Circuit Values:

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

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

JULY 1, 1945
RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
RADECHON
CHARGE STORAGE TUBE
SINGLE-BEAM, BARRIER-GRID TYPE
NON-EQUILIBRIUM WRITING CAPACITANCE-DISCHARGE READING

**DATA**

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

**Direct Interelectrode Capacitances (Approx.):**
- Grid No. 1 to all other electrodes: 9 μf
- Deflecting electrode DJ 1 to all other electrodes: 13 μf
- Deflecting electrode DJ 2 to all other electrodes: 13 μf
- Deflecting electrode DJ 3 to all other electrodes: 11.5 μf
- Deflecting electrode DJ 4 to all other electrodes: 11.5 μf
- DJ 1 to DJ 2: 3 μf
- DJ 3 to DJ 4: 3 μf
- Grid No. 5 to backing-electrode: 800 μf
- Grid No. 5 and backing-electrode to collector: 4 μf

Collector to all other electrodes & external cylindrical shield: See Curve

**Focusing Method:** Electrostatic
**Deflection Method:** Electrostatic
**Overall Length:** 11-27/32" ± 3/8"
**Greatest Diameter of Tube:** 3.30" ± 0.05"
**Minimum Useful Storage-Surface Diameter:** 2-1/4"
**Mounting Position:** Any except those positions where the diheptal base is up and the tube axis is at an angle of less than 60° from the vertical.

**Weight (Approx.):** 1 lb

**Base:**
- On large end of tube: Small-Button Twentyninar 8-Pin (JETEC No.E8-19)

**VIEW OF TWENTYNINAR-BASE END OF TUBE**

Pin 2 - Multiple Connections to Backing-Electrode. Only
Pin 6
Pin 10
Pin 14
Pin 18
Pin 21 - No Connection
Pin 25 - No Connection
Pin 28 - Grid No. 5

**PINS 2, 6, 10, 14, 18: ON 1-7/8" DIA. PIN CIRCLE**
**PINS 24, 25, 28: ON 7/8" DIA. PIN CIRCLE**

SOLID-LINE CIRCLES DEPICT DIHEPTAL BASE. BROKEN-LINE CIRCLES DEPICT TWENTYNINAR BASE

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
On small end of tube. 

**VIEW OF DIHEPTAL-BASE END OF TUBE**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Heater</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Cathode</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>Grid No.1</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>Internal Connection-Do</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>Grid No.3</td>
<td>14</td>
</tr>
<tr>
<td>6</td>
<td>No Connection</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Deflecting Electrode DJ_4</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Deflecting Electrode DJ_3</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Ultron (Grids No.2 &amp; No.4)</td>
<td></td>
</tr>
</tbody>
</table>

All voltages are with respect to cathode unless otherwise specified.

**Maximum Ratings, Absolute Values:**

- **BACKING-ELECTRODE-TO-GRID-No.5**
  - Backing-electrode positive with respect to grid No.5: 100 max. volts
  - Backing-electrode negative with respect to grid No.5: 100 max. volts

- **COLLECTOR-TO-GRID-No.5 VOLTAGE:**
  - Positive value: 100 max. volts
  - Negative value: 0 max. volts

- **ULTOR VOLTAGE:**
  - Negative bias value: 200 max. volts
  - Positive bias value: 0 max. volts
  - Positive peak value: 2 max. volts

- **GRID-No.3 VOLTAGE:**
  - 500 max. volts

- **GRID-No.1 VOLTAGE:**
  - Negative bias value: 125 max. volts
  - Positive bias value: 10 max. volts

**Equipment Design Ranges:**

- For any ultor voltage ($E_{dc}$) between 1000 and 1500 volts*

  - Backing-Electrode-to-Grid-No.5 Voltage... See Note 1

  - The "ultor" in a storage tube is the electrode to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection. In the 6499, the ultor function is performed by grid No.4. Since grid No.4 and grid No.2 are connected together within the 6499, they are collectively referred to simply as "ultor" for presenting data.

*: See next page.
### RADECHON

**Collector-to-Grid-No.5 Voltage.**

| Voltage | 0 to 50 volts |

**Grid-No.3 Voltage for Focus with grid-No.1 volts = 0.**

| Voltage | 14% to 26% of $E_{c4}$ volts |

**Grid-No.1 Voltage for collector-current cutoff.**

| Voltage | -2.5% to -4.7% of $E_{c4}$ volts |

**Collector Current for grid-No.1 volts = 0.**

| Current | 20 to 50 $\mu$amp |

**Max. Cathode Current for grid-No.1 volts = 0.**

| Current | See Curve |

**Deflection Factors:**

- $DJ_1$ and $DJ_2$: 85 to 105 v dc/in./kv of $E_{c4}$
- $DJ_3$ and $DJ_4$: 78 to 96 v dc/in./kv of $E_{c4}$

**Spot Position.**

| See Note 2 |

**Signal-Uniformity Ratio.**

| See Note 3 |

### Examples of Use Design Ranges:

For ultor voltage of 1000 volts:

- Grid-No.3 Voltage for Focus with grid-No.1 volts = 0: 140 to 260 volts
- Grid-No.1 Voltage for collector-current cutoff: -25 to -47 volts

**Deflection Factors:**

- $DJ_1$ and $DJ_2$: 85 to 105 v dc/in.
- $DJ_3$ and $DJ_4$: 78 to 96 v dc/in.

**Maximum Circuit Values:**

- Grid-No.1-Circuit Resistance: 1.5 max. megohms
- Resistance in Any Deflecting-Electrode Circuit: 1.0 max. megohm

---

In general, the recommended minimum ultor voltage should not be less than 1000 volts. Signal output and resolution decrease with decreasing ultor voltage. Secondary emission characteristics of the dielectric layer limit the maximum ultor voltage to 1500 volts.

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

**Note 1:** The backing-electrode, grid No.5, and ultor are usually operated at the same dc potential. During the writing cycle, the backing-electrode may be pulsed to 260 volts with respect to grid No.5.

**Note 2:** The underdeflected focused spot will fall within a circle having a diameter equal to 10% of the minimum storage-surface diameter and having its center coincident with the center of the storage surface. Spot position is calculated as follows: With heater voltage of 6.3 volts, ultor voltage of 1000 volts, grid-No.5 voltage of 1000 volts, collector voltage of 1050 volts, grid-No.3 voltage adjusted to give focus, grid-No.1 voltage adjusted for 15 microamperes peak collector current, each deflecting electrode connected through a 1-megohm resistor to ultor, and the tube shielded from all extraneous fields, the voltages

**Note 3:** See next page.
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
\[ = \frac{1}{2} \sqrt{\frac{(c-a)^2}{b+a} + \frac{(d-c)^2}{d+c}} \times 100 \]

Note 3: With voltages as specified in Note 2, and with a signal written into storage by applying a series of well-formed symmetrical square waves to grid No.1 such that a series of 25 equally spaced stored elements are written across a single line scan, the ratio of the maximum to minimum signal amplitude observed as the single line scan is moved across the storage surface will not exceed 1.35.

OPERATING CONSIDERATIONS

Shielding. The use of a magnetic shield of high-permeability material surrounding the tube is recommended. This shield prevents the effect of stray fields in causing unwanted deflection of the electron beam.

INDICATED CAPACITANCE VS. SHIELD DIAMETER

SHIELD LENGTH = 14"
TUBE IS CENTERED WITHIN SHIELD

DIAMETER OF EXTERNAL CYLINDRICAL SHIELD-INCHES
10 12 14 16 18 20 22 24 26
CAPACITANCE BETWEEN COLLECTOR AND ALL OTHER CYLINDRICAL SHIELD-μF
10 12 14 16 18 20 22 24 26
92CS-8959T
NOTE 1: THE ANGLE BETWEEN PLANE THROUGH PIN 6 OF TWENTYNINAR BASE AND TUBE AXIS, AND PLANE THROUGH PIN 2 OF DlHEPTAL BASE AND TUBE AXIS WILL NOT EXCEED 10°. THE INDICATED PINS ARE BOTH ON THE SAME SIDE OF THE TUBE.

NOTE 2: DEFLECTING ELECTRODES DJ₁ & DJ₂ ARE NEARER THE TARGET. DEFLECTING ELECTRODES DJ₃ & DJ₄ ARE NEARER THE DIHEPTAL BASE.

NOTE 3: ANGLE BETWEEN DJ₁ & DJ₂ DEFLECTION PATH AND DJ₃ & DJ₄ DEFLECTION PATH IS 90° ± 30°.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

8-56
CE-8891
MAXIMUM CATHODE CURRENT

$E_f = 6.3$ VOLTS
GRID-NR1 VOLTS = 0

ULTOR VOLTS

92CS-8949T

AVERAGE TRANSFER CHARACTERISTICS

$E_f = 6.3$ VOLTS
GRID-NR5 VOLTS = BACKING-ELECTRODE VOLTS = ULTOR VOLTS
COLLECTOR VOLTS = ULTOR VOLTS + 50 VOLTS
GRID-NR 3 VOLTS = ADJUSTED FOR BEST OVERALL FOCUS
RESOLUTION CHARACTERISTICS

E₁=6.3 VOLTS
GRID-N5 VOLTS=ULTOR VOLTS=1000
COLLECTOR VOLTS=1050
GRID-N3 VOLTS—ADJUSTED FOR BEST OVERALL FOCUS
GRID-N2 VOLTS—ADJUSTED TO GIVE EQUILIBRIUM COLLECTOR
CURRENT SHOWN ON EACH CURVE
BACKING—ELECTRODE:
DURING WRITING—PULSED APPROX. 50 VOLTS POSITIVE WITH
RESPECT TO ULTOR
DURING READING—AT GRID-N5 POTENTIAL

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8948
RESOLUTION CHARACTERISTICS

$E_c = 6.3$ VOLTS
GRID-$N^5$ VOLTS = ULTOR VOLTS
COLLECTOR VOLTS = ULTOR VOLTS + 50 VOLTS
GRID-$N^3$ VOLTS = ADJUSTED FOR BEST OVERALL FOCUS
GRID-$N^1$ VOLTS = ADJUSTED TO GIVE EQUILIBRIUM COLLECTOR CURRENT OF 7.5 MICROAMPERES
BACKING-ELECTRODE:
  DURING WRITING — PULSED APPROX. 50 VOLTS POSITIVE WITH RESPECT TO ULTOR
  DURING READING — AT GRID-$N^5$ POTENTIAL

![Graph showing resolution characteristics for 92CM-8954 tube division.](attachment:resolution_characteristics.png)
TYPICAL TARGET CHARACTERISTICS

