This HANDBOOK of data on all RCA tubes has been compiled to meet the requirements of electronic engineers for tube information which can be kept up-to-date. Its convenient, loose-leaf form permits the revision of data on existing tubes and the addition of data on new tubes as they are made available.

The material is arranged in sections with tabbed separators to facilitate quick reference. The general section contains a table of contents for the complete Handbook, a detailed explanation of tube ratings and typical operating conditions, tube outline drawings, base drawings, and other useful information concerning tubes. The other sections, indexed according to tube classes, contain ratings, characteristics, operating conditions, and curves for the many different tubes in those classes.

The RCA Tube Handbook is especially useful to designers of tube equipment but will prove helpful to anyone having need for concise data on our various tubes. If further data on any tube type are desired, we shall be glad to be of assistance.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
The information in this section, in general, applies to all classes of RCA tubes. It includes the Index of Contents for all sections, preferred-type lists, discussion of ratings, drawings of bases, caps, and tubes, as well as other general information of interest to the equipment designer.

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

Service sheets for this Handbook will be sent during the subscription period to the subscriber whose name appears in our records.

In case this Handbook is resold or transferred within any subscription period, we shall be glad to register the change and to send service sheets to the new owner providing he notifies us of the change.

Each of the binders for this Handbook has an identifying serial number at the lower right of the inside back cover. Use of these numbers in correspondence pertaining to this Handbook is requested to facilitate its identification in our records.

In order that the new owner may not miss any of the service sheets, notification for change in registration of ownership of this Handbook identified by serial numbers should be forwarded promptly to

Commercial Engineering
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

Photolithographed in U. S. A.
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The TABLE OF CONTENTS and INDEX OF TUBE TYPES may be used to determine:

1. location of individual data sheets
2. completeness of Handbook
3. arrangement of Handbook sheets

Reference is to front of sheet only unless otherwise indicated. Date appearing on sheet is identified by month and year only (i.e., 2-56).

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C = CATHODE RAY
F = THYRATRON & IGNITRON
G = GENERAL
M = MISCELLANEOUS
P = PHOTOTUBE
R = RECEIVING
S = SEMICONDUCTOR DEVICE
T = TRANSMITTING

" Indicates that data for this type follow data for another type on same sheet.
* Type is approaching obsolescence. Not recommended for new equipment design.
* Discontinued type. Data retained in Handbook for reference purposes only.

Reference is to front of sheet only unless otherwise indicated. Date appearing on sheet is identified by month and year only (i.e., 2-56).

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RADIO CORPORATION OF AMERICA, MARIKN, NEW JERSEY
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## ADDITIONS & REVISIONS

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The following tube types have been discontinued. To indicate this fact for your future reference, please place a large dot (•) after each of the types in the "Tube Type" column of the Index of Tube Types sheets.

1AC5  105-GT  1T6  5Y4-G
6AF4  6AU4-GT  6AV5-GT  6SN7-GT
6SN7-GTA  6ST7  12AX4-GT  12BH7
12BY7  20CP4  71-A  6323

DISCONTINUED TYPES
### ADDITIONS & REVISIONS

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**INDEX OF TUBE TYPES**

For All Sections

For key to symbols, see sheet INDEX OF TUBE TYPES 1
### ADDITIONS & REVISIONS

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<thead>
<tr>
<th>Tube Type</th>
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### DISCONTINUED TYPES

The following types have been discontinued. To indicate this fact for your future reference please place a large dot (•) after each of the types in the "Tube Type" column of the Index of Tube Types sheets.

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Information as to the retail prices of RCA electron tubes and semiconductor devices described in this handbook may be obtained from your local RCA Tube Distributor. A list of RCA Tube Distributors in your locality will gladly be supplied upon request to Commercial Engineering, RCA, Harrison, N.J.

Equipment manufacturers desiring price information on electron devices for initial installation in equipment will gladly be supplied such information by an RCA Equipment Sales representative, who may be reached at the following RCA Equipment Sales Offices:

(East) 744 Broad Street
Newark 1, New Jersey
Humboldt 5-3900

(Central) Suite 1181
Merchandise Mart Plaza
Chicago 54, Illinois
Whitehall 4-2900

(West) 6355 E. Washington Blvd.
Los Angeles 22, California
Raymond 3-8361

EXPORT

RCA International Division
Tube Department
Radio Corporation of America
30 Rockefeller Plaza
New York 20, N.Y. (U.S.A.)
This list of Preferred Tube Types is presented to assist equipment manufacturers in formulating their plans for future production of electronic equipment. It is based on a careful survey of the needs of the engineering and manufacturing fields.

The soundness of the Preferred Tube Program, first introduced by RCA in January, 1940, has been proven with the passing years.

By using Preferred Tube Types, electronic-equipment manufacturers can reduce manufacturing costs for the following reasons:

1. LOWER INITIAL COST OF TUBES
   a. We can manufacture more efficiently for stock.
   b. Our production rate on preferred types is more uniform because of smaller demand for other types.

2. MORE PROFIT THROUGH BETTER DELIVERIES
   a. Fewer tube types mean better deliveries and insure continuous production of electronic equipment.
   b. Tube operator acquires more skill working on one type for a considerable length of time. Such skill results in better quality which means less cost to equipment manufacturers on their production line because of fewer stoppages.

3. IMPROVED QUALITY OF PRODUCT FROM LONGER PRODUCTION RUNS
   a. Permits standardizing fewer accessory parts, such as capacitors, resistors, etc.
   b. Results in purchasing and stocking economies.

4. STANDARDIZATION OF FEWER TUBE TYPES
   a. Purchasers of electronic equipment equipped with Preferred Type Tubes will have greater satisfaction, we believe, because these fast-moving types can be regularly stocked and will, therefore, be easier to obtain for renewal purposes.

5. CUSTOMER SATISFACTION
   a. Purchasers of electronic equipment equipped with Preferred Type Tubes will have greater satisfaction, we believe, because these fast-moving types can be regularly stocked and will, therefore, be easier to obtain for renewal purposes.

This list, of course, is subject to change resulting from technological advances in tube design and application. When such changes become necessary, they will be incorporated in revised issues of this list.

JAN. 4, 1954
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**RCA PREFERRED TUBE TYPES**

**Miniature Types are shown in italics**

**VAUCUM TYPES FOR RF AND AF POWER APPLICATIONS**

Values shown are Unmodulated Class C Ratings for Continuous Commercial Service

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<th>TYPE</th>
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<tr>
<td>5765*</td>
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<tr>
<td>2E24*</td>
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<td>2E26*</td>
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<tr>
<td>807*</td>
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- **Twin Type** - Input values per tube for push-pull operation.
- Type may be operated at higher ratings in intermittent Commercial and Amateur Service (ICAS) as given in published data for each type.
- For Television Picture Service over the range of 54 Mc. to 216 Mc., the CCS maximum rated input power is 6.5 kw.
- For Television Picture Service over the range of 54 Mc. to 216 Mc., the CCS maximum rated input power is 22 kw.

**THYRATRONS**

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**IGNITRONS**

- For additional vacuum-type rectifiers, see listing of types for Receiver Applications.
VACUUM TYPES FOR RF AND AF POWER APPLICATIONS (Cont'd)

Values shown are Unmodulated Class C Ratings for Continuous Commercial Service

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</table>

SMALL TYPES FOR INDUSTRIAL AND COMMUNICATION SERVICES

<table>
<thead>
<tr>
<th>HOME ENTERTAINMENT TYPES OF SPECIAL INTEREST</th>
<th>VACUUM TYPES FOR CRITICAL APPLICATIONS</th>
<th>TYPES FOR REGULATOR SERVICE</th>
<th>GLOW DISCHARGE TRIODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>6A6</td>
<td>6L6-G</td>
<td>1620</td>
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<td>5641</td>
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<td>6C4</td>
<td>12A7A*</td>
<td>5692</td>
<td>5680</td>
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</table>

* Also see types for AM, FM, & TV Receivers.

△ Tapped heater, for 6.3-volt or 12.6-volt operation.

JAN. 4, 1954
RCA PREFERRED TUBE TYPES

Types for AM and FM Broadcast Receiver Applications

<table>
<thead>
<tr>
<th>Rectifiers and Diode Detectors</th>
<th>Converters</th>
<th>Amplifiers, Oscillators, &amp; Mixers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td><strong>Triodes</strong></td>
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<tr>
<td></td>
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<td>Twin</td>
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<td>6BE6</td>
<td>6AU6</td>
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<td>5Y3-GT</td>
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<td>6L4</td>
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<td>12AU7*</td>
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<td>35V4</td>
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Types for Television Receiver Applications

<table>
<thead>
<tr>
<th>RF Tuner Tubes</th>
<th>Amplifiers</th>
<th>Deflection Oscillators</th>
<th>Sound &amp; Video Detector</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>IF</td>
<td>Video</td>
<td>Audio</td>
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<td>6AF4*</td>
<td>6AV6</td>
<td>6AV6</td>
<td>6AV5</td>
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<tr>
<td>6BQ7-A*</td>
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<td>6AP6</td>
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<td>6J6</td>
<td>6AU6</td>
<td>6AV6</td>
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<td>6K6-GT</td>
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<table>
<thead>
<tr>
<th>Rectifiers</th>
<th>Damper Tube</th>
<th>Control Circuits</th>
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<tbody>
<tr>
<td>High-Voltage</td>
<td>Low-Voltage</td>
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</tr>
<tr>
<td>1B3-GT</td>
<td>5U4-G</td>
<td>6AU6</td>
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<td>6SN7-GT</td>
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<td>12AU7*</td>
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<td></td>
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<td>12BB7*</td>
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* For UHF.
* Tapped heater, for 6.3-volt or 12.6-volt operation.
* Including synchronizing functions, AGC, etc.
**C-R OSCILLOGRAPH TYPES**

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<thead>
<tr>
<th>P1 SCREEN</th>
<th>P7 SCREEN</th>
<th>P11 SCREEN</th>
<th>P14 SCREEN</th>
<th>P16 SCREEN</th>
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<td>2BP11</td>
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<td>3JP1*</td>
<td></td>
<td>3KP11</td>
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<tr>
<td>3RP1*</td>
<td>3JP7*</td>
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<tr>
<td>5ABP1*</td>
<td>5ABP7*</td>
<td>5ABP11*</td>
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<td>5UP1</td>
<td>5FP7-A</td>
<td>5UP11</td>
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<td>7MP7</td>
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<td>16ADP7</td>
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* Transcriber Type  † Flying-Spot Type

**PHOTOTUBES**

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<td>922</td>
<td>6199</td>
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<td>927</td>
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**CAMERA AND TV STUDIO TYPES**

<p>| | |</p>
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<tr>
<td>5820</td>
<td>Image Orthicon</td>
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<td>6198</td>
<td>Vidicon</td>
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<tr>
<td>2F21</td>
<td>Monoscope</td>
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* Industrial Type
Certain tube types should be avoided in the design of new equipment because they are approaching obsolescence or have limited or dwindling demand. Such RCA types are listed below for the benefit of equipment designers.

### RECEIVING TUBE TYPES

<table>
<thead>
<tr>
<th>0Z4-G</th>
<th>1A5-GT</th>
<th>1C5-GT</th>
<th>1D8-GT</th>
<th>1G6-GT</th>
<th>1LA4</th>
<th>1Q5-GT</th>
<th>1S4</th>
<th>1T5-GT</th>
<th>1-v</th>
<th>5T4</th>
<th>5W4-GT</th>
<th>5X4-G</th>
<th>5Y3-G</th>
<th>5Y4-G</th>
<th>5Z3</th>
<th>6A3</th>
<th>6A7</th>
<th>6A8</th>
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<tbody>
<tr>
<td>6A8-G</td>
<td>6A8-GT</td>
<td>6A8/6N5</td>
<td>6A87</td>
<td>6AC5-GT</td>
<td>6AF6-G</td>
<td>6B8</td>
<td>6C6</td>
<td>6C8-G</td>
<td>6D6</td>
<td>6F5</td>
<td>6F5-GT</td>
<td>6F6-G</td>
<td>6F7</td>
<td>6G6-G</td>
<td>6H6-GT</td>
<td>6J7-GT</td>
<td>6J8-G</td>
<td>6K7</td>
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<tr>
<td>6K7-G</td>
<td>6K7-GT</td>
<td>6N7</td>
<td>6Q7-GT</td>
<td>6Q7-GT</td>
<td>6R7</td>
<td>6S7</td>
<td>6SA7-GT</td>
<td>6SB7-Y</td>
<td>6SF7</td>
<td>6SK7-GT</td>
<td>6S7</td>
<td>6ST7</td>
<td>6SZ7</td>
<td>6U5</td>
<td>6U7-G</td>
<td>6X5</td>
<td>7E7</td>
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<td>12A8-GT</td>
<td>12AH7-GT</td>
<td>12J5-GT</td>
<td>12J7-GT</td>
<td>12K7-GT</td>
<td>12Q7-GT</td>
<td>12SK7-GT</td>
<td>14B8</td>
<td>14C5</td>
<td>14H7</td>
<td>24-A</td>
<td>25A6</td>
<td>25W4-GT</td>
<td>25Z5</td>
<td>35Z4-GT</td>
<td>35Z4-GT</td>
<td>35Z4-GT</td>
<td>42</td>
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### TRANSMITTING TUBE TYPES

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<tr>
<th>10-Y</th>
<th>203-A</th>
<th>207</th>
<th>211</th>
<th>217-C</th>
<th>800</th>
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<tbody>
<tr>
<td>801-A</td>
<td>803</td>
<td>804</td>
<td>830-B</td>
<td>838</td>
<td>841</td>
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<td>842</td>
<td>843</td>
<td>846</td>
<td>849</td>
<td>851</td>
<td>860</td>
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<tr>
<td>861</td>
<td>862-A</td>
<td>865</td>
<td>893-A</td>
<td>893A-R</td>
<td>898-A</td>
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<tr>
<td>1619</td>
<td>1623</td>
<td>1624</td>
<td>1626</td>
<td>8012-A</td>
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### CATHODE-RAY TUBE TYPES

<table>
<thead>
<tr>
<th>2AP1-A</th>
<th>3AP1-A</th>
<th>3KP4</th>
<th>5BP1-A</th>
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<tbody>
<tr>
<td>10FP4-A</td>
<td>12KP4-A</td>
<td>14CP4</td>
<td>16DP4-A</td>
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<td>16KP4</td>
<td>16LP4-A</td>
<td>16RP4</td>
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<td>16TP4</td>
<td>16WP4-A</td>
<td>902-A</td>
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| 905-A | 908-A | 913 | (continued on next page)
RCA TUBE TYPES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

<table>
<thead>
<tr>
<th>PHOTOTUBES</th>
<th>THYRATRONS</th>
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<tbody>
<tr>
<td>923</td>
<td>629</td>
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<td>924</td>
<td>885</td>
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**MISCELLANEOUS**

<table>
<thead>
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<th>Type</th>
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<tbody>
<tr>
<td>2A4-G</td>
<td>2V3-G</td>
<td>874</td>
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<tr>
<td>2C21/1642</td>
<td>559</td>
<td>878</td>
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<tr>
<td>2C22</td>
<td>864</td>
<td>1634</td>
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JAN. 4, 1954
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
TYPES NOT RECOM.
## INTERCHANGEABILITY LIST

**POWER TUBES, RECTIFIER TUBES, THYRATRONS, IGNITRONS, VOLTAGE REGULATORS, PHOTOTUBES, CATHODE-RAY TUBES, AND SPECIAL TYPES**

### Direct Replacement Types*

<table>
<thead>
<tr>
<th>Type to be Replaced</th>
<th>Replace by RCA Type</th>
<th>Type to be Replaced</th>
<th>Replace by RCA Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>0A3/VR75</td>
<td>0A3</td>
<td>RK-25B</td>
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<td>0C3/VR105</td>
<td>0C3</td>
<td>CE-28(A-D)</td>
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<td>0D3/VR150</td>
<td>0D3</td>
<td>RK-28</td>
<td>803</td>
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<td>CE-1(A-D)</td>
<td>868, 918</td>
<td>RK28A</td>
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<td>1P32</td>
<td>927</td>
<td>CE-29(A-D)</td>
<td>929, 1P39</td>
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<td>2AP1</td>
<td>2AP1-A</td>
<td>CE-30(A-D)</td>
<td>930, 1P40</td>
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<td>2B4</td>
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<td>CE-30V</td>
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<td>2C39-A</td>
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<td>FG-32</td>
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<td>4-125A/4D21</td>
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<td>4-250A</td>
<td>4-250A/5D22</td>
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<td>4-250A/5D22</td>
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<td>CE-23(A-D)</td>
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<td>2050</td>
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<td>6H6</td>
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<td>RK-25</td>
<td>802</td>
<td>WT-210-0008</td>
<td>866-A</td>
</tr>
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* RCA types are direct replacements under all circumstances.

* Direct replacement, except in high-altitude service.
# INTERCHANGEABILITY LIST

## Direct Replacement Types* (Cont’d)

<table>
<thead>
<tr>
<th>Type to be Replaced</th>
<th>Replace by RCA Type</th>
<th>Type to be Replaced</th>
<th>Replace by RCA Type</th>
</tr>
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<tbody>
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<td>84/6Z4</td>
<td>WT-210-0009</td>
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<td>WT-210-0011</td>
<td>0C3</td>
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<td>50B5</td>
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<td>WT-210-0012</td>
<td>80</td>
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<td>633-A</td>
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<td>523</td>
<td>WT-210-0007</td>
<td>6K8-GT</td>
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<td>WT-210-0015</td>
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<td>6J5-GT</td>
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<td>6G6-G</td>
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* RCA types are direct replacements under all circumstances.
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*RCA types are direct replacements under all circumstances.*
# INTERCHANGEABILITY LIST

## Direct Replacement Types* (Cont'd)

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## INTERCHANGEABILITY LIST

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*RCA types are not directly interchangeable with the types to be replaced because of mechanical and/or electrical differences. For more information as to degree of interchangeability, refer to respective tube data.*
Three Rating Systems are in use by the Electron-Device Industry. The oldest is known as the Absolute-Maximum System, the next as the Design-Center System, and the latest and newest is the Design-Maximum System. Definitions of these systems have been formulated by the Joint Electron Tube Engineering Council (JETEC)—now identified as the Joint Electron Device Engineering Council (JEDEC)—and standardized by National Electrical Manufacturers Association (NEMA) and Electronic Industries Association (EIA) as follows:

**Absolute-Maximum Rating System**

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environment variations, and the effects of changes in operating conditions due to variations in device characteristics.

The equipment manufacturer should design so that initially and throughout life no Absolute-Maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment-component variation, equipment-control adjustment, load variation, signal variation, environmental conditions, and variations in device characteristics.

**Design-Center Rating System**

Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey electron device of a specified type as defined by its published data, and should not be exceeded under normal conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation*, equipment-component variation, equipment-control adjustment, load variation, signal variation, environmental conditions, and variations in device characteristics.

The equipment manufacturer should design so that initially no Design-Center value for the intended service is exceeded with a bogey device in equipment operating at the stated normal supply voltage*.

---

* For an ac power source, 117 volts plus or minus 10 per cent is accepted USA practice.
Design-Maximum Rating System

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in device characteristics.

The equipment manufacturer should design so that initially and throughout life no Design-Maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply-voltage variation, equipment-component variation, equipment-control adjustment, load variation, signal variation, and environmental conditions.

Differences Between Systems

The significant differences between the three Rating Systems can be summarized as follows:

Absolute-Maximum System:

\[
\text{Ratings} = \begin{bmatrix}
\text{Maximum capabilities of any electron device of the type rated}
\end{bmatrix}
\]

Design-Center System:

\[
\text{Ratings} = \begin{bmatrix}
\text{Maximum capabilities of any electron device of the type rated} \\
\text{Allowance for electron-device variations} \\
\text{Allowance for component and supply variations}
\end{bmatrix}
\]

Design-Maximum System:

\[
\text{Ratings} = \begin{bmatrix}
\text{Maximum capabilities of any electron device of the type rated} \\
\text{Allowance for electron-device variations}
\end{bmatrix}
\]
TUBE RATINGS
AND THEIR SIGNIFICANCE

A rating is a designation, as established by definite standards, of an operating limit of a tube. Tubes are rated by either of two systems, i.e., the "absolute maximum" system or the "design-center maximum" system. Of the two, the absolute maximum system is the older and dates back to the beginning of tubes. With either system, each maximum rating for a given tube type must be considered in relation to all other maximum ratings for that type, so that no one maximum rating will be exceeded in utilizing any other maximum rating. For convenience in referring to these two systems, the former will hereinafter be called the "absolute system," and the latter, the "design-center system."

In the absolute system,* the maximum ratings shown for each type thus rated are limiting values above which the serviceability of the tube may be impaired from the viewpoint of life and satisfactory performance. Therefore, in order not to exceed these absolute ratings, the equipment designer has the responsibility of determining an average design value for each rating below the absolute value of that rating by an amount such that the absolute values will never be exceeded under any usual condition of supply-voltage variation, load variation, or manufacturing variation in the equipment itself.

The equipment should be designed to operate the filament or heater of each tube type at rated normal value for full-load operating conditions under average voltage-supply conditions. Variations from this normal value due to voltage-supply fluctuation or other causes, should not exceed ±5 per cent unless otherwise specified by the tube manufacturer.

* Types rated according to the absolute system have no identification on their data pages issued prior to April 1, 1942. Sheets issued after that date carry the statement "Maximum Ratings Are Absolute Values" preceding the ratings.
In the design-center system adopted by the receiving-tube industry late in 1939, the maximum ratings shown for each type thus rated are working design-center maximums. The basic purpose underlying this system is to provide satisfactory average performance in the greatest number of equipments on the premise that they will not be adjusted to local power-supply conditions at time of installation. In the setting up of design-center ratings, consideration has been given to three important kinds of power-supply commonly in use, i.e., a-c and d-c power lines, storage battery with connected charger, and dry batteries.

In the case of a-c or d-c power lines, the maximum ratings for tubes rated according to the design-center system have been chosen so that the tubes will give satisfactory performance at these maximum ratings in equipment operated from power-line supplies whose normal voltage including normal variations fall within ±10 per cent of a specified center value. In other words, it is basic to the design-center system of ratings for tubes operated from power-line supplies that filaments or heaters as well as positive- and negative-potential electrodes may have to operate at voltages differing as much as ±10 per cent from their rated values. It also recognizes that equipment may occasionally be used on power-line supplies outside the normal range, but since such extreme cases are the exception, they should be handled by adjustment made locally.

The choice of ±10 per cent takes care of voltage differences in power lines in the U.S.A. where surveys have shown that the voltages delivered fall within ±10 per cent of 117 volts. Therefore, satisfactory performance from tubes rated according to the design-center system will ordinarily be obtained

** Types rated according to the design-center system are identified on their data pages either by a large star in the index corner or by the statement "Maximum Ratings Are Design-Center Values" preceding the ratings. This statement is used on sheets issued since April 1, 1942.
anywhere in the U.S.A. In equipment designed so that the design-center maximum ratings are not exceeded at a line-voltage-center value of 117 volts. While 117 volts represents present-day conditions, the design-center system permits the utilization of a new line-center value as new surveys may indicate the necessity for such a change.

In the case of storage-battery-with-charger supply or similar supplies, the normal battery-voltage fluctuation may be as much as 35 per cent or more. This fluctuation imposes severe operating conditions on tubes. Under these conditions, latitude for operation of tubes is provided for by the stipulation that only 90 per cent of the design-center maximum values of plate voltages, screen-supply voltages, dissipations, and rectifier output currents is never exceeded for a terminal potential at the battery source of 2.2 volts per cell. While a tube's operating voltages in this service will at times exceed the maximum values, satisfactory performance with probable sacrifice in life will be obtained.

In the cases of dry-battery supply and rectified a-c supply for 1.4-volt tubes, recommended design practice is given in RMA Standard M8-210.

RMA Standard M8-210 (Jan. 8, 1940 Rev.'11-40) is reproduced here for the convenient reference of design engineers with permission of the Engineering Department of the Radio Manufacturers Association. Although worded to cover only receiving tubes, it can be applied to any tube having design-center-system ratings.

* * *

It shall be standard to interpret the ratings on receiving types of tubes according to the following conditions:

1. CATHODE—The heater or filament voltage is given as a normal value unless otherwise stated. This means that transformers or resistances in the heater or filament circuit should be designed to op-
erate the heater or filament at rated value for full-
load operating conditions under average supply-
voltage conditions. A reasonable amount of leeway
is incorporated in the cathode design so that moder-
ate fluctuations of heater or filament voltage down-
ward will not cause marked falling off in response;
also, moderate voltage fluctuations upward will not
reduce the life of the cathode to an unsatisfactory
degree.

A. 1.4-Volt Battery Tube Types—The filament
power supply may be obtained from dry-cell bat-
teries, from storage batteries, or from a power
line. With dry-cell battery supply, the filament
may be connected either directly across a battery
rated at a terminal potential of 1.5 volts, or in
series with the filaments of similar tubes across
a power supply consisting of dry cells in series.
In either case, the voltage across each 1.4-volt
section of filament should not exceed 1.6 volts.
With power-line or storage-battery supply, the
filament may be operated in series with the fila-
ments of similar tubes. For such operation, de-
sign adjustments should be made so that, with
tubes of rated characteristics, operating with all
electrode voltages applied and on a normal line
voltage of 117 volts or on a normal storage-bat-
tery voltage of 2.0 volts per cell (without a
charger) or 2.2 volts per cell (with a charger),
the voltage drop across each 1.4-volt section of
filament will be maintained within a range of 1.25
to 1.4 volts with a nominal center of 1.3 volts.
In order to meet the recommended conditions for
operating filaments in series from dry-battery,
storage-battery, or power-line sources it may be
necessary to use shunting resistors across the
individual 1.4-volt sections of filament.

B. 2.0-Volt Battery Tube Types—The 2.0-volt
line of tubes is designed to be operated with 2.0
volts across the filament. In all cases the operat-
TUBE RATINGS

(continued from preceding page)

ing voltage range should be maintained within the limits of 1.8 volts to 2.2 volts.

2. POSITIVE POTENTIAL ELECTRODES — The power sources for the operation of radio equipment are subject to variations in their terminal potential. Consequently, the maximum ratings shown on the tube-type data sheets have been established for certain Design Center Voltages which experience has shown to be representative. The Design Center Voltages to be used for the various power supplies together with other rating considerations are as given below:

A. AC or DC Power Line Service in U.S.A.—The design center voltage for this type of power supply is 117 volts. The maximum ratings of plate voltages, screen-supply voltages, dissipations, and rectifier output currents are design maximums and should not be exceeded in equipment operated at a line voltage of 117 volts.

B. Storage-Battery Service—When storage-battery equipment is operated without a charger, it should be designed so that the published maximum values of plate voltages, screen-supply voltages, dissipations, and rectifier output currents are never exceeded for a terminal potential at the battery source of 2.0 volts per cell. When storage-battery equipment is operated with a charger, it should be designed so that 90% of the same maximum values is never exceeded for a terminal potential at the battery source of 2.2 volts.

C. "B"-Battery Service—The design center voltage for "B" batteries is the normal voltage rating of the battery block, such as 45 volts, 90 volts, etc. Equipment should be designed so that under no condition of battery voltage will the plate voltages, the screen-supply voltages, or dissipations ever exceed the recommended respective maximum values shown in the data for each tube type by more than 10%.

JUNE 1, 1943  RCA VICTOR DIVISION  RATINGS 3
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
D. Other Considerations

a. Class A Amplifiers—The maximum plate dissipation occurs at the “Zero-Signal” condition. The maximum screen dissipation usually occurs at the condition where the peak-input signal voltage is equal to the bias voltage.

b. Class B Amplifiers—The maximum plate dissipation theoretically occurs at approximately 63% of the “Maximum-Signal” condition, but practically may occur at any signal voltage value.

c. Converters—The maximum plate dissipation occurs at the “Zero-Signal” condition and the frequency at which the oscillator-developed bias is a minimum. The screen dissipation for any reasonable variation in signal voltage must never exceed the rated value by more than 10%.

d. Screen Ratings—When the screen voltage is supplied through a series voltage-dropping resistor, the maximum screen voltage rating may be exceeded, provided the maximum screen dissipation rating is not exceeded at any signal condition, and the maximum screen voltage rating is not exceeded at the maximum-signal condition. Provided these conditions are fulfilled, the screen-supply voltage may be as high as, but not above, the maximum plate voltage rating.

8. TYPICAL OPERATION — For many receiving tubes, the data show typical operating conditions in particular services. These typical operating values are given to show concisely some guiding information for the use of each type. They are not to be considered as ratings, because the tube can be used under any suitable conditions within its rating limitations.
TUBE RATINGS
(continued from preceding page)

RECEIVING TUBES
The ratings of all receiving tubes currently used in new equipment are set up according to the design-center system. Older and obsolescent types of receiving tubes still have absolute maximum ratings because these types are used only for renewal purposes and, therefore, design-center values are of no practical value. Receiving-tube types rated on the design-center system are identified in the Receiving-Tube Section either by a large star in the index corner of each data page or by the statement "Maximum Ratings Are Design-Center Values" preceding the ratings on each data page.