$E_f = 6.3$ VOLTS  
GRID-N$5$ VOLTS = ULTOR VOLTS = 1000  
COLLECTOR VOLTS = 1050  
GRID-N$8$ VOLTS - ADJUSTED FOR BEST OVERALL FOCUS  
GRID-N$2$ VOLTS - ADJUSTED TO GIVE EQUILIBRIUM COLLECTOR CURRENT OF 15 MICROAMPERES  
STORAGE SURFACE IS AT EQUILIBRIUM POTENTIAL PRIOR TO APPLICATION OF PULSE.
APPROXIMATE DISCHARGE-FACTOR CHARACTERISTIC

$E_x = 6.3$ VOLTS
GRID-N85 VOLTS=ULTOR VOLTS=1000
COLLECTOR VOLTS=1050
GRID-N83 VOLTS—ADJUSTED FOR BEST OVERALL FOCUS
GRID-N81 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
COMPUTER STORAGE TUBE
SINGLE-BEAM, PRIMARY-CURRENT-MODULATION TYPE
REDISTRIBUTION 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: 6.5 μf
- Grid No.1 to deflecting electrode DJ₁: 0.2 μf
- Grid No.1 to deflecting electrode DJ₂: 0.2 μf
- Grid No.1 to deflecting electrode DJ₃: 0.2 μf
- Grid No.1 to deflecting electrode DJ₄: 0.2 μf
- Cathode to all other electrodes: 5 μf
- DJ₁ to DJ₂: 2.8 μf
- DJ₃ to DJ₄: 2.6 μf
- DJ₁ to all other electrodes: 9 μf
- DJ₂ to all other electrodes: 9 μf
- DJ₃ to all other electrodes: 8 μf
- DJ₄ to all other electrodes: 7 μf

Focusing Method: Electrostatic
Deflection Method: Electrostatic
Deflecting-electrode arrangement: See Dimensional Outline

Storage Surface: Metal plate or 50-line (minimum) mesh covering external surface of faceplate and capacitively coupled to the storage surface. (This electrode is not supplied with the tube).

- Overall Length: 11-1/2" ± 1/4"
- Greatest Diameter of Bulb: 3" ± 1/16"
- Weight (Approx.): 9 oz
- Mounting Position: Center of tube face must be at same elevation as or at higher elevation than tube base.

Cap. Recessed Small Cavity (JETEC No.J1-21)
Base: Small-Shell Duodeca 10-Pin (JETEC No.B10-75)

---

Pin 1-Heater
Pin 2-Grid No.1
Pin 3-Cathode
Pin 4-Grid No.3
Pin 6-Deflecting Electrode DJ₄
Pin 7-Deflecting Electrode DJ₃
Pin 8-Ultor (Grids No.2 & No.4)

Pin 9-Deflecting Electrode DJ₂
Pin 10-Deflecting Electrode DJ₁
Pin 12-Heater Cap-Collector
Pin 11-Storage Surface

The Signal-output Electrode is capacitively coupled to the Storage Surface.

MAY 1, 1955
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
COMPUTER STORAGE TUBE

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

**COLLECTOR VOLTAGE:**
- Difference between collector voltage and ultor voltage: 150 max. volts

**ULTOR VOLTAGE:**
- 2500 max. volts

**GRID-No.3 VOLTAGE:**
- 1000 max. volts

**GRID-No.1 VOLTAGE:**
- Negative bias value: 200 max. volts
- Positive bias value: 0 max. volts
- Positive peak value: 2 max. volts

**PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFLECTING ELECTRODE:**
- 500 max. volts

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

**Equipment Design Ranges:**

*For any ultor voltage \(E_c\) between 1000 and 2500 volts*

- Collector Voltage: 95% to 105% of \(E_c\) volts
- Grid-No.3 Voltage: 20% to 28% of \(E_c\) volts
- Max. Grid-No.1 Voltage for Beam-Current Cutoff: 2.4% of \(E_c\) volts
- Max. Grid-No.3 Current Range: -15 to +10 \(\mu\)amp

**Deflection Factors:**
- \(D_{J1} & D_{J2}\): 39 to 53 v dc/in./kv of \(E_c\)
- \(D_{J3} & D_{J4}\): 35.5 to 48.5 v dc/in./kv of \(E_c\)
- Focused-Beam Position: ##

**Examples of Use of Design Ranges:**

*For ultor voltage of 1000 2500 volts*

- Collector Voltage: 950 to 1050 2375 to 2625 volts
- Grid-No.3 Voltage: 200 to 280 500 to 700 volts
- Max. Grid-No.1 Voltage for Beam-Current Cutoff: -24 -60 volts

**Deflection Factors:**
- \(D_{J1} & D_{J2}\): 39 to 53 97.5 to 133 volts dc/in.
- \(D_{J3} & D_{J4}\): 35.5 to 48.5 89 to 122 volts dc/in.

*The "ultor" in a storage tube is the electrode to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection. In the 6571, the ultor function is performed by grid No.1. Since grid No.4 and grid No.2 are connected together within the 6571, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.

## The center of the undeflected focused beam will fall within a circle having a 7.5-mm radius concentric with the center of the tube face.*
**Storage Characteristics for Ultor Voltage of 2500 Volts:**

Storage-Surface Boundary (in terms of deflection voltage):

- In the \( DJ_1 - DJ_2 \) direction from position of undeflected focused beam: \( \pm 109 \) volts
- In the \( DJ_3 - DJ_4 \) direction from position of undeflected focused beam: \( \pm 100 \) volts

Blemish Factor*, for storage surface within indicated boundary: \( 0.5 \) max.

Spill [Determined for Double-Dot Pattern]:**

**Under conditions involving 255 references to "spill" element and 1 reference to "test" element**

Separation Between Storage Elements, in either the \( DJ_1 - DJ_2 \) or \( DJ_3 - DJ_4 \) direction in terms of deflection voltage:

- At center of storage surface: \( 8 \) max. volts
- At midpoint on each side of storage-surface boundary: \( 10 \) max. volts

<table>
<thead>
<tr>
<th>Maximum Circuit Values:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1-Circuit Resistance</td>
</tr>
<tr>
<td>Resistance in Any Deflecting-Electrode Circuit*</td>
</tr>
</tbody>
</table>

* Blemish factor is defined as the factor by which the normal positive signal is reduced by the blemish.

** Spill is indicative of the amount of binary information that can be stored by the tube. The storage capability is determined by the separation between two storage elements at which the signal from one element is changed by no more than a specified amount after repeated references to the other element. For the 6571, the separation is measured in terms of deflection voltage, when the amplitude of the negative signal of the "test" element has decreased to 50% of its maximum negative amplitude. The maximum negative amplitude is determined by separating the two elements far enough to eliminate the effects of secondary electron redistribution from the "spill" element.

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

**OPERATING CONSIDERATIONS**

**Shielding.** In typical computer applications, the 6571 is mounted in a compartment having effective magnetic and electrostatic shielding. It is recommended that the bulb be provided with a tight-fitting electrostatic shield extending from the base to the collector coating. (See Dimensional Outline). This external shield supplements the shielding action of the collector in preventing cross-coupling between the electron gun and the external signal electrode.

A signal-output electrode shaped to conform with the external contour of the faceplate and placed in contact with the entire area of the faceplate is required. The signal-output electrode is connected to a low-noise video...
amplifier having sufficient gain to amplify signals from a fraction of a millivolt to the desired level.

The amount of information that can be stored by the 6571 is dependent on the manner in which it is operated, and is affected by the stability of the deflecting system, freedom from noise in the associated output circuit, the number of regenerations compared with the number of addresses, and the effectiveness of the electrostatic and magnetic shielding.

In general, the number of storage elements is proportional to the operating voltage. For the greatest number of storage elements, the 6571 should be operated at the rated maximum voltage and so that the peak grid-No.1 drive is less than that required for the maximum positive amplitude but high enough to provide a satisfactory output signal.

It is recommended that the beam current be limited to the minimum value which provides satisfactory signal amplitude.

The storage characteristics in the tabulated data and curve are based on the use of a double-dot pattern. In this method of storage, the positive signal is produced by adjusting the beam current and the distance between two dot storage elements so that the optimum positive signal is produced when the "test" element is addressed. Other methods of storage such as superimposed focused and defocused spots or dots and dashes may be used equally well with the 6571.
CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE.

DJ1 AND DJ2 ARE NEARER THE STORAGE SURFACE; DJ3 AND DJ4 ARE NEARER THE BASE. WITH DJ1 POSITIVE WITH RESPECT TO DJ2, THE BEAM WILL BE DEFLECTED TOWARD PIN 2; LIKewise, WITH DJ3 POSITIVE WITH RESPECT TO DJ4, THE BEAM WILL BE DEFLECTED TOWARD VACANT PIN POSITION 11.

THE PLANE THROUGH TUBE AXIS AND EACH OF THE FOLLOWING ITEMS MAY VARY FROM THE DEFLECTION PATH PRODUCED BY DJ1 AND DJ2 BY THE FOLLOWING ANGULAR TOLERANCES (MEASURED ABOUT THE TUBE AXIS): PIN 2, 10°; SIDE TERMINAL (ON SAME SIDE AS PIN 8), 10°. ANGLE BETWEEN DJ1-DJ2 DEFLECTION PATH AND DJ3-DJ4 DEFLECTION PATH IS 90°±3°.
COLLECTOR VOLTS = 2500
ULTOR VOLTS = 2500
GRID-N\&3 VOLTS = ADJUSTED FOR FOCUS
STORAGE PATTERN: DOUBLE DOT
GRID-N\&1 PULSE DURATION: 1 \mu\text{SEC.} (APPROX.)
6472
MULTIPLIER PHOTOTUBE
9-STAGE TYPE WITH S-4 RESPONSE
For Headlight-Control Service

DATA

General:
Spectral Response ........................................ S-4
Wavelength of Maximum Response ...................... 4000 ± 500 angstroms
Cathode:
  Minimum projected length* ................................... 15/16" 
  Minimum projected width* .................................... 5-16"
Direct Interelectrode Capacitances:
  Anode to dynode No.9 ........................................ 4.2 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"
Minimum projected length .................. 15/16" ± 3/32"
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 ................................. See Dimensional Outline

BOTTOM VIEW

Lead 1 - Cathode
Lead 2 - Dynode No.1
Lead 3 - Dynode No.2
Lead 4 - Dynode No.3
Lead 5 - Dynode No.4
Lead 6 - Dynode No.5
Lead 7 - Dynode No.6
Lead 8 - Dynode No.7
Lead 9 - Dynode No.8
Lead 10 - Dynode No.9
Lead 11 - Anode

DIRECTION OF LIGHT

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC or Peak AC) ............ 1250 max. volts
SUPPLY VOLTAGE BETWEEN DYNODE No.9 AND ANODE (DC or Peak AC) ....... 250 max. volts
AVERAGE ANODE CURRENT° .............................. 0.1 max. ma
AMBIENT TEMPERATURE .................................... 75 max. °C

* On plane perpendicular to the indicated direction of light (See Dimensional Outline).
° Averaged over any interval of 30 seconds maximum.

MAY 1, 1955
TUBE DIVISION
TENTATIVE DATA
RADIO 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>-</td>
<td>µamp/µwatt</td>
</tr>
<tr>
<td>Luminous:</td>
<td>5</td>
<td>35</td>
<td>250</td>
</tr>
<tr>
<td>At 0 cps</td>
<td>-</td>
<td>33</td>
<td>-</td>
</tr>
<tr>
<td>At 100 Mc.</td>
<td>-</td>
<td>-</td>
<td>0.25</td>
</tr>
<tr>
<td>Electrode Dark Current (At 25°C):</td>
<td>-</td>
<td>-</td>
<td>0.75</td>
</tr>
</tbody>
</table>

For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870K. A light input of 10 microminutes 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

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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.
MULTIPLIER PHOTOTUBE


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
AVERAGE ANODE CHARACTERISTICS

VOLTS/STAGE = 100

ANODE MILLIAMPERATURES

JAN. 29, 1955

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM - 8029RI
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.

<table>
<thead>
<tr>
<th>DISTANCE ALONG CATHODE FROM END OF CATHODE NEARER LEADS—MILLIMETERS</th>
<th>RELATIVE ANODE CURRENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td>90</td>
</tr>
<tr>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>30</td>
<td>90</td>
</tr>
</tbody>
</table>

FEB. 11, 1955
TUBE DIVISION
92CM-8535
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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

Graph: Relative anode current vs. distance along plane of grill from left to right—millimeters

FEB. 11, 1955
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-8536
## Display Storage Tube

**Direct-View Type**

**4"-Diameter Display**

**Non-Equilibrium Writing**

**Grid-Control Reading (Viewing)**

### Data

<table>
<thead>
<tr>
<th>General</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</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></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 D1 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>6</td>
<td>-</td>
</tr>
<tr>
<td>D3 to all other tube electrodes</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>D4 to all other tube electrodes</td>
<td>7</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>-</td>
<td>See Dimensional Outline</td>
</tr>
<tr>
<td>Phosphor</td>
<td>-</td>
<td>High-Visual-Efficiency Type, Aluminized</td>
</tr>
<tr>
<td>Fluorescence</td>
<td>-</td>
<td>Yellow</td>
</tr>
<tr>
<td>Phosphorescence</td>
<td>-</td>
<td>Yellow</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>
</tbody>
</table>

### Bulb Terminals:
- Caps (two) | Recessed small cavity (JETEC No.J1-21)
- Flange | See Dimensional Outline
- Flexible cable | See Dimensional Outline
- Ambient-temperature range | -65°C to +100°C
- Mounting position | Any
- Weight (approx.) | 2 lbs
- Socket | Alden part No. 435SBA, or equivalent
- Base | Small-button thirty-fivar 31-pin (JETEC No.E31-36)

O Without external shield.

10-56

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
DISPLAY STORAGE TUBE

Pin 1 - No Connection
Pin 2 - Same as Pin 1
Pin 3 - Deflecting Electrode DJ of Writing Gun
Pin 4 - Deflecting Electrode DJ of Writing Gun
Pin 5 - Same as Pin 1
Pin 6 - Grid No.3 of Writing Gun
Pin 7 - Same as Pin 1
Pin 8 - Heater of Writing Gun
Pin 9 - Heater of Writing Gun
Pin 10 - Grid No.1 of Writing Gun
Pin 11 - Same as Pin 1
Pin 12 - Same as Pin 1
Pin 13 - Deflecting Electrode DJ of Writing Gun
Pin 14 - Deflecting Electrode DJ of Writing Gun
Pin 15 - Grid No.2 of Writing Gun
Pin 16 - Internal Connection - Do Not Use
Pin 17 - Grid No.4 of Writing Gun, Grid No.2 of Viewing Gun
Pin 18 - Same as Pin 1
Pin 19 - Same as Pin 1
Pin 20 - Same as Pin 16
Pin 21 - Same as Pin 1

Pin 22 - Heater of Viewing Gun
Pin 25 - Same as Pin 1
Pin 26 - Same as Pin 1
Pin 27 - Cathode of Writing Gun
Pin 28 - Same as Pin 1
Pin 29 - Same as Pin 1
Pin 32 - Grid No.1 of Viewing Gun
Pin 33 - Cathode of Viewing Gun
Pin 34 - Same as Pin 1
Pin 35 - Heater of Viewing Gun
Flexible Cable - Connection to Screen
Flange - Backing Electrode
Recessed Cavity Cap - Nearer Tube Face - Grid No.4 of Viewing Gun
Nearer Electron Guns - Grid No.3 of Viewing Gun

Maximum Ratings, Absolute Values:

<table>
<thead>
<tr>
<th>Writing Section</th>
<th>Viewing Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen Voltage</td>
<td>11000 max. volts</td>
</tr>
<tr>
<td>Peak Backing-Electrode Voltage</td>
<td>20 max volts</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.

**: See next page.
### Writing Section

<table>
<thead>
<tr>
<th>Equivalent Values</th>
<th>Writing Section</th>
<th>Viewing Section**</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRID-No.4 VOLTAGE</td>
<td>2900 max.*</td>
<td>150 max.*</td>
</tr>
<tr>
<td>GRID-No.3 VOLTAGE</td>
<td>1000 max.*</td>
<td>-</td>
</tr>
<tr>
<td>GRID-No.2 VOLTAGE</td>
<td>2750 max.*</td>
<td>-</td>
</tr>
<tr>
<td>CATHODE VOLTAGE</td>
<td>-</td>
<td>-2900 max.*</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>100 max.*</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max.*</td>
<td>0 max.*</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max.*</td>
<td>0 max.*</td>
</tr>
<tr>
<td>PEAK VOLTAGE BETWEEN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRID No.4 AND ANY</td>
<td>500 max.</td>
<td>-</td>
</tr>
<tr>
<td>DEFLECTING ELECTRODE</td>
<td></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>125 max.*</td>
<td>125 max.*</td>
</tr>
<tr>
<td>Heater positive with respect to cathode.</td>
<td>125 max.*</td>
<td>125 max.*</td>
</tr>
</tbody>
</table>

### Viewing Section**

<table>
<thead>
<tr>
<th>Operating Values and Typical Performance Characteristics:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen Voltage . . . . . . . . . . . . . . . . . . . . . . .</td>
</tr>
<tr>
<td>DC Backing-Electrode</td>
</tr>
<tr>
<td>Voltage . . . . . . . . . . . . . . . . . . . . . . . .</td>
</tr>
<tr>
<td>Grid-No.4 Voltage . . . . . . . . . . . . . . . . . . .</td>
</tr>
<tr>
<td>Grid-No.3 Voltage:</td>
</tr>
<tr>
<td>Grid-No.2 Voltage:</td>
</tr>
<tr>
<td>Grid-No.1 Voltage:</td>
</tr>
<tr>
<td>Maximum Screen Current.</td>
</tr>
<tr>
<td>Maximum Peak Backing-Electrode Current</td>
</tr>
<tr>
<td>Maximum Grid-No.4 Current</td>
</tr>
<tr>
<td>Maximum Grid-No.3 Current</td>
</tr>
<tr>
<td>Maximum Cathode Current</td>
</tr>
<tr>
<td>Writing Speed</td>
</tr>
<tr>
<td>Number of Half-Tone Steps</td>
</tr>
<tr>
<td>Viewing Duration</td>
</tr>
<tr>
<td>Maximum Erasing-Uniformity Factor</td>
</tr>
<tr>
<td>Resolution</td>
</tr>
<tr>
<td>Brightness</td>
</tr>
</tbody>
</table>

** Voltagess are shown with respect to cathode of Viewing Gun.

# Adjusted for brightest, most uniform pattern.

† Grid No.2 of the viewing Gun is connected internally to grid No.4 of the Writing Gun.

For conditions with combined adjustment of grid-No.1 voltage, grid-No.2 voltage, and grid-No.3 voltage to give brightest, most uniform pattern.

* † ‡ § : See next page. — indicates a change.
**WRITE STORAGE SECTION**

**Range Values for Equipment Design:**

*With any grid-No.2 voltage ($E_{c2}$) between 500 and 2750 volts*

- **Grid-No.4 Voltage ($E_{c4}$)**: 95% to 105% of $E_{c2}$ volts
- **Grid-No.3 Voltage for Focus**: 14% to 28% of $E_{c2}$ volts
- **Maximum Grid-No.1 Voltage for Cutoff of Undeflected Focused Spot**: -4.6% of $E_{c2}$ volts
- **Maximum Grid-No.3 Current**: -15 to +10 μamp
- **Maximum Cathode Current**: See Curve

**Deflection Factors:**

- **$D_{1}$ and $D_{2}$**: 28 to 38 v dc/in./kv of $E_{c4}$
- **$D_{3}$ and $D_{4}$**: 28 to 38 v dc/in./kv of $E_{c4}$
- **Focused Beam Position**: See Curve

**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 2625 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 volts

**Deflection Factors**

- when $E_{c4} = E_{c2}$:
  - **$D_{1}$ and $D_{2}$**: 42 to 57 to 70 to 95 v dc/in.
  - **$D_{3}$ and $D_{4}$**: 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 +180 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
- **Back-End-Circuit Resistance**: 0.005 max. megohm
- **Series Current-Limiting Resistance in Screen Circuit**: 1.0 min. megohm

* Voltages are shown with respect to cathode of Writing Gun.
† Measured under conditions of writing from just zero brightness (viewing-beam cutoff) to maximum brightness with grid No.1 of Writing Gun at -10 volts with respect to cathode of Writing Gun, and grids No.2 and No.4 of Writing Gun at 2500 volts with respect to cathode of Writing Gun.
* Observed with an RCA-2F21 Monoscope display.

▲, □, †, ‡, ††, †††, ††‡: See next page.
DISPLAY STORAGE TUBE

Expressed in terms of the time required for the brightness of the un-written background to rise from just zero brightness (viewing-beam cutoff) to 10% of the maximum brightness.

Defined as \((t_2 - t_1)/t_z\), where

- \(t_1\) = time measured from start of erasing to instant at which any screen area is reduced to zero brightness.
- \(t_2\) = time measured from start of erasing to instant at which entire screen area is reduced to zero brightness.

Measured by shrinking-raster method at a display brightness of 50% of saturated brightness and with grids No.2 and No.4 of Writing Gun at +2500 volts with respect to cathode of Writing Gun.

Measured with entire storage grid written to produce maximum brightness and with screen at indicated voltage.

The cathode of the Writing Gun is operated at about -2500 volts with respect to the cathode of the Viewing Gun which is usually operated at ground potential.

The center of the undeflected focused beam will fall within a circle having a 10-mm radius concentric with the center of the face under the following conditions: grids No.2 and No.4 of Writing Gun at +2500 volts with respect to cathode of Writing Gun, grid No.3 of Writing Gun at voltage to give focus, grid No.1 of Writing Gun at voltage which will permit storage of a charge just sufficient to give a barely perceptible spot on screen, viewing section operating under normal conditions, and tube shielded against extraneous fields.