TRANSMITTING TUBES
The ratings of transmitting tubes grouped in the Transmitting-Tube Section are on the basis of the absolute system. This system enables the transmitter design engineer to choose his design values so as to obtain maximum performance within the tube ratings. Such design procedure has been considered practical for large transmitters where adequate controls are usually incorporated in the design, and ordinarily an experienced operator is present to make any necessary adjustments.

The maximum ratings given for each transmitting type on its data pages apply only when the type is operated at frequencies lower than some specified value which depends on the design of the type. As the frequency is raised above the specified value, the radio-frequency currents, dielectric losses, and heating effects increase rapidly. Most types can be operated above their specified maximum frequency provided the plate voltage and plate input are reduced in accordance with the information given in the table "Transmitting-Tube Ratings vs Operating Frequency" in the front part of the Transmitting-Tube Section.

For certain air-cooled transmitting tubes, two sets
of absolute maximum values are shown to meet diversified design requirements. One set is designated as CCS (Continuous Commercial Service) ratings, while the other is called ICAS (Intermittent Commercial and Amateur Service) ratings.

Continuous Commercial Service is defined as that type of service in which long tube life and reliability of performance under continuous operating conditions are the prime consideration. To meet these requirements, the CCS ratings have been established.

Intermittent Commercial and Amateur Service is defined to include the many applications where the transmitter design factors of minimum size, light weight, and maximum power output are more important than long tube life. These various factors have been taken into account in establishing the ICAS ratings.

Under the ICAS classification are such applications as the use of tubes in amateur transmitters, and the use of tubes in equipment where transmissions are of an intermittent nature. The term "intermittent" is used to identify operating conditions in all applications other than amateur in which no operating or "on" period exceeds 5 minutes and every "on" period is followed by an "off" or standby period of at least the same or greater duration.

ICAS ratings are considerably higher than CCS ratings. They permit the handling of greater power, but tube life under ICAS conditions, of course, is reduced. However, the transmitter designer may very properly decide that a small tube operated with ICAS ratings better meets his requirements than a larger tube operated with CCS ratings. Although such use involves some sacrifice in tube life, the period over which tubes will continue to give satisfactory performance in intermittent service can be extremely long depending on the exact nature of the service.
The choice of tube operating conditions best fitted for any particular application should be based on a careful consideration of all pertinent factors.

**RECTIFIER TUBES**

Rectifier tubes used principally in receiving equipment are rated according to the design-center system, while those used primarily in transmitting and laboratory equipment are rated according to the absolute system. The method of identifying which rating system is used for any rectifier tube in this Handbook is the same as that for other tubes in the particular section of the Handbook in which data for the rectifier tube are given.

The ratings of rectifier tubes are based on fundamental limitations in the operation of the tubes themselves, and in general include the following: maximum peak inverse plate voltage, maximum peak plate current, and maximum d-c output current.

**Maximum peak inverse plate voltage** is the highest instantaneous plate voltage which the tube can withstand recurrently in the direction opposite to that in which it is designed to pass current. For mercury-vapor tubes and gas-filled tubes, it is the safe top value to prevent arc-back in the tube operating within the specified temperature range.

In determining peak inverse plate voltage on a rectifier tube in a particular circuit, the equipment designer should remember that the relations between peak value of inverse plate voltage, rms value of input voltage, and average value of output voltage, depend largely on the characteristics of the particular rectifier circuit and the power supply. Furthermore, the presence of transients, such as line surges and keying surges, or waveform distortion, may raise the actual inverse plate voltage to a peak higher than that calculated for sine-wave voltages. Therefore, the actual inverse plate voltage on a rec-
TUBE RATINGS

(continued from preceding page)

tifier tube should never exceed the maximum peak inverse plate voltage rating for that tube. The peak inverse plate voltage may be determined with an electronic peak voltmeter of the self-contained battery type.

In single-phase, full-wave rectifier circuits with sine-wave input and pure resistance load, the peak inverse plate voltage is approximately 1.4 times the rms value of the plate-to-plate voltage supply. In single-phase, half-wave circuits with sine-wave input and pure resistance load, the peak inverse plate voltage is approximately 1.4 times the rms value of the plate voltage supply, but with condenser input to filter, the peak inverse plate voltage may be as high as 2.8 times the rms value of the plate voltage supply.

Maximum peak plate current is the highest instantaneous plate current that a tube can safely carry recurrently in the direction of normal current flow. The safe value of this peak current in hot-cathode types of rectifier tubes is a function of the electron emission available and the duration of the pulsating current flow from the rectifier tube in each half-cycle.

The value of peak plate current in a given rectifier circuit is largely determined by filter constants. If a large choke is used at the filter input, the peak plate current is not much greater than the load current; but if a large condenser is used at the filter input, the peak current may be many times the load current. In order to determine accurately the peak plate current in any rectifier circuit, the designer should measure it with a peak-indicating meter or use an oscillograph.

Maximum d-c output current is the highest average plate current which can be handled continuously by a rectifier tube. Its value for any rectifier tube type is based on the permissible plate dissipation of that type. Under operating conditions involving a rapidly
repeating duty cycle (steady load), the average plate current may be measured with a d-c meter. In the case of certain mercury-vapor tubes where the load is fluctuating, it is necessary to determine the average current over the time interval specified on the data pages for these types.

In addition to the above ratings for rectifier tubes, other ratings may be set up for a rectifier tube when the service in which the tube is to be used makes such ratings essential for satisfactory performance. Such ratings are: maximum surge plate current, and maximum heater-cathode potential.

Maximum surge plate current is the highest value of abnormal peak currents of short duration that should pass through the rectifier tube under the most adverse conditions of service. This value is intended to assist the equipment designer in a choice of circuit components such that the tube will not be subjected to disastrous currents under abnormal service conditions approximating a short circuit. This surge-current rating is not intended for use under normal operating conditions because subjecting the tube to the maximum surge current even only once may impair tube life. If the tube is subjected to repeated surge currents, its life will be seriously reduced or even terminated.

Maximum heater-cathode potential is the highest instantaneous value of voltage that a rectifier tube can safely stand between its heater and cathode. This rating is applied to certain rectifier tubes having a separate cathode terminal and used in applications where excessive potential may be introduced between heater and cathode. For convenience, this rating is usually given as a d-c value.

**CATHODE-RAY TUBES**

The ratings of some cathode-ray tubes are set up on the absolute system while others are set up on the design-center system. Initially, cathode-ray tubes
were all rated according to the absolute system. With the advent of television which presented design conditions similar to those in the receiving-set field, the method of rating popular types of cathode-ray tubes was changed to the design-center system. More recently, because of procedure standardized by the RMA Cathode-Ray-Tube Committee, newer types of cathode-ray tubes are being rated on the absolute system. Cathode-ray types rated according to the design-center system are identified in the Cathode-Ray Types Section by a statement to that effect just ahead of the maximum ratings on each data page. The data pages of types rated according to the absolute system have either (1) no identifying statement as to the rating system, or (2) an identifying statement that the ratings are according to the absolute system.

PHOTOTUBES

The ratings of all phototubes in the Phototube Section are on the absolute maximum basis. This basis enables the designing engineer to choose design values so as to obtain optimum performance within tube ratings. In the case of gas phototubes, the value to which the plate voltage and the plate current can be raised is abruptly limited by ionization effects. If these are allowed to occur, they may ruin the photosurface almost instantly. While phototubes in general might be rated on the design-center basis, such a procedure, with provision for an adequate factor of safety to take care of all conditions of operation, would impose undue limitations on the use of gas phototubes.

MISCELLANEOUS SPECIAL TUBES

The ratings of some of the various tube types grouped in the Miscellaneous-Types Section are according to the design-center system while others are according to the absolute system. Miscellaneous types rated on the design-center basis are identified
by a statement to that effect on the data pages or else refer back for ratings to a receiving-tube type whose rating basis is explained under TUBE RATINGS—Receiving Tubes. The data pages of types rated according to the absolute system have either (1) no identifying statement as to the rating system, or (2) an identifying statement that the ratings are according to the absolute system.

CHARACTERISTICS and TYPICAL OPERATING CONDITIONS

In addition to showing the ratings of each tube type, the data pages for many of the types in this Handbook include “characteristics,” such as amplification factor, plate resistance, and transconductance, which help to distinguish between the electrical features of the respective types. Usually, the characteristics shown for any type are obtained for that type in class A service: where class A data are given for the type, the characteristics are included with that data for convenience. Based on a large number of tubes of a given type, the values shown for these characteristics are average values.

Range of Characteristics—The equipment designer should bear in mind that individual tubes of a given type may have characteristics values either side of the average values shown for the type. He should also realize that these characteristics change during the life of individual tubes. In designing equipment, therefore, he should allow for the maximum cumulative variation of any characteristic from the average value of that characteristic as shown in the tabulated data for the type. The exact percentage of the variation will be different for different types of tubes depending on the design of the tubes and their intended application, but in general the designer should consider a probable plus or minus variation of not less than 30 per cent.

Furthermore, the equipment designer should recog-
nize the desirability of designing equipment so that the full range of the operating characteristics of tubes will be utilized. If this practice is not followed, he imposes on the equipment user special replacement problems in that the user will have to select tubes suitable for use in the equipment, and may not be able to obtain the full life capability of such tubes.

**Typical Operating Values**—Also included on the data pages is information on typical operating conditions for most of the various tubes when used in particular services. These typical operating values are intended to show concisely some guiding information for the use of each type. They must not be considered as ratings because each type can, in general, be used under any suitable conditions within its rating limitations. In referring to these values for transmitting tubes, it should be noted that the power output value is not a rating. It is an approximate tube output, i.e., tube input minus plate loss. Circuit losses must be subtracted from tube output in determining useful output.

**Datum Point for Electrode Potentials**—In the data for any type in the Handbook, the values for grid bias and positive-potential-electrode voltages are given with reference to a specified datum point as follows. For types having filaments heated with d.c., the negative filament terminal is taken as the datum point to which other electrode voltages are referred. For types having filaments heated with a.c., the mid-point (i.e., the center tap on the filament-transformer secondary, or the mid-point on a resistor shunting the filament) is taken as the datum point. For types having equipotential cathodes indirectly heated, the cathode is taken as the datum point.

**Grid Bias vs Filament Excitation**—If the filament of any type for which data are given on a d-c basis is to be operated with an a-c supply, the given grid
bias should be increased by an amount approximately equal to one half the rated filament voltage and be referred to the filament mid-point. Conversely, if it is required to use d-c filament excitation on any filament type for which the data are given on an a-c basis, the grid-bias values as given on the data pages should be decreased by an amount approximately equal to one half the rated filament voltage and be referred to the negative filament terminal instead of the mid-point as in a-c operation.

In practice, the necessity for following this rule depends on circuit conditions and operating requirements. If the bias is relatively small compared with the filament voltage and hum is a consideration, adjustment of the grid bias is ordinarily essential. Conversely, if the bias is relatively large compared with the filament voltage, adjustment of the grid bias may be unnecessary.

When filament excitation of tubes used as Audio Amplifiers is changed from d.c to a.c., the grid return should, in general, be shifted to the mid-point of the filament circuit to minimize hum, and the bias adjusted accordingly. When the excitation is changed from a.c. to d.c., bias adjustment depending on the relative values of bias and filament voltage may be required to provide the full signal-handling capability of the tubes.

When filament excitation of tubes used as R-F Amplifiers is changed, bias adjustment is not required unless the change makes the circuit critical as to hum or signal-handling capability. For example, in class C amplifiers, the bias is usually so large in comparison with the filament voltage that adjustment is generally unnecessary.

Grid Current and Driving Power—The typical values of d-c grid current and driving power shown for triodes and tetrodes in class B r-f service and in class C service are subject to variations depending on the impedance of the load circuit. High-impe-
dance load circuits require more grid current and driving power to obtain the desired output. Low-impedance circuits need less grid current and driving power, but plate-circuit efficiency is sacrificed. In comparison, the d-c grid current and driving power shown for beam tubes and pentodes in class B r-f service and in class C service are not as critical to variations in load-circuit conditions. In any event, sufficient grid current should be used so that the stage is "saturated," i.e., so that a small change in grid current results in negligible change in power output. Regardless of the type of tube used, the driving stage should have a tank circuit of good regulation and should be capable of delivering power in excess of the indicated power by a factor of several times.
TYPES OF CATHODES
AND THEIR USE

In electron tubes, a cathode is an electrode which is the primary source of electron or ion emission. There are two broad classes of cathodes, i.e., hot and cold. “Hot cathodes” are defined as cathodes which are heated or otherwise operate at elevated temperature (frequently incandescent) in order to function as emitters. In contrast, “cold cathodes” are defined as cathodes which do not rely on heat or on elevated temperature in order to function as emitters.

HOT CATHODES

Hot cathodes commonly in use in electron tubes are classified as directly heated, indirectly heated, and ionic-heated.

A directly heated cathode, or filament-cathode, is a wire or ribbon which is heated by the passage of current through it. It is further classified by identifying the filament material or the electron-emitting material. Such materials in regular use are pure tungsten, thoriated tungsten, and metals coated with alkaline-earth oxides. Each of these materials has distinctive advantages which are utilized in the design of tubes for particular applications.

PURE-TUNGSTEN FILAMENTS are used in certain tubes, especially those for high-voltage transmitting service. Since these filaments must operate at a high temperature of about 2500°C (a dazzling white) to emit sufficient electrons, a relatively large amount of filament power is required. The operating life of these filaments is determined by the rate of tungsten evaporation. Their failure, therefore, occurs through decreased emission or burn-out.

Pure-tungsten filaments give best life performance when they are operated so as to conserve their emitting capability. They are designed with voltage and current ratings in accord with the service expected of the particular tube type. However, in applications where the normal emission at rated voltage is not
required, the filament can be operated at a somewhat reduced voltage. The extent of the reduction depends on the peak emission requirements of the application as well as on the percentage regulation of the filament voltage. When these are known, the correct operating filament voltage for any tungsten-filament type can be calculated from its filament-emission characteristic. The permissible regulation in transmitters may be checked by reducing the filament voltage (with the transmitter under normal operation) to a value such that reduction in output can just be detected. The filament voltage must then be increased by an amount equivalent to the maximum percentage regulation of the filament-supply voltage and then increased further by approximately 2 per cent to allow for minor variations in emission of individual tubes. It follows that the better the regulation, the less the filament operating voltage and, therefore, the longer the filament life.

It should be noted that a reduction of 5 per cent in the filament voltage applied to tubes with pure-tungsten filaments will approximately double their life. A reduction of 15 per cent will increase the filament life almost tenfold.

During long or frequent standby periods, pure-tungsten-filament tubes may be operated at decreased filament voltage to conserve life. When the average standby time is an appreciable portion of the average duty cycle and is less than 2 hours, it is recommended that the filament voltage of all but the largest types be reduced to 80 per cent of normal; and that for longer periods, the filament power be turned off. For the largest types, such as the 8898, it is recommended that the filament voltage be reduced to 80 per cent of normal during standby operation up to 12 hours; and that for longer periods, the filament power be turned off.

For turning on filament power, a filament starter should be used so as to increase the voltage gradually and to limit the high initial rush of current through
the filament. It is important that the filament current never exceed, even momentarily, a value of more than 150 per cent of normal, unless the tube data specify otherwise. Similarly, as an added precaution, the filament power should be turned off gradually to prevent cooling strains in the filament.

THORIATED-TUNGSTEN FILAMENTS are now used mainly in certain transmitting and special tubes. Thoriated-tungsten filaments are made from tungsten impregnated with thoria. Due to the presence of thorium, these filaments liberate electrons at a more moderate temperature of about 1700°C (a bright yellow), and are, therefore, much more economical of filament power than are pure-tungsten filaments. The operating life of thoriated-tungsten filaments is ordinarily ended by a decrease in electron emission. Decreased emission, however, may be caused by the accidental application of too high filament, screen, or plate voltage. If the over-voltage has not been continued for a long time, the activity of the filament can often be restored by operating the filament at its normal voltage for 10 minutes or longer without plate, screen, or grid voltage. The reactivation process may be accelerated by raising the filament voltage to not higher than 120 per cent of normal value for a few minutes. This reactivation schedule is often effective in restoring the emission of thoriated-tungsten filaments in tubes which have failed after normal service. Sometimes a few hundred hours of additional life may be obtained after reactivation.

The operating voltage of a thoriated-tungsten filament should, in general, be held to within ±5 per cent of its rated value. However, in transmitting applications where the tube is lightly loaded, the filament may be operated on the low side—as much as 5 per cent below normal voltage. As conditions require, the voltage should be increased gradually to maintain output. Toward the end of life, additional service may be obtained by operating the fila-
ment above its rated voltage. It should be noted that a tube having a thoriated-tungsten filament should never be operated under emission-limited conditions since this type of operation may overheat the tube and cause permanent loss of emission.

During standby periods in transmitting service, thoriated-tungsten filaments may be operated according to the following recommendations to conserve life. For short standbys of less than 15 minutes duration, the filament voltage of all but the largest types should be reduced to 80 per cent of normal; for longer periods, the filament power should be turned off. For the largest types, such as the 827-R and 861, it is recommended that the filament voltage be reduced to 80 per cent of normal during standby operation up to 2 hours; and that for longer periods, the filament power be turned off.

COATED FILAMENTS are used in receiving tubes, certain transmitting tubes, most mercury-vapor rectifiers, and some special tubes. Coated filaments employ a relatively thick coating of alkaline-earth compounds on a metallic base as a source of electronic emission. The metallic base carries the heating current. These filaments operate at a low temperature of about 800°C (a dull red) and require relatively little power to produce a copious supply of electrons.

For proper performance of these types, rated filament voltage should, in general, be applied at the filament terminals. However, when coated-filament, high-vacuum tubes are used in transmitting service with light loading, the filament voltage may be reduced as much as 5 per cent below normal to conserve life. Then, as conditions require, the voltage should be increased gradually to maintain output. Toward the end of life, the gradual increase may be carried above rated filament voltage to obtain additional service. In the case of gas or vapor tubes, it is important that these types be operated, in general, at rated filament voltage. However, if the line regu-
lotion regularly and consistently does not exceed 1 to 2 per cent, it is practical to reduce the filament voltage slightly (not over 5 per cent) with benefit to tube life.

During standby periods of less than 15 minutes, the filament voltage of quick-heating, high-vacuum types, such as the 1616 and 1624, should be reduced to 80 per cent of normal; for longer periods, the filament power should be turned off. In contrast, the voltage of coated filaments in gas or vapor tubes should not be reduced during standbys except under conditions explained in the preceding paragraph. In general, the filament voltage of small and medium types, such as the 866-A/866 and 872-A/872, should be maintained at normal rated value during standbys up to 2 hours; for longer periods, the filament power should be turned off. For large types, such as the 857-B, the filament voltage should be maintained at normal rated value during standbys up to 12 hours; for longer periods, the filament power should be turned off.

After having given normal service or after having been operated at excessive voltage, coated filaments lose their emission. When such is the case, their usefulness may be considered as terminated.

An indirectly heated cathode, or heater-cathode, consists of a heater wire enclosed in a thin metal sleeve coated on the outside with electron-emitting material similar to that used for coated filaments. The sleeve is heated by radiation and conduction from the heater through which current is passed. Useful emission does not take place from the heater wire. An important feature of this kind of cathode construction is that the functions of heating and emission can be independent of each other.

HEATER-CATHODES, or unipotential cathodes as they are frequently called, are used in high-vacuum tubes operating at low plate voltage, such as receive...
ing tubes, low-power transmitting tubes, and small special tubes. They also find application in mercury-vapor tubes and in cathode-ray tubes. Heater-cathodes, like coated filaments, provide a copious supply of electron emission at low cathode temperature (a dull red).

For proper performance of heater-cathode tubes, rated heater voltage should, in general, be applied at the heater terminals. However, when heater-cathode high-vacuum tubes are used in transmitting service and are lightly loaded, the heater voltage may be reduced as much as 5 per cent below normal to conserve life. As conditions require, the voltage should be increased gradually to maintain output. Toward the end of life, the gradual increase may be carried above rated heater voltage to obtain additional service.

During standby periods of less than 15 minutes, the heater voltage of high-vacuum tubes should be maintained at normal rated value; for longer periods, the heater power should be turned off. In the case of vapor or gas tubes, the heater voltage should be maintained at normal during standby periods up to 12 hours; for longer periods, the heater power should be turned off.

An ionic-heated cathode is one which liberates electrons when it is subjected to intense positive ion bombardment. The bombardment may be so intense as to raise the temperature of the cathode, frequently causing it to become visibly hot. The ionic-heated cathode in radio tubes has found application in gas rectifiers intended primarily for automobile receiver service.

COLD CATHODES

The designation "cold cathode" is commonly used in referring to those cathodes which emit electrons when they are subjected to bombardment by other electrons, ions, or metastable atoms. Cathodes of
TYPES OF CATHODES
(continued from preceding page)

this type are sometimes designated as secondary-emission cathodes. They are used in certain glow-discharge tubes, and also in multiplier phototubes where they contribute to electron multiplication in the successive dynode stages.

Not customarily referred to as cold cathodes, although they are such, is another group of emitters known as photocathodes. By definition, a photocathode is one which emits electrons when it is energized with radiant flux, such as light, infra-red radiation, or ultra-violet radiation. Such cathodes are used in phototubes. When used in gas phototubes, these cathodes not only emit under the influence of radiant flux but also as a result of bombardment and thus become partial secondary-emission cathodes.

Photocathodes are classified according to the spectral response characteristics of their respective photoactive surfaces. The S1 photosurface gives high response to red and near infra-red radiation. The S2 photosurface is similar to the S1 surface but extends somewhat further into the infra-red region. The S3 photosurface has a spectral response characteristic which is closest to that of the eye. The S4 photosurface has exceptionally high response to blue and blue-green radiation with negligible response to red radiation.

Exposure of photocathodes to intense light, such as direct sunlight, may decrease the sensitivity of the tubes in which they are used, even though there is no voltage applied. The magnitude and duration of the decrease depend on the length of the exposure. Permanent damage to a phototube may result if it is exposed to radiant energy so intense as to cause excessive heating of the cathode.
CONVERSION FACTOR NOMOGRAPH

The Conversion Factor Nomograph shown above may be used to determine the approximate characteristics of an electron tube when all the electrode voltages are changed in the same proportion from the published or measured values.

The conversion factors obtained from the nomograph are applicable to triodes, tetrodes, pentodes, and beam power tubes when the plate voltage, grid-No.1 voltage, and grid-No.2 voltage are changed simultaneously by the same factor. They may be used for any class of tube operation (class A, AB1, AB2, B, or C).

The nomograph may be used to determine the proper value for each conversion factor for a specified relationship ($F_e$)
CONVERSION FACTORS

between published or measured values ($E_{pub}$) and desired values ($E_{des}$) of operating voltage. The dashed lines on the nomograph indicate the correct procedure for determining each of these conversion factors when it is desired to reduce the operating electrode voltage from 250 to 200 volts.

EXAMPLE

Published characteristics for a typical pentode are listed below for a plate voltage of 250 volts. If it is desired to determine the characteristics of this tube for a plate voltage of 200 volts, the voltage conversion factor, $F_e$, is equal to 200/250 or 0.8. The values for the other conversion factors are obtained from the nomograph. By use of these factors characteristics values at a plate voltage of 200 volts are obtained.

<table>
<thead>
<tr>
<th>Published Value</th>
<th>Conversion Factor</th>
<th>Desired Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>250</td>
<td>0.8</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>250</td>
<td>0.8</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td>-15</td>
<td>0.8</td>
</tr>
<tr>
<td>Plate Current</td>
<td>30</td>
<td>0.72</td>
</tr>
<tr>
<td>Grid-No.2 Current</td>
<td>6</td>
<td>0.72</td>
</tr>
<tr>
<td>Plate Resistance (Approx.)</td>
<td>0.13</td>
<td>1.12</td>
</tr>
<tr>
<td>Transconductance.</td>
<td>2000</td>
<td>0.89</td>
</tr>
<tr>
<td>Load Resistance</td>
<td>10000</td>
<td>1.12</td>
</tr>
<tr>
<td>Total Harmonic Distortion</td>
<td>10</td>
<td>unchanged</td>
</tr>
<tr>
<td>Max.-Signal Power Output</td>
<td>2.5</td>
<td>0.57</td>
</tr>
</tbody>
</table>

LIMITATIONS

Because this method for conversion of characteristics is necessarily an approximation, progressively greater errors will be introduced as the voltage conversion factor ($F_e = E_{des}/E_{pub}$) departs from unity. In general, it may be assumed that results obtained will be approximately correct when the value of $F_e$ is between 0.7 and 1.5. When $F_e$ is extended beyond these limits (down to 0.5 or up to 2.0), the accuracy becomes considerably reduced and the results obtained can serve only as a rough approximation.

It should be noted that this method does not take into account the effects of contact potential or secondary emission in electron tubes. Contact potential, however, may safely be neglected for most applications because its effects are noticeable only at very low grid-No.1 voltages. Secondary emission may occur in conventional tetrodes at low plate voltages. For such tubes, therefore, the use of conversion factors should be limited to regions of the plate characteristic in which the plate voltage is greater than the grid-No.2 voltage. For beam power tubes, the regions of both low plate currents and low plate voltages should also be avoided.
OUTLINES — Glass Tubes

SUBMINIATURE—Flexible Lead Type

* Measured from bulb seat to bulb-top line as determined by a ring gauge of 0.210" ± 0.001" I.D.

**RCA**

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

MAY 1, 1955
OUTLINES 1
OUTLINES — Glass Tubes

SUBMINIATURE—Sub-Minar 8-Pin Base Type

Measured from base seat to bulb-top line as determined by a ring gauge of 0.210" ± 0.001" I.D.
For additional socket design information, see back of "Outlines 3" sheet.
OUTLINES — Glass Tubes

ACORN—Radial 5-Pin Base Type
with End Terminals

For additional socket design information,
see back of "Outlines 3" sheet
ACORN—Radial 7-Pin Base Type

For additional socket design information, see back of this sheet.
MAXIMUM PIN AND TERMINAL VARIATIONS AT SOCKET CLIPS AND TERMINAL CONNECTORS

ESSENTIAL DIMENSIONS FOR SOCKET DESIGN

Reference Pin (R)

<table>
<thead>
<tr>
<th>Base Type</th>
<th>Pin No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radial 5-Pin</td>
<td>5</td>
</tr>
<tr>
<td>Radial 5-Pin with End Terminals</td>
<td>5</td>
</tr>
<tr>
<td>Radial 7-Pin</td>
<td>7</td>
</tr>
</tbody>
</table>

The above composite diagram shows the ideal positions of radial-pin cross-sections at socket clips located on a circle of 0.938" diameter, as well as end-terminal cross-sections at terminal ends.

The areas within the cross-hatching show actual variations of radial-pin and end-terminal cross-sections, and indicate the maximum variations which socket clips and terminal connectors should accommodate.

The clear area for pin position R is narrower than the others because pin position R is used as a reference for the other pins.

Sockets should be designed so that the maximum diametral clearance between socket clips is never less than 0.850".

* For pin numbering of each of these bases, see respective Dimensional Outline on preceding pages.
OUTLINES—Glass Tubes

MINIATURE—Miniature 7-Pin Base Types

- SMALL-BUTTON MINIATURE 7-PIN
  - JETEC No. 5-1
  - JETEC No. 5-2
  - JETEC No. 5-3

* Measured from base seat to bulb-top line as determined by ring gauge of 7/16" I.D.

MAY 1, 1955
OUTLINES 4
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
MINIATURE—Noval 9-Pin Base Types

**OUTLINES**

**Glass Tubes**

**MINIATURE—Noval 9-Pin Base Types**

**JETEC No. 6-1**

**T6 1/2**

1 3/4" MAX.

1/2" ± 3/32"

SMALL-BUTTON NOVAL 9-PIN

**JETEC No. 6-2**

**T6 1/2**

2 3/16" MAX.

9/16" ± 3/32"

SMALL-BUTTON NOVAL 9-PIN

**JETEC No. 6-3**

**T6 1/2**

2 5/8" MAX.

2 3/8" MAX.

SMALL-BUTTON NOVAL 9-PIN

**JETEC No. 6-7**

**T6 1/2**

2 27/32" MAX.

2 1/8" ± 1/8"

SMALL-BUTTON NOVAL 9-PIN

*Measured from base seat to bulb-top line as determined by ring gauge of 7/16" I.D.*

MAY 1, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
OUTLINES—Glass Tubes

GLASS OCTAL—Octal Base Types
with T9 Bulbs

Fig. 1
Fig. 2
Fig. 3

<table>
<thead>
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<th>OUTLINE</th>
<th>DIMENSION</th>
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<td>JETEC No.</td>
<td>A Max. Inches</td>
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<td>Fig. 1</td>
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<td>-</td>
<td>9-15</td>
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<td>-</td>
<td>9-33</td>
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</table>

For electron-ray tubes, the seated height is 1-11/16" + 1/16" - 1/4".

MAY 1, 1955

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
GLASS OCTAL—Octal Base Types with T9 Bulbs

JETEC No. 9-23

JETEC No. None

JETEC No. None

JETEC No. 9-51
GLASS OCTAL—Octal Base Types with Ti2 Bulbs

MAY 1, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
OUTLINES—Glass Tubes

LOCK-IN—Lock-In 8-Pin Base Types

JETEC No.9-32

JETEC No.9-30

JETEC No.9-31

MAY 1, 1955

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
OUTLINES — Glass Tubes

SMALL 4-PIN, SMALL 5-PIN, SMALL 6-PIN, & SMALL 7-PIN BASE TYPES

MAY 1, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
For correlation of TUBE TYPE, ENVELOPE DESIGNATION, & OUTLINE No., see KEY on back of this sheet

OUTLINES—Metal Tubes

JETEC No.8-5

JETEC No.8-3

JETEC No.8-1

JETEC No.8-4

MAY 1, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, Harrison, New Jersey

OUTLINES 8
## OUTLINES - Metal Tubes

### KEY

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<th>Type No.</th>
<th>Envelope Designation</th>
<th>Outline Jetec No.</th>
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MAY 1, 1955

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
## BASES
### MINIMUM DIAMETERS

Until such time as the Handbook pages covering bases are re-issued to include minimum diameters of wafers, shells, and sleeves, this provisional sheet will supply these minimum diameters for the following bases to supplement the maximum diameters which are shown on the respective base drawings.

<table>
<thead>
<tr>
<th>Base</th>
<th>Minimum Diameter</th>
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<td><strong>3-PIN &amp; 4-PIN TYPES:</strong></td>
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<td>Peewee 3-Pin</td>
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<tr>
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<td>WD 4-Pin</td>
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<tr>
<td>Tapered Small 4-Pin</td>
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<tr>
<td>Small 4-Pin</td>
<td>1.136&quot;</td>
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<tr>
<td>Medium 4-Pin</td>
<td>1.337&quot;</td>
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<tr>
<td>Medium 4-Pin with Bayonet</td>
<td>1.337&quot;</td>
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<tr>
<td>Jumbo 4-Pin</td>
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<tr>
<td>Super-Jumbo 4-Pin</td>
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<td><strong>5-PIN TYPES:</strong></td>
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<td>Small 5-Pin</td>
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<tr>
<td>Medium 5-Pin</td>
<td>1.337&quot;</td>
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<tr>
<td>Giant 5-Pin</td>
<td>2.142&quot;</td>
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<td><strong>6-PIN TYPES:</strong></td>
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<td><strong>7-PIN TYPES:</strong></td>
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MAR. 30, 1945
RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
BASES
1 - TERMINAL TYPES (CAPS)

MINIATURE WITH WAFFER

SKIRTED MINIATURE

SKIRTED MINIATURE

SKIRTED SMALL

SMALL

JETEC No.CI-1
RCA No.3907

JETEC No.CI-2
RCA No.3927

JETEC No.CI-3
RCA No.3933

JETEC No.CI-4
RCA No.M-399

JETEC No.CI-1-3
RCA No.3933

JETEC No.CI-1-2
RCA No.3927

JETEC No.CI-1-33

JETEC No.CI-1-22

* Add .020" for solder on finished tube.
BASES
1-Terminal Types (Caps)

**Medium**

- Diameter: 0.566" ± 0.007"
- Height: 0.500"
- Min. Diameter: 0.400" (for JETEC No.CI-5, RCA No.3903)

**Skirted Medium**

- Diameter: 0.566" ± 0.007"
- Height: 0.500"
- Min. Diameter: 0.400" (for JETEC No.CI-14, RCA No.3980)

**Additional Notes:**
- Add 0.040" for solder on finished tube.
- Dimensions are approximate and subject to manufacturing tolerance.

MAY 3, 1954

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**BASES**
1 TERMINAL TYPES (CAPS)

**SKIRTED MEDIUM WITH ROLLED EDGE**
- JETEC No.CI-19
- RCA No.3940

**LARGE**
- JETEC No.CI-8
- RCA No.3910

**SKIRTED LARGE**
- JETEC No.CI-9
- RCA No.3905

° Add 0.040" for solder on finished tube.
* Add 0.060" for solder on finished tube.
BASES
1-Terminal Types (Caps)

SKIRTED LARGE

2.281" * 2.230"

.625" MIN.

.813" R

JETEC No. CI-10
RCA No. 1904

SKIRTED LARGE

2.750" *

.800" ± .007"

.713" MIN.

.813" R

JETEC No. CI-30
RCA No. 1902

* Add 0.060" for solder on finished tube.

MAY 3, 1954
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
DETAILS OF
RECESSED SMALL BALL CAP
& BULB ASSEMBLY
JETEC No.J1-22

OUTSIDE CONTOUR
OF BULB

3/16" R. MAX.
(SEE NOTE)

.140" R. MIN.
TO FILLET

.113" ± .005" DIA.

.056" R.

.080" ± .005" DIA.

.150" ± .015" -.010" POST

.150" ± .030" -.010" RIM

.135" ± .060" ± .056" DIA.

.113" ± .005" DIA.

ALTERNATE EDGE DESIGN

5/16" R. MAX.

3/32" MAX.

.200" R. MIN.

3/16" MAX.

VARIANT SEAL SHAPES

3/64" MAX.

1/32" MAX.

1/32" MAX.

3/16" MAX.

NOTE: PROTRUSION OF GLASS AROUND CAP
ABOVE BULB CONTOUR IS LIMITED
TO AREA BOUNDED BY CIRCLE
CONCENTRIC WITH CAP AXIS AND
HAVING RADIUS OF 3/16" MAX.

FOR ATTACHING OR DETACHING, THE CONNECTOR SHOULD REQUIRE NOT MORE THAN 8 POUNDS TOTAL FORCE PERPENDICULAR TO THE PLANE OF THE RIM OF THE CAP.

ANGLE BETWEEN PLANE OF THE RIM OF CAP AND PLANE TANGENT TO ORIGINAL CONTOUR OF BULB AT CENTER OF CAP WILL NOT BE MORE THAN 10°.
DETAILS OF
RECESSED SMALL CAVITY CAP
& BULB ASSEMBLY

JETEC No. JI-21

NOTE: PROTRUSION OF GLASS AROUND CAP ABOVE BULB CONTOUR IS LIMITED TO AREA BOUNDED BY CIRCLE CONCENTRIC WITH CAP AXIS AND HAVING RADIUS OF 3/4" MAX.

FOR ATTACHING OR DETACHING, THE CONNECTOR SHOULD REQUIRE NOT MORE THAN 8 POUNDS TOTAL FORCE PERPENDICULAR TO THE PLANE OF THE RIM OF THE CAP.

CONNECTOR SHOULD PROVIDE POSITIVE SPRING CONTACT TO TOP AND BOTTOM INTERIOR SURFACES. IT SHOULD NOT MAKE CONTACT TO THE INSIDE TOP SURFACE ONLY.

ANGLE BETWEEN PLANE OF THE RIM OF CAP AND PLANE TANGENT TO ORIGINAL CONTOUR OF BULB AT CENTER OF CAP WILL NOT BE MORE THAN 10°.

92CM-665IR2

MAY 3, 1954

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No.GA3-1) having thickness of 1/4" and three holes with diameters of 0.1030" - 0.1035" so located on a 0.3440" ± 0.0005" diameter circle that the distance along the chord between two adjacent hole centers is 0.2340" ± 0.0005" and the distance along the chord between the remaining pin and the two adjacent pins is 0.3175" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 2 pounds will not be lifted when pins are withdrawn.

* Add 0.020" for solder on finished tube.
BASES

3-TERMINAL TYPES

LARGE TERMINAL CONNECTED TO SHELL

2 SMALL TERMINALS INSULATED FROM SHELL

.015" MAX

.007" .500" MAX

.437" ± .007"

11/16" MIN.

11/16" MIN.

3/8" MIN.

7/8" MAX.

JETEC No. A3-80
RCA No. 3232

* Add 1/8" for solder on finished tube.

NOV. 5, 1954

BASES 1
Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No.AA4-11) having thickness of 1/4" and four holes, two with diameters of 0.1650" ± 0.0005" and two with diameters of 0.1340" ± 0.0005" so located on a 0.6400" ± 0.0005" diameter circle that the distance between the adjacent 0.1650" diameter pins is 0.468" ± 0.0005" and the distance between the adjacent 0.1340" diameter pins is 0.437" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 4 pounds will not be lifted when pins are withdrawn.

**DWARF-SHELL SMALL 4-PIN**

- 1.436"H
- 1.037"- 1.072"

**SMALL-SHELL SMALL 4-PIN**

- 1.436"H
- 1.136"- 1.175"

JETEC No.A4-26  
RCA No.4107

JETEC No.A4-5  
RCA No.4108

* Add 0.030" for solder on finished tube.
MEDIUM-SHELL SMALL 4-PIN

JETEC No. A4-9
RCA No. 4106

MEDIUM-SHELL SMALL 4-PIN WITH BAYONET

JETEC No. A4-10
RCA No. 4102

For other dimensions, see first page of the "Small 4-Pin" series.

* Add 0.030" for solder on finished tube.
MEDIUM-METAL-SHELL
JUMBO 4-PIN
WITH BAYONET

Other dimensions are same as Base JETEC No.A4-29 above.

* Add 0.060" for solder on finished tube.
SUPER-JUMBO 4-PIN
PIN DIMENSIONS AND ORIENTATION

Base-pin positions are held to tolerances such that pin centers may deviate a maximum distance of 0.010" from their true geometric position.

SMALL-SHELL SUPER-JUMBO 4-PIN
MEDIUM-SHELL SUPER-JUMBO 4-PIN

* Add 0.060" for solder on finished tube.

JAN. 3, 1955
LARGE-SHELL
SUPER-JUMBO 4-PIN
WITH BAYONET

2.187" - 2.219"
1.453"
2.181" B
1.000"
.500"
.313" R
.500"
.750"
.562"
.500"
.94" WIDE

JETEC No. 84-133
RCA No. 3982

For other dimensions, see first page of the "Super-Jumbo" series.

* Add 0.060" for solder on finished tube.
LARGE-METAL-SHELL
SUPER-JUMBO 4-PIN
WITH BAYONET

For other dimensions, see first page
of the "Super-Jumbo" series.

* Add 0.060" for solder on finished tube.

JAN. 3, 1955
JUMBO 4-PIN

4 PINS
.187" ± .003"
DIA.

.109" MAX.
.082" MAX.
1.165"

1.395" NOM.

.275"

1.867" MAX.

.971"

No. 1839

* On finished tube, add .060" for solder.

Dec. 1, 1942

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.
SUPER-JUMBO 4-PIN

4 PINS
.186" 1.003" DIA.

* On finished tube, add .030" for solder.

Dec. 1, 1942
“SMALL 5-PIN”
PIN DIMENSIONS AND ORIENTATION

Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No.GA5-I) having thickness of 1/4" and five holes with diameters of 0.1360" ± 0.0005" so located on a 0.7500" ± 0.0005" diameter circle that the distance between centers of the four adjacent holes is 0.3750" ± 0.0005" and the distance between the center of the remaining hole and its adjacent hole centers is 0.5300" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 4 pounds will not be lifted when pins are withdrawn.

SMALL-SHELL
SMALL 5-PIN

MEDIUM-SHELL
SMALL 5-PIN

* Add 0.030" for solder on finished tube.
MEDIUM-SHELL GIANT 5-PIN WITH BAYONET

SPECIAL METAL-SHELL GIANT 5-PIN

See Tube Types 4-125A/4D21 and 4-250A/5D22

SPECIAL METAL-SHELL SUPER-GIANT 5-PIN

See Tube Type 4-1000A

* Add 0.030" for solder on finished tube.

MAR. 1, 1955

BASES 5

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
SMALL-SHELL DUODECAL 5-PIN

For details of this base, see corresponding DUODECAL 12-PIN type

DWARF-SHELL OCTAL 5-PIN
SMALL-SHELL OCTAL 5-PIN
SMALL-WAFER OCTAL 5-PIN
SMALL-WAFER OCTAL 5-PIN WITH SLEEVE
INTERMEDIATE-SHELL OCTAL 5-PIN
SHORT INTERMEDIATE-SHELL OCTAL 5-PIN
SHORT INTERMEDIATE-SHELL OCTAL 5-PIN WITH EXTERNAL BARRIERS
MEDIUM-SHELL OCTAL 5-PIN
SHORT JUMBO-SHELL OCTAL 5-PIN

For details of above bases, see corresponding OCTAL 8-PIN type

SMALL RADIAL 5-PIN

See OUTLINES—Glass Types

MEDIUM-MOLDED-FLARE
SEPTAR 5-PIN

See Tube Type 4-65A
"SMALL 6-PIN"
PIN DIMENSIONS AND ORIENTATION

Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No.A6-1) having thickness of 1/4" and six holes, two adjacent with diameters of 0.1650" ± 0.0005" and four with diameters of 0.1360" ± 0.0005" so located on a 0.7500" ± 0.0005" diameter circle that the distance between any two adjacent hole centers is 0.3750" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 4 pounds will not be lifted when pins are withdrawn.

SMALL-SHELL SMALL 6-PIN

MEDIUM-SHELL SMALL 6-PIN

* Add 0.030" for solder on finished tube.

MAR. 1, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
LONG MEDIUM-SHELL SMALL 6-PIN

For other dimensions, see first page of the "Small 6-Pin" series.

SMALL-SHELL DUODECAL 6-PIN
For details of this base, see corresponding DUODECAL 12-PIN type

SMALL-SHELL OCTAL 6-PIN
INTERMEDIATE-SHELL OCTAL 6-PIN
SHORT INTERMEDIATE-SHELL OCTAL 6-PIN
SHORT INTERMEDIATE-SHELL OCTAL 6-PIN WITH EXTERNAL BARRIERS
MEDIUM-SHELL OCTAL 6-PIN
SHORT JUMBO-SHELL OCTAL 6-PIN
SMALL-WAFER OCTAL 6-PIN
SMALL-WAFER OCTAL 6-PIN WITH SLEEVE

For details of above bases, see corresponding OCTAL-8 PIN type

* Add 0.030" for solder on finished tube.

MAR. 1, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
SPACE FOR CONNECTOR BETWEEN WING NUT AND LOCK NUT IS \( \frac{3}{16} \) INCH MAX.

JETEC No. FO-6
RCA No. 6628
Base-pin positions are held to tolerances such that entire length of pins will without undue force pass into and disengage from flat-plate gauge (part of gauge JETEC No. GE7-1) having thickness of 1/4" and eight holes with diameters of 0.0520" ± 0.0005" so located on a 0.3750" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.1434" ± 0.0005".

The design of the socket should be such that circuit wiring can not impress lateral strains through the socket contacts on the base pins. The point of bearing of the contacts on the base pins should not be closer than 1/8" from the bottom of the seated tube.

* This dimension around the periphery of any individual pin may vary within the limits shown.
"SMALL 7-PIN"
PIN DIMENSIONS AND ORIENTATION

Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No.GA7-11) having thickness of 1/4" and seven holes, two adjacent with diameters of 0.1650" ± 0.0005" and five with diameters of 0.1360" ± 0.0005" so located on a 0.7500" ± 0.0005" diameter circle that the distance between centers of the adjacent 0.1650" diameter holes is 0.3288" ± 0.0005" and the distance between centers of the adjacent 0.1360" diameter holes is 0.3229" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 4 pounds will not be lifted when pins are withdrawn.

SMALL-SHELL
SMALL 7-PIN

* Add 0.030" for solder on finished tube.
"MEDIUM 7-PIN"
PIN DIMENSIONS AND ORIENTATION

Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No.GA7-2) having thickness of 1/4" and seven holes, two adjacent with diameters of 0.1650" ± 0.0005" and five with diameters of 0.1360" ± 0.0005" so located on a 0.8550" ± 0.0005" diameter circle that the distance between centers of the adjacent 0.1650" diameter holes is 0.3748" ± 0.0005" and the distance between centers of the adjacent 0.1360" diameter holes is 0.3681" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 4 pounds will not be lifted when pins are withdrawn.

MEDIUM-SHELL MEDIUM 7-PIN

MEDIUM-SHELL MEDIUM 7-PIN WITH BAYONET

* Add 0.030" for solder on finished tube.
MEDIUM-METAL-SHELL
GIANT 7-PIN
WITH BAYONET

VENTILATED MEDIUM-METAL-SHELL
GIANT 7-PIN
See Tube Type 4E27A/5-125B

* Add 0.060" for solder on finished tube.
"SEPTAR 7-PIN"

PIN DIMENSIONS AND ORIENTATION

Septar Base Pin Contour

Base-pin positions are held to tolerances such that entire length of pins will without undue force pass into and disengage from flat-plate gauge having thickness of 3/8" and seven holes, one with diameter of 0.1450 ± 0.0005" and six with diameters of 0.0800 ± 0.0005" located on a 1.0000 ± 0.0005" diameter circle at specified angles with a tolerance of ±5' for each angle. Gauge is also provided with a hole 0.500" ± 0.010" concentric with pin circle.

It is essential that the socket shall be constructed with floating-contact clips.
SMALL-BUTTON SEPTAR 7-PIN

1 9/16" MAX. DIA.

JETEC No.E7-26
RCA No.FSB710

SMALL-WAFER SEPTAR 7-PIN

1 5/16" MAX. DIA.

JETEC No.E7-21
RCA No.FSB712

MEDIUM MOLDED-FLARE SEPTAR 7-PIN

2 3/8" MAX. DIA.

JETEC No.E7-2
RCA No.FSB603

For other dimensions of above bases, see first page of the "Septar 7-Pin" series.

MAY 1, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
SMALL-SHELL DUODECAL 7-PIN
For details of this base, see corresponding DUODECAL 12-PIN type

SMALL-SHELL OCTAL 7-PIN
INTERMEDIATE-SHELL OCTAL 7-PIN
SHORT INTERMEDIATE-SHELL OCTAL 7-PIN
WITH EXTERNAL BARRIERS
MEDIUM-SHELL OCTAL 7-PIN
SHORT JUMBO-SHELL OCTAL 7-PIN
SMALL-WAFER OCTAL 7-PIN
SMALL-WAFER OCTAL 7-PIN
WITH SLEEVE
For details of above bases, see corresponding OCTAL 8-PIN type

SMALL RADIAL 7-PIN
See OUTLINES—Glass Tubes
Base-pin positions are held to tolerances such that entire length of pins will without undue force pass into and disengage from flat-plate gauge (part of gauge JETEC No. GE8-1) having thickness of 13/64" and nine holes with diameters of 0.0240" ± 0.0005" so located on a 0.2350" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.0804" ± 0.0005".

The design of the socket should be such that the point of bearing of the contacts on the base pins should not be closer that 0.050" from the bottom of the seated tube.

* The specified pin diameter applies only in the zone between 0.050" from the base seat and the end of the pin.
Base-pin positions are held to tolerances such that entire length of pins will without undue force pass into and disengage from flat-plate gauge having thickness of 1/4" and nine holes with diameters of 0.0700" ± 0.0005" so located on a 0.6000" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.2052" ± 0.0005". Gauge is also provided with a hole having diameter of 0.300" ± 0.001" concentric with the pin circle.
Base-pin positions are held to tolerances such that entire length of pins will pass into and disengage from gauge JETEC No. GD8-1. This gauge contains a flat-plate section having thickness of 1/4" and eight slots located and dimensioned as shown on the following diagram. Flat-plate section is also provided with a hole having diameter of 0.272" ± 0.002" concentric with slot circle, and with a keyway as shown on the diagram.
**“OCTAL”**

**PIN DIMENSIONS AND ORIENTATION AND INDEX GUIDE**

<table>
<thead>
<tr>
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<th>Center</th>
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<td>.500&quot;</td>
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Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No.GB8-1) having thickness of 1/4" and eight holes with diameters of 0.1030" ± 0.0005" so located on a 0.6870" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.2629" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 2 pounds will not be lifted when pins are withdrawn.

* Add 0.030" for solder on finished tube.
### Dwarf-Shell Octal

<table>
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<tr>
<th>No. of Pins</th>
<th>Pins</th>
<th>JETEC No.</th>
<th>RCA No.</th>
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### Small-Shell Octal

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For other dimensions of above bases, see first page of the "Octal" series.
### SHORT INTERMEDIATE-SHELL OCTAL

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### SHORT INTERMEDIATE-SHELL OCTAL WITH EXTERNAL BARRIERS

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For other dimensions of above bases, see first page of the "Octal" series.
### INTERMEDIATE-SHELL OCTAL

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For other dimensions, see first page of the "Octal" series.
### Short Medium-SHELL Octal with External Barriers

#### Style A
![Diagram of Style A](image)

#### Style B
![Diagram of Style B](image)

<table>
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*For other dimensions, see first page of the "Octal" series*
MEDIUM-SHELL OCTAL

No. of Pins | JETEC No. | RCA No.
--- | --- | ---
8-Pin | 1, 2, 3, 4, 5, 6, 7, 8 | B8-11 | 8533
7-Pin | 1, 2, 3, 4, 5, 7, 8 | B7-12 | 7533
6-Pin | 1, 2, 3, 5, 7, 8 | B6-13 | 6533
5-Pin | 1, 2, 4, 6, 8 | B5-15 | 5533

LONG MEDIUM-SHELL OCTAL

No. of Pins | JETEC No. | RCA No.
--- | --- | ---
8-Pin | 1, 2, 3, 4, 5, 6, 7, 8 | B8-65 | 8545
5-Pin | 2, 3, 5, 7, 8 | B5-80 | 5545

For other dimensions of above bases, see first page of the "Octal" series.
SHORT JUMBO-SHELL OCTAL
WITH EXTERNAL BARRIERS

No. of
Pins
8-Pin
7-Pin
6-Pin
5-Pin

Pins
1, 2, 3, 4, 5, 6, 7, 8
1, 2, 3, 4, 5, 7, 8
1, 2, 3, 5, 7, 8
1, 2, 4, 6, 8

JETEC No.
B8-71
B7-72
B6-73
B5-74

RCA No.
8556
7556
6556
5556

For other dimensions, see first page of the "Octal" series
### SMALL-WAFER OCTAL

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### SMALL-WAFER OCTAL WITH SHORT SLEEVE

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For other dimensions of above bases, see first page of the "Octal" series

---

JULY 1, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
### Small-Wafer Octal with Sleeve

**No. of Pins** | **Pins** | **JETEC No.** | **RCA No.**
---|---|---|---
8-Pin | 1, 2, 3, 4, 5, 6, 7, 8 | B8-26 | -
7-Pin | 1, 2, 3, 4, 5, 7, 8 | B7-27 | -
6-Pin | 1, 2, 3, 5, 7, 8 | B6-28 | -
5-Pin | 1, 2, 4, 6, 8 | B5-30 | -

*For other dimensions, see first page of the "Octal" series*
### LARGE-WAFER OCTAL

![Diagram of Large-Wafer Octal Base](image)

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### LARGE-WAFER OCTAL WITH SLEEVE

![Diagram of Large-Wafer Octal with Sleeve](image)

<table>
<thead>
<tr>
<th>No. of Pins</th>
<th>Pines</th>
<th>JETEC No.</th>
<th>RCA No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-Pin</td>
<td>1,2,3,4,5,6,7,8</td>
<td>88-86</td>
<td>-</td>
</tr>
</tbody>
</table>

*For other dimensions of above bases, see first page of the "Octal" series*
LARGE-WAFER OCTAL
WITH FLARED SLEEVE

SLEEVE
RCA No.
T253

4 SLOTS SPACED
90° APART

No. of Pins
8-Pin

JETEC No.
1, 2, 3, 4, 5, 6, 7, 8

RCA No.

For other dimensions, see first page
of the "Octal" series
LARGE-WAFER OCTAL WITH EXTERNAL BARRIERS

<table>
<thead>
<tr>
<th>No. of Pins</th>
<th>Pins</th>
<th>JETEC No.</th>
<th>RCA No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-Pin</td>
<td>1, 2, 3, 4, 5, 6, 7, 8</td>
<td>88-94</td>
<td>8554</td>
</tr>
</tbody>
</table>

LARGE-WAFER OCTAL WITH EXTERNAL BARRIERS AND SLEEVE

<table>
<thead>
<tr>
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<th>Pins</th>
<th>JETEC No.</th>
<th>RCA No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-Pin</td>
<td>1, 2, 3, 4, 5, 6, 7, 8</td>
<td>88-98</td>
<td>-</td>
</tr>
</tbody>
</table>

For other dimensions of above bases, see first page of the "Octal" series.
BASES
9-PIN TYPES

SMALL-BUTTON NOVAL 9-PIN

Base-pin positions are held to tolerances such that entire length of pins will without undue force pass into and disengage from gauge JETEC No.E9-1. This gauge contains a flat-plate section having thickness of 1/4" and ten holes with diameters of 0.0520" ± 0.0005" so located on a 0.4680" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.1446" ± 0.0005".

The design of the socket should be such that circuit wiring cannot impress lateral strains through the socket contacts on the base pins. The point of bearing of the contacts on the base pins should not be closer than 1/8" from the bottom of the seated tube.

* This dimension around the periphery of any individual pin may vary within the limits shown.
Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge having thickness of 1/4" and eleven holes with diameters of 0.1030" ± 0.0005" so located on a 0.7500" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.2113" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 3 pounds will not be lifted when pins are withdrawn.

* Add 0.030" for solder on finished tube.
"SUBMAGNAL"
PIN DIMENSIONS AND ORIENTATION
AND INDEX GUIDE

<table>
<thead>
<tr>
<th>Min.</th>
<th>Center</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.550&quot;</td>
<td>.560&quot;</td>
</tr>
<tr>
<td>B</td>
<td>.490&quot;</td>
<td>.500&quot;</td>
</tr>
<tr>
<td>C</td>
<td>.300&quot;</td>
<td>.308&quot;</td>
</tr>
<tr>
<td>D</td>
<td>.427&quot;</td>
<td>.437&quot;</td>
</tr>
<tr>
<td>E</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>F</td>
<td>.085&quot;</td>
<td>.090&quot;</td>
</tr>
<tr>
<td>G</td>
<td>.352&quot;</td>
<td>.362&quot;</td>
</tr>
<tr>
<td>H</td>
<td>-</td>
<td>.750&quot;</td>
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<tr>
<td>J</td>
<td>.090&quot;</td>
<td>.093&quot;</td>
</tr>
<tr>
<td>K</td>
<td>16-4/11°</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Min.</th>
<th>Center</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>-</td>
<td>32-8/11°</td>
</tr>
<tr>
<td>M</td>
<td>.305&quot;</td>
<td>.312&quot;</td>
</tr>
<tr>
<td>N</td>
<td>.075&quot;</td>
<td>.080&quot;</td>
</tr>
<tr>
<td>P</td>
<td>.343&quot;</td>
<td>.353&quot;</td>
</tr>
<tr>
<td>Q</td>
<td>.040&quot;</td>
<td>.047&quot;</td>
</tr>
<tr>
<td>R1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>R2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>R3</td>
<td>-</td>
<td>.040&quot;</td>
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<tr>
<td>T</td>
<td>.340&quot;</td>
<td>-</td>
</tr>
<tr>
<td>U</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No.GBI1-2) having thickness of 1/4" and eleven holes with diameters of 0.1030" ± 0.0005" so located on a 0.7500" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.2113" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 3 pounds will not be lifted when pins are withdrawn.

* Add 0.030" for solder on finished tube.

JULY 1, 1955

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
### SMALL-SHELL SUBMAGNAL

<table>
<thead>
<tr>
<th>No. of Pins</th>
<th>Pins</th>
<th>JETEC No.</th>
<th>RCA No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-Pin</td>
<td>1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11</td>
<td>811-88</td>
<td>11344</td>
</tr>
</tbody>
</table>

For other dimensions, see first page of the "Submagnal" series.
**"MAGNAL"**

**PIN DIMENSIONS AND ORIENTATION AND INDEX GUIDE**

---

![Diagram of a base-pin arrangement](image)

<table>
<thead>
<tr>
<th>Min.</th>
<th>Center</th>
<th>Max.</th>
<th>Min.</th>
<th>Center</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.550&quot;</td>
<td>.560&quot;</td>
<td>L</td>
<td>-</td>
<td>32-8/11°</td>
</tr>
<tr>
<td>B</td>
<td>.490&quot;</td>
<td>.500&quot;</td>
<td>M</td>
<td>.305&quot;</td>
<td>.312&quot;</td>
</tr>
<tr>
<td>C</td>
<td>.300&quot;</td>
<td>.308&quot;</td>
<td>N</td>
<td>.075&quot;</td>
<td>.080&quot;</td>
</tr>
<tr>
<td>D</td>
<td>.427&quot;</td>
<td>.437&quot;</td>
<td>P</td>
<td>.343&quot;</td>
<td>.353&quot;</td>
</tr>
<tr>
<td>E</td>
<td>-</td>
<td>.050&quot;</td>
<td>Q</td>
<td>.040&quot;</td>
<td>.047&quot;</td>
</tr>
<tr>
<td>F</td>
<td>.085&quot;</td>
<td>.090&quot;</td>
<td>R</td>
<td>-</td>
<td>.031&quot;</td>
</tr>
<tr>
<td>G</td>
<td>.352&quot;</td>
<td>.362&quot;</td>
<td>R1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>H</td>
<td>1.063&quot;</td>
<td>-</td>
<td>R2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>J</td>
<td>.090&quot;</td>
<td>.093&quot;</td>
<td>R3</td>
<td>-</td>
<td>.040&quot;</td>
</tr>
<tr>
<td>K</td>
<td>16-4/11°</td>
<td>-</td>
<td>T</td>
<td>.340&quot;</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>-</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No. GB11-1) having thickness of 1/4" and eleven holes with diameters of 0.1030" ± 0.0005" so located on a 1.0630" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.2995" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 3 pounds will not be lifted when pins are withdrawn.