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

OPERATING CONSIDERATIONS

Magnetic shielding must be provided to prevent external fields from interfering with the required accurate control of the low-velocity viewing beam. A cylindrical shield of properly annealed high-permeability material about 1/16-inch thick is usually satisfactory. The screen cable should be placed outside the shield.

The metal flange at the face end of the tube requires the use of a spring-contact ring bearing against the edge of the flange.

To prevent possible damage to the tube, allow the viewing-gun beam current to reach normal operating value before turning on the writing-gun beam current, and keep the viewing beam on until the writing beam is turned off.

Indicates a change.
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 27), ± 170°; ENCAPSULATED JUNCTION, ± 10°. ANGLE BETWEEN DJ₁ - DJ₂ DEFLECTION PATH AND DJ₃ - DJ₄ DEFLECTION PATH IS 90° ± 30°.
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR

RELATIVE RADIANT ENERGY

WAVELENGTH-ANGSTROMS

4000 5000 6000 7000 8000

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

92CM-9042
AVERAGE CHARACTERISTIC

VIEWING SECTION

$E_t = 6.3$ 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

SCREEN KILOVOLTS

SATURATED SCREEN BRIGHTNESS—FOOT-LAMBERTS

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

92CM-9043RI
AVERAGE CHARACTERISTICS

VIEWING SECTION
Ef = 6.3 VOLTS
SCREEN KILOVOLTS* = 5 TO 10
BACKING-ELECTRODE VOLTS* = 5
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

FOR EXPLANATION, SEE TABULATED DATA

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9044
TYPICAL ERASURE CHARACTERISTICS

VIEWING SECTION

E_f = 6.3 VOLTS
GRID-N° 4 VOLTS* = 210
GRID-N° 3 VOLTS* = 85
GRID-N° 2 VOLTS* = 85
GRID-N° 1 VOLTS* = ADJUSTED FOR BRIGHTEST,
MOST UNIFORM DISPLAY
*REFERRED TO CATHODE OF VIEWING GUN

<table>
<thead>
<tr>
<th>CURVE</th>
<th>BACKING-ELECTRODE VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DC</td>
</tr>
<tr>
<td>A</td>
<td>10</td>
</tr>
<tr>
<td>B</td>
<td>5</td>
</tr>
<tr>
<td>C</td>
<td>2</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.

RELATIVE BRIGHTNESS OF ENTIRE SCREEN—PER CENT OF SATURATED BRIGHTNESS

TOTAL ERASING-PULSE DURATION AFTER CESSION OF WRITING—MILLISECONDS
CURRENT CHARACTERISTIC FOR WRITING GUN

WRITING SECTION

$E_f = 6.3$ VOLTS
GRID-N2 4 VOLTS$^*$ = GRID-NO.2 VOLTS
GRID-N2 3 VOLTS$^*$ = ADJUSTED FOR FOCUS
GRID-N2 1 VOLTS$^*$ = 0
$^*$REFERRED TO CATHODE OF WRITING GUN

VIEWING SECTION

NORMAL OPERATION

MAXIMUM PEAK CATHODE OR GRID-N2 2 MILLIAMPERES

GRID-N2 2 VOLTS

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
TYPICAL DRIVE CHARACTERISTIC
FOR WRITING GUN

WRITING SECTION

E_f = 6.3 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
*REFERRED TO CATHODE OF WRITING GUN

VIEWING SECTION
NORMAL OPERATION

WRITE - BEAM MICROAMPERES
AT GRID-N2 4 OF VIEWING SECTION

PEAK GRID-N1 DRIVE FROM SPOT CUTOFF = VOLTS
**OPERATION CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Element</th>
<th>Voltage</th>
<th>Writing Gun</th>
<th>Reading Gun</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.f</td>
<td>6.3 V</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Backing Electrode-to-Grid</td>
<td>-10 V</td>
<td>ADJUSTED</td>
<td>ADJUSTED</td>
</tr>
<tr>
<td>Shading Electrode-to-Grid</td>
<td>-20 V</td>
<td>ADJUSTED</td>
<td>VARIOUS TO GIVE TARGET</td>
</tr>
<tr>
<td>Grid-94 to Ground</td>
<td>0 V</td>
<td>ADJUSTED</td>
<td>VARIOUS</td>
</tr>
<tr>
<td>Grid-93 to Ground</td>
<td>0 V</td>
<td>ADJUSTED</td>
<td>0</td>
</tr>
<tr>
<td>Grid-92 to Ground</td>
<td>-8750 V</td>
<td>ADJUSTED</td>
<td>0</td>
</tr>
<tr>
<td>Grid-91 to Ground</td>
<td>-24 V</td>
<td>ADJUSTED</td>
<td>VARIOUS</td>
</tr>
<tr>
<td>Cathode to Ground</td>
<td>0 V</td>
<td>ADJUSTED</td>
<td>VARIOUS</td>
</tr>
<tr>
<td>Grid-91 Peak Pulse Volts</td>
<td>-9000 V</td>
<td>ADJUSTED</td>
<td>0</td>
</tr>
<tr>
<td>From Beam-Current Cutoff</td>
<td>12.5 V</td>
<td>VARIOUS</td>
<td>0</td>
</tr>
<tr>
<td>Scanning:</td>
<td></td>
<td>TV</td>
<td></td>
</tr>
<tr>
<td>Rate (Rev/Sec)</td>
<td>0</td>
<td>VARIOUS</td>
<td>0</td>
</tr>
<tr>
<td>Sweep PRF (PPS)</td>
<td>1000</td>
<td>VARIOUS</td>
<td>0</td>
</tr>
<tr>
<td>Sweep Time (μSec/RAD)</td>
<td>100</td>
<td>VARIOUS</td>
<td>0</td>
</tr>
</tbody>
</table>

**Input Signal, Rectangular Pulse:**
- Duration (μSec): 1
- Repetition Rate (PPS): 1000
- Number of Pulses: AS SHOWN

![Graph](image-url)

**Electron Tube Division**

**RCA Corporation of America, Harrison, New Jersey**
OPERATION CHARACTERISTICS

E<sub>c</sub> = 6.3 VOLTS—EACH GUN
BACKING—ELECTRODE—TO—GRID—N<sup>®</sup> 4 VOLTS = -10
SHADING—ELECTRODE—TO—GRID—N<sup>®</sup> 4 VOLTS = +20

GRID—N<sup>®</sup> 4 VOLTS TO GROUND • 0 • 0
GRID—N<sup>®</sup> 3 VOLTS • ADJUSTED • ADJUSTED
FOR FOCUS FOR FOCUS
GRID—N<sup>®</sup> 2 VOLTS TO GROUND • -8750 • 0
GRID—N<sup>®</sup> 1 VOLTS • ADJUSTED • ADJUSTED TO GIVE
TO CUTOFF TARGET μA = 0.5
CATHODE VOLTS TO GROUND • -9000 • -1000
TARGET MICROAMPERES • 0.5
SCANNING: PPI TV
RATE (REV/SEC) • 0 •
SWEEP PRF (PPS) • 1000 •
SWEEP TIME (μSEC/RADIUS) • 100 •
INPUT SIGNAL, RECTANGULAR PULSE:
DURATION (μSEC) • 1 •
REPETITION RATE (PPS) • 1000 •
NUMBER OF PULSES • AS SHOWN

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CL-9411
OPERATION CHARACTERISTICS

- $E_c = 6.3$ VOLTS—EACH GUN
- BACKING—ELECTRODE—TO—GRID—NO. 4 VOLTS $= -10$
- SHADING—ELECTRODE—TO—GRID—NO. 4 VOLTS $= +20$

<table>
<thead>
<tr>
<th>Writing Gun</th>
<th>Reading Gun</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRID—NO. 4 VOLTS TO GROUND $= 0$</td>
<td>GRID—NO. 4 VOLTS TO GROUND $= 0$</td>
</tr>
<tr>
<td>GRID—NO. 3 VOLTS $= ADJUSTED$ FOR FOCUS</td>
<td>GRID—NO. 3 VOLTS $= ADJUSTED$ FOR FOCUS</td>
</tr>
<tr>
<td>GRID—NO. 2 VOLTS TO GROUND $= -8750$</td>
<td>GRID—NO. 2 VOLTS TO GROUND $= 0$</td>
</tr>
<tr>
<td>GRID—NO. 1 VOLTS $= ADJUSTED$ TO CUTOFF</td>
<td>GRID—NO. 1 VOLTS $= VARIED TO GIVE TARGET FF AS SHOWN$</td>
</tr>
<tr>
<td>CATHODE VOLTS TO GROUND $= -9000$</td>
<td>CATHODE VOLTS TO GROUND $= -1000$</td>
</tr>
<tr>
<td>GRID—NO. 1 PEAK PULSE VOLTS FROM BEAM—CURRENT CUTOFF $= 12.5$</td>
<td>GRID—NO. 1 PEAK PULSE VOLTS FROM BEAM—CURRENT CUTOFF $= TV$</td>
</tr>
<tr>
<td>SCANNING:</td>
<td>SCANNING:</td>
</tr>
<tr>
<td>RATE (REV/SEC) $= 0$</td>
<td>RATE (REV/SEC) $= 0$</td>
</tr>
<tr>
<td>SWEEP PAR (PPS) $= 1000$</td>
<td>SWEEP PAR (PPS) $= 100$</td>
</tr>
<tr>
<td>SWEEP TIME (USEC/RADIUS) $= 1000$</td>
<td>SWEEP TIME (USEC/RADIUS) $= AS SHOWN$</td>
</tr>
<tr>
<td>INPUT SIGNAL, RECTANGULAR PULSE:</td>
<td>INPUT SIGNAL, RECTANGULAR PULSE:</td>
</tr>
<tr>
<td>DURATION (USEC) $= 1$</td>
<td>DURATION (USEC) $= 1$</td>
</tr>
<tr>
<td>REPETITION RATE (PPS) $= 1000$</td>
<td>REPETITION RATE (PPS) $= AS SHOWN$</td>
</tr>
<tr>
<td>NUMBER OF PULSES $= AS SHOWN$</td>
<td>NUMBER OF PULSES $= AS SHOWN$</td>
</tr>
</tbody>
</table>

**Graphs:**

- **Electron Tube Division:** 92CL-9414
- **Radio Corporation of America, Harrison, New Jersey**
DISPLAY STORAGE TUBE

DIRECT-VIEW TYPE
4"-DIAMETER DISPLAY

WRITING GUN:
MAGNETIC DEFLECTION
ELECTROSTATIC FOCUS

VIEWING GUN:
NO DEFLECTION
NO FOCUS

General:

<table>
<thead>
<tr>
<th>Writing Section</th>
<th>Viewing Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing Gun</td>
<td>Viewing Gun</td>
</tr>
<tr>
<td>MAGNETIC DEFLECTION</td>
<td>NO DEFLECTION</td>
</tr>
<tr>
<td>ELECTROSTATIC FOCUS</td>
<td>NO FOCUS</td>
</tr>
</tbody>
</table>