* Add 0.030" for solder on finished tube.
SMALL-SHELL MAGNAL

No. of Pins: 11-Pin

<table>
<thead>
<tr>
<th>Pins</th>
<th>JETEC No.</th>
<th>RCA No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11</td>
<td>B11-33</td>
<td>11247</td>
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</tbody>
</table>

MEDIUM-SHELL MAGNAL

No. of Pins: 11-Pin

<table>
<thead>
<tr>
<th>Pins</th>
<th>JETEC No.</th>
<th>RCA No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11</td>
<td>B11-66</td>
<td>11248</td>
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</table>

For other dimensions of above bases, see first page of the "Magnal" series.
**DWARF-SHELL DUODECAL**

Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No. GB12-1) having thickness of 1/4" and twelve holes with diameters of 0.1030" ± 0.0005" so located on a 1.0630" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.2751" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 3 pounds will not be lifted when pins are withdrawn.

*Add 0.030" for solder on finished tube.*

**Table:**

<table>
<thead>
<tr>
<th>No. of Pins</th>
<th>JETEC No.</th>
<th>RCA No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-Pin</td>
<td>B12-157</td>
<td>-</td>
</tr>
<tr>
<td>6-Pin</td>
<td>B6-158</td>
<td>6353</td>
</tr>
</tbody>
</table>

---

**Figure:**

- Diagram showing dimensions and pin arrangements for the 12-Pin and 6-Pin Dwarf-SHELL Duodecal bases.
- Dimensions include max/min values for various pin lengths and spacing.
- Pin fit in gauge details with tolerances provided.
12-PIN TYPES

SMALL-SHELL DUODECAL

No. of Pins | Pins | JETEC No. | RCA No.
---|---|---|---
12-Pin | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 | B12-43 | 12253
10-Pin | 1, 2, 3, 4, 6, 7, 8, 9, 10 | B10-75 | 10253
7-Pin | 1, 2, 6, 7, 10, 11, 12 | B7-51 | 7253
6-Pin | 1, 2, 6, 10, 11, 12 | B6-63 | 6253
5-Pin | 1, 2, 10, 11, 12 | B5-57 | 5253

Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No. GB12-1) having thickness of 1/4" and twelve holes with diameters of 0.1030" ± 0.0005" so located on a 1.0630" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.2751" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 3 pounds will not be lifted when pins are withdrawn.

* Add 0.030" for solder on finished tube.

JULY 1, 1955

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
SMALL-SHELL NEO DIHEPTAL

Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No.GBI4-2) having thickness of 1/4" and fourteen holes with diameters of 0.1030" ± 0.0005" so located on a 1.5500" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.3449" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 3 pounds will not be lifted when pins are withdrawn.

Add 0.030" for solder on finished tube.

JULY 1, 1955
BASES 21
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
"DIHEPTAL"
PIN DIMENSIONS AND ORIENTATION
AND INDEX GUIDE

Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No. G814-1) having thickness of 1/4" and fourteen holes with diameters of 0.1030" ± 0.0005" so located on a 1.750" ± 0.0005" diameter circle that the distance along the chord between any two hole centers is 0.3895" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 3 pounds will not be lifted when pins are withdrawn.

* Add 0.030" for solder on finished tube.
SMALL-SHELL DIHEPTAL

No. of Pins
14-Pin: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
12-Pin: 1, 2, 3, 4, 5, 6, 7, 9, 11, 12, 13, 14

JETEC No.: B14-45, B12-105
RCA No.: 14151, 12151

MEDIUM-SHELL DIHEPTAL

No. of Pins
14-Pin: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
12-Pin: 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 14

JETEC No.: B14-38, B12-37
RCA No.: 14146, 12146

For other dimensions of above bases, see first page of the "Diheptal" series.

JULY 1, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No.GB20-1) having thickness of 1/4" and twenty holes with diameters of 0.1030" ± 0.0005" so located on a 1.7500" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.2758" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 3 pounds will not be lifted when pins are withdrawn.
# Small-Button Twentynininar

**Dimensions:**
- **2.562" MAX.**
- **1.100" MAX.**
- **.640" MAX.**
- **.406" MIN. MAX.**
- **.125" MIN. FLAT**
- **2.047" MAX.**

**Twentyninar Base Pin Contour**

- **.156" MAX.**
- **.18"**
- **36°**
- **.875" L 8.75°**
- **.050" DIA. PIN**
- **.045" MAX. FLAT**
- **NOT BROUGHT TO A SHARP POINT**

<table>
<thead>
<tr>
<th>No. of Pins</th>
<th>Pins</th>
<th>JETEC No.</th>
<th>RCA No.</th>
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<tbody>
<tr>
<td>29-Pin</td>
<td>1 through 29</td>
<td>E29-17</td>
<td>-</td>
</tr>
<tr>
<td>22-Pin</td>
<td>1 through 19, 21, 25, 28</td>
<td>E22-16</td>
<td>FSB693</td>
</tr>
<tr>
<td>8-Pin</td>
<td>2, 6, 10, 14, 18, 21, 25, 28</td>
<td>E8-19</td>
<td>FSB693A</td>
</tr>
</tbody>
</table>
SMALL-BUTTON TWENTYNINAR (CONT'D)

Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge having thickness of 3/8" and twenty-nine holes with diameters of 0.0700" ± 0.0005", nineteen of which are located with hole centers corresponding to the specified location of pin centers on a 1.8750" ± 0.0005" diameter circle, and ten of which are located with hole centers corresponding to the specified location of pin centers on a 0.8750" ± 0.0005" diameter circle concentric with the 1.8750" circle.

Pin fit in gauge is such that entire length of pins will, without undue force, enter into and disengage from the gauge.
"THIRTYFIVAR"
PIN DIMENSIONS AND ORIENTATION

Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge having thickness of 3/8" and thirty-six holes with diameters of 0.0700" ± 0.0005", twenty-two of which are located with hole centers corresponding to the specified location of
pin centers on a 2.1250" ± 0.0005" diameter circle, and fourteen of which are located with hole centers corresponding to the specified location of pin centers on a 1.3750" ± 0.0005" diameter circle concentric with the 2.1250" circle.

Pin fit in gauge is such that entire length of pins will, without undue force, enter into and disengage from the gauge. Gauge is also provided with a hole 1.000" diameter minimum concentric with pin circles.

**SMALL-BUTTON THIRTYFIVAR**

<table>
<thead>
<tr>
<th>No. of Pins</th>
<th>Pins</th>
<th>JETEC No.</th>
<th>RCA No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>35-Pin</td>
<td>1 through 35</td>
<td>E35-28</td>
<td>-</td>
</tr>
<tr>
<td>33-Pin</td>
<td>Omit pins 24 and 30</td>
<td>E33-29</td>
<td>-</td>
</tr>
<tr>
<td>31-Pin</td>
<td>Omit pins 24 and 30; pins 23 and 31 are trimmed to same dimension as index pin</td>
<td>E31-36</td>
<td>-</td>
</tr>
</tbody>
</table>

For other dimensions of above base, see first page of the "Thirtyfivar" series.
Amplification Factor ($\mu$) is a special case of mu-factor. It is the ratio of the change in plate voltage to a change in control-electrode voltage under the conditions that the plate current remains unchanged and that all other electrode voltages are maintained constant. It is a measure of the effectiveness of the control-electrode voltage relative to that of the plate voltage upon the plate current. The sense is usually taken as positive when the voltages are changed in opposite directions. As most precisely used, the term amplification factor refers to infinitesimal changes.

Class A Amplifier: An amplifier in which the grid bias and the alternating grid voltages are such that plate current in a specific tube flows at all times.

The ideal class A amplifier is one in which the alternating component of the plate current is an exact reproduction of the form of the alternating grid voltage, and the plate current flows during the 360 electrical degrees of the cycle. The characteristics of a class A amplifier are low efficiency and output.

Class AB Amplifier: An amplifier in which the grid bias and alternating grid voltages are such that plate current in a specific tube flows for appreciably more than half but less than the entire electrical cycle.

The characteristics of a class AB amplifier are efficiency and output intermediate to those of a class A and a class B amplifier. The idle plate current and attendant dissipation may be made substantially less than is possible with class A amplifiers. This amplifier has been called class A prime.

Definitions taken from the 1933 Report of the Standards Committee of the I.R.E. are followed by the definition number in the report.

To denote that grid current does not flow during any part of the input cycle, the suffix 1 may be added to the letter or letters of the class identification. The suffix 2 may be used to denote that grid current flows during some part of the cycle.
DEFINITIONS
(continued from preceding page)

Class B Amplifier:* An amplifier in which the grid bias is approximately equal to the cutoff value so that the plate current is approximately zero when no exciting grid voltage is applied and so that plate current in a specific tube flows for approximately one half of each cycle when an alternating grid voltage is applied.

The ideal class B amplifier is one in which the alternating component of plate current is an exact replica of the alternating grid voltage for the half cycle when the grid is positive with respect to the bias voltage, and the plate current flows during 180 electrical degrees of the cycle. The characteristics of a class B amplifier are medium efficiency and output.

Class C Amplifier:* An amplifier in which the grid bias is appreciably greater than the cutoff value so that the plate current in each tube is zero when no alternating grid voltage is applied, and so that plate current in a specific tube flows for appreciably less than one half of each cycle when an alternating grid voltage is applied.

Class C amplifiers find application where high plate-circuit efficiency is a paramount requirement and where departure from linearity between input and output is permissible. The characteristics of a class C amplifier are high plate-circuit efficiency and high power output.

Control-Grid—Plate Transconductance \( (g_m) \) is the name for the plate-current-to-control-grid-voltage transconductance. This is ordinarily the most important transconductance and is commonly understood when the term “transconductance” is used.

Formerly it was known as mutual conductance. See definition of Transconductance.

Conversion Transconductance \( (g_c) \) is the quotient

* See preceding page.
DEFINITIONS
(continued from preceding page)

of the magnitude of a single beat-frequency component \((f_1 + f_2)\) or \((f_1 - f_2)\) of the output-electrode current by the magnitude of the control-electrode voltage of frequency \(f_1\), under the conditions that all direct electrode voltages and the magnitude of the electrode alternating voltage \(f_2\) remain constant and that no impedances at the frequencies \(f_1\) or \(f_2\) are present in the output circuit. As most precisely used, the term refers to infinitesimal changes. 1E60

When the performance of a frequency converter is determined, conversion transconductance is used in the same way as transconductance is used in single-frequency amplifier computations.

Deflection Factor of a cathode-ray oscillograph tube is the reciprocal of the deflection sensitivity. 3E11

Deflection Sensitivity of a cathode-ray oscillograph tube is the quotient of the displacement of the electron beam at the place of impact by the change in the deflecting field. It is usually expressed in millimeters per volt applied between the deflecting electrodes or in millimeters per gauss of the deflecting magnetic field. 3E10

Direct Capacitance between two electrodes in a multielectrode tube is the ratio of the charge placed on either electrode to its resulting change in potential above the other electrode when all remaining \((n-2)\) electrodes are at the potential of the first electrode, the charge placed on the second electrode being equal to the sum of the charges placed on all the other electrodes.

Electrode Current is the current passing to or from an electrode through the vacuous space. 1E39

The terms grid current, anode current, plate current, etc., are used to designate currents passing to or from these specific electrodes.

Electrode Dissipation is the power dissipated in the
form of heat by an electrode as a result of electron
and/or ion bombardment.  1E46

Electrode Voltage is the voltage between an elec-
trode and a specified point of the cathode.  1E40

The terms grid voltage, anode voltage, plate voltage,
etc., are used to designate the voltage between these
specific electrodes and the cathode.

Gas Amplification Factor of a phototube is the fac-
tor of increase in the sensitivity of a gas phototube
due solely to the ionization of the contained gas.
For a gas phototube having a structure such as to
permit saturation to occur at a voltage (approxima-
tely 25 volts) less than that causing appreciable
ionization, the gas amplification factor at a specified
operating voltage is the ratio of the sensitivity mea-
sured at that voltage to the sensitivity measured at
the saturation voltage.  4E5

Grid Driving Power is the average product of the
instantaneous value of the grid current and of the
alternating component of the grid voltage over a
complete cycle. This comprises the power supplied
to the biasing device and to the grid.  1E42

Input Capacitance of a vacuum tube is the sum of
the direct capacitances between the control grid and
the cathode and such other electrodes as are oper-
ated at the alternating potential of the cathode.
This is not the effective input capacitance, which is
a function of the impedances of the associated
circuits.  1E67

Modulation Factor in an amplitude-modulated wave
is the ratio of half the difference between the maxi-
mum and minimum amplitudes to the average
amplitude.

In linear modulation the average amplitude of the
envelope is equal to the amplitude of the unmodu-
lated wave, provided there is no zero-frequency com-
ponent in the modulating signal wave (as in telephony). For modulating signal waves having unequal positive and negative peaks, positive and negative modulation factors may be defined as the ratios of the maximum departures (positive and negative) of the envelope from its average value to its average value. (See Percentage Modulation.)

1T-39

**Mu-Factor** (µ-factor) is the ratio of the change in one electrode voltage to the change in another electrode voltage, under the conditions that a specified current remains unchanged and that all other electrode voltages are maintained constant. It is a measure of the relative effect of the voltages on two electrodes upon the current in the circuit of any specified electrode. As most precisely used, the term µ-factor refers to infinitesimal changes. 1E61

**Output Capacitance** of a vacuum tube is the sum of the direct capacitances between the output electrode (usually the plate) and the cathode and such other electrodes as are operated at the alternating potential of the cathode. This is not the effective output capacitance, which is a function of the impedances of the associated circuits. 1E68

**Peak Forward Plate Voltage** is the maximum instantaneous plate voltage in the direction in which the tube is designed to pass current. 1E43

**Peak Inverse Plate Voltage** is the maximum instantaneous plate voltage in the direction opposite to that in which the tube is designed to pass current. 1E44

**Peak Plate Current** is the maximum instantaneous plate current passing recurrently through the tube in the direction of normal current flow.

**Percentage Modulation** is the modulation factor expressed in per cent. 1T-40

**Plate Resistance** is the quotient of the alternating
DEFINITIONS

(continued from preceding page)

plate voltage by the in-phase component of the alternating plate current, all other electrode voltages being maintained constant. This is the effective parallel resistance and is not the real component of the electrode impedance. As most precisely used, the term refers to infinitesimal amplitudes.

Sensitivity of a phototube is basically defined as the quotient of the current through the tube by the radiant flux received by the cathode. The term "radiant flux" includes both visible radiation (light) and invisible infra-red and ultra-violet radiation. When stated in accordance with this basic definition, sensitivity is usually given in terms of microamperes per microwatt of radiant flux.

For convenience, sensitivity is frequently stated in terms of visible radiation only, and is then known as Luminous Sensitivity. When so stated, it is usually expressed in terms of microamperes per lumen of light flux, and depends on the color of the light or the spectral distribution of the radiant flux used to excite the phototube.

2870 Tungsten Sensitivity is the luminous sensitivity when the incident luminous flux is produced by a tungsten-filament lamp at a color temperature of 2870 degrees Kelvin.

When a phototube is used under steady illumination, its luminous sensitivity is known as Static Luminous Sensitivity. This is defined as the direct anode current produced by the light flux divided by the incident light flux of constant value.

When the light input to a phototube varies, as at audio frequency in sound reproduction, the luminous sensitivity is identified as Dynamic Sensitivity, and may be conveniently defined as the quotient of the amplitude of variation in anode current to the amplitude of variation in light input.

In high-vacuum phototubes, the dynamic sensitivity
is ordinarily independent of frequency. In gas phototubes, the dynamic sensitivity falls off at the higher frequencies because there is a time lag between the current component produced by the secondary electrons resulting from excited atoms and positive ions arriving at the cathode. As the phase difference between these two components increases with increasing frequency of light variation, the net current variation decreases with consequent reduction in sensitivity. In the application of gas phototubes to audio frequencies, this effect is relatively unimportant but can be compensated for, if desired, in the design of the associated amplifier.

In the design of equipment utilizing phototubes, consideration should always be given to the effect of the time constant of the circuit consisting of the phototube and its associated load in reducing the performance capability of the phototube with increasing frequency.

Transconductance from one electrode to another is the quotient of the in-phase component of the alternating current of the second electrode by the alternating voltage of the first electrode, all other electrode voltages being maintained constant. As most precisely used, the term refers to infinitesimal amplitudes.

Tube Voltage Drop in a gas or vapor-filled tube is the plate voltage during the conducting period.
This section pertains to RCA tubes for signal-to-image, image-to-signal, and image-to-image applications. It includes data on cathode-ray tubes for oscillographic and picture-reproduction use, camera tubes for television pickup, and monoscopes for testing the performance of television equipment.

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

### OF CATHODE-RAY TUBE TYPES

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* Discontinued type. Data sheet has been retained in book for reference purpose only.

O, O, O: See next page.

APRIL 1, 1953

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TUBE DEPARTMENT

CATHODE-RAY TUBE

PRICES
This price list applies only in the United States of America and is subject to change without notice. All prices are exclusive of all Federal, State and local excise, sales, and similar taxes.

• Schedule D shows list prices for tube types priced for distribution through dealer and service channels.

• Schedule U shows list prices for tube types priced for distribution through other than dealer and service channels.

♦ Not recommended for new equipment design.

* For data see 9APA/1804-P4 and 12APM/1803-P4, respectively.

INFORMATION ON PURCHASING ABOVE TYPES

Information as to where RCA Cathode-Ray Tube Types can be purchased may be obtained from our regional office nearest you or from Tube Department, Radio Corporation of America, Harrison, N.J.
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.

## KINESCOPES

### Direct-Viewing

**Black & White**

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* Design-center values.

- **G** = Glass rectangular.
- **C** = Glass round.
- **E** = Electrostatic.
- **M** = Metal rectangular.
- **M** = Metal round.
- **M** = Magnetic.
## Classification Chart for Types in Cathode-Ray Tube Section

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<td>23-7/16 x 18-1/8</td>
<td>18000</td>
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### Color

| E | E | M | Yes | 11-1/2 x 8-5/8 | 18000 | 15AP22 |
| M | E | M | Yes | 19-1/16 x 15-1/4 | 25000 | 21AP22 |

### Monitor

| G | M | M | No | 6 Dia. | 10000 | 7QP4 |
| G | E | M | Yes| 6 Dia. | 12000 | 7TP4 |
| G | E | M | Yes| 9-1/8 Dia. | 14000 | 10SP4 |

- G = Glass rectangular.
- © = Glass round.
- E = Electrostatic.
- M = Magnetic.
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.

### KINESCOPES (Cont’d)

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<thead>
<tr>
<th>Envelope</th>
<th>Focusing Method</th>
<th>Deflection Method</th>
<th>Aluminized Screen</th>
<th>Minimum Screen Size Inches</th>
<th>Max. Ultron Voltsf</th>
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### CAMERA TUBES

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<tr>
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<th>Focusing Method</th>
<th>Deflection Method</th>
<th>Image Size Inches</th>
<th>TUBE TYPE</th>
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<td>Film Pickup</td>
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<td>Image Orthicons</td>
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<td>Vidicons</td>
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<td>Industrial</td>
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- Quality circle diameter of faceplate. When used with suitable reflective optical system, the 5AZP4 provides an 8" x 6" picture.
- 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 A except projection-throw distance is 80'.
- Design-center values except as noted. † Absolute value.
- © Round glass. \[=\] Electrostatic. M = Magnetic.
<table>
<thead>
<tr>
<th>Approx. Bulb Dia. Inches</th>
<th>Max. Ulter Volts</th>
<th>Electrostatic Focus and Deflection</th>
<th>Post-Deflection Accelerator Types</th>
<th>Magnetic Focus and Deflection</th>
<th>Electrostatic Focus, Magnetic Deflection</th>
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<td>P4</td>
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* Design-center values.
* See sheet FEATURES OF FLUORESCENT SCREENS.
* Similar to 3RP1 except for flat faceplate.
* Maximum post-ulter volts.
* Similar to 12DP7-A except for Filterglass faceplate.
### CLASSIFICATION CHART
### FOR TYPES IN
### CATHODE-RAY TUBE SECTION

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

<table>
<thead>
<tr>
<th>TUBE TYPE</th>
<th>Approx. Bulb Dia. Inches</th>
<th>Phosphor</th>
<th>Maximum Ultron Volts*</th>
<th>Focusing Method</th>
<th>Deflection Method</th>
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<td>M</td>
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<td>Color</td>
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<td>Monoscope</td>
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<td>Resolution Chart</td>
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<td>M</td>
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</tbody>
</table>

* See sheet FEATURES OF FLUORESCENT SCREENS.

* Design-center values.

E = Electrostatic.

M = Magnetic.
FEATURES OF FLUORESCENT SCREENS

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

Phosphor P1 produces a brilliant spot having 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 P4 is a highly efficient screen having white fluorescence and medium persistence. Types having this phosphor are of particular interest for television picture tubes.

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

Phosphor P7 is a long-persistence, cascade (two-layer) screen. During excitation by the electron beam, this phosphor produces a bluish fluorescence of short persistence. After excitation, the screen exhibits a greenish-yellow 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 bluish fluorescence and has sufficiently short persistence to permit its use in all moving film photographic applications without blurring except in those where film moves at a high speed. P11 screens, because of their unusually high brightness characteristic, may also be used for visual observation of phenomena.

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

Phosphor P14 is a medium-long-persistence cascade (two-layer) screen. During excitation by the electron beam, this phosphor exhibits purple fluorescence of short persistence. After excitation, it exhibits an 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.

Phosphor P15 produces a spot of very short persistence and having both blue-green and near-ultraviolet fluorescence. The persistence of the latter is even shorter than that of the blue-green fluorescence, a feature which makes this phosphor particularly suitable for the high-speed scanning requirements of a flying-spot signal generator.

NOV. 5, 1954
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
FLUOR. SCREEN
FEATURES
FEATUES OF FLUORESCENT SCREENS

**Phosphor P16** produces a spot of extremely short persistence and has both violet and near-ultra violet fluorescence and phosphorescence. This phosphor is particularly useful for the high-speed scanning requirements of a flying-spot signal generator because it features a stable exponential decay characteristic.

**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** has a spectral-energy emission characteristic with peak in the blue-green region and with sufficient range to provide useable energy over the visible spectrum required for generating color signals from color transparencies. The persistence of the phosphor is extremely short.
AVERAGE CHARACTERISTICS OF PHOSPHOR № 1

NOTE: THESE CURVES ARE GENERAL FOR CATHODE-RAY TYPES HAVING PHOSPHOR № 1. APPLICATION OF THESE CURVES, THEREFORE, DEPENDS ON THE MAXIMUM RATINGS OF SPECIFIC TYPES.

HIGH-VOLTAGE ELECTRODE (ANODE № 2) MICROAMP. PER SQ CM
NOTE: THESE CURVES ARE GENERAL FOR CATHODE-RAY TYPES HAVING PHOSPHOR NO. 1. APPLICATION OF THESE CURVES, THEREFORE, DEPENDS ON THE MAXIMUM RATINGS OF SPECIFIC TYPES.
SPECTRAL-ENERGY EMISSION CHARACTERISTIC
OF PHOSPHOR P1

DEC. 14, 1948
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-5372RI
PERSISTENCE CHARACTERISTIC
OF PHOSPHOR PI

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
HIGH-VOLTAGE ELECTRODE (ANODE N22) MICROAMPERES PER SQ CM

NOTE: THESE CURVES ARE GENERAL FOR CATHODE-RAY AVERAGE CHARACTERISTICS OF PHOSPHOR N4.

MAXIMUM RATINGS OF SPECIFIC TYPES.

OF THESE CURVES, THEREFORE, DEPENDS ON THE TYPES HAVING PHOSPHOR N4. APPLICATION
AVERAGE CHARACTERISTICS OF PHOSPHOR No. 4

NOTE: THESE CURVES ARE GENERAL FOR CATHODE-RAY TYPES HAVING PHOSPHOR No. 4. APPLICATION OF THESE CURVES, THEREFORE, DEPENDS ON THE MAXIMUM RATINGS OF SPECIFIC TYPES.
COLOR TEMPERATURE: 7000°K
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

WAVELENGTH-ANGSTROMS

RELATIVE RADIANT ENERGY

AUG. 2, 1949
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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 N°4
SILICATE-SULFIDE TYPE

COLOR TEMPERATURE: 6300°K

MARCH 6, 1950
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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.
AVERAGE CHARACTERISTICS OF PHOSPHOR No. 5

NOTE: THESE CURVES ARE GENERAL FOR CATHODE-RAY TYPES HAVING PHOSPHOR No. 5. APPLICATION OF THESE CURVES, THEREFORE, DEPENDS ON THE MAXIMUM RATINGS OF SPECIFIC TYPES.
NOTE: THESE CURVES ARE GENERAL FOR CATHODE-RAY TYPES HAVING PHOSPHOR NO. 5. APPLICATION OF THESE CURVES, THEREFORE, DEPENDS ON THE MAXIMUM RATINGS OF SPECIFIC TYPES.
PERSISTENCE CHARACTERISTIC
OF PHOSPHOR Nº 5

RELATIVE BRIGHTNESS—PERCENT OF MAXIMUM

TIME AFTER EXCITATION IS REMOVED—MICROSECONDS

MAY 3, 1949

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7266
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P7

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

FINAL HIGH-VOLTAGE-
ELECTRODE VOLTS: 4000-9000
SCREEN MICROAMP: 150
SCANNING AREA (CM): 7 x 7
SCANNING PERIOD (SEC): 1/60
NUMBER OF LINES: 260 APPROX.
EXCITATION: SINGLE PULSE OF 0.24-MILLISECOND DURATION
BUILDUP CHARACTERISTICS OF PHOSPHOR P7

FINAL HIGH-VOLTAGE-ELECTRODE VOLTS: 4000–9000
SCANNING AREA (CM): 7x7
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>
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<tbody>
<tr>
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<tr>
<td>B</td>
<td>75</td>
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<tr>
<td>C</td>
<td>37</td>
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RELATIVE SCREEN BRIGHTNESS—PER CENT OF SATURATION VALUE

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 \( \frac{1}{60} \)-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.

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

![Graph showing the build-up characteristics of phosphor P7](image-url)
PERSISTENCE CHARACTERISTICS OF PHOSPHOR P7

EXCITATION LEVEL (SATURATION)

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

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

*CURVE FOR THESE CONDITIONS WOULD BE MIDWAY BETWEEN CURVES 1 & 2
**CURVE FOR THESE CONDITIONS WOULD BE MIDWAY BETWEEN CURVES 2 & 3

TIME AFTER EXCITATION IS REMOVED-SECONDS

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CL-6804R5
SPECTRAL-ENERGY EMISSION CHARACTERISTIC
OF PHOSPHOR № II

WAVELENGTH - ANGSTROMS

RELATIVE RADIANT ENERGY

3000 4000 5000 6000 7000 8000

APRIL 9, 1946

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6749
PERSISTENCE CHARACTERISTICS
OF PHOSPHOR NO. 11

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

CURVE A: 2\( \mu \text{A}/\text{CM}^2 \), 1/60 SEC. PULSE
B: 20\( \mu \text{A}/\text{CM}^2 \), SINGLE-LINE SCAN
C: 50\( \mu \text{A}/\text{CM}^2 \), 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-6806R2
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P12

WAVELENGTH-ANGSTROMS

RELATIVE RADIANT ENERGY

JULY 18, 1949
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-7317
PERSISTENCE CHARACTERISTIC OF PHOSPHOR P12

Curves is essentially independent of tube operating values.

Time after excitation is removed—milliseconds

Relative brightness—percent of maximum

FEB. 1, 1951
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P15
PERSISTENCE CHARACTERISTIC
OF PHOSPHOR PI5

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

SPOT: SHARPLY FOCUSED

RELATIVE BRIGHTNESS—PER CENT OF MAXIMUM

TIME AFTER EXCITATION IS REMOVED — MICROSECONDS

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
SPECTRAL-ENERGY EMISSION CHARACTERISTIC
OF PHOSPHOR P16

WAVELENGTH—ANGSTROMS

RELATIVE RADIANT ENERGY

OCT. 30, 1950

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7563
PERSISTENCE CHARACTERISTIC OF PHOSPHOR P16

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

RELATIVE BRIGHTNESS — PER CENT OF MAXIMUM

TIME AFTER EXCITATION IS REMOVED — MICROSECONDS

FEB. 23, 1955
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
### SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF GROUP PHOSPHOR P22

**Equal Excitation of Each Phosphor**

<table>
<thead>
<tr>
<th>PHOSPHOR</th>
<th>RANGE OF MAX. VALUE ANGSTROMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLUE EMITTING</td>
<td>4420 TO 4520</td>
</tr>
<tr>
<td>GREEN EMITTING</td>
<td>5230 TO 5270</td>
</tr>
<tr>
<td>RED EMITTING</td>
<td>6360 TO 6580</td>
</tr>
</tbody>
</table>

---

**Diagram:**

- **Wavelength-Angstroms:**
  - **3000** to **7000**

- **Relative Radiant Energy:**
  - **0** to **100**

**Legend:**
- **Blue**
- **Green**
- **Red**

**Date:**
- **Jan. 14, 1954**

**Tube Department**
- **Radio Corporation of America, Harrison, New Jersey**

**Document Number:**
- **92CM-7969R2**
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

RELATIVE RADIANT ENERGY

WAVELENGTH - ANGSTROMS

DEC. 18, 1953
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8204
PERSISTENCE CHARACTERISTIC
OF PHOSPHOR P24

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

RELATIVE BRIGHTNESS — PER CENT OF MAXIMUM

TIME AFTER EXCITATION IS REMOVED — MICROSECONDS
REFERENCE-LINE GAUGE
JETEC NO. 110

With Supplementary Information on Recommended Inside Contour of Yoke to Provide Proper Location of Yoke on Neck-Funnel Section.

NOTE: INNER SURFACE OF YOKE MUST NOT EXTEND INTO SHADEd REGION

92CS-7391
REFERENCE-LINE GAUGE
JETEC NO. 116

3.012" ± .015" DIA.
3.500" ± .015" DIA.
3.244" ± .003" DIA.
1.542" ± .003" DIA.

90°

6" TAPER WITHIN INDICATED AREA

.500" ± .005" R.
.500" ± .005" R.
.500" ± .005" R.
.500" ± .005" R.
.562" ± .005" R.
.448" ± .005" R.
.650" ± .005" R.

3/16"
1/4"
2 1/2"

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

CE-7896
X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES

WARNING

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

Above 16 kilovolts, special shielding precautions for X-ray radiation may be necessary.
DEFINITIONS
OF CATHODE-RAY TUBE TERMS

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

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

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

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

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

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 Magna 11-Pin
Basing Designation for BOTTOM VIEW .............................................. 11L
Pin 1  Heater
Pin 2  Cathode
Pin 3  Deflecting  Electrode DJ1
Pin 4  Anode No.1
Pin 5  No Connection
Pin 6  Deflecting  Electrode DJ4
Pin 7  Anode No.2, Grid No.2

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

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

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

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

JULY 1, 1945

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

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

Typical Operation:

Anode-No. 2 & Grid-No. 2 Voltage*: 500 1000 ... volts
Anode-No. 1 Voltage for Focus at 75% of Grid-No. 1 Voltage for Cutoff*: 125 250 ... volts
Grid-No. 1 Volt. for Visual Cutoff#: -30 -60 ... volts
Max. Anode-No. 1 Current Range*: Between -50 and +10 ... µamp.

Deflection Sensitivity:
- DJ1 and DJ2: 0.220 0.110 ... mm/v dc
- DJ3 and DJ4: 0.260 0.130 ... mm/v dc
Deflection Factor: DJ1 and DJ2: 0.220 0.110 ... v dc/in.
- DJ3 and DJ4: 0.260 0.130 ... v dc/in.

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

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

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

▲ See curve for average values.

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

Spot Position:

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

Maximum Circuit Values:

Grid-No. 1-Circuit Resistance: 1.5 max. megohms
Impedance of Any Deflecting-Electrode Circuit at Heater-Supply Frequency: 1.0 max. megohm
Resistance in Any Deflecting-Electrode Circuit** 5.0 max. megohms

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

TYPICAL OSCILLOGRAPH CIRCUIT

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.

** Data 2

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

JULY 1, 1945
© OF BULB WILL NOT DEVIATE MORE THAN 2°
IN ANY DIRECTION FROM PERPENDICULAR
ERECTED AT CENTER OF BOTTOM OF BASE
DATA

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

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

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

Focusing Method.......................... Electrostatic
Deflection Method......................... Electrostatic
Overall Length............................ 7-5/8" ± 3/16"
Greatest Diameter of Bulb................ 2" ± 1/16"
Minimum Useful Screen Diameter......... 1-3/4"
Mounting Position........................ Any

Base........................................ Small-Shell Duodecal 12-Pin
Basing Designation for BOTTOM VIEW....... 12E

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

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

With DJ₁ positive with respect to DJ₂, the spot is deflected toward pin 4. With DJ₃ positive with respect to DJ₄, the spot is deflected toward pin 1.
The plane through the tube axis and pin No. 4 may vary from the trace produced by DJ₁ and DJ₂ by an angular tolerance (measured about the tube axis) of 10°.
The angle between DJ₁ - DJ₂ trace and DJ₃ - DJ₄ trace is 90° ± 30°.

Indicates a change.

SEPT. 1, 1950  TUBE DEPARTMENT  DATA
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Maximum Ratings, Design-Center Values:

ANODE-No.2 VOLTAGE. .......................... 2500 max. volts
ANODE-No.1 VOLTAGE. .......................... 1000 max. volts

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

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

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

Equipment Design Ranges:

For any anode-No.2 voltage (Eb₂) between 500* and 2500 volts
ANODE-No.1 Voltage. .......................... 15% to 28% of Eb₂

Max. Grid-No.1 Voltage for Visual Cutoff. 6.75% of Eb₂
Max. Anode-No.1 Current Range. -15 to +10 microamperes

Deflection Factors:
- DJ₁ & DJ₂. 115 to 155 v dc/in./kv of Eb₂
- DJ₃ & DJ₄. 74 to 100 v dc/in./kv of Eb₂

Spot Position.

Examples of Use of Design Ranges:

For anode-No.2 voltage of 1000 2000 volts
ANODE-No.1 Voltage. 150 - 280 300 - 560
Max. Grid-No.1 Voltage for Visual Cutoff. -67.5 -135
Deflection Factors:
- DJ₁ & DJ₂. 115 - 155 230 - 310 volts dc/in.
- DJ₃ & DJ₄. 74 - 100 148 - 200 volts dc/in.

Maximum Circuit Values:

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

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

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

Anode No.2 and grid No.2 which are connected together within the 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.
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

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

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

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.
ORANGEGRAPH TUBE

SCREEN RADIUS

3 1/16"

6" R.

12° 37′

1 3/8" ± 1/16"

7 1/8" ± 3/16"

SMALL-SHELL DUODECAL 12-PIN BASE

2" ± 1/16" - .225"

7 5/8" ± 3/16"

G 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
$E_f = 6.3$ VOLTS
ANODE NO. 1 VOLTS ADJUSTED FOR FOCUS

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

ANODE NO. 2 MILLIAMPERES

ANODE NO. 2 VOLTS

CONSTANT LINEIDGE-NO.1 0.00422

CONSTANT LINE-WIDER-NO.1 0.00422

RELATIVE BRIGHTNESS

500 1000 1500 2000 2500
2BPI

AVERAGE CHARACTERISTICS

E_g = 6.3 VOLTS
ANODE - Nº 2 VOLTS = 1000
ANODE - Nº 1 VOLTS ADJUSTED FOR FOCUS

GRID - Nº 1 VOLTS

RELATIVE LINE BRIGHTNESS

ANODE Nº 2 MILLIAMPERES

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

92CM-6747RI
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 Inter electrode Capacitances:
Grid No. 1 to All Other Electrodes: 7 μf
Pattern Electrode to Grid No. 4: 5 μf

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

Base: Long-Shell Medium 6-Pin

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

Maximum Ratings, Design-Center Values:

PATTERN-ELECTRODE VOLTAGE: 1500 max. volts
GRID-No. 4 (COLLECTOR) VOLTAGE: 1500 max. volts
GRID-No. 3 (FOCUSING ELECTRODE) VOLTAGE: 600 max. volts
GRID-No. 2 (ACCELERATING ELECTRODE) VOLTAGE: 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: 300 approx. volts
Grid-No. 2 Voltage: 1000 volts
Grid-No. 1 Voltage for Visual Cutoff on Monitor#: -50 approx. volts

Internal Resistance between Grid No. 4 and Pattern Electrode: Greater than 1 meg.
Grid-No. 4 Current: 0.5 μamp

†, ‡, #: See next page.

JUNE 20, 1946
TUBE DIVISION
TENTATIVE DATA
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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.

TENTATIVE DATA

JUNE 20, 1946
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: TIP 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.
## DATA

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

Direct Interelectrode Capacitance:
- Anode to All Other Electrodes: 20 \(\mu\)f

Photocathode Spectral Response: See Curve

Image Size (4 x 3 aspect ratio): 1.6" Diagonal

Focusing Method: Magnetic

Deflection Method: Magnetic

Overall Length: 15-1/4" ± 1/4"

Greatest Diameter of Bulb: 3" ± 1/16"

Minimum Deflecting-Coil Inside Diameter: 2-1/8"

Deflecting-Coil Length: 5"

Focusing-Coil Length: 10"

Alignment-Coil Length: 15/16"

Photocathode Distance Inside End of Focusing Coil: 1/2"

Operating Position: Any except with diheptal base up and tube axis at angle of less than 20° from the vertical.

End Base: Small-Shell Diheptal 14-Pin

### Pin Layout:
- **Pin 1:** Heater
- **Pin 2:** Grid No. 4
- **Pin 3:** Grid No. 3
- **Pin 4:** Internal Connection—Do Not Use
- **Pin 5:** Dynode No. 2
- **Pin 6:** Dynode No. 4
- **Pin 7:** Anode
- **Pin 8:** Dynode No. 5
- **Pin 9:** Dynode No. 3
- **Pin 10:** Dynode No. 1, Grid No. 2
- **Pin 11:** Internal Connection—Do Not Use
- **Pin 12:** Grid No. 1
- **Pin 13:** Cathode
- **Pin 14:** Heater

**Shoulder Base:** Jumbo Annular 7-Pin

**Pin Layout:**
- **Pin 1:** Grid No. 6
- **Pin 2:** Photocathode
- **Pin 3:** Internal Connection—Do Not Use
- **Pin 4:** Internal Connection—Do Not Use
- **Pin 5:** Grid No. 5
- **Pin 6:** Target
- **Pin 7:** Internal Connection—Do Not Use

\(-\rightarrow\) indicates a change.

MAR. 15, 1948
**Maximum Ratings, Absolute Values:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photocathode Voltage</td>
<td>-550 max. volts</td>
</tr>
<tr>
<td>Photocathode Illumination</td>
<td>50 max. ft-c</td>
</tr>
<tr>
<td>Operating Temperature of any part of bulb</td>
<td>65 max. °C</td>
</tr>
<tr>
<td>Operating Temperature of bulb at large end</td>
<td>35 min. °C</td>
</tr>
<tr>
<td>Temperature difference between target section and any part of bulb hotter than target section</td>
<td>5 max. °C</td>
</tr>
<tr>
<td>Grid-No. 6 Voltage</td>
<td>-550 max. volts</td>
</tr>
<tr>
<td>Target Voltage</td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>50 max. volts</td>
</tr>
<tr>
<td>Negative value</td>
<td>50 max. volts</td>
</tr>
<tr>
<td>Grid-No. 5 Voltage</td>
<td>150 max. volts</td>
</tr>
<tr>
<td>Grid-No. 4 Voltage</td>
<td>300 max. volts</td>
</tr>
<tr>
<td>Grid-No. 3 Voltage</td>
<td>400 max. volts</td>
</tr>
<tr>
<td>Grid-No. 2 &amp; Dynode-No. 1 Voltage</td>
<td>350 max. volts</td>
</tr>
<tr>
<td>Grid-No. 1 Voltage</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 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>
<tr>
<td>Anode-Supply Voltage</td>
<td>1650 max. volts</td>
</tr>
<tr>
<td>Voltage per multiplier stage</td>
<td>350 max. volts</td>
</tr>
</tbody>
</table>

**Typical Operation:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photocathode Voltage (Image Focus)</td>
<td>-300 to -500 volts</td>
</tr>
<tr>
<td>Grid-No. 6 Voltage (Accelerator)</td>
<td>-240 to -400 volts</td>
</tr>
<tr>
<td>Target Voltage</td>
<td></td>
</tr>
<tr>
<td>80% of photocathode voltage</td>
<td></td>
</tr>
<tr>
<td>0 volts</td>
<td></td>
</tr>
<tr>
<td>Grid-No. 5 Voltage (Decelerator)</td>
<td>0 to 100 volts</td>
</tr>
<tr>
<td>Grid-No. 4 Voltage (Beam Focus)</td>
<td>160 to 240 volts</td>
</tr>
<tr>
<td>Grid-No. 3 Voltage</td>
<td>225 to 330 volts</td>
</tr>
<tr>
<td>Grid-No. 2 &amp; Dynode-No. 1 Voltage</td>
<td>300 volts</td>
</tr>
<tr>
<td>Grid-No. 1 Voltage (For Picture Cutoff)</td>
<td>-15 to -85 volts</td>
</tr>
<tr>
<td>Dynode-No. 2 Voltage</td>
<td>600 volts</td>
</tr>
<tr>
<td>Dynode-No. 3 Voltage</td>
<td>880 volts</td>
</tr>
<tr>
<td>Dynode-No. 4 Voltage</td>
<td>1160 volts</td>
</tr>
<tr>
<td>Dynode-No. 5 Voltage</td>
<td>1450 volts</td>
</tr>
<tr>
<td>Anode Voltage</td>
<td>1500 volts</td>
</tr>
<tr>
<td>Anode Current</td>
<td>50 µamp</td>
</tr>
<tr>
<td>Target Temperature Range</td>
<td>35 to 60 °C</td>
</tr>
<tr>
<td>Ratio of Peak-to-Peak Highlight</td>
<td></td>
</tr>
<tr>
<td>Video-Signal Current to</td>
<td></td>
</tr>
<tr>
<td>RMS Noise Current (Approx.)</td>
<td>35</td>
</tr>
<tr>
<td>Minimum Peak-to-Peak Blanking Voltage</td>
<td>10 volts</td>
</tr>
<tr>
<td>Field Strength at Center of Focus</td>
<td>75 gausses</td>
</tr>
<tr>
<td>MAR. 15, 1948 TUBE DEPARTMENT DATA 1</td>
<td></td>
</tr>
</tbody>
</table>
**2P23 IMAGE ORTHICON**

<table>
<thead>
<tr>
<th>Components:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deflecting-Coil Assembly (Includes Keyed Jumbo Annular 7-Pin Socket).</td>
</tr>
<tr>
<td>Focusing-Coil Assembly.</td>
</tr>
<tr>
<td>Alignment-Coil Assembly.</td>
</tr>
<tr>
<td>Hor. Deflection Output Transformer.</td>
</tr>
<tr>
<td>Ver. Deflection Output Transformer.</td>
</tr>
</tbody>
</table>

- Ratio of dynode voltages is shown under Typical Operation.
- For best operation, this voltage should be adjustable within ± 25% of indicated value. For simplified equipment, this voltage can be fixed.
- Adjustable within ± 3 volts of indicated value, with blanking voltage off.
- Taps at 0, 30, 60, and 90 volts are recommended. Set at voltage giving most uniform resolution and signal output over entire picture area.
- Adjust to give the most uniformly shaded picture near maximum signal.

**OPERATING NOTES**

After the 2P23 has been inserted in its sockets and the voltages applied, allow it to warm up for 1/2 to 1 hour with the camera lens iris closed. Then, proceed with normal operating adjustments.

When the equipment design or operating conditions are such that the maximum temperature rating or maximum temperature difference will be exceeded, provision should be made to direct a blast of cooling air from the diheptal-base end of the tube along the entire length of the bulb surface, i.e., through the space between the bulb surface and the surrounding deflecting coil and its extension. For this purpose, a small blower is satisfactory, but it should run at low speed to prevent vibration of the 2P23 and the associated amplifier equipment. Unless vibration is prevented, distortion of the picture may occur. To keep the operating temperature of the large end of the tube from falling below 45°C, some form of controlled heating should be employed. Ordinarily, adequate heat will be supplied by the focusing coil, deflection coils, and associated amplifier tubes so that the temperature can be controlled by the amount of cooling air directed along the bulb surface.

Resolution of better than 400 lines at the center of the picture can be produced by the 2P23 when the highlight illumination is above the knee of the typical signal-output curve for this type. To utilize such resolution capability in the horizontal direction with the standard scanning rate of 525 lines, it is necessary to use a video amplifier having a bandwidth of at least 5.6 megacycles. The maximum resolution obtainable is limited by the mesh-screen portion of the target.

MAR. 15, 1948  TUBE DEPARTMENT  RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**IMAGE ORTHICON**

**DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE**

**Cross-hatched area is flat**

- **1.315” R. MIN.**
- **1.185” R. MAX.**

SEE NOTE 2

15" ± .010"

**NOTE 2:** DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

**ANNULAR BASE GAUGE**

**Angular variations between pins as well as eccentricity of neck cylinder with respect to photocathode cylinder are held to tolerances such that pins and neck cylinder will fit flat-plate gauge with:**

- **a. Seven holes having diameter of 0.065" ± 0.001" and depth of 0.265" ± 0.001". Holes are enlarged by 45° taper to depth of 0.047" and are spaced at angles of 51°26' ± 5' on circle diameter of 2.500" ± 0.001".**

- **b. Six stops having height of 0.187" ± 0.001", centered between pin holes, to bear against flat areas of base.**

- **c. Rim extending out a minimum of 1/8" from 2-13/16" diameter and having height of 0.126" ± 0.001".**

- **d. Neck-cylinder clearance hole having diameter of 2.200" ± 0.001".**

---

**92CH-6685**

AUG. 15, 1946

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-6685
HIGH-VACUUM CATHODE-RAY TUBE
Supersedes Type 3BP1

General:

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

Direct Interelectrode Capacitances (Approx.):
Grid No. 1 to All Other Electrodes ........ 8.5 µf
Cathode to All Other Electrodes ........ 3.0 µf
DJ1 to DJ2 .................................. 2.0 µf
DJ3 to DJ4 .................................. 2.0 µf
DJ1 to All Other Electrodes ........ 3.0 µf
DJ3 to All Other Electrodes except DJ2 6.0 µf
DJ1 to All Other Electrodes except DJ2 6.0 µf
DJ2 to All Other Electrodes except DJ1 5.0 µf
DJ3 to All Other Electrodes except DJ4 4.0 µf
DJ4 to All Other Electrodes except DJ3 6.0 µf

Phosphor (For Curves, see front of this Section) No. 1
Fluorescence ................................ Medium
Persistence .................................. Medium
Focusing Method .......................... Electrostatic
Deflection Method ........................ Electrostatic
Overall Length .......................... 10" ± 1/4"
Greatest Diameter of Bulb .............. 3" ± 1/16"
Minimum Useful Screen Diameter ........ 2-3/4"
Mounting Position ........................ Any

Base .............................. Medium Shell Diheptal 12-Pin

Basing Designation for BOTTOM VIEW ........ 14C
Pin 1-Heater .......................... Pin 9-Anode No. 2,
Pin 2-Cathode .......................... Pin 10-Anode No. 2,
Pin 3-Grid No. 1 ........................ Pin 4-Internal Con.
Pin 4-Internal Con. ........................ Do Not Use
Pin 5-Anode No. 1 ........................ Pin 11-Deflecting
Pin 7-Deflecting ........................ Pin 12-No Conn.
Electrode DJ3 .......................... Electrode DJ1
Electrode DJ4 .......................... 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 de-
flxed 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

DATA 1

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 . 2000 . . . . . volt.
Anode No.1 Voltage for Focus
at 75% of Grid-No.1 Voltage for Cutoff. .. 430 . 575 . . . . . volt.
Grid-No.1 Volt. for Visual Cutoff# ...... -45 . -60 . . . . . volt.
Max. Anode-No.1 Current Range* Between -50 and +10 μamp.

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

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

* Brilliance and definition decrease with decreasing anode-No.2 voltage.
  In general, anode-No.2 voltage should not be less than 1500 volts.
* Individual tubes may require between +20% and -30% of the values shown
  with grid-No.1 voltages between zero and cutoff.
# Visual extinction of stationary focused spot. Supply should be adjust-
  able 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. Suit-
able 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 applica-
tion of anode voltages.

Maximum Circuit Values:
Grid-No.1-Circuit Resistance .................. 1.5 max. megohms
Impedance of Any Deflecting-Electrode
  Circuit at Heater-Supply Frequency ........ 1.0 max. megohm
Resistance in Any Deflecting-
  Electrode Circuit*** .......................... 5.0 max. megohms

*** It is recommended that all deflecting-electrode-circuit resistances
  be approximately equal.
A typical oscillograph circuit is shown with the following components:

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

When the cathode is grounded, the capacitors should have a high voltage rating. When the anode No. 2 is grounded, they may have a low voltage rating. For dc amplifier service, deflecting electrodes should be connected directly to the amplifier output. In this service, it is preferable to remove the deflecting-electrode resistor to minimize the loading effect on the amplifier. In order to minimize spot defocusing, it is essential that the 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.
$3BPI-A$

**HIGH-VACUUM CATHODE-RAY TUBE**

$3" \pm \frac{1}{16}"

SCREEN RADIUS $1\frac{3}{8}"$ MIN.

$\frac{1}{4}" R.

$12\frac{7}{16}" R.$

$6" R.$

$3\frac{7}{8}"

$10" \pm \frac{1}{4}$

$9\frac{1}{4}"

$\pm \frac{1}{4}$

$2" \pm \frac{1}{16}$

MEDIUM SHELL DIHEPTAL 12-PIN BASE

$\xi$ 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

DATA 2

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
E_f = 6.3 VOLTS
ANODE NO. 1 VOLTS ADJUSTED TO GIVE FOCUS

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

GRID NO. 1 VOLTS

ANODE NO. 1, MICROAMPERES

GRID NO. 2 & GRID NO. 2 MICROAMPERES

GRID NO. 2 VOLTS

APR. 18, 1945
RCA VICTOR 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: 8 μf
- Cathode to All Other Electrodes: 8 μf
- DJ1 to DJ2: 2.5 μf
- DJ3 to DJ4: 2 μf
- DJ1 to All Other Electrodes: 8 μf
- DJ2 to All Other Electrodes: 7 μf
- DJ3 to All Other Electrodes: 7 μf
- DJ4 to All Other Electrodes: 8 μf

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

### Mounting Information:
- **Cao**: Recessed Small Ball
- **Base**: Medium-Shell Diheptal 12-Pin

### Pin Configuration:
- **Pin 1** - Heater
- **Pin 2** - Cathode
- **Pin 3** - Grid No. 1
- **Pin 4** - Internal Connection-Do Not Use
- **Pin 5** - Anode No. 1
- **Pin 6** - Deflecting Electrode DJ4
- **Pin 7** - Deflecting Electrode DJ3
- **Pin 8** - Anode No. 2
- **Pin 9** - Deflecting Electrode DJ2
- **Pin 10** - Deflecting Electrode DJ1
- **Pin 11** - Deflecting Electrode DJ1
- **Pin 12** - No Connection
- **Pin 13** - Heater
- **Pin 14** - Heater Cap

**Diagram Notes:**
- DJ1 and DJ2 are nearer the screen
- DJ3 and DJ4 are nearer the base

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

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

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANODE-No. 3 VOLTAGE</td>
<td>4000 max. volts</td>
</tr>
<tr>
<td>ANODE-No. 2* VOLTAGE</td>
<td>2000 max. volts</td>
</tr>
<tr>
<td>RATIO OF ANODE-No. 3 VOLTAGE TO ANODE-No. 2 VOLTAGE</td>
<td>2.3 : 1 max.</td>
</tr>
<tr>
<td>ANODE-No. 1 VOLTAGE</td>
<td>1000 max. volts</td>
</tr>
</tbody>
</table>

#### GRID-No. 1 (CONTROL ELECTRODE) VOLTAGE:

<table>
<thead>
<tr>
<th>Bias Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative bias</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Positive bias</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive peak</td>
<td>2 max. volts</td>
</tr>
</tbody>
</table>

### Equipment Design Ranges:

*For any anode-No 3 voltage ($E_{b3}$) between 2000* and 4000 volts and any anode-No.2 voltage ($E_{b2}$) between 1500** and 2000 volts*

- **Anode-No. 1 Voltage:** 20% to 34.5% of $E_{b2}$
- **Max. Grid-No. 1 Voltage for Visual Cutoff:** 4.5% of $E_{b2}$
- **Anode-No. 1 Current for any Operating Condition:** -50 to +10 μamp

### Deflection Factors:

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

- **DJ1 & DJ2:** 85 to 115 v dc/in./kv of $E_{b2}$
- **DJ3 & DJ4:** 62.5 to 85 v dc/in./kv of $E_{b2}$

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

- **DJ1 & DJ2:** 68 to 92 v dc/in./kv of $E_{b2}$
- **DJ3 & DJ4:** 50 to 68 v dc/in./kv of $E_{b2}$

### 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 Voltage:** 400–690, 300–515, 400–690 volts
- **Max. Grid-No. 1 Voltage for Visual Cutoff:** -90, -67.5, -90 volts

### Deflection Factors:

- **DJ3 & DJ4:** 100–136, 94–128, 125–170 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

---

*See next page.*
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.

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.

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

SCREEN RADIUS
13\(\frac{3}{8}\)" MIN.

13\(\frac{3}{4}\)" ± \(\frac{1}{4}\)"

ANODE NO. 3
RECESSED
SMALL BALL CAP

12\(\frac{7}{16}\)" R.

MEDIUM-SHELL DIHEPTAL
12-PIN BASE

8" R.

2" ± \(\frac{1}{16}\)"

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

9\(\frac{1}{4}\)" ± \(\frac{1}{4}\)"

350"

3" ± \(\frac{1}{16}\)"

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

92CM-6583

NOV. 15, 1949
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, MARRISON, NEW JERSEY

CE-6583
CHARACTERISTICS

$E_p = 6.3 \text{ VOLTS}$
ANODE-N°1 VOLTS ADJUSTED FOR FOCUS
ANODE-N°3 VOLTS GREATER THAN
ANODE-N°2 VOLTS
GRID-N°1 VOLTS=0
-- - TYPICAL FLUORESCENT-SCREEN
(ANODE-N°3) CURRENT

TOTAL ANODE-N°2 & ANODE-N°3 MICROAMPERES

FLUORESCENT-SCREEN MICROAMPERES

1000 800 600 400 200

1500 1600 1700 1800 1900 2000
ANODE-N°2 VOLTS
### AVERAGE CHARACTERISTICS

**E_f = 6.3 Volts**

Anode-No1 Volts Adjusted to Give Focus

<table>
<thead>
<tr>
<th>CURVE</th>
<th>ELECTRODE CURRENT</th>
<th>ANODE-No2 VOLTS</th>
<th>ANODE-No3 VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ANODE No1</td>
<td>2000</td>
<td>4000</td>
</tr>
<tr>
<td>B</td>
<td>ANODE No1</td>
<td>1500</td>
<td>3000</td>
</tr>
<tr>
<td>C</td>
<td>ANODE No2</td>
<td>2000</td>
<td>4000</td>
</tr>
<tr>
<td>D</td>
<td>ANODE No2</td>
<td>1500</td>
<td>3000</td>
</tr>
<tr>
<td>E</td>
<td>ANODE No3</td>
<td>2000</td>
<td>4000</td>
</tr>
<tr>
<td>F</td>
<td>ANODE No3</td>
<td>1500</td>
<td>3000</td>
</tr>
</tbody>
</table>

---

**APR. 24, 1945**

**TUBE DEPARTMENT**

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

**92CM-6421RI**
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 Eulb .................... 3" ± 1/16"
Minimum Useful Screen Diameter .......... 2-3/4"
Weight (Approx.) .................................. 9 oz
Mounting Position .............................. Any
Base .................................................. J-24

Basing Designation for BOTTOM VIEW ........ 11M
Pin 1-Heater
Pin 2-Grio No.1
Pin 3-Cathode
Pin 4-Grid No.3
Pin 5-Deflecting Electrode DJ3
Pin 6-Deflecting Electrode DJ4
Pin 7-Ulror (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

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

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

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

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

**ULTOR VOLTAGE** ........................................ 2500 max. volts

**ULTOR INPUT (AVERAGE)** ............................... 6 max. watts

**GRID-No.3 VOLTAGE** .................................... 1000 max. volts

**GRID-No.1 VOLTAGE:**

- Negative bias value .................................. 200 max. volts
- Positive bias value ................................... 0 max. volts
- Positive peak value .................................. 2 max. volts

**PEAK VOLTAGE BETWEEN ULTOR AND**

**ANY DEFLECTING ELECTRODE.** ...................... 500 max. volts

**PEAK HEATER-CATHODE VOLTAGE:**

- Heater negative with respect to cathode ....... 125 max. volts
- Heater positive with respect to cathode ....... 125 max. volts

**Equipment Design Ranges:**

For any ultor voltage \((E_{c4})\) 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 \(\mu\)amp

**Deflection Factors:**

- DJ₁ & DJ₂ ........................................ 50 to 68 \(v \text{ dc/in.}/kv\) of \(E_{c4}\)
- DJ₃ & DJ₄ ........................................ 38 to 52 \(v \text{ dc/in.}/kv\) of \(E_{c4}\)

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

**Examples of Use of Design Ranges:**

For ultor voltage of

- 1000 volts
- 2000 volts

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

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

**Indicates a change.**

---

**Note:**

- 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.
For ultor voltage of 1000 2000 volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot .................. -19 to -45 -38 to -90 volts
Deflection Factors:
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.