Heater, for Unipotential Cathode:
Voltage (AC or DC) ....... 6.3 ± 10% volts
Current ................. 0.6 amp

Minimum Cathode Heating Time before other electrode voltages are applied ........ 30 sec

Direct Inter-electrode Capacitances
(Approx.):
Grid No. 1 to all other tube electrodes ........ 7 μf
Cathode to all other tube electrodes ........ 5 μf
Backplate to all other tube electrodes ........ 300 μf

Focusing Method ........ Electrostatic None
Deflection Method ........ Magnetic None

Deflection Angle ........
Phosphor ........ P20, Aluminized
Fluorescence ........ Yellow-Green
Phosphorescence ........ Yellow-Green

Minimum Useful Screen Diameter ........ 4"
Maximum Overall Length ........ 11.62"
Seated Length ........ 11.16" ± 0.10"
Maximum Tube Radius ........ 3.00"
Maximum Tube Diameter ........ 5.19"
Greatest Bulb Diameter ........ 5.00" ± 0.06"
Ambient-Temperature Range ........ -65° to +100° C

Operating Position ........ Any
Weight (Approx.) ........ 1-3/4 lbs

Terminal Connectors ........ See Operating Considerations

Bulb Terminals:
Caps (Three) ........ Recessed Small Cavity (JETEC No.11-21)
Flexible leads (Two) ........ See Dimensional Outline

Base:
Writing gun ........ Small-Button Neodytetrar 8-Pin (JETEC No.E8-49)
Viewing gun ........ Small-Button Miniature 7-Pin (JETEC No.E7-1)

°, ±. See next page.
DISPLAY STORAGE TUBE

SOLID-LINE CIRCLES DEPICT
MINIATURE 7-PIN BASE
BROKEN-LINE CIRCLES DEPICT
NEODITETRAR 8-PIN BASE

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 - No Connection
Pin 8 - Grid No. 3

VIEWING SECTION
Small-Button Miniature 7-Pin Base

Pin 1 - Grid No. 2 Flexible Lead (Large) - Screen
Pin 2 - Grid No. 1 Flexible Lead (Small) - Backplate
Pin 3 - Heater Recessed Cavity Cap:
Pin 4 - Heater Located 1-1/4" from Tube Face - Grid No. 5
Pin 5 - Internal Located 3" from Tube Face - Grid No. 4
Connection — Located Near Viewing Gun - Grid No. 3,
Do Not Use Grids No. 4
Pin 6 - No Connection & No. 2 of Writing Gun
Pin 7 - Cathode

Maximum Ratings, Absolute Values:

<table>
<thead>
<tr>
<th>Writing Section</th>
<th>Viewing Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCREEN VOLTAGE</td>
<td>10000 max.**</td>
</tr>
<tr>
<td>PEAK BACKPLATE</td>
<td>volts</td>
</tr>
<tr>
<td>VOLTAGE</td>
<td>30 max.**</td>
</tr>
<tr>
<td>. . .</td>
<td>volts</td>
</tr>
</tbody>
</table>

◊, Δ, **: See next page.

9-58

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

TENTATIVE DATA 1
<table>
<thead>
<tr>
<th>GRID-No. 5</th>
<th>Writing Section</th>
<th>Viewing Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOLTAGE</td>
<td>Equivalent Values</td>
<td>Equivalent Values</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>GRID-No. 4</td>
<td>2900 max.** 150 max.**</td>
<td>-</td>
</tr>
<tr>
<td>VOLTAGE</td>
<td>-</td>
<td>2900 max.** 150 max.**</td>
</tr>
<tr>
<td>GRID-No. 3</td>
<td>1200 max.*</td>
<td>-</td>
</tr>
<tr>
<td>VOLTAGE</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>GRID-No. 2</td>
<td>2900 max.** 150 max.**</td>
<td>-</td>
</tr>
<tr>
<td>VOLTAGE</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CATHODE VOLTAGE</td>
<td>-</td>
<td>-2750 max.**</td>
</tr>
<tr>
<td>GRID-No. 1</td>
<td>VOLTAGE:</td>
<td>Negative-bias value</td>
</tr>
<tr>
<td></td>
<td>Positive-bias value</td>
<td>0 max.*</td>
</tr>
<tr>
<td></td>
<td>Positive-peak value</td>
<td>2 max.*</td>
</tr>
<tr>
<td>PEAK HEATER-</td>
<td>CATHODE VOLT-</td>
<td>HEATER:</td>
</tr>
<tr>
<td></td>
<td>AGE:</td>
<td>Heater positive with respect to cathode</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 beam on till the writing beam is turned off.

| SCREEN VOLTAGE | 8500 volts |
| DC BACKPLATE VOLTAGE | 0 volts |
| GRID-No. 5 VOLTAGE | 220 to 250 volts |
| GRID-No. 4 VOLTAGE | 40 to 100 volts |
| GRID-No. 3 VOLTAGE | 10 to 40** volts |
| Grid-No. 2 VOLTAGE | 2510 to 2540* volts |
| Grid-No. 1 VOLTAGE | 100 volts |
| MAXIMUM SCREEN CURRENT | 0.6 ma |
| MAXIMUM PEAK BACKPLATE CURRENT | 2 ma |
| MAXIMUM GRID-No. 5 CURRENT | 2.4 ma |

** See next page.**

9-58 ELECTRON TUBE DIVISION TENTATIVE DATA 2
Display Storage Tube

Maximum Grid-No. 4 Current: 0.3 ma
Maximum Grid-No. 3 Current: 0.5 ma
Maximum Grid-No. 2 Current: 0.08 ma
Maximum Cathode Current: 4 ma
Number of Half-Tone Steps: 5
Viewing Duration: 20 sec
Maximum Erasing-Uniformity Factor:
For 4"-diameter area (A4): 0.65
For the 3.5"-diameter portion (A3.5) centered on A4: 0.50
Resolution: 50 lines/in.
Brightness: 1500 ft

Writing Section

Operating Values:

<table>
<thead>
<tr>
<th>Grid-No. 4 Voltage</th>
<th>2510 to 2540*</th>
<th>10 to 40** volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No. 3 Voltage for focus</td>
<td>425 to 925*</td>
<td>volts</td>
</tr>
<tr>
<td>Grid-No. 2 Voltage</td>
<td>2510 to 2540*</td>
<td>10 to 40** volts</td>
</tr>
<tr>
<td>Maximum Grid-No. 1 Voltage for cutoff of undeflected focused spot</td>
<td>-130*</td>
<td>-2630** volts</td>
</tr>
<tr>
<td>Cathode Voltage</td>
<td>-</td>
<td>-2500** volts</td>
</tr>
<tr>
<td>Maximum Grid-No. 3 Current</td>
<td>-15 to +10</td>
<td>( \mu )</td>
</tr>
<tr>
<td>Maximum Peak Cathode Current</td>
<td>4.5</td>
<td>ma</td>
</tr>
</tbody>
</table>

Viewing Section and Writing Section

Maximum and Minimum Circuit Values:

<table>
<thead>
<tr>
<th>Grid-No. 1-Circuit Resistance (Either gun)</th>
<th>1 max. megohm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series Current-Limiting Resistor (Unbypassed)</td>
<td>0.005 min. megohm</td>
</tr>
<tr>
<td>in Grid-No. 5 (Viewing-Section) Circuit</td>
<td></td>
</tr>
<tr>
<td>Backplate-Circuit Resistance</td>
<td>0.005 max. megohm</td>
</tr>
<tr>
<td>Series Current-Limiting Resistance in Screen Circuit</td>
<td>1 min. megohm</td>
</tr>
</tbody>
</table>

* Without external shield.

See accompanying drawing CE-9578 showing angles of deflection.

Grids No. 4 & No. 2 of Writing Gun are connected together and to grid No. 3 of Viewing Gun within the tube.

** Voltages shown with respect to cathode of Viewing Gun.

* Voltages shown with respect to cathode of Writing Gun.

# Adjusted for brightest, most uniform pattern.

For conditions with combined adjustment of grid-No. 1 voltage, grid-No. 2 voltage, grid-No. 3 voltage, and grid-No. 4 voltage to give brightest, most uniform pattern. After final adjustment, the grid-No. 1 voltage should not be more positive than -20 volts to maintain electrode current within the maximum value indicated.

O Observed with an RCA-2F21 Monoscope display.

Expressed in terms of the time required for the brightness of the unwritten background to rise from just zero brightness (viewing-beam cutoff) to 10% of saturated brightness.

\( \* \) \( \* \) \( \* \) \( \* \) See next page.
DISPLAY STORAGE TUBE

Determined as follows: With no erasing pulse, overscan the storage surface with writing beam to obtain maximum pattern brightness. Then cut off writing beam and adjust erasing pulse to obtain complete erasure in approximately 10 seconds. Measure time \( t_1 \) from start of erasing to the instant at which any area within the 4" diameter (or the 3.5"-diameter portion) is reduced to background-brightness level, and time \( t_2 \) from start of erasing to the instant at which the entire area within the 4" diameter area (or the 3.5"-diameter portion) is reduced to background-brightness level. The erasing-uniformity factor is defined as \( \frac{t_2 - t_1}{t_2} \).

* Measured by shrinking-raster method at a display brightness of 50 percent of saturated brightness and with grids No. 2 & No. 4 of Writing Gun at about +2500 volts with respect to cathode of Writing Gun.

\( \star \) 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 -2500 volts with respect to the cathode of the Viewing Gun which is usually operated at ground potential.

OPERATING CONSIDERATIONS

Support and shielding for the 7183 may be provided by a shield made of properly annealed high-permeability material. The screen lead and the backplate lead should be placed outside the shield.

Terminal Connectors. The base pins of the Neoditetrar 8-pin base on the Writing-Gun neck fit the Ditentrar 8-contact connector, such as Cinch No. 54A10086, or equivalent. The base pins of the Small-Button Miniature 7-pin base on the Viewing-Gun neck fit the Miniature 7-contact socket. The recessed cavity caps require standard flexible-lead connectors as used for television picture tubes.

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.
NOTE A: CENTERING OF THE WRITING BEAM ON THE STORAGE SURFACE IS NECESSARY FOR A CENTERED PPI DISPLAY. THE BEAM IS CENTERED BY SHIFTING IT FROM THE WRITING-GUN AXIS THROUGH AN ANGLE OF 11° WITH A CENTERING MAGNET WHOSE EFFECTIVE CENTER (A) IS LOCATED 1.3" FROM REFERENCE LINE.

NOTE B: WITH ROTATING YOKE WHOSE EFFECTIVE CENTER OF DEFLECTION (B) IS LOCATED 0.5" FROM REFERENCE LINE, THE CENTERED WRITING BEAM (NOTE A) MUST BE DEFLECTED THROUGH AN ANGLE OF 32° TO SWEEP FULLY THE STORAGE SURFACE.