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

3" ± 1/16" SCREEN DIA.
2 3/4" MIN. 3/4" R.
15" R.
8" R.
1/8" R.
11 1/2" ± 1/4
15/8" ± 1/16

MEDIAN SHELL MAGNAL 11-PIN BASE JETEC NO BII-66
92CM-6599RI

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

C1: 0.1 µf, 3000 Volts
C2: 1.0 µf, 200 Volts
C3 C4 C5 C6: 0.05-µf Blocking Capacitors
R1 R2: 2 Megohms, 0.5 Watt
R3: 6 Megohms, 0.5 Watt
R4: 2-Megohm Potentiometer, 0.5 Watt
R5: 1.0 Megohm, 0.5 Watt
R6: 0.5-Megohm Potentiometer, 0.5 Watt
R7 R8: Dual 5-Megohm Potentiometer, 0.5 Watt
R9 R10: Dual 5-Megohm Potentiometer, 0.5 Watt
R11 R12 R13 R14: 2 Megohms, 0.5 Watt

* When cathode is grounded, capacitors should have high voltage rating (3000 volts); when ulti or 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 ulti or be returned to a point in the amplifier system which will give the lowest possible potential difference between ulti or 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-N3 VOLTS ADJUSTED FOR FOCUS

GRID-P1 VOLTS ADJUSTED TO GIVE ULTOR-
CURRENT VALUE REQUIRED TO MAINTAIN
CONSTANT LINE WIDTH AT DIFFERENT
ULTOR VOLTAGES. FOR A GIVEN ULTOR
VOLTAGE, LINE WIDTH AND RELATIVE LINE
BRIGHTNESS INCREASE WITH INCREASE IN
ULTOR CURRENT.
MAXIMUM ULTOR-CURRENT REQUIREMENTS FROM POWER SUPPLY

$E_C = 6.3$ VOLTS
GRID-Nº3 VOLTS ADJUSTED FOR FOCUS

MAX. ULTOR CURRENT FOR ANY TUBE AT ZERO GRID-Nº1 VOLTAGE

RECOMMENDED MAX. ULTOR CURRENT

ULTOR MILLIAMPERES

ULTOR VOLTS

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7192R1
AVGAGE CHARACTERISTIC

$E_g = 6.3 \text{ VOLTS}$
GRID-$\#3$ VOLTS ADJUSTED TO FOCUS
ULTOR VOLTS = 2000

ULTOR MILLIAMPERES

GRID-$\#1$ VOLTS
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: Short

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

The persistence characteristics of the P4-sulfide phosphor are the same as those shown for the P11 phosphor at the front of this section.

---

### 3KP7

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

**General:**
- Phosphor (for curves, see front of this section). P7
  - Fluorescence: Blue
  - Persistence: Short
  - Phosphorescence: Greenish-Yellow
  - Persistence: Long

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

---

### 3KP11

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

**General:**
- Phosphor (for curves, see front of this section). P11
  - Fluorescence: Blue
  - Phosphorescence: Blue
  - Persistence: Short

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

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

DATA

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

Direct Interelectrode Capacitances (Approx.):
Cathode to All Other Electrodes ........... 2.2
Grid No.1 to All Other Electrodes .......... 10.3 μf
DJ1 to DJ2 ........... 1.3 μf
DJ3 to DJ4 ........... 1.2 μf
DJ1 to All Other Electrodes Except DJ2 .... 4.4 μf
DJ2 to All Other Electrodes Except DJ1 .... 5.6 μf
DJ3 to All Other Electrodes Except DJ4 .... 5.0 μf
DJ4 to All Other Electrodes Except DJ3 .... 4.5 μf

Phosphor (For Curves, see front of this Section) ........ No. 1
Fluorescence .................. Green
Persistence .................. Medium
Focusing Method .................. Electrostatic
Deflection Method .................. Electrostatic
Overall Length ........... 8" ± 1/4"
Greatest Diameter of Bulb ........... 3" ± 1/16"
Minimum Useful Screen Diameter ....... 2-3/4"
Mounting Position ........... Any
Base ........... Small-Shell Duodecal 12-Pin

Basing Designation for Bottom View ........... 12F
Pin 1 – Heater .................. Pin 7 – Deflecting Electrode
Pin 2 – Grid No.1 ........... Pin 8 – Deflecting Electrode DJ2
Pin 3 – Anode No.1 ........... Pin 9 – Anode No.2, Grid No.2
Pin 4 – Deflecting Electrode DJ3 ........... Pin 10 – No Connection
Pin 5 – Deflecting Electrode DJ4 ........... Pin 11 – Cathode
Pin 6 – 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 4. With DJ3 positive with respect to DJ4, the spot is deflected toward pin 1.

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

Maximum Ratings, Design-Center Values:
ANODE-NO.2 VOLTAGE# ........... 2500 max. volts
* Anode No. 2 and grid No. 2 which are connected together within tube, are referred to herein as anode No. 2.
# The product of anode-No. 2 voltage and average anode-No. 2 current should be limited to 6 watts.

JULY 3, 1950
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
TENTATIVE DATA
### OSCILLOGRAPH TUBE

<table>
<thead>
<tr>
<th>ANODE-No.1 VOLTAGE</th>
<th></th>
<th>1000 max. volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRID-No.1 VOLTAGE:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative bias value.</td>
<td></td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Positive bias value.</td>
<td></td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive peak value.</td>
<td></td>
<td>2 max. volts</td>
</tr>
<tr>
<td>PEAK VOLTAGE BETWEEN ANODE No.2 AND ANY DEFLECTING ELECTRODE.</td>
<td></td>
<td>500 max. volts</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>125 max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode.</td>
<td></td>
<td>125 max. volts</td>
</tr>
</tbody>
</table>

**Equipment Design Ranges:**

For any anode-No.2 voltage ($E_{b2}$) between **recommended minimum** and 2500 volts

<table>
<thead>
<tr>
<th>Anode-No.1 Voltage</th>
<th></th>
<th>20% to 35% of $E_{b2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Grid-No.1 Voltage for Visual Cutoff</td>
<td></td>
<td>6.3% of $E_{b2}$</td>
</tr>
<tr>
<td>Anode-No.1 Cur. for any Operating Condition</td>
<td></td>
<td>-15 to +10 microamperes</td>
</tr>
</tbody>
</table>

**Deflection Factors:**

- $D_{J1} & D_{J2}$: 115 to 145 $\text{vdc/in./kv of } E_{b2}$
- $D_{J3} & D_{J4}$: 110 to 140 $\text{vdc/in./kv of } E_{b2}$

**Examples of Use of Design Ranges:**

For anode-No.2 voltage of

<table>
<thead>
<tr>
<th>Anode-No.1 Voltage</th>
<th></th>
<th>200-350</th>
<th>400-700</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Grid-No.1 Voltage for Visual Cutoff</td>
<td></td>
<td>-63</td>
<td>-126</td>
</tr>
</tbody>
</table>

**Deflection Factors:**

- $D_{J1} & D_{J2}$: 115-145 $\text{volts dc/in.}$
- $D_{J3} & D_{J4}$: 110-140 $\text{volts dc/in.}$

**Maximum Circuit Values:**

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

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

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

---

**July 3, 1950**

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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

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

**Diagram:**
- Screen Dia: 2 3/4" min.
- 9 1/8" ± 1/8" [92cm ± 0.03 cm]
- SMALL-SHELL DUODECAL 10-PIN BASE JETEC K#B10-75 OR SMALL-SHELL DUODECAL 12-PIN BASE JETEC K#B12-43

Center line of bulb will not deviate more than 2° in any direction from perpendicular erected at center of bottom of base.
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: Small-Shell Duodecal 10-Pin (JETEC No.B10-75), or Small-Shell Duodecal 12-Pin (JETEC No.B12-43)

Basing Designation for BOTTOM VIEW: J24S1

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 DJ2
Pin 7 - Deflecting Electrode DJ3
Pin 8 - Ultron (Grid No. 2, Collector)
Pin 9 - Deflecting Electrode DJ1
Pin 10 - Deflecting Electrode DJ4
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.
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° ± 30°.

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR(^{0}) VOLTAGE</td>
<td>2500 max. volts</td>
</tr>
<tr>
<td>ULTOR INPUT (AVERAGE)</td>
<td>6 max. watts</td>
</tr>
<tr>
<td>GRID-No.3 VOLTAGE</td>
<td>1000 max. volts</td>
</tr>
<tr>
<td>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\(_{c4}\)) between 500* and 2500 volts

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.3 Voltage</td>
<td>16.5% to 31% of E(_{c4}) volts</td>
</tr>
<tr>
<td>Maximum Grid-No.1 Voltage</td>
<td>-6.75% of E(_{c4}) volts</td>
</tr>
<tr>
<td>Voltage for Visual Extinction of Un-deflected Focused Spot</td>
<td>-15 to +10 μamp</td>
</tr>
<tr>
<td>Grid-No.3 Current for Any Operating Condition</td>
<td>73 to 99 v dc/in./kv of E(_{c4})</td>
</tr>
<tr>
<td>DJ1 &amp; DJ2</td>
<td>73 to 99 v dc/in./kv of E(_{c4})</td>
</tr>
<tr>
<td>DJ3 &amp; DJ4</td>
<td>52 to 70 v dc/in./kv of E(_{c4})</td>
</tr>
</tbody>
</table>

* The "ultor" in a cathode-ray tube is the electrode to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection. In the 3RP1-A, the ultor function is performed by grid No.3. Since grid No.4, grid No.2, and collector are connected together within the 3RP1-A, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.

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

### The center of the undeflected focused spot will fall within a circle having 7.5-mm radius concentric with the center of the tube face.
Examples of Use of Design Ranges:

For ultimate voltages of 1000 to 2000 volts:

Grid-No. 3 Voltage for Focus: 165 to 310, 330 to 620 volts

Maximum Grid-No. 1 Voltage for visual Extinction of Un-deflected Focused Spot: -67.5 to -135 volts

Deflection Factors:
DJ₁ & DJ₂: 73 to 99, 146 to 198 volts dc/in.
DJ₃ & DJ₄: 52 to 70, 104 to 140 volts dc/in.

Maximum Circuit Values:

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

Resistance in Any Deflecting- Electrode Circuit: 5 max. megohms

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

JULY 1, 1955
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:** 840V DC
- **R5:** 0.5 Megohm, 0.5 Watt
- **R6:** 0.35 Megohm, 0.5 Watt
- **R7 R8:** Dual 5-Megohm Potentiometer
- **R9 R10:** Dual 5-Megohm Potentiometer
- **R11 R12 R13 R14:** 2 Megohms, 0.5 Watt

*When cathode is grounded, capacitors should have high voltage rating; when ultiro 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 ultiro be returned to a point in the amplifier system which will give the lowest possible potential difference between ultiro 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
CHARACTERISTICS

E_f = 6.3 VOLTS
GRID-N23 VOLTS ADJUSTED FOR FOCUS

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

ULTOR MILLIAMPERES

RELATIVE BRIGHTNESS

ULTOR VOLTS

MAR. 24, 1955
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-7143R1
AVERAGE CHARACTERISTICS

E C = 6.3 VOLTS
ULTOR VOLTS = 1000
GRID-N®3 VOLTS ADJUSTED FOR FOCUS

RELATIVE LINE BRIGHTNESS

UGRA. MILLIAMPERES

GRID-N®1 VOLTS

MAR. 24, 1955
92CM-7141RI
The 3RP4 is the same as the 3RP1 except for the following items:

General:
Phosphor (For curves, see front of this Section)  P4—Sulfide Type
  Fluorescence .................................................. White
  Phosphorescence .............................................. White
  Persistence ..................................................... Short

In general, operation of the 3RP4 at an ultor voltage less than 1500 volts is not recommended.
General:
Heater, for Unipotential Cathode:
Voltage .................. 6.3 ................ ac or dc volts
Current .................. 0.6 ................... amp

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

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

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

Overall Length ............ 16-3/4" ± 3/8"
Greatest Diameter of Bulb ...... 5-1/4" ± 3/32"
Minimum Useful Screen Diameter ...... 4-9/16"

Bulb .................. J42
Weight (Approx.) ........... 2-1/2 lbs
Mounting Position ............. Any
Cap .................. Recessed Small Ball (JETEC No.J1-22)
Base ........... Medium-Shell Diheptal 12-Pin (JETEC No.B12-37)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid No. 1
Pin 4 - No Connection - Do Not Use
Pin 5 - Grid No. 3
Pin 7 - Deflecting Electrode DJ3
Pin 8 - Deflecting Electrode DJ4

Pin 9 - Ultor (Grid No. 2, Grid No. 4)
Pin 10 - Deflecting Electrode DJ2
Pin 11 - Deflecting Electrode DJ1
Pin 12 - No. Conn.
Pin 14 - Heater
Cap - Post-Ulter (Grid No. 5, Collector)

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

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

The plane through the tube axis and each of the following items may vary from the trace produced by DJ1 and DJ2 by
the following angular tolerances (measured about the tube axis): Pin 5, 10°; side terminal (on same side of tube as pin 5), 10°. Angle between DJ₁ - DJ₂ trace and DJ₃ - DJ₄ trace is 90° ± 1.5°.

Maximum Ratings, Design-Center Values:

- POST-ULTOR* VOLTAGE: 6000 max. volts
- ULTOR* VOLTAGE: 2600 max. volts
- RATIO OF POST-ULTOR VOLTAGE TO ULTOR VOLTAGE: 2.3:1 max.
- GRID-No.3 VOLTAGE: 1000 max. volts
- GRID-No.1 VOLTAGE:
  - Negative bias value: 200 max. volts
  - Positive bias value: 0 max. volts
  - Positive peak value: 2 max. volts
- PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFLECTING ELECTRODE: 500 max. volts
- PEAK HEATER-CATHODE VOLTAGE:
  - Heater negative with respect to cathode: 125 max. volts
  - Heater positive with respect to cathode: 125 max. volts

Equipment Design Ranges:

For any post-ultor voltage \( (E_{c4}) \) between 2000* and 6000 volts and any ultor voltage \( (E_{c4}^{\prime}) \) between 1500** and 2600 volts:

- Grid-No.3 Voltage for Focus: 20% to 34.5% of \( E_{c4} \) volts
- Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot: 2.6% to 4.3% of \( E_{c4} \) volts
- Grid-No.3 Current for Any Operating Condition: -15 to +10 μamp

Deflection Factors:

- When \( E_{c5} = 2 \times E_{c4} \):
  - \( DJ₁ & DJ₂ \): 26.5 to 36 v dc/in./kv of \( E_{c4} \)
  - \( DJ₃ & DJ₄ \): 18 to 24 v dc/in./kv of \( E_{c4} \)
- When \( E_{c5} = E_{c4} \):
  - \( DJ₁ & DJ₂ \): 21.5 to 29 v dc/in./kv of \( E_{c4} \)
  - \( DJ₃ & DJ₄ \): 14.5 to 19.5 v dc/in./kv of \( E_{c4} \)

Spot Position

Examples of Use of Design Ranges:

For post-ultor voltage of:
- 2000 volts
- 3000 volts
- 4000 volts
And ultor voltage of:
- 2000 volts
- 1500 volts
- 2000 volts

- Grid-No.3 Volt. for Focus: 400 to 690 volts
- Grid-No.1 Volt. for Visual Extinction: -52 to -87 volts

\( *,*,*,**,*,**,\): See next page.

JUNE 1, 1953
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Deflection Factors:

DJ1 & DJ2  43 to 58  40 to 54  53 to 72  v dc/in.
DJ3 & DJ4  29 to 39  27 to 36  36 to 48  v dc/in.

Maximum Circuit Values:

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

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

- The "ultor" in a cathode-ray tube is the electrode to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection. In the 5AB-types, the ultor function is performed by grid No.4. Since grid No.4 and grid No.2 are connected together within the 5AB-types, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.

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

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

- Recommended minimum value of ultor voltage.

- The deflecting electrodes DJ3 and DJ4 are designed to have extra-high deflection sensitivity and consequently produce less than full-screen deflection. With post-deflection acceleration, the length of deflection may be limited to 6 inches; without post-deflection acceleration, deflection to full screen diameter will ordinarily be obtained. These electrodes are, therefore, more suitable for the signal voltage than for the time-base voltage.

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

- For visual cutoff of undeflected focused spot.

- It is recommended that the deflecting-electrode-circuit resistances be approximately equal.
C1: 0.1 μf, 2500 Volts
C2: 1.0 μf, 2500 Volts
C3: 0.1 μf, 2500 Volts
C4 C5 C6 C7: 0.05 μf, Blocking Capacitors
C8: 0.0001 μf, 2500 Volts
R1: 5 Megohms (Five 10-Meg-ohm, 5-Watt Resistors in Series)
R2 R3: 2 Megohms, 0.5 Watt
R4: 5.5 Megohms, 2 Watts
R5: 2-Megohm Potentiometer
R6: 1.5 Megohms, 0.5 Watt
R7: 0.5-Megohm Potentiometer
R8 R9: 5-Megohm Potentiometer
R10 R11: Dual 5-Megohm Potentiometer
R12 R13 R14 R15: 2 Megohms, 0.5 Watt
R16: 0.5 Megohm, 0.5 Watt
R17: Not less than 2000 ohms per volt of positive signal
R18: 5 Megohms, 0.5 Watt

When cathode is grounded, capacitors should have high voltage rating (2500 volts); when ultor is grounded, they may have low voltage rating (200 volts). For dc amplifier service, deflecting electrodes should be connected 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.
5ABPI

OSCILLOGRAPH TUBE

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

SCREEN DIA.
4 9/16" MIN.

1/4" R.

.875"

16 3/4" ± 3/8"

10 9/32" MAX.

2" ± 1/16"

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

92CM-7842

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

JUNE 1, 1953

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Typical Characteristics

$E_p = 6.3$ Volts
Grid $-3$ Volts adjusted for focus
Post-Ultor Volts $= 2 \times$ Ultor Volts

FEB. 11, 1953
Tube Department
RCA Corporation of America, Harrison, New Jersey
CHARACTERISTICS

$E_F = 8.3\, \text{VOLTS}$

GRID-NR3 VOLTS ADJUSTED FOR FOCUS
POST-ULTOR (GRID NR 5 & COLLECTOR) VOLTS
GREATER THAN ULTOR (GRIDS NR 2 & NR 4)
VOLTS
GRID-NR1 VOLTS = 0

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

ULTOR VOLTS

TOTAL ULTOR & POST-ULTOR MICROAMPERES

FLUORESCENT-SCREEN MICROAMPERES

FEB. 3, 1953

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7910
AVERAGE CHARACTERISTICS

$E_F = 6.3$ VOLTS
GRID-№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>
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...
Phosphorescence...
Persistence...

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

5ABP7 OSCILLOGRAPH TUBE
POST-DEFLECTION ACCELERATOR
ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

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

**General:**
Phosphor (For Curves, see front of this Section)...
P7
Fluorescence...
Phosphorescence...
Persistence...

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...
Phosphorescence...
Persistence...
COLOR FLYING-SPOT CATHODE-RAY TUBE

ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

For use in Flying-Spot Color Video-Signal Generators

**DATA**

**General:**

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

Direct Interelectrode Capacitances:
- Grid No. 1 to all other electrodes: 8 μf
- Cathode to all other electrodes: 5 μf

External conductive neck coating to ultor* (500 max. μf
100 min. μf)

Faceplate, Flat: Clear Glass

Phosphor, Metal-Backed (For Curves, see front of this section): P24

Fluorescence: Light Green
Phosphorescence: Light Green
 Persistence: Extremely Short

Focusing Method: Electrostatic
Deflection Method: Magnetic
Deflection Angle (Approx.): 40°
Overall Length: 12-1/2" ± 3/8"
Greatest Diameter: 5" ± 1/8"
Minimum Useful Screen Diameter: 4-1/4"
Mounting Position: Any
Weight (Approx.): 1.4 lbs

Cap: Recessed Small Cavity (JETEC No.J1-21)
Base: Small-Shell Duodecal 7-Pin (JETEC No.B7-51)

**BOTTOM VIEW**

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

**Socket Contacts Corresponding to Vacant PIN Positions 3, 4, 5, 8, and 9 Should Be Removed**

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

ULTOR* VOLTAGE: 27000 max. volts
GRID-No.3 VOLTAGE: 6000 max. volts
GRID-No.2 VOLTAGE: 350 max. volts

* The "ultor" in a cathode-ray tube is the electrode to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection. In the 5AUP24, the ultor function is performed by grid No.4. Since grid No.4 and collector are connected together within the 5AUP24, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.

AUG. 16, 1954

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
COLOR 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: 125 max. volts
- Heater positive with respect to cathode: 125 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 µamp: 17% to 21.5% of $E_{C4}$ volts
- Grid-No.2 Voltage when circuit design utilizes fixed grid-No.1 voltage ($E_{C1}$) for visual extinction of undeflected focused spot: 2 to 5 times $E_{C1}$ volts
- Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot when circuit design utilizes grid-No.2 voltage ($E_{C2}$) at fixed value: -20% to -50% of $E_{C2}$ volts
- Maximum Grid-No.3 Current for ultor current of 200 µamp: 170 µamp
- Grid-No.2 Current: -15 to +15 µamp

Examples of Use of Design Ranges:
- For ultor voltage of 27000 volts
- Grid-No.3 Voltage for Focus with Ultor Current of 200 µamp: 4600 to 5800 volts
- Grid-No.2 Voltage when circuit design utilizes fixed grid-No.1 voltage of -70 volts for visual extinction of undeflected focused spot: 140 to 350 volts
- Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot when circuit design utilizes grid-No.2 voltage of 200 volts: -40 to -100 volts

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

* Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 20000 volts.
OPERATING CONSIDERATIONS

Resolution of better than 800 lines at the center of the reproduced picture can be produced by the 5AUP24 when it is operated with 27000 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.

For x-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section.
COLOR 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 OF PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

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

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

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"

GRID-N°1 VOLTS

SCREEN BRIGHTNESS - FOOT-LAMBERTS

ULTOR OR GRID-N°3 MICROAMPERES

JUNE 21, 1954 TUBE DIVISION 92CM-6343
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
# 5AYP4 VIEW-FINDER KINESCOPE

**METAL-BACKED SCREEN**

## ELECTROSTATIC FOCUS

## MAGNETIC DEFLECTION

### DATA

**General:**

Heater, for Unipotential Cathode:

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

Direct Interelectrode Capacitances:

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

Faceplate, Spherical: Clear Glass

Phosphor (for curves, see front of this section): P4-Sulfide Type, Metal-Backed

- **Fluorescence**: White
- **Phosphorescence**: White
- **Persistence**: Short

Focusing Method: Electrostatic

Deflection Method: Magnetic

Deflection Angle (Approx.): 53°

Overall Length: 11-9/16" ± 3/8"

Greatest Diameter of Bulb: 4-15/16" ± 3/32"

Minimum Useful Screen Diameter: 4-1/4"

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

Weight (Approx.): 1 lb 6 oz

Mounting Position: Any

Ultor® Terminal: Recessed Small Ball Cap (JETEC No. J1-22)

Bulb: J-39-1/2

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

### Bottom View

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

### Maximum Ratings, Design-Center Values:

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

*The "ultor" in a cathode-ray tube is the electrode to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection. In the 5AYP4, the ultor function is performed by grid No. 4. Since grid No. 4 and collector are connected together within the 5AYP4, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.*

---

**TENTATIVE DATA**

MAY 1, 1955

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**VIEW-FINDER KINESCOPE**

<table>
<thead>
<tr>
<th>GRID-No.1 VOLTAGE:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative bias value.</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>Positive bias value.</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive peak value.</td>
<td>2 max. volts</td>
</tr>
</tbody>
</table>

**PEAK HEATER-CATHODE VOLTAGE:**
- Heater negative with respect to cathode: 180 max. volts
- Heater positive with respect to cathode: 180 max. volts

**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

<table>
<thead>
<tr>
<th>Grid-No.3 Voltage for Focus</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>with Ultor Current of 100 µamp</td>
<td>9.8% to 14.1% of (E_{c4}) volts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grid-No.1 Voltage for Visual Extinction of Focused Raster</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Grid-No.3 Current**</td>
<td>See Curves</td>
</tr>
<tr>
<td>Grid-No.2 Current.</td>
<td>-15 to +15 µamp</td>
</tr>
</tbody>
</table>

**Field Strength of Adjustable Centering Magnet**
- 0 to 8 gausses

**Examples of Use of Design Ranges:**

For ultor voltage of 7000 and grid-No.2 voltage of 200 and 300 volts

<table>
<thead>
<tr>
<th>Grid-No.3 Voltage for Focus with Ultor Current of 100 µamp.</th>
<th>680 to 990</th>
<th>980 to 1410 volts</th>
</tr>
</thead>
</table>

| Grid-No.1 Voltage for Visual Extinction of Focused Raster | -17 to -47 | -25 to -71 volts |

**Maximum Circuit Values:**

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

* Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 5000 volts.

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

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

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

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.
AVERAGE GRID-DRIVE CHARACTERISTIC

- $E_F = 6.3$ VOLTS
- ULTOR (GRID #4 AND COLLECTOR) VOLTS = 10000
- GRID #3 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS
- GRID #1 BIASED TO CUTOFF OF FOCUSED RASTER
- RASTER SIZE = $3\frac{3}{8}'' \times 2\frac{1}{2}''$

---

Diagram with grid lines and curves indicating the relationship between video signal volts from raster cutoff and highlight brightness in foot-lamberts.
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_c = 6.3$ VOLTS
ULTOR (GRID NO. 4 AND COLLECTOR) VOLTS = 10000
GRID NO. 3 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS
GRID NO. 1 BIASED TO CUTOFF OF FOCUSED RASTER

FEB. 24, 1955
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ULTOR (GRID NO. 4 AND COLLECTOR) VOLTS = 10000
GRID-NO. 3 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS
GRID NO. 1 BIASED TO CUTOFF OF FOCUSED RASTER

[Graph showing relationship between video signal volts and max. grid-no. 3 microamperes]
**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 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: White
  - Phosphorescence: White
- Persistence: Medium

**Focusing Method:**
- Electrostatic

**Deflection Method:**
- Magnetic

**Deflection Angle (Approx.):**
- 50°

**Overall Length (Approx.):**
- 12-3/16" ± 3/8" (Approx.)

**Greatest Diameter of Bulb:**
- 5" ± 1/8" (Approx.)

**Minimum Useable Screen Diameter:**
- 4-1/2" (Approx.)

**Minimum Optical-Quality-Circle Diameter:**
- 4-1/4" (Approx.)

**Weight (Approx.):**
- 1-1/2 lbs

**Mounting Position:**
- Any

**Ultor Lead:**
- Molded-On Insulated Cable 48" Long
- Bulb: J-40

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

**Basing Designation for BOTTOM VIEW:**
- 12AA

**Pin 1** — Heater
**Pin 2** — Grid No. 1
**Pin 6** — Grid No. 3
**Pin 7** — Internal Connection—Flexible Cable — Ultor (Grid No. 4, Collector)
**Pin 10** — Grid No. 2

**Pin 11** — Cathode
**Pin 12** — Heater

**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

---

**4-56 TUBE DIVISION**

**TENTATIVE DATA**

**RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY**
## Maximum Ratings, Absolute Values:

**ULTOR VOLTAGE.** .......... 40000 max. volts

**ULTOR INPUT (AVERAGE):**

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

**GRID-No.3 VOLTAGE.** .......... 9000 max. volts

**GRID-No.2 VOLTAGE.** .......... 400 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 .......... 175 max. volts
- Heater positive with respect to cathode .......... 10 max. volts

## Equipment Design Ranges:

*For any ultor voltage \( E_c \) between 35000* and 40000 volts*

- Grid-No.3 (Focusing Electrode) Voltage for ultor current of 300 \( \mu \)amp. .......... 18.5% to 22.5% of \( E_c \) volts

- Grid-No.2 Voltage when circuit design utilizes grid-No.1 voltage \( E_c \) at fixed value for raster cutoff .......... 2.15 to 5.4 times \( E_c \) volts

- Grid-No.1 Voltage for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2 voltage \( E_c \) at fixed value .......... -18.5% to -46.5% of \( E_c \) volts

- Maximum Grid-No.3 Current for ultor current of 300 \( \mu \)amp .......... 100 \( \mu \)amp

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

## Examples of Use of Design Ranges:

*For ultor voltage of 36000 volts*

- Grid-No.3 (Focusing Electrode) Voltage for ultor current of 300 \( \mu \)amp .......... 6650 to 8100 volts

- Grid-No.2 Voltage when circuit design utilizes grid-No.1 voltage of -65 volts for raster cutoff .......... 140 to 350 volts

- Grid-No.1 Voltage for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2 voltage of 200 volts .......... -37 to -93 volts

*: See next page.
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 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 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**

- $E_c = 6.3$ 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"

---

**Diagram Notes:**
- Video Signal Volts from Raster Cutoff
- Grid-N@ 3 or Ultron Microamperes
- Highlight Brightness - Foot-Lamberts

---

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

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**TUBE DIVISION**

---

**92CM - 8549**
HIGH-VACUUM CATHODE-RAY TUBE

Supersedes Type 5BP1

General:

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

Direct Interelectrode Capacitances (Approx.):
Grid No.1 to All Other Electrodes: ... 8.0 ... \mu f
DJ1 to DJ2: .............. 1.3 ... \mu f
DJ3 to DJ4: .............. 1.2 ... \mu f
DJ1 to All Other Electrodes: .... 9.5 ... \mu f
DJ3 to All Other Electrodes: .... 12.0 ... \mu f
DJ1 to All Other Electrodes except DJ2: ... 8.0 ... \mu f
DJ2 to All Other Electrodes except DJ1: ... 7.5 ... \mu f
DJ3 to All Other Electrodes except DJ4: ... 10.0 ... \mu f
DJ4 to All Other Electrodes except DJ3: ... 7.5 ... \mu f

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

Fluorescence: ........................................ Green
Persistence: ........................................ Medium

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

Base: .............. Medium. Shell 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. Do not use
Pin 6-Deflecting Electrode DJ4
Pin 7-Anode No.2
Pin 8-Deflecting Electr. DJ2
Pin 9-Deflecting Electr. DJ3
Pin 10-Grid No.1
Pin 11-Heater, Cathode

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

With DJ1 positive with respect to DJ2, the spot is deflected toward pin 4. With DJ3 positive with respect to DJ4, the spot is deflected toward pin 1.
The angle between the trace produced by DJ3 and DJ4 and its intersection with the plane through the tube axis and pin 1 does not exceed 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:

<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. volts</td>
</tr>
<tr>
<td>ANODE-No. 1 VOLTAGE</td>
<td>1100 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>550 max. volts</td>
</tr>
</tbody>
</table>

### Typical Operation:

- **Anode-No. 2 & Grid-No. 2 Voltage**: 1500 to 2000 volts
- **Anode-No. 1 Volt. for Focus at 75% of Grid-No. 1 Volt. for Cutoff**: 337 to 450 volts
- **Grid-No. 1 Volt. for Visual Cutoff**: -30 to -40 volts

### Deflection Sensitivity:

- **DJ1 and DJ2**: 0.404 to 0.303 mm/v dc
- **DJ3 and DJ4**: 0.446 to 0.334 mm/v dc

### Deflection Factor:

- **DJ1 and DJ2**: 63 to 84 v dc/in.
- **DJ3 and DJ4**: 57 to 76 v dc/in.

- **Brilliance and definition decrease with decreasing anode-No. 2 voltage. In general, anode-No. 2 voltage should not be less than 1500 volts.**
- **Individual tubes may require between +25% and -30% of the values shown with grid-No.1 voltages between zero and cutoff.**
- **Visual extinction of stationary focused spot. Supply should be adjustable to ± 50% of these values.**
- **See curve for average values.**
- **Individual tubes may vary from these values by ± 17%.**

### Spot Position:

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

### Maximum Circuit Values:

- **Grid-No.1—Circuit Resistance**: 1.5 max. megohms
- **Impedance of Any Deflecting-Electrode Circuit at Heater-Supply Frequency**: 1.0 max. megohm
- **Resistance in Any Deflecting-Electrode Circuit**: 5.0 max. megohms

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

---

*Data sheet from RCA Victor Division, Radio Corporation of America, Harrison, New Jersey.*
TYPICAL OSCILLOGRAPH CIRCUIT

C1: 0.1 µf
C2: 0.1 µf
C3 C4 C5 C6: 0.05-µf Blocking Capacitors
R1 R2: 2 Megohms
R3: 6 Megohms

R4: 2-Megohm Potentiometer
R5: 1.0 Megohm
R6: 0.5-Megohm Potentiometer
R7 R8: Dual 5-Megohm Potentiometer
R9 R10: Dual 5-Megohm Potentiometer
R11 R12 R13 R14: 7 Megohms

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

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

JULY 1, 1945
HIGH-VACUUM CATHODE-RAY TUBE

SCREEN RADIUS
2 1/4" MIN.

5 1/4" + 1/16" - 3/32"

.808"

1/2" R.

8" R.

22° 19'

16 3/16

± 3/8"

16 3/4

± 3/8"

10 5/16

MAX.

MEDIUM SHELL MAGNAL 11-PIN BASE

1 5/8" ± 1/16"

92CM-4976R2

° 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

DATA 2

RADIO CORPORATION OF AMERICA, MARRISON, NEW JERSEY
General:
Heater, for Unipotential Cathode:
  Voltage ........................................ 6.3 ac or dc volts
  Current ........................................ 0.6 amp
Direct Inter-electrode Capacitances (Approx.):
  Grid No. 1 to All Other Electrodes ........ 8 μf
  Cathode to All Other Electrodes ............ 9 μf
  DJ 1 to DJ 2 ................................ 2 μf
  DJ 3 to DJ 4 ................................ 2 μf
  DJ 1 to All Other Electrodes ............... 9 μf
  DJ 2 to All Other Electrodes ............... 9 μf
  DJ 3 to All Other Electrodes ............... 7 μf
  DJ 4 to All Other Electrodes ............... 8 μf
Phosphor (For Curves, see front of this Section) .... P1
  Fluorescence and Phosphorescence .......... Green
  Persistence of Phosphorescence ............. Medium
Focusing Method .................................. Electrostatic
Deflection Method ................................ Electrostatic
Overall Length .................................. 16-3/4" ± 3/8"
Greatest Diameter of Bulb ...................... 5-1/4" ± 3/32"
Minimum Useful Screen Diameter .............. 4-1/2"
Mounting Position ................................ Any
Cap. .................................. Recessed Small Ball (JETEC No.J1-22)
Base .... Medium-Shell Diheptal 12-Pin (JETEC No.B12-37)
Basing Designation for BOTTOM VIEW ........ 14J
Pin 1-Heater .................................. 9-Anode No.2,
Pin 2-Cathode .................................. Grid No.2
Pin 3-Grid No.1 ................................ Deflecting
Pin 4-Internal Con. .............................. Electro.DJ 2
  Do not use ...................................
Pin 5-Anode No.1 ................................ Deflecting
Pin 7-Deflecting ................................ Electro.DJ 3
  Electrode DJ 3 ................................
Pin 8-Deflecting ................................ Deflecting
  Electrode DJ 4 ................................
Pin 11-Deflecting ................................ Electro.DJ 4
Pin 12-No Con- ................................
  nnection .....................................
Pin 14-Heater ...................................
  Cap ...................................... Anode No.3

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

With DJ 1 positive with respect to DJ 2, the spot is deflected toward pin 5. With DJ 3 positive with respect to DJ 4, the spot is deflected toward pin 2.

The plane through the tube axis and each of the following items may vary from the trace produced by DJ 1 and DJ 2 by the following angular tolerances measured about the tube axis: Pin 5, 10°; Cap (on same side of tube as pin 5), 10°.

The angle between the trace produced by DJ 1 and DJ 2 and the trace produced by DJ 3 and DJ 4 is 90° ± 3°.
Maximum Ratings, Design-Center Values:

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

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

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

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

Equipment Design Ranges:
For any anode-No. 3 voltage \((E_b_3)\) between 2000\(^*\) and 4000 volts
and any anode-No. 2 voltage \((E_b_2)\) between 1500\(^*\) and 2000 volts

\[ E_b_3 = 2 \times E_b_2 \]

DJ1 & DJ2 ............................................... 39 to 53 v dc/in./kv of \(E_b_2\)
DJ3 & DJ4 ............................................... 33 to 45 v dc/in./kv of \(E_b_2\)

\[ E_b_2 = E_b_2 \]

DJ1 & DJ2 ............................................... 31 to 42 v dc/in./kv of \(E_b_2\)
DJ3 & DJ4 ............................................... 27 to 37 v dc/in./kv of \(E_b_2\)

Spot Position. ................................................. ##

Examples of Use of Design Ranges:
For anode-No. 3 voltage of . 2000 3000 4000 volts
and anode-No. 2 voltage of . 2000 1500 2000 volts

\[ E_b_3 = 2 \times E_b_2 \]

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 \(\Delta\)
DJ3 & DJ4 ............................................... 54 to 74 50 to 68 66 to 90 \(\Delta\)

Maximum Circuit Values:
Grid-No. 1 Circuit Resistance ................................ 1.5 max. megohms
Resistance in Any Deflecting-Electrode Circuit\(^*\) ....... 5.0 max. megohms

\(\Delta\): See next page. \(\rightarrow\) 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.

Volts dc/in.

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

It is recommended that the deflecting-electrode-circuit resistances be approximately equal.
C1: 0.1 µf, 2500 Volts
C2: 1.0 µf, 200 Volts
C3: 0.1 µf, 2500 Volts
C4 C5 C6 C7: 0.05-µf, Blocking Capacitors
C8: 0.0001 µf, 2500 Volts
R1: 50 Megohms (Five 10-Megohm, 1-Watt Resistors in Series)
R2 R3: 2 Megohms, 0.5 Watt
R4: 5.5 Megohms, 2 Watts

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

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

OCTOBER 1, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
The bulb will not deviate more than $2^\circ$ in any direction from perpendicular erected at center of bottom of base.

92CM-6408R4
$E_f = 6.3$ VOLTS
ANODE - No. 1 VOLTS ADJUSTED FOR FOCUS
ANODE - No. 3 VOLTS = 2 x ANODE - No. 2 VOLTS
$E_f = 6.3$ VOLTS

ANODE-N° 1 VOLTS ADJUSTED FOR FOCUS
ANODE-N° 3 VOLTS GREATER THAN
ANODE-N° 2 VOLTS

GRID-N° 1 VOLTS = 0

MAX. TOTAL CURRENT FOR ANY TUBE

TYPICAL FLUORESCENT-SCREEN
(ANODE N° 3) CURRENT

TOTAL ANODE-N° 2 & ANODE-N° 3 MICROAMPERES

FLUORESCENT-SCREEN MICROAMPERES

ANODE-N° 2 VOLTS

DEC. 24, 1946

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6821
### AVERAGE CHARACTERISTICS

- **Eₚ = 6.3 VOLTS**
- **ANODE-№1 VOLTS ADJUSTED TO GIVE FOCUS**

#### Table

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

#### Diagram

- **GRID №1 VOLTS**
  - -60, -40, -20, 0
- **ANODE №1 MICROAMPERES**
- **ANODE №2 MICROAMPERES**
- **ANODE №3 MICROAMPERES**

---

**Dec. 26, 1946**

**Tube Department**

**Radio Corporation of America, Harrison, New Jersey**

**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 BUILDUP 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.
5FP4-A
KINESCOPE

DATA

General:
Heater, for Unipotential Cathode:
  Voltage........................................ 6.3 ± 10% ac or dc volts
  Current........................................ 0.6 amp
Direct Interelectrode Capacitances (Approx.):
  Grid No.1 to All Other Electrodes........... 8.5 μf
  Cathode to All Other Electrodes............ 5.0 μf
Phosphor (For Curves see front of this section)..... No.4
  Fluorescence.................................. White
  Persistence.................................... Medium
Focusing Method................................... Magnetic
Deflection Method................................... Magnetic
Solid 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"
Raster Size (Approx.)............................ 3" x 4"
Mounting Position................................... Any
Cap.................................................... Recessed Small Ball
Base.................................................. Long Medium-Shell Octal 8-Pin

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

Maximum Ratings, Design-Center Values:
ANODE & GRID-No.3 VOLTAGE...................... 8000 max. volts
GRID-No.2 VOLTAGE................................ 300 max. volts
GRID-No.1 VOLTAGE:
  Negative bias value........................... 125 max. volts
  Positive bias value........................... 2 max. volts
PEAK HEATER-CATHODE VOLTAGE:
  Heater negative with respect to cathode.................................................. 125 max. volts
  Heater positive with respect to cathode.................................................. 125 max. volts

Typical Operation:
Anode & Grid-No.3 Voltage*...................... 6000 volts
Grid-No.2 Voltage................................ 250 volts
Grid-No.1 Voltage*.............................. -45 volts
Focusing-Coil Current (DC)†...................... 122 approx. ma.
Horizontal Deflecting Coil Current (DC)‡........ 340 approx. ma.

* ±, †, ‡: see next page.

AUG. 15, 1946
Maximum Circuit Values:

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

- Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 4000 volts.
- Visual extinction of undeflected focused spot. Supply should be adjustable to +55% and -45% of indicated value.
- For RCA Focusing Coil, Stock No.52446, or equivalent, with the combined grid-No.1-bias voltage and video-signal voltage adjusted to produce a highlight brightness of 10 foot-lamberts on a 2-7/8" x 3-7/8" picture area.
- To deflect beam from side to side of a raster 3-7/8" wide with RCA Deflection Yoke, Stock No.51586, or equivalent. Coil current varies directly as the square root of the anode voltage.

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

92CM-6362R3
AVERAGE CHARACTERISTICS

\( E_F = 6.3 \text{ VOLTS} \)
ANODE VOLTS = 6000
GRID-N\#2 VOLTS = 250
GRID-N\#1 BIASED TO CUTOFF
RASTER FOCUSED

POSITIVE SIGNAL SWING EQUALS NEGATIVE BIAS

HIGHLIGHT BRIGHTNESS—FOOT-LAMBERTS
ANODE CURRENT—MICROAMPERES
PEAK GRID-N\#1 SIGNAL VOLTS

FEB. 26, 1946
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-6683
5FP7-A
OSCILLOGRAPH TUBE
MAGNETIC FOCUS MAGNETIC DEFLECTION

DATA

General:
Heater, for Unipotential Cathode:
  Voltage ................................ 6.3 ac or dc volts
  Current ................................ 0.6 amp
Direct Interelectrode Capacitances (Approx.):
  Grid No.1 to All Other Electrodes ........ 8.5 μuf
  Grid No.2 to All Other Electrodes ........ 7 μuf
  Cathode to All Other Electrodes .......... 5 μuf
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 ................................ 11-1/8" ± 3/8"
Greatest Diameter of Bulb .................. 4-15/16" ± 3/32"
Minimum Useful Screen Diameter .......... 4-1/4"
Mounting Position ............................ Any
Base ............................................ Recessed Small Ball

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

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 ............................... #

* O A #: See next page.

JUNE 15, 1948 TUBE DEPARTMENT R.C.A. TENTATIVE DATA
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Maximum Circuit Values:
Grid-No. 1-Circuit Resistance ............. 1.5 max. megohms

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

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

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

* Anode and grid No. 3, which are connected together within tube, are referred to herein as anode.
* At or near this rating, the effective resistance of the anode supply should be adequate to limit the anode input power to 6 watts.
* Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 4000 volts.
* For visual extinction of undeflected focused spot.
* For JETEC Focusing Coll 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 9 mm radius concentric with the center of the tube face.

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

JUNE 15, 1948
TENTATIVE DATA
5FP15-A
OSCILLOGRAPH TUBE
MAGNETIC FOCUS MAGNETIC DEFLECTION

DATA

General:
Heater, for Unipotential Cathode:
Voltage ................ 6.3 ................ ac or dc volts
Current ................ 0.6 ± 10% ................ amp
Direct Interelectrode Capacitances (Approx.):
Grid No.1 to all other electrodes ........ 8 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 1 - No Connection
Pin 2 - Heater
Pin 3 - Grid No.2
Pin 4 - No Connection
Pin 5 - Grid No.1
Pin 6 - No Connection
Pin 7 - Cathode
Pin 8 - Heater
Cap - Ultron (Grid No.3, Collector)

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

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

10-56
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Equipment Design Ranges:
For any ultor voltage (Ec ) between 4000H and 8000 volts
and grid-No. 2 voltage (E7c2) between 150 and 700 volts
Grid-No.l Voltage for Visual
Extinction of Undeflected
Focused Spot..............................
Grid-No. 2 Current.........................

Focus'ing-Coi 1

Current

-10% to -28% of Ec2
-15 to +15

(DC)00. Qy'EC5/4000 x 96] ± 15%

volts
/zamp|
ma

##

Spot Position...................................

Examples of Use of Design Ranges:

For ultor voltage of
and grid-No. 2 voltage of
Grid-No.l Voltage for Visual
Extinction of Undeflected
Focused Spot..............................
Focusing-Coil Current (DC). .

5000
250

4000
250

-25 to -70 -25 to -70
82 to 110 91 to 123

volts
volts

volts
ma

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

SPECIAL PERFORMANCE DATA
Line Width:
For Ultor Voltage of 4000 Volts . . . •
For Ultor Voltage of 5000 Volts ....

0.010 max.*
0.009 max.*

inch
inch

# Brilliance and definition decrease with decreasing ultor voltage.
In
general, the ultor voltage should not be less than 4000 volts.
OO For specimen focusing coil similar to JETEC Focusing Coil No.106
positioned with air gap toward faceplate and center line of air gap
2-3/4" from Reference Line
Out line; and ultor current
of 200 microamperes.
## with the tube shielded from extraneous fields, the center of the
undeflected, unfocused, 1ow-intensity spot will fall within a circle
having a 9-mm radius concentric with the center of the tube face.

(See Dimensional

*

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 vol tage of 250 volts, and a 49-line raster.
Raster width is adjusted to 11.4 cm and focusing-coil Current is
adjusted t0give sharpest focus at center of tube face.
Raster height
is contracted until individual scanning lines are just barely distin­
guishable.
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).

Line width

10-56
TUBE DIVISION
RADIO CORPORATION of AMERICA. HARRISON, NEW JERSEY

TENTATIVE DATA



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
5TP4
PROJECTION KINESCOPE
ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

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........... μf
Cathode to All Other Electrodes........ 5.0............. μf
External Conductive Coating to Anode No.2
{ 500 max............ μf
100 min.............. μf
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 Usefull 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 μa........ 4320 to 5400 volts
* See next page.

MAR. 15, 1948
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Grid-No.2 Voltage** .............. 200 .... volts
Grid-No.1 Voltage for Visual Cutoff°  -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
Grid-No.2—Circuit Resistance .... 390 min. ohms
Anode-No.1—Circuit Resistance .. 6800 min. ohms
Anode-No.2—Circuit Resistance .. 30000 min. ohms

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 6B6G-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.

[5TP4 PROJECTION KINESCOPE]

Grid-Number 1
Voltage:
-42 to -98 volts

Anode-Number 1
Current:
65 μa

Anode-Number 2
Current:
±15 μa

Maximum Circuit Values:
Grid-Number 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-Number 1—Circuit Resistance:
180 min. ohms

Grid-Number 2—Circuit Resistance:
390 min. ohms

Anode-Number 1—Circuit Resistance:
6800 min. ohms

Anode-Number 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 6B6G-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.

[5TP4 PROJECTION KINESCOPE]

Grid-Number 1
Voltage:
-42 to -98 volts

Anode-Number 1
Current:
65 μa

Anode-Number 2
Current:
±15 μa

Maximum Circuit Values:
Grid-Number 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-Number 1—Circuit Resistance:
180 min. ohms

Grid-Number 2—Circuit Resistance:
390 min. ohms

Anode-Number 1—Circuit Resistance:
6800 min. ohms

Anode-Number 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 6B6G-G's) .. RCA Type No.211T2
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* 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.

[5TP4 PROJECTION KINESCOPE]

Grid-Number 1
Voltage:
-42 to -98 volts

Anode-Number 1
Current:
65 μa

Anode-Number 2
Current:
±15 μa

Maximum Circuit Values:
Grid-Number 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-Number 1—Circuit Resistance:
180 min. ohms

Grid-Number 2—Circuit Resistance:
390 min. ohms

Anode-Number 1—Circuit Resistance:
6800 min. ohms

Anode-Number 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 6B6G-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.

[5TP4 PROJECTION KINESCOPE]

Grid-Number 1
Voltage:
-42 to -98 volts

Anode-Number 1
Current:
65 μa

Anode-Number 2
Current:
±15 μa

Maximum Circuit Values:
Grid-Number 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-Number 1—Circuit Resistance:
180 min. ohms

Grid-Number 2—Circuit Resistance:
390 min. ohms

Anode-Number 1—Circuit Resistance:
6800 min. ohms

Anode-Number 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 6B6G-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.

[5TP4 PROJECTION KINESCOPE]

Grid-Number 1
Voltage:
-42 to -98 volts

Anode-Number 1
Current:
65 μa

Anode-Number 2
Current:
±15 μa

Maximum Circuit Values:
Grid-Number 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-Number 1—Circuit Resistance:
180 min. ohms

Grid-Number 2—Circuit Resistance:
390 min. ohms

Anode-Number 1—Circuit Resistance:
6800 min. ohms

Anode-Number 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 6B6G-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.
**5TP4**

**PROJECTION KINESCOPE**

---

**OPTICAL QUALITY CIRCLE**

- 2 1/8" MIN. R.
- SCREEN RADIUS 2 1/4" MIN.
- 7.100 ± .200" I.R.
- 49/32 ± 3/16" EXTERNAL INSULATING COATING
- 2" ± 1/8" DIA.
- 11 3/4" ± 3/8"

**HIGH-VOLTAGE EXTERNAL CONDUCTIVE COATING CONNECTED TO CAP**

- 3/4" ± 3/16"
- 11 1/2" ± 1/4"

**ANODE-NR2 RECESSED SMALL CAVITY CAP (NOTE 1)**

- .950" MAX.

**REFERENCE LINE (NOTE 2)**

- 4" ± 3/16"

**EXTERNAL CONDUCTIVE COATING (NOTE 4)**

- 17/16" ± 1/16"

**SMALL-SHELL DUODECAL 7-PIN BASE**

**SEE NOTE 3**

---

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

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

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

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

Anode-Ne 2 Volts = 27000
Anode-Ne 1 Volts Adjusted to Give Focus
Grid-Ne 2 Volts = 200
Grid-Ne 1 Biased to Cutoff
Raster Size = 3" x 4"

Peak Grid-Ne 1 Signal Volts

Anode-Ne 2 or Anode-Ne 1 Current - Microamperes
Highlight Brightness - Foot-Lamberts

FEB. 7, 1946
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 Inter-electrode Capacitances (Approx.):
- Grid No. 1 to All Other Electrodes: 8.0 μf
- DJ1 to DJ2 .................................. 2.5 μf
- DJ3 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)
- Fluorescence ................................ Green
- Persistence .................................. Medium

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

Overall Length .................................. 14-3/4" ± 3/8"
Greatest Diameter of Bulb: 5-1/4" ± 3/32"
Minimum Useful Screen Diameter: 4-1/2"

Mounting Position .................................. Any

Base .................................. Small-Shell Duodecal 12-Pin

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

Pin 1 - Heater .................................. Pin 8 - Anode No.2
Pin 2 - Grid No. 1 ................................ Pin 9 - Deflecting
Pin 3 - Cathode ................................... Pin 10 - Deflecting
Pin 4 - Anode No. 1 ................................. Pin 11 - Internal Con.
Pin 5 - Internal Con. Do Not Use .......................... Pin 12 - Heater
Pin 6 - Deflecting Electrode DJ3 Do Not Use
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°.
**Maximum Ratings, Design-Center Values:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Range</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>
</tbody>
</table>

**GRID-No. 1 (CONTROL ELECTRODE) VOLTAGE:**

<table>
<thead>
<tr>
<th>Bias Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative bias</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Positive bias</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Peak positive</td>
<td>2 max. volts</td>
</tr>
</tbody>
</table>

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

**PEAK HEATER-CATHODE VOLTAGE:**

<table>
<thead>
<tr>
<th>Bias Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater negative</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>Heater positive</td>
<td>125 max. volts</td>
</tr>
</tbody>
</table>

**Equipment Design Ranges:**

For any anode-No. 2 voltage ($E_{b2}$) between 1000* and 2500 volts:

- **Anode-No. 1 Voltage**: 17% to 32% of $E_{b2}$
- **Max. Grid-No. 1 Voltage for Visual Cutoff**: 4.5% of $E_{b2}$
- **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.
- **DJ3 & DJ4**: 23 - 31 46 - 62 volts dc/in.

**Maximum Circuit Values:**

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

---

* Recommended minimum value.

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

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

CE-6819
The bulb will not deviate more than 2° in any direction from the perpendicular erected at the center of bottom of the base.

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

A = 1.85° max., B = 0.500°, C = 0.200° min., D = 0.925°.

92CM-6763
$E_p = 6.3 \text{ VOLTS}$

ANODE-N½ I VOLTS ADJUSTED FOR FOCUS
CHARACTERISTICS

E<sub>φ</sub> = 6.3 VOLTS
ANODE-N<sub>1</sub> VOLTS ADJUSTED FOR FOCUS
GRID-N<sub>1</sub> VOLTS = 0
--- TYPICAL FLUORESCENT-SCREEN CURRENT
(SEE TEXT)

ANODE-N<sub>2</sub> MILLIAMPERES

ANODE-N<sub>2</sub> VOLTS

FLUORESCENT-SCREEN MICROAMPERES

OCT. 21, 1949
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6811R1
AVERAGE CHARACTERISTICS

$E_p = 6.3 \text{ VOLTS}$
ANODE-N°1 VOLTS ADJUSTED FOR FOCUS
ANODE-N°2 VOLTS = 2000
- - - ANODE-N°2 CURRENT
--- FLUORESCENT-SCREEN CURRENT (SEE TEXT)
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.
**ELECTROSTATIC FOCUS**

**MAGNETIC DEFLECTION**

### DATA

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

#### Direct Interelectrode Capacitances:
- Grid No.1 to All Other Electrodes: 7.5 µf
- Cathode to All Other Electrodes: 5 µf
- External Conductive Coating to Anode No.2: 500 max. µf
  - 100 min. µf

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

#### Focusing Method:
- Electrostatic

#### Deflection Method:
- Magnetic

#### Deflection Angle (Approx.)
- 50°

#### Overall Length (Approx.)
- 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
- Recessed Small Cavity

#### Base
- Small-Shell Duodecal 7-Pin

**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.
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 6AST-G booster scanning tube and separate high-voltage supply . . . RCA Type No. 204T1
For use with single high-voltage tripler supply employing 3 183-G7/8016'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 ± 40% when grid-No.1 voltage cutoff is desired at -70 volts.

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

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

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

OCTOBER 28, 1948
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
FLYING-SPOT CATHODE-RAY TUBE
ELECTROSTATIC FOCUS MAGNETIC DEFLECTION
For use in Flying-Spot Video-Signal Generators

**DATA**

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

Direct Interelectrode Capacitances:
- Grid No.1 to All Other Electrodes: 7.5 μμf
- Cathode to All Other Electrodes: 5 μμf
- External Conductive Coating to Anode No.2: (500 max. μμf)
- (100 min. μμf)

Phosphor: No.15

Fluorescence:
- Visible Radiation: Blue-Green
- Invisible Radiation: Near Ultraviolet

Phosphorescence:
- Persistence of Visible Radiation: Very Short
- Persistence of Invisible Radiation: Extremely 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"
Minimum Inside Diameter of Deflecting Coil: 1.505"
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.-
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater
Cap. - Anode No.2

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>27000 max. volts</td>
</tr>
<tr>
<td>ANODE-No.1 VOLTAGE</td>
<td>6000 max. volts</td>
</tr>
<tr>
<td>GRID-No.2 VOLTAGE</td>
<td>350 max. volts</td>
</tr>
<tr>
<td>GRID-No.1 VOLTAGE:</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>
</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: 125 max. volts
- Heater positive with respect to cathode: 125 max. volts

JUNE 15, 1948
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**Typical Operation:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode-No.2 Voltage</td>
<td>20000 volts</td>
</tr>
<tr>
<td>Anode-No.1 Voltage Range</td>
<td>20000 volts</td>
</tr>
<tr>
<td>Anode-No.2 Current of 150 μamp.</td>
<td>3000 to 3800 volts</td>
</tr>
<tr>
<td>Grid-No.2 Voltage**</td>
<td>200 volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage for Visual Cutoff</td>
<td>-42 to -98 volts</td>
</tr>
<tr>
<td>Anode-No.2 Current</td>
<td>150 μamp</td>
</tr>
<tr>
<td>Max. Anode-No.1 Current</td>
<td>200 μamp</td>
</tr>
<tr>
<td>Grid-No.2 Current Range</td>
<td>-15 to +15 μamp</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>

**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:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1-Circuit Resistance</td>
<td>180 min. ohms</td>
</tr>
<tr>
<td>Grid-No.2-Circuit Resistance</td>
<td>390 min. ohms</td>
</tr>
<tr>
<td>Anode-No.1-Circuit Resistance</td>
<td>6800 min. ohms</td>
</tr>
<tr>
<td>Anode-No.2-Circuit Resistance</td>
<td>30000 min. ohms</td>
</tr>
</tbody>
</table>

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

**Components:**

- Deflecting Yoke. RCA Type No. 201D11

* Brilliance and definition decrease with decreasing anode voltages. In general, anode-No. 2 voltage should not be less than 15000 volts.
* Subject to variation of ±40% when grid-No. 1 voltage cutoff is desired at -70 volts.
* Visual extinction of undeflected focused spot.

**OPERATING NOTES**

Soft x-rays are produced when the 5WP15 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 5WP15. To utilize such resolution capability in the horizontal direction with the standard scanning rate of 625 lines, it is necessary to use a video amplifier having a band-width of at least 10 megacycles.

The blue-green radiation decays hyperbolically to about 30 per cent of its initial value in 1.6 microseconds. The ultra
violet radiation has an equivalent exponential decay with a
time constant less than 0.06 microsecond. The frequency re-
sponse of the ultraviolet radiation is substantially constant
for a range of 3 megacycles and then decreases exponentially
toward zero at approximately 100 megacycles.

The P15 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 when optimum efficiency of the screen is desired at
maximum anode-No. 2 current.

Operation of the 5WP15 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.

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

[Diagram of a block diagram with labels for vertical & horizontal sawtooth generators, vertical output amplifier, horizontal output amplifier, high-voltage power supply, multiplier phototube power supply, synchronizing signal generator, mixed blanking signal, blanking amplifier, video amplifier with equalization, type 931-A, objective lens, slide, condenser lenses, to grid No. 1, deflection yoke, high voltage, anode No. 2, and to line amplifier.]

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" + .003" - .000" AND 2" LONG WILL REST ON BULB CONE.

NOTE 3: EXTERNAL CONDUCTIVE 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.
$E_f = 6.3$ VOLTS
ANODE - N°2 VOLTS = 20000
ANODE - N°1 VOLTS ADJUSTED TO GIVE FOCUS
GRID - N°2 VOLTS = 200
AVERAGE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ANODE - $N^2$ VOLTS $= 27000$
ANODE - $N^1$ VOLTS ADJUSTED TO FOCUS
GRID - $N^2$ VOLTS $= 200$

DEC. 8/1947
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-8917
FLYING-SPOT CATHODE-RAY TUBE

ELECTROSTATIC FOCUS
MAGNETIC DEFLECTION

For use in Flying-Spot Video-Signal Generators

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 .... \( \mu \)f
Cathode to All Other Electrodes. .... 5 .... \( \mu \)f

External Conductive Coating to Anode .... 500 max. \( \mu \)f

Phosphor (For Curves, see front of this Section) . . . . No.16
Fluorescence .......... Violet and Near-Ultraviolet
Phosphorescence .......... Violet and Near-Ultraviolet
Persistence. .......... Extremely Short

Focusing Method. .......... Electrostatic
Deflection Method. .......... Magnetic
Deflection Angle (Approx.) .......... 40°
Overall Length .......... 14-3/8" \pm 3/8"
Greatest Diameter of Bulb. .......... 5" \pm 1/8"
Minimum Useful Screen Diameter .......... 4-1/4"

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

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

SOCKET CONTACTS CORRESPONDING TO VACANT PIN POSITIONS 3, 4, 5, 8, & 9 SHOULD BE REMOVED

Maximum Ratings, Design-Center Values:
ANODE VOLTAGE. .......... 27000 max. volts
GRID-No.3 VOLTAGE. .......... 7000 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 .... 150 max. volts
Heater positive with respect to cathode. .... 150 max. volts

MARCH 1, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**Typical Operation:**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Grid-No. 3</th>
<th>Grid-No. 2</th>
<th>Grid-No. 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>20000</td>
<td>27000</td>
<td></td>
</tr>
<tr>
<td>Grid-No. 3 Voltage Range for</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anode Current as Indicated</td>
<td>4700 ± 12%</td>
<td>6300 ± 12%</td>
<td></td>
</tr>
<tr>
<td>Grid-No. 2 Voltage**</td>
<td>200</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Grid-No. 1 Voltage for Visual</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extinction of Undelected</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Focused Spot°</td>
<td>-70</td>
<td>-70</td>
<td></td>
</tr>
<tr>
<td>Anode Current</td>
<td>25</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Max. Grid-No. 3 Current for</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anode Current as Indicated</td>
<td>75</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Grid-No. 2 Current Range</td>
<td>-15 to +15</td>
<td>-15 to +15</td>
<td></td>
</tr>
</tbody>
</table>

**Maximum Circuit Values:**

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

* Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 20000 volts.

** Subject to variation of ± 40% when grid-No. 1 voltage cutoff is desired at the average cutoff value of -70 volts.

O Subject to variation of ± 40% when grid-No. 2 voltage is maintained at 200 volts.

**Operating Notes**

* X-Ray Warning. X-ray radiation is produced at the face of the 5ZP16 when it is operated at its normal anode 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.

Resolution of better than 1000 lines at the center of the reproduced picture can be produced by the 5ZP16 when it is operated with 27000 volts on the anode. At lower anode 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 anode current. For any particular value of anode current, the ultraviolet output is approximately 50 per cent higher when the 5ZP16 is operated with 27000 volts on the anode than when operated with 20000 volts.

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 OF PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

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

MARCH 1, 1951

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
$E_f = 6.3$ VOLTS
ANODE VOLTS = 20000
GRID-№ 3 VOLTS ADJUSTED TO GIVE FOCUS
GRID-№ 2 VOLTS = 200
AVERAGE CHARACTERISTICS

E. f. = 6.3 VOLTS
ANODE VOLTS = 27000
GRID-N. 3 VOLTS ADJUSTED TO GIVE FOCUS
GRID-N. 2 VOLTS = 200
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 µuf
Grid No.2 to All Other Electrodes: 7 µuf
Cathode to All Other Electrodes: 5 µuf

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

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

Overall Length: 13-1/4" ± 3/8"
Greatest Diameter of Bulb: 7" ± 1/8"
Maximum Useful Screen Diameter: 6"

Mounting Position: Any
Cap.: Recessed Small Ball
Base: Long Medium-Shell Octal 8-Pin

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

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

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

*,°,* See next page.

JUNE 15, 1948
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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

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

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

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

- Anode and grid No. 3, which are connected together within tube, are referred to herein as anode.
- At or near this rating, the effective resistance of the anode supply should be adequate to limit the anode input power to 6 watts.
- Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 4000 volts.
- For visual extinction of undeflected focused spot.
- For JETEC Focusing Coil No. 106, or equivalent, with center line of air gap approximately 2-3/4" from reference line (see Outline Drawing), and total anode current of 200 microamperes.
- The center of the undeflected, unfocused spot will fall within a circle having 12 mm radius concentric with the center of the tube face.
NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN No. 5 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF 10°. ANODE TERMINAL IS ON SAME SIDE OF TUBE AS PIN No. 5.

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

NOTE 3: The bulb will not deviate more than 2° in any direction from the perpendicular erected at the center of the bottom of the base.

92CM-6367R3
AVERAGE CHARACTERISTIC

$E_f = 6.3$ VOLTS
GRID-NO. 2 VOLTS = 250

MAR. 22, 1948  TUBE DEPARTMENT  RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY  92CM-6373RI
ELECTROSTATIC FOCUS, MAGNETIC DEFLECTION

General:
Heater, for Unipotential Cathode:
  Voltage: \( 6.3 \pm 10\% \) ac or dc volts
  Current: \( 0.6 \) amp
Direct Interelectrode Capacitances (Approx.):
  Grid No.1 to All Other Electrodes: \( 8.0 \) \( \mu \)f
  Cathode to All Other Electrodes: \( 6.5 \) \( \mu \)f
Phosphor (For Curves, see front of this Section): No.1 Green
  Persistence: Medium
Focusing Method:
  Electrostatic
Deflection Method:
  Magnetic
Overall Length: \( 13-7/16" \pm 3/8" \)
Greatest Diameter of Bulb: \( 7" \pm 1/8" \)
Minimum Useful Screen Diameter: 6-1/2"
Cap. Mounting Position: Recessed Small Ball
Base: Long Medium-Shell Octal 8-Pin
Basing Designation for BOTTOM VIEW: 6AZ
  Pin 1 - No Connection
  Pin 2 - Anode No.1
  Pin 3 - No Connection
  Pin 4 - Grid No.2
  Pin 5 - Grid No.1
  Pin 6 - Cathode
  Pin 7 - Heater
  Pin 8 - Heater
  Cap - Anode No.2

Maximum Ratings, Design-Center Values:
ANODE-No.2 VOLTAGE: \( 8000 \) max. volts
ANODE-No.1 VOLTAGE: \( 2400 \) max. volts
GRID-No.2 VOLTAGE: \( 300 \) max. volts
GRID-No.1 VOLTAGE:
  Negative bias value: \( 125 \) max. volts
  Positive bias value: \( 2 \) max. volts
PEAK HEATER-CATHODE VOLTAGE:
  Heater negative with respect to cathode: \( 125 \) max. volts
  Heater positive with respect to cathode: \( 125 \) max. volts

Typical Operation:
Anode-No.2 Voltage*: \( 4000 \) \( 7000 \) volts
Anode-No.1 Voltage for Focus at 75% of Grid-No.1 Voltage for Cutoff**: \( 780 \) \( 1365 \) \( 250 \) \( 250 \) \( 1365 \) \( 250 \) \( 250 \) \( 250 \) volts
Grid-No.2 Voltage: \( 250 \) \( 250 \) \( 1365 \) \( 250 \) \( 250 \) \( 250 \) \( 250 \) \( 250 \) volts
Grid-No.1 Voltage for Visual Cutoff**: \( -45 \) \( -45 \) \( -45 \) \( -45 \) \( -45 \) \( -45 \) \( -45 \) \( -45 \) \( -45 \) volts

*\ O, **: See next page.
Brilliance and definition decrease with decreasing anode-No. 2 voltage. In general, the anode-No. 2 voltage should not be less than 4000 volts.

Individual tubes may require between -30% and +20% of the values shown with grid-No. 1 voltages between zero and cutoff.

Visual extinction of undeflected focused spot. Supply should be adjustable to ±50% of indicated value.

Maximum Circuit Values:
Grid-No. 1-Circuit Resistance. . . . . . . 1.5 max. megohms
NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN No.2 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE No.2 TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF 10°. ANODE No.2 TERMINAL IS ON SAME SIDE OF TUBE AS PIN No.2.

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

NOTE 3: ½ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

92CM-6364R2

AUG. 15, 1946 TUBE DEPARTMENT RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
$E_t = 6.3$ VOLTS
ANODE-$N\#1$ VOLTS ADJUSTED TO GIVE FOCUS
GRID-$N\#2$ VOLTS = 250

GRID VOLTS

ANODE $N\#2$ MICROAMPERES

4200

4000

3000

2000

1000

600

500

400

300

200

100

0

-10

-20

-30

-40

AUG. 23, 1946
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92C-6424
**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

External Conductive Coating to Anode No.2: 1500 max. \(\mu\)f (400 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°
Ion Trap: Magnetic
External Coating: Conductive
Overall Length: 14-1/16" ± 3/8"
Greatest Diameter of Bulb: 7-3/16" ± 1/8"
Minimum Useful Screen Diameter: 6"
Raster Size (Approx.): 4" x 5-1/2"
Mounting Position: Any
Cap. Base: Small-She Duodecal 7-Pin Recessed Small Cavity

**Pin Configuration:**
- Pin 1: Heater
- Pin 2: Grid No.1
- Pin 6: Anode No.1
- Pin 7: Internal Con.- Do Not Use
- Pin 10: Grid No.2
- Pin 11: Cathode
- Pin 12: Heater
- Cap: Anode No.2, Grid No.3

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

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

*: See next page.
+: Indicates a change.

NOV. 15, 1949

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Typical Operation:
Anode-No.2 Voltage* ......... 6000 .. volts
Anode-No.1 Voltage for Focus° ......... 1215 to 1645 volts
Grid-No.2 Voltage. ........ 250 .. volts
Grid-No.1 Voltage for Visual Cutoff** ......... -27 to -63 volts
Max. Anode-No.1 Current Range. ......... -15 to +10 μamp

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

Minimum Circuit Values:
The power supply should be of the limited-energy type with inherent regulation to limit the continuous short-circuit current to 5 ma. If the supply permits the instantaneous short-circuit current to exceed 1 ampere, or is capable of storing more than 250 microcoulombs, the effective resistance in circuit between indicated electrode and the output capacitor should be as follows:
Grid-No.1-Circuit Resistance ......... 150 min. ohms
Grid-No.2-Circuit Resistance ......... 470 min. ohms
Anode-No.1-Circuit Resistance ......... 2700 min. ohms
Anode-No.2-Circuit Resistance ......... 9100 min. ohms

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

Components:
Ion-Trap Magnet* ......... RCA Type No.203D1
Deflecting Yoke* ......... RCA Type No.201D12

- Anode No.2 and grid No.3, which are connected together within tube, are referred to herein as anode No.2.
- The product of anode-No.2 voltage and average anode-No.2 current should never exceed 6 watts.
- Brilliance and definition decrease with decreasing anode-No.2 voltage. In general, anode-No.2 voltage should not be less than 5000 volts.
- With the combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 12 foot-lamberts on a 5-1/2" picture area.
- Visual extinction of undeflected focused spot.
- The dc current required by this magnet is approx. 70 ma. for the typical operating conditions shown.
- The horizontal deflecting-coil current required by this yoke to produce 5-1/2" picture width is approx. ±10 ma. peak-to-peak under the typical operating conditions shown. The current varies directly as the square root of the anode-No.2 voltage.

Indicates a change.

NOV. 15, 1949

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

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

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: DISTANCE TO INTERNAL POLE PIECES. PLANE THROUGH
PIN No. 6 and tube axis passes through line joining centers of pole pieces. Direction of principal field of ion-trap magnet should be such that north pole is adjacent to PIN No. 6 and south pole to PIN No. 12.

**NOTE 6:** Location of deflecting yoke must be within this space.

**NOTE 7:** Keep this space clear for ion-trap magnet.

**NOTE 8:** For tube support which must not cover specified clear area around anode cap.

92CM-6664R1

OCTOBER 15, 1947

TUBE DEPARTMENT

CE-6664R1B
AVERAGE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ANODE-N2 VOLTS = 6000
ANODE-N1 VOLTS ADJUSTED TO GIVE FOCUS
GRID-N2 VOLTS = 250
GRID-N1 BIASED TO CUTOFF
RASTER SIZE 4.2" X 5.6"

OCT. 14, 1947
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-6674RI
Heater, for Unipotential Cathode:
Voltage: 6.3 ac or dc volts
Current: 0.6 amp

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

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

Focus Method: Electrostatic
Deflection Method: Electrostatic
Deflecting-Electrode Arrangement: See Outline Drawing
Overall Length: 14-1/2" ± 3/8"
Greatest Diameter of Bulb: 7" ± 1/8"
Minimum Useful Screen Diameter: 6"
Mounting Position: Any
Base: Medium-Shell Diheptal 12-Pin Socket
Basing Designation for BOTTOM VIEW: 14G1

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid No. 1
Pin 4 - No
Connection
Pin 5 - Anode No. 1
Pin 7 - Deflecting Electrode
DJ1
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 - Internal Connection - Do Not Use

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

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

The plane through the tube axis and pin 5 may vary from the trace produced by DJ1 and DJ2 by an angular tolerance (measured about the tube axis) of 10°. Angle between DJ1 - DJ2 trace and DJ3 - DJ4 trace is 90° ± 30°.
Maximum Ratings, Design-Center Values:

ANOYE-No. 2 VOLTAGE 6000 max. volts
ANOYE-No. 1 VOLTAGE 2800 max. volts
GRID-No. 1 VOLTAGE:
Negative bias value 200 max. volts
Positive bias value 0 max. volts
Positive peak value 2 max. volts
PEAK VOLTAGE BETWEEN ANODE No. 2 AND
ANY DEFLECTING ELECTRODE 750 max. volts
PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode 125 max. volts
Heater positive with respect to cathode 125 max. volts

Equipment Design Ranges:
For any anode-No. 2 voltage (Eb2) between 1000* and 6000 volts
Anode-No. 1 Voltage 27% to 40% of Eb2 volts
Max. Grid-No. 1 Voltage for Visual Cutoff 2.8% of Eb2 volts
Anode-No. 1 Current for any Operating Condition -15 to +10 microamps
Deflection Factors:
DJ1 & DJ2 31 to 41 v dc/in./kv of Eb2
DJ3 & DJ4 25 to 34 v dc/in./kv of Eb2
Spot Position

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

Maximum Circuit Values:
Grid-No. 1-Circuit Resistance 1.5 max. meegohms
Resistance in Any Deflecting-Electrode Circuit 5.0 max. meegohms

Minimum Circuit Values:
The power supply should be of the limited-energy type with
inherent regulation to limit the continuous short-circuit
current to 5 milliamperes. If the supply permits the
instantaneous short-circuit current to exceed 1 ampere, or
is capable of storing more than 250 microcoulombs, the
effective resistance in circuit between indicated electrode
and the output capacitor should be as follows:
Grid-No. 1-Circuit Resistance 220 min. ohms

* , D , # , 0: See next page.

JAN. 1, 1951
OSCILLOGRAPH TUBE

Anode-No. 1—Circuit Resistance: 3000 min. ohms
Anode-No. 2—Circuit Resistance: 6800 min. ohms

The resistors used should be capable of withstanding the applied voltage.

- Anode No. 2 and grid No. 2, which are connected together within tube, are referred to herein as anode No. 2.
- For operation at or near 0 volts on grid No. 1 and with 4000 to 6000 volts on anode No. 2, it is essential that the effective resistance of the anode-No. 2 supply be adequate to limit the anode-No. 2 input power to 6 watts.
- Brilliance and definition decrease with decreasing anode-No. 2 voltage. A value as low as 1000 volts is recommended only for low-velocity deflection and low ambient-light levels.
- The center of the undeflected, focused spot will fall within a circle having a 10-mm radius concentric with the center of the tube face.
- It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

SCREEN RADIUS
3” MIN.

1.134”
3 4” R.
1 1/2” R.
3” R.

13 3/4” ± 3/8”
14 1/2” ± 3/8”

2” ± 1/16”

MEDIUM-SHELL DIHEPTAL 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.

JAN. 1, 1951

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE DATA 2
AVERAGE CHARACTERISTICS

$E_T = 6.3$ VOLTS
ANODE-NR1 VOLTS ADJUSTED FOR FOCUS

GRID-NR1 VOLTS

ANODE-NR2 MICROAMPERES
General:
Heater, for Unipotential Cathode:
Voltage. 6.3 ± 10% ac or dc volts
Current. 0.6 amp

Direct Interelectrode Capacitances (Approx.):
Grid No. 1 to All Other Electrodes. 8.5 µf
Cathode to All Other Electrodes. 9.5 µf
DJ1 to DJ2. 3.5 µf
DJ3 to DJ4. 2.0 µf
DJ1 to All Other Electrodes. 11.0 µf
DJ2 to All Other Electrodes. 11.0 µf
DJ3 to All Other Electrodes. 8.0 µf
DJ4 to All Other Electrodes. 8.0 µf

Phosphor (For Curves, see front of this Section) No. 4
Fluorescence White
Persistence. 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"
Raster Size. 4" x 5-1/2"
Mounting Position. Any

Base Medium-Shell Diheptal 12-Pin
Basing Designation for BOTTOM VIEW 14-G

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

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

With DJ1 positive with respect to DJ2, the spot is deflected toward pin 5. With DJ3 positive with respect to DJ4, the spot is deflected toward pin 2.
The plane through the tube axis and pin 5 may vary from the trace produced by DJ1 and DJ2 by an angular tolerance (measured about the tube axis) of 10°.
The angle between the trace produced by DJ1 and DJ2 and the trace produced by DJ3 and DJ4 is 90° ± 3°.

* The 7JP4 replaces the 7GP4 provided no connections are made to the 7GP4 socket contacts for pins 4 and 12.
## Maximum Ratings, Design-Center 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>6000 max. volts</td>
</tr>
<tr>
<td>Anode-No. 1 Voltage</td>
<td>2800 max. volts</td>
</tr>
<tr>
<td>Grid-No. 1 (Control Electrode) Voltage:</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max. volts</td>
</tr>
<tr>
<td>Peak Voltage Between Anode No. 2 and Any Deflecting Electrode</td>
<td>750 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>125 max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode.</td>
<td>125 max. volts</td>
</tr>
</tbody>
</table>

## Equipment Design Ranges:

### For any anode-No. 2 voltage (Eb₂) between 3000* and 6000 volts

- **Anode-No. 1 Voltage**
  - for Focus
    - 27% to 40% of Eb₂
  - 1620 to 2400 volts

- **Grid-No. 1 Voltage for Visual Cutoff**
  - 1.2% to 2.8% of Eb₂
  - 186 to 246 volts dc/in./kv of Eb₂

- **Anode-No. 1 Current for Any Operating Condition**
  - -15 to +10 µamp

- **Deflection Factors:**
  - DJ₁ & DJ₂
    - 31 to 41 v dc/in./kv of Eb₂
  - DJ₃ & DJ₄
    - 25 to 34 v dc/in./kv of Eb₂

### Examples of Use of Design Ranges:

**For anode-No. 2 voltage of 6000 volts**

- **Anode-No. 1 Voltage**
  - 1620 to 2400 volts

- **Grid-No. 1 Voltage for Visual Cutoff**
  - -72 to -168 volts

- **Deflection Factors:**
  - DJ₁ & DJ₂
    - 186 to 246 volts dc/in.
  - DJ₃ & DJ₄
    - 150 to 204 volts dc/in.

## Maximum Circuit Values:

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

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

## Minimum Circuit Values:

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**
  - 220 min. ohms

- **Anode-No. 1-Circuit Resistance**
  - 3000 min. ohms

- **Anode-No. 2-Circuit Resistance**
  - 6800 min. ohms

# : See next page.

---

**SEPT. 2, 1947**

**TENTATIVE DATA**

**TUBE DEPARTMENT**

**RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY**
At or near this rating, with 4000 to 6000 volts on anode No.2, the effective resistance of the anode-No.2 supply should be adequate to limit the anode-No.2 input power to 6 watts.

Brilliance and definition decrease with decreasing anode-No.2 voltage.

With the combined grid-No.1 bias voltage and video-signal voltage adjusted for a highlight brightness of 12 foot-lamberts on a 4" x 5-1/2" picture area.

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

The 7JP4 is designed to be used in television circuits with horizontal deflection applied to deflecting electrodes DJ3 and DJ4, and should be so used to obtain maximum picture width. When the 7JP4 is operated in this way, the deflecting voltage required to produce the vertical height is approximately the same as that required to produce the horizontal width of a television picture of standard proportions.
OPERATION CHARACTERISTICS

$E_F = 6.3$ VOLTS
ANODE-Nº1 VOLTS ADJUSTED TO GIVE FOCUS
GRID-Nº1 BIASED ADJUSTED TO CUTOFF
RASTER SIZE 4" X 5.5" (FOCUSED)

HIGHLIGHT BRIGHTNESS — FOOT-LAMBERTS

PEAK GRID-Nº1 SIGNAL VOLTS
Oscillograph Tube

**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

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

Focusing Method: Magnetic
Deflection Method: Magnetic
Deflection Angle (Approx.): 50°
Overall Length: 12-3/4" ± 3/8"
Greatest Diameter of Bulb: 7-3/16" ± 1/8"
Minimum Useful Screen Diameter: 6" Mounting Position: Any
Cap. Recessed Small Cavity (JETEC No.1J-21)
Base Small-Shell Duodecal 5-Pin (JETEC No.B5-57)

**Bottom View**

Pin 1-Heater
Pin 2-Grid No.1
Pin 10-Grid No.2
Pin 11-Cathode
Pin 12-Heater
Cap - Grid No.3.
Collector

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

Ultor® Voltage: 8000 max. volts

Grid-No.2 Voltage:
- Positive Value (DC or Peak AC): 700 max. volts
- Negative Value (DC or Peak AC): 180 max. volts

Grid-No.1 Voltage:
- Negative bias value: 180 max. volts
- Positive bias value*: 0 max. volts
- Positive peak value: 2 max. volts

Peak Grid-No.1 Drive From Cutoff: 65 max. volts

Peak Heater-Cathode Voltage:
- Heater negative with respect to cathode: 125 max. volts
- Heater positive with respect to cathode: 125 max. volts

* In the 7M-types, grid No.3 which has the ultor function, and collector are connected together within the tube and are conveniently referred to collectively as "ultor". The "ultor" in a cathode-ray tube is the electrode, or the electrode in combination with one or more additional electrodes connected within the tube to it, to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection.

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Value Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ulterior Voltage*</td>
<td>4000 to 7000</td>
</tr>
<tr>
<td>Grid-No. 2 Voltage</td>
<td>250 to 250</td>
</tr>
<tr>
<td>Grid-No. 1 Voltage</td>
<td>-27 to -63</td>
</tr>
<tr>
<td>Grid-No. 2 Current</td>
<td>-15 to +15</td>
</tr>
<tr>
<td>Focusing-Coil Current (DC Approx.)**</td>
<td>64 ± 15% to 85 ± 15%</td>
</tr>
<tr>
<td>Spot Position</td>
<td></td>
</tr>
</tbody>
</table>

### Maximum Circuit Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value Range</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 ulterior voltage. In general, the ulterior voltage should not be less than 4000 volts.

** For visual extinction of undeflected, focused spot.

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OCTOBER 1, 1951

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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

$E_f = 6.3$ VOLTS
ULTOR VOLTS = 7000
GRID No. 1 BIASED TO CUTOFF OF UNDEFOCUSED FOCUSED SPOT
SCANNING AREA: 12 X 12 CM

- ULTOR CURRENT
- HIGHLIGHT BRIGHTNESS

Highlight Brightness (Foot-Lamberts) vs. Video Signal Volts from Cutoff

RADIO CORPORATION OF AMERICA, MARRISON, NEW JERSEY

JULY 18, 1951
The 7MPI4 is the same as the 7MP7 except that it utilizes a medium-long-persistence, cascade (two-layer) screen which exhibits purple fluorescence of short persistence and orange phosphorescence which persists for a little over a minute under conditions of adequate excitation and ambient light.

Because of its medium-long-persistence, the 7MPI4 is particularly useful where either low- and medium-speed non-recurring phenomena or high-speed recurring phenomena are to be observed. Furthermore, two or more phenomena can be observed simultaneously on the screen by means of a suitable switching arrangement.

The persistence is such that the 7MPI4 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 7MPI4 can be operated with much lower scanning frequencies.

In general, operation of the 7MPI4 at an ultor voltage below 4000 volts will not give persistence of useable brightness.

THE SPECTRAL-ENERGY EMISSION CHARACTERISTIC and the PERSISTENCE CHARACTERISTIC of the P14 Phosphor are shown at the front of this Section.
PROJECTION KINESCOPE
METAL-BACKED FLUORESCENT SCREEN
FORCED-AIR COOLED

ELECTROSTATIC FOCUS
MAGNETIC DEFLECTION

DATA

General:
Heater, for Unipotential Cathode:
Voltage .............................................. 6.6 ac or dc volts
Current .................................................. 0.62 amp

Direct Interelectrode Capacitances (Approx.):
Grid No.1 to All Other Electrodes ...... 12 µf
Cathode to All Other Electrodes ........ 6 µf

Phosphor (For Curves, see front of this Section) No.4—Silicate-Sulfide Type
Fluorescence and Phosphorescence .............. White
Persistence of Phosphorescence ................. Medium

Focusing Method .................................. Electrostatic
Deflection Method ................................ Magnetic
Deflection Angle (Approx.) ...................... 35°

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 Face Plate
(See Outline Drawing) .......................... 5" x 3-3/4" Cap.
Mounting Position ................................ Medium

Base ........................................ Plastic-Filled, Small-Shell Diheptal 14-Pin

Basing Designation For BOTTOM VIEW ....... 14N

Pin 1-Heater .................................. Pin 9-Grid No.3
Pin 2-Cathode .................................. Pin 10-No Conn.
Pin 3-Grid No.1 ................................. Pin 11-No Conn.
Pin 4-Grid No.2 ................................. Pin 12-No Conn.
Pin 5-No Conn ................................. Pin 13-Int. Conn.-
Pin 6-No Conn ................................. Do Not Use
Pin 7-No Conn ................................. Pin 14-Heater
Pin 8-No Conn ................................. Cap-Anode

NOTE: Socket contacts for pins No.5, 6, 7, 8, 10, 11, 12, and 13 should be removed so that maximum insulation is provided for pin No.9.

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:
ANODE-to-GRID-No.1 VOLTAGE* .............. 80000 max. volts

* Indicate a change

JUNE 1, 1953
TUBE DEPARTMENT
TENTATIVE DATA 1
| 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 ANODE 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 |

**Typical Operation