NOTE C: WITH STATIONARY TV-TYPE YOKE WHOSE EFFECTIVE CENTER OF DEFLECTION (C) IS LOCATED 0.8" FROM REFERENCE LINE, THE CENTERED WRITING BEAM MUST BE DEFLECTED THROUGH AN ANGLE OF 32° TO SWEEP FULLY THE STORAGE SURFACE.

NOTE D: WHEN ROTATING YOKE IS USED WITH UNCENTERED DISPLAY, i.e., THE WRITING BEAM IS NOT CENTERED (NOTE A) BUT STRIKES THE STORAGE SURFACE ON THE WRITING-GUN AXIS, AND WITH THE EFFECTIVE CENTER OF DEFLECTION OF THE ROTATING YOKE LOCATED 0.5" FROM THE REFERENCE LINE, THE UNCENTERED WRITING BEAM MUST BE DEFLECTED THROUGH AN ANGLE OF 56° TO SWEEP FULLY THE STORAGE SURFACE.
TYPICAL CHARACTERISTIC

VIEWING SECTION

\( E_f = 6.3 \text{ VOLTS} \)

BACKPLATE VOLTS\(^*\) = 0
GRID-N \(^a\) 5 VOLTS\(^*\) = 250
GRID-N \(^a\) 2 VOLTS\(^*\) = 100

GRID-N \(^a\) 4 VOLTS\(^*\) ADJUSTED FOR
BACKPLATE VOLTS\(^*\) = 0
GRID-N \(^a\) 3 VOLTS\(^*\) BRIGHTEST, MOST
GRID-N \(^a\) 1 VOLTS\(^*\) UNIFORM DISPLAY.

*REFERRED TO CATHODE OF VIEWING GUN.

WRITING SECTION

NORMAL OPERATION

TYPICAL STORAGE-GRID CHARACTERISTIC

VIEWING SECTION

\( E_f = 6.3 \text{ VOLTS} \)

SCREEN VOLTS\(^*\) = 8500
BACKPLATE VOLTS\(^*\) = 0
GRID-N \(^a\) 5 VOLTS\(^*\) = 250
GRID-N \(^a\) 2 VOLTS\(^*\) = 100

GRID-N \(^a\) 4 VOLTS\(^*\) ADJUSTED FOR BEST
GRID-N \(^a\) 3 VOLTS\(^*\) COLLIMATION.
GRID-N \(^a\) 1 VOLTS\(^*\)

*REFERRED TO CATHODE OF VIEWING GUN.

WRITING SECTION

NORMAL OPERATION

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
TYPICAL ERASURE CHARACTERISTICS

VIEWING SECTION

- $E_F = 6.3$ VOLTS
- SCREEN VOLTS $* = 8500$
- BACKPLATE VOLTS $* = 0$
- GRID-N°5 VOLTS $* = 250$
- GRID-N°4 VOLTS $\rightarrow$ ADJUSTED
- GRID-N°3 VOLTS $\rightarrow$ FOR BEST COLLIMATION.
- GRID-N°1 VOLTS $\rightarrow$ COLLIMATION.
- GRID-N°2 VOLTS $* = 100$

* REFERRED TO CATHODE OF VIEWING GUN.

ERASING CONDITIONS

- PULSE SHAPE: RECTANGULAR
- PULSE DURATION: 10 $\mu$SEC. APPROX.
- PULSE REPETITION FREQUENCY:
  - CURVES: 2000 PPS
  - CURVE: 500 PPS

RELATIVE BRIGHTNESS — PER CENT OF SATURATED BRIGHTNESS

TIME AFTER WRITING TO SATURATED BRIGHTNESS — SECONDS

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

92CM-9555
# Display Storage Tube

**7315**

**Direct-View Type**

**3.8"-Diameter Display**

## Writing Gun:

- Electrostatic Deflection

## Viewing Gun:

- No Deflection

## Electrostatic Focus:

- No Focus

### General:

<table>
<thead>
<tr>
<th>Writing Section</th>
<th>Viewing Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater, for Unipotential Cathode:</td>
<td>Heaters,</td>
</tr>
<tr>
<td>Voltage (AC or DC)</td>
<td>volts</td>
</tr>
<tr>
<td>Current</td>
<td>amp</td>
</tr>
<tr>
<td>Minimum Cathode Heating Time before other electrode voltages are applied.</td>
<td>0.6</td>
</tr>
<tr>
<td>Direct Interelectrode Capacitances (Approx.):</td>
<td>30</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 DJ1 to deflecting electrode DJ2</td>
<td>1.9</td>
</tr>
<tr>
<td>Deflecting electrode DJ3 to deflecting electrode DJ4</td>
<td>2</td>
</tr>
<tr>
<td>DJ1 to all other tube electrodes</td>
<td>6</td>
</tr>
<tr>
<td>DJ2 to all other tube electrodes</td>
<td>7</td>
</tr>
<tr>
<td>DJ3 to all other tube electrodes</td>
<td>5.5</td>
</tr>
<tr>
<td>DJ4 to all other tube electrodes</td>
<td>4.8</td>
</tr>
</tbody>
</table>

### Focusing Method:

- Electrostatic

### Deflection Method:

- Electrostatic

### Deflecting- Electrode Arrangement:

- See Dimensional Outline

## Phosphor (For Curves, see front of this section):

- P20, Aluminized

## Fluorescence:

- Yellow-Green

## Phosphorescence:

- Yellow-Green

## Minimum Useful Viewing Diameter:

- 3.8"

## Maximum Overall Length:

- 13.64"

## Seated Length:

- 12.50" ± 0.59"

## Greatest Bulb Diameter:

- 5.25" ± 0.06"

## Maximum Tube Radius:

- 2.69"

## Bulb Terminals:

- Recessed Small Ball (JEDEC No. J-22)

## Temperature Range:

- Operating: -65° to +100° C
- Storage: -55° to +85° C

## Operating Position:

- Any

## Weight (Approx.):

- 2-3/4 lbs

## Base:

- Medium-Shell Diheptal 14-Pin (JEDEC Group 5, No. B-14-38)

ELECTRON TUBE DIVISION

TENTATIVE DATA 1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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 DJ, of Writing Gun
Pin 5—Deflecting Electrode DJ, of Writing Gun
Pin 6—Grid No. 2 of Viewing Gun, Grid No. 2 and Grid No. 4 of Writing Gun
Pin 7—Grid No. 1 of Viewing Gun
Pin 8—Grid No. 3 of Viewing Gun
Pin 9—Heater of Viewing Gun
Pin 10—Heater and Cathode of Viewing Gun
Pin 11—Deflecting Electrode DJ, of Writing Gun
Pin 12—Deflecting Electrode DJ, of Writing Gun

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>
<tr>
<td>Equivalent Values</td>
<td></td>
</tr>
<tr>
<td>GRID-No. 5 VOLT-</td>
<td></td>
</tr>
<tr>
<td>AGE . . . . .</td>
<td>300 max.**</td>
</tr>
<tr>
<td>GRID-No. 4 VOLT-</td>
<td></td>
</tr>
<tr>
<td>AGE . . . . .</td>
<td>200 max.**</td>
</tr>
<tr>
<td>GRID-No. 3 VOLT-</td>
<td></td>
</tr>
<tr>
<td>AGE . . . . .</td>
<td>200 max.**</td>
</tr>
<tr>
<td>PEAK VOLTAGE</td>
<td></td>
</tr>
<tr>
<td>BETWEEN GRID No.3 AND GRID No. 2 &amp; No. 4 . . . . .</td>
<td></td>
</tr>
<tr>
<td>2950 max.</td>
<td>10 min.**</td>
</tr>
<tr>
<td>volts</td>
<td>volts</td>
</tr>
</tbody>
</table>

Pin 13—Cathode of Writing Gun
Pin 14—Heater of Writing Gun
Recessed Ball Cap:
Over Pin 3—Grid No. 5 of Viewing Gun
Over Pin 12—Grid No. 4 of Viewing Gun On Side of Tube Opposite Base Key—Backplate Recessed Cavity Cap:
Over Base Key—Screen

ELECTRON TUBE DIVISION
tentative data 1

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 VOLT-AGE</td>
<td>2950 max.* 200 max.**</td>
</tr>
<tr>
<td>CATHODE VOLT-AGE</td>
<td>2950 max.* 200 max.**</td>
</tr>
<tr>
<td>GRID-No.1 VOLT-AGE</td>
<td>200 max.*</td>
</tr>
<tr>
<td>Negative-bias value</td>
<td>200 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>
<tr>
<td>PEAK VOLTAGE BETWEEN GRIDS</td>
<td>500 max.</td>
</tr>
<tr>
<td>No.2 &amp; No.4 AND ANY DELECTING 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.

| Screen Voltage | 10000 | 10000 |
| Backplate Voltage (DC) | 2 | 2 |
| Grid-No.5 Voltage | 210 | 150 |
| Grid-No.4 Voltage | 50 to 150 | 30 to 90 |
| Grid-No.3 Voltage | 10 to 50 | 10 to 40 |
| Grid-No.2 Voltage | 150 | 125 |
| Grid-No.1 Voltage | 0 to –80 | 0 to –60 |
| Maximum Screen Current | 0.75 | 0.5 |
| Maximum Backplate Current (Peak) | 2 | 1.5 |
| Maximum Grid-No.5 Current | 3 | 2.5 |
| Maximum Grid-No.4 Current | 3 | 2.5 |
| Maximum Grid-No.3 Current | 5 | 4 |

RCA 7315

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

TENTATIVE DATA 2

6-59
## DISPLAY STORAGE TUBE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value 1</th>
<th>Value 2</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Grid-No.2 Current</td>
<td>3</td>
<td>2.5</td>
<td>ma</td>
</tr>
<tr>
<td>Maximum Cathode Current</td>
<td>8</td>
<td>6.5</td>
<td>ma</td>
</tr>
<tr>
<td>Number of Half-Tone Steps</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Viewing Duration</td>
<td>20</td>
<td>40</td>
<td>sec</td>
</tr>
<tr>
<td>Maximum Erasing-Uniformity Factor</td>
<td>0.45</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>50</td>
<td>50</td>
<td>lines/in.</td>
</tr>
<tr>
<td>Brightness</td>
<td>2750</td>
<td>1500</td>
<td>fl</td>
</tr>
</tbody>
</table>

### WRITING SECTION

**Range Values for Equipment Design:**

For any grids-No. 2 & No.4 voltage ($E_{C2+}^{+}$) between 1500 and 2750 volts

<table>
<thead>
<tr>
<th>Grid-No.3 Voltage for focus</th>
<th>17.5% to 37.5% of $E_{C2+}^{+}$</th>
<th>volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Grid-No.1 Voltage for cutoff of undeflected focused spot</td>
<td>-4.6% of $E_{C2+}^{+}$</td>
<td>volts</td>
</tr>
<tr>
<td>Current</td>
<td>-15 to +10</td>
<td>$\mu$A</td>
</tr>
<tr>
<td>Maximum Cathode Current</td>
<td>See Curve</td>
<td></td>
</tr>
<tr>
<td>Deflection Factors:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$DJ_1$ &amp; $DJ_2$.</td>
<td>36 to 48</td>
<td>$v_{dc/in.}kv$ of $E_{C2+}^{+}$</td>
</tr>
<tr>
<td>$DJ_3$ &amp; $DJ_4$.</td>
<td>35 to 47</td>
<td>$v_{dc/in.}kv$ of $E_{C2+}^{+}$</td>
</tr>
<tr>
<td>Focused Beam Position</td>
<td>#</td>
<td></td>
</tr>
<tr>
<td>Writing Speed</td>
<td>3000</td>
<td>in./sec</td>
</tr>
</tbody>
</table>

**Examples of Use of Design Ranges:**

For grids-No.2 & No.4 voltage ($E_{C2+}^{+}$)

| Grid-No.3 Voltage for focus        | 350 to 750                      | volts |
| Maximum Grid-No.1 Voltage for cutoff of undeflected focused spot | -92 | volts |
| Deflection Factors:                |                                 |       |
| $DJ_1$ & $DJ_2$.                   | 72 to 96                        | volts |
| $DJ_3$ & $DJ_4$.                   | 70 to 94                        | volts |

**Equivalent Values of Writing-Gun Voltages Referred to Cathode of Viewing Gun:**

| Cathode Voltage                    | -1875                            | -1850 | volts |
| Grid-No.3 Voltage for focus        | -1125 to -1525                   | -1100 to -1500 | volts |
| Grids-No.2 & No.4 Voltage          | +125                             | +150  | volts |

### VIEWING SECTION and WRITING SECTION

**Circuit Values:**

| Grid-No.1 Circuit Resistance (Either gun) | l 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

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backplate-Circuit Resistance</td>
<td>0.005 max. megohm</td>
</tr>
<tr>
<td>Series Current-Limiting Resistance in Screen Circuit</td>
<td>1 min. megohm</td>
</tr>
</tbody>
</table>

- Without external shield.
- Minimum useful viewing area may be eccentric with respect to the tube face.
- Voltages are shown with respect to cathode of Viewing Gun.
- Voltages are shown with respect to cathode of Writing Gun.
- Grids No. 2 and No. 4 of Writing Gun are connected together and to grid No. 2 of Viewing Gun within the tube.
- Adjusted for brightest, most uniform pattern.
- Observed with an RCA-2F21 Monoscope display.
- Expressed in terms of the time required for the brightness of the unwritten background to rise from just zero brightness (viewing-beam cutoff) to 10 per cent of saturated brightness.
- Determined as follows: With no erasing pulse, overscan the storage surface with writing beam to obtain maximum pattern brightness. Then cut off writing beam. Apply erasing pulses having an amplitude of between 8 to 10 volts and adjust duty cycle to obtain complete erasure in approximately 10 seconds. Measure time \( t_1 \) from start of erasing to the instant at which any area within the minimum useful viewing diameter is reduced to background-brightness level, and time \( t_2 \) from start of erasing to the instant at which the entire area within the minimum useful viewing-diameter area is reduced to background-brightness level. The erasing-uniformity factor is defined as \( \frac{t_2 - t_1}{t_2} \).
- Measured by shrinking-raster method at a display brightness of 50 per cent of saturated brightness and with grids No. 2 & No. 4 of Writing Gun at about +2000 volts with respect to cathode of Writing Gun.
- Measured with entire storage grid written to produce saturated brightness and with screen at indicated voltage.
- The cathode of the Writing Gun is operated at about -2000 volts with respect to the cathode of the Viewing Gun which is usually operated at ground potential.
- The center of the undeflected focused beam will fall within a circle having a 10-mm radius and having its center on the Writing-Gun axis (See Dimensional Outline) under the following conditions: grids No. 2 & No. 4 of Writing Gun at +2000 volts with respect to cathode of Writing Gun, grid No. 3 of Writing Gun at voltage to give focus, grid No. 1 of Writing Gun at voltage which will permit storage of a charge just sufficient to give a barely perceptible spot on screen, Viewing Section operating under normal conditions, and tube shielded against extraneous fields.
- Measured under conditions of writing from just zero brightness (viewing-beam cutoff) to maximum brightness with grid No. 1 of Writing Gun at -30 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 cutoff 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.
DISPLAY STORAGE TUBE

13.64" MAX.

12.50" ±.39"

7.00" ±.25"

4.00" ±.25"

.218" R.

13” R.

1.5” R.

2.00” ±.12"

2.00” ±.06 DIA.

5.25” ±.06” DIA.

3.8” MIN. USEFUL VIEWING DIA.

(SEE NOTE)

MEDIUM-SHELL DIHEPTAL 14-PIN BASE JEDEC GROUP 5, NO B14-38

92CM-9855R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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 20° 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 CHARACTERISTICS

VIEWING SECTION

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

BACKPLATE VOLTS\(^*\) = 2

GRID-\(\#4\) VOLTS\(^*\) ADJUSTED FOR

GRID-\(\#3\) VOLTS\(^*\) BRIGHTEST, MOST

GRID-\(\#5\) VOLTS = 210; GRID-\(\#2\) VOLTS\(^*\) = 150

GRID-\(\#5\) VOLTS = 150; GRID-\(\#2\) VOLTS\(^*\) = 125

* REFERRED TO CATHODE OF VIEWING GUN.

WRITING SECTION

NORMAL OPERATION

TYPICAL STORAGE-GRID CHARACTERISTIC

VIEWING SECTION

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

SCREEN VOLTS = 10000

BACKPLATE VOLTS\(^*\) = 2

GRID-\(\#5\) VOLTS\(^*\) = 150

GRID-\(\#2\) VOLTS\(^*\) = 125

* REFERRED TO CATHODE OF VIEWING GUN.

WRITING SECTION

NORMAL OPERATION
TYPICAL ERASURE CHARACTERISTIC

VIEWING SECTION

$E_f = 6.3$ VOLTS
SCREEN VOLTS* = 10000
BACKPLATE VOLTS* = 2
GRID-N5 VOLTS* = 150

GRID-N2 COLLIMATION.
GRID-N3 VOLTS FOR BEST
GRID-N4 VOLTS* = 125
ADJUSTED
* REFERRED TO CATHODE OF VIEWING GUN.

![Graph of erasure characteristic](image)

ERASING CONDITIONS

PULSE SHAPE: RECTANGULAR
PULSE DURATION ($\mu$SEC) = 10 APPROX.
PULSE-REPETITION FREQUENCY
(PPS) = 200
PULSE AMPLITUDE (VOLTS) = 6 TO 10

WRITEING-GUN-CURRENT CHARACTERISTIC

WRITEING SECTION

$E_f = 6.3$ VOLTS
GRID-N3 VOLTS* = ADJUSTED FOR FOCUS
GRID-N1 VOLTS* = 0
* REFERRED TO CATHODE OF WRITING GUN.

VIEWING SECTION
NORMAL OPERATION

![Graph of writing-gun-current characteristic](image)
## DISPLAY STORAGE TUBE

**DIRECT-VIEW TYPE**

**3.8"-DIAMETER DISPLAY**

### WRITING GUN:
- **ELECTROSTATIC DEFOCTION**
- **ELECTROSTATIC FOCUS**

### VIEWING GUN:
- **NO DEFLECTION**
- **NO FOCUS**

### DATA

#### General:

<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 DJ₁ to deflecting electrode DJ₂</td>
<td>1.9</td>
</tr>
<tr>
<td>Deflecting electrode DJ₃ to deflecting electrode DJ₄</td>
<td>2</td>
</tr>
<tr>
<td>DJ₁ to all other tube electrodes</td>
<td>6</td>
</tr>
<tr>
<td>DJ₂ to all other tube electrodes</td>
<td>7</td>
</tr>
<tr>
<td>DJ₃ to all other tube electrodes</td>
<td>5.5</td>
</tr>
<tr>
<td>DJ₄ 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>
<tr>
<td>Phosphor (For Curves, see front of this Section)</td>
<td>P20, Aluminized</td>
</tr>
<tr>
<td>Fluorescence</td>
<td>Yellow-Green</td>
</tr>
<tr>
<td>Phosphorescence</td>
<td>Yellow-Green</td>
</tr>
<tr>
<td>Minimum Useful Viewing Diameter</td>
<td>3.8&quot;</td>
</tr>
<tr>
<td>Maximum Overall Length</td>
<td>12.50&quot; ± 0.39&quot;</td>
</tr>
<tr>
<td>Seated Length</td>
<td>5.25&quot; ± 0.06&quot;</td>
</tr>
<tr>
<td>Greatest Bulb Diameter</td>
<td>2.69&quot;</td>
</tr>
<tr>
<td>Maximum Tube Radius</td>
<td></td>
</tr>
<tr>
<td>Bulb Terminals:</td>
<td></td>
</tr>
<tr>
<td>Caps (Three)</td>
<td>Recessed Small Ball (JEDEC No.J1-22)</td>
</tr>
<tr>
<td>Cap</td>
<td>Recessed Small Cavity (JEDEC No.J1-21)</td>
</tr>
<tr>
<td>Temperature Range:</td>
<td></td>
</tr>
<tr>
<td>Operating</td>
<td>-65°C to +85°C</td>
</tr>
<tr>
<td>Storage</td>
<td>-65°C to +100°C</td>
</tr>
<tr>
<td>Operating Position</td>
<td>Any</td>
</tr>
<tr>
<td>Weight (Approx.)</td>
<td>2-3/4 lbs</td>
</tr>
<tr>
<td>Base</td>
<td>Medium-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-38)</td>
</tr>
</tbody>
</table>

8-59

**ELECTRON TUBE DIVISION**

**RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY**
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 D13 of Writing Gun
**Pin 5** - Deflecting Electrode D14 of Writing Gun
**Pin 6** - Grid No. 2 of Writing Gun, Grid No. 2 and Grid No. 4 of Writing Gun
**Pin 7** - Grid No. 1 of Viewing Gun
**Pin 8** - Grid No. 3 of Viewing Gun
**Pin 9** - Heater of Viewing Gun
**Pin 10** - Heater and Cathode of Viewing Gun
**Pin 11** - Deflecting Electrode D11 of Writing Gun
**Pin 12** - Deflecting Electrode D12 of Writing Gun
**Pin 13** - Cathode of Writing Gun
**Pin 14** - Heater of Writing Gun

Recessed Ball Cap:
- Over Pin 3 - Grid No. 5 of Viewing Gun
- Over Pin 12 - Grid No. 4 of Viewing Gun
On Side of Tube
- Opposite Base Key - Backplate
- Recessed Cavity Cap: Over Base Key - Screen

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

*For altitudes up to 10,000 feet*

<table>
<thead>
<tr>
<th>Writing Section</th>
<th>Viewing Section</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Screen Voltage</strong></td>
<td><strong>11000 max.</strong> volts</td>
</tr>
<tr>
<td><strong>Backplate Voltage Age (Peak)</strong></td>
<td><strong>20 max.</strong> volts</td>
</tr>
<tr>
<td><strong>Equivalent Values</strong></td>
<td><strong>Equivalent Values</strong></td>
</tr>
<tr>
<td><strong>Grid-No. 5 Voltage Age</strong></td>
<td>-</td>
</tr>
<tr>
<td><strong>Grid-No. 4 Voltage Age</strong></td>
<td>-</td>
</tr>
<tr>
<td><strong>Grid-No. 3 Voltage Age</strong></td>
<td>-</td>
</tr>
<tr>
<td><strong>Peak Voltage Between Grid No. 3 and Grids No. 2 &amp; No. 4.</strong></td>
<td>-</td>
</tr>
</tbody>
</table>

8-59 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><strong>GRID-No.2 VOLT-AGE:</strong></td>
<td>2950 max.** 200 max.** volts</td>
</tr>
<tr>
<td><strong>CATHODE VOLT-AGE:</strong></td>
<td>2950 max.** 200 max.** volts</td>
</tr>
<tr>
<td><strong>GRID-No.1 VOLT-AGE:</strong></td>
<td>200 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><strong>GRID-No.2 &amp; GRID-No.4 PEAK VOLTAGE BETWEEN GRIDS:</strong></td>
<td>500 max.</td>
</tr>
<tr>
<td><strong>GRID-No.3 PEAK VOLTAGE:</strong></td>
<td>125 max.**</td>
</tr>
<tr>
<td><strong>GRID-No.2 PEAK HEATER-CATHODE VOLTAGE:</strong></td>
<td>125 max.**</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>

**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 until the writing beam is turned off.

<table>
<thead>
<tr>
<th>Screen Voltage</th>
<th>10000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backplate Voltage (DC)</td>
<td>2</td>
</tr>
<tr>
<td>Grid-No.5 Voltage</td>
<td>210</td>
</tr>
<tr>
<td>Grid-No.4 Voltage</td>
<td>150</td>
</tr>
<tr>
<td>Grid-No.3 Voltage</td>
<td>10 to 50</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>10 to 40</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td>150</td>
</tr>
<tr>
<td>Maximum Screen Current</td>
<td>0.75 ma</td>
</tr>
<tr>
<td>Maximum Backplate Current (Peak)</td>
<td>2 ma</td>
</tr>
<tr>
<td>Maximum Grid-No.5 Current</td>
<td>3 ma</td>
</tr>
<tr>
<td>Maximum Grid-No.4 Current</td>
<td>2.5 ma</td>
</tr>
<tr>
<td>Maximum Grid-No.3 Current</td>
<td>5 ma</td>
</tr>
</tbody>
</table>

**DATA 2**

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

Maximum Grid-No.2 Current: 3 mA
Maximum Cathode Current: 8 mA
Number of Half-Tone Steps: 5
Viewing Duration: 20 sec
Maximum Erasing-Uniformity Factor: 0.45
Resolution: 50 lines/in.
Brightness: 2750

WRITING SECTION

Range Values for Equipment Design:

For any grids-No.2 & No.4 voltage (Ec2+4) between 1500 and 2750 volts:

Grid-No.3 Voltage for focus: 17.5% to 37.5% of Ec2+4

Maximum Grid-No.1 Voltage for cutoff of undeflected focused spot: -4.6% of Ec2+4

Maximum Cathode Current: See Curve

Deflection Factors:

- Dj1 & Dj2: 36 to 48
- Dj3 & Dj4: 35 to 47

Focused Beam Position: 
Writing Speed: 300000 in./sec

Examples of Use of Design Ranges:

For grids-No.2 & No.4 voltage (Ec2+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:

- Dj1 & Dj2: 72 to 96
- Dj3 & Dj4: 70 to 94

Equivalent Values of Writing-Gun Voltages Referred to Cathode of Viewing Gun:

- Cathode Voltage: -1850 to -1875 volts
- Grid-No.3 Voltage for focus: -1100 to -1500 to -1125 to -1525 volts
- Grids-No.2 & No 4 Voltage: +150 to +125 volts

VIEWING SECTION and WRITING SECTION

Circuit Values:

- Grid-No.1-Circuit Resistance (Either gun): 0.1 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.
- Voltages are shown with respect to cathode of Writing Gun.
- Grids No. 2 and No. 4 of Writing Gun are connected together and to grid No. 2 of Viewing Gun within the tube.
- Adjusted for brightest, most uniform pattern.
- With writing beam cut off. Since grid No. 2 of the Viewing Gun and grids No. 2 & No. 4 of Writing Gun are connected together and to grid No. 2 of Viewing Gun within the tube, the maximum total current collected by these electrodes is essentially equal to the sum of the maximum grid-No. 2 current of the Viewing Gun and the maximum cathode current of the Writing Gun (See Writing-Gun-Current-Characteristc Curve).

- Observed with an RCA-2FZ1 Monoscope display.

Expressed in terms of the time required for the brightness of the unwritten background to rise from just zero brightness (viewing-beam cutoff) to 10 per cent of saturated brightness.

- Determined as follows: With no erasing pulse, overscan the storage surface with writing beam to obtain maximum pattern brightness. Then cut off writing beam. Apply rectangular erasing pulses having an amplitude of between 8 to 10 volts and adjust duty cycle to obtain complete erasure in approximately 10 seconds. Measure time (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 Outline) under the following conditions: grids No. 2 & No. 4 of Writing Gun at +2000 volts with respect to cathode of Writing Gun, grid No. 3 of Writing Gun at voltage to give focus, grid No. 1 of Writing Gun at voltage which will permit storage of a charge just sufficient to give a barely perceptible spot on screen. Viewing Section operating under normal conditions, and tube shielded against extraneous fields.

- Measured under conditions of writing from just zero brightness (viewing-beam cutoff) to maximum brightness with grid No. 1 of Writing Gun at -10 volts with respect to cathode of Writing Gun and grids No. 2 & No. 4 of Writing Gun at +2000 volts with respect to cathode of Writing Gun.

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

OPERATING CONSIDERATIONS

Shielding. Magnetic shielding must be provided to prevent external fields from interfering with the required accurate control of the low-velocity viewing beam. A cylindrical shield of properly annealed high-permeability material about 1/16-inch thick is usually satisfactory.
Terminal Connections. The base pins of the 7448 fit the Diheptal l4-contact socket. The Recessed Small Ball caps and the Recessed Small Cavity cap require standard flexible-lead connectors.

The high voltages at which the 7448 is operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Safety precautions include the enclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is desired.

In the use of high-voltage tubes, it should always be remembered that high voltages may appear at normally low-potential points in the circuit as a result of capacitor breakdown or incorrect circuit connections. Therefore, before any part of the circuit is touched, the power-supply switch should be turned off, and both terminals of any capacitors grounded.

To prevent possible damage to the tube, allow the Viewing-Gun beam current to reach normal operating value before turning on the Writing-Gun beam current, and keep the viewing beam on till the writing beam is turned off.

Failure of scanning while the writing beam is turned on may permanently damage the storage grid. Therefore, provision should be made to cut off automatically the writing-beam current in case of a scanning failure. The writing-beam current can be cut off by an electronic switch which applies -200 volts bias to grid No.1 of the Writing Gun. This switch should be actuated by a portion of the scanning voltages applied to both sets of deflecting electrodes.
DISPLAY STORAGE TUBE

- 2.69" MAX. R. 4 CAPS
- RECESSED SMALL BALL CAP JEDEC N°2JI-22 BACKPLATE
- 180° ±5° DJ1-DJ2 DEFLECTION PATH
- 60° ±5° RECESSED SMALL BALL CAP JEDEC N°2JI-22
- VIEWING-GUN AXIS
- WRITING-GUN AXIS
- 2.00" ±.12" VIEWING DIA.
- 1.5" R.
- 13" R.
- 12.50" ±.39"
- 4.00" ±.25"
- 7.00" ±.25"
- 5.25" ±.06" DIA.
- RECESSED SMALL GRID N°4 OF VIEWING GUN
- BALL CAP
- JEDEC N°2JI-22
- RECESSED SMALL CAVITY CAP JEDEC N°2JI-21 SCREEN
- MEDIUM-SHELL DIHEPTAL 14-PIN BASE JEDEC GROUP 5, N°B14-38 92CM-9855R2
- 13.64" MAX.
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 CHARACTERISTICS

VIEWING SECTION

\[ E_f = 6.3 \text{ VOLTS} \]
\[ \text{GRID-\#4 VOLTS}^* \]
\[ \text{GRID-\#3 VOLTS}^* \]
\[ \text{GRID-\#1 VOLTS}^* \]

GRID-N\#5 VOLTS\(^*\) = 210; GRID-\#2 VOLTS\(^*\) = 150

GRID-N\#5 VOLTS\(^*\) = 150; GRID-\#2 VOLTS\(^*\) = 125

*REFERRED TO CATHODE OF VIEWING GUN.

NORMAL OPERATION

Saturated Screen Brightness (Footlamberts) vs. Screen Kilovolts

TYPICAL STORAGE-GRID CHARACTERISTIC

VIEWING SECTION

\[ E_f = 6.3 \text{ VOLTS} \]
\[ \text{GRID-\#4 VOLTS} \]
\[ \text{GRID-\#3 VOLTS} \]
\[ \text{GRID-\#1 VOLTS} \]

GRID-N\#5 VOLTS\(^*\) = 150; GRID-\#2 VOLTS\(^*\) = 125

*REFERRED TO CATHODE OF VIEWING GUN.

NORMAL OPERATION

Relative Brightness vs. Storage-Grid Volts

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
TYPICAL ERASURE CHARACTERISTIC

**VIEWING SECTION**

- $E_f = 6.3$ VOLTS
- SCREEN VOLTS* = 10000
- BACKPLATE VOLTS* = 28
- GRID-N25 VOLTS* = 150

$* \text{REFERRED TO CATHODE OF VIEWING GUN.}$

**ERASING CONDITIONS**

- PULSE SHAPE: RECTANGULAR
- PULSE DURATION (µSEC) = 10 APPROX.
- PULSE-REPETITION FREQUENCY (PPS) = 200
- PULSE AMPLITUDE (VOLTS) = 6 TO 10

**Writing-Gun-Current Characteristic**

**Writing Section**

- $E_f = 6.3$ VOLTS
- GRID-N23 VOLTS* = ADJUSTED FOR FOCUS
- GRID-N21 VOLTS* = 0

$* \text{REFERRED TO CATHODE OF WRITING GUN.}$

**Viewing Section**

NORMAL OPERATION

92CS-9860

92CS-9859R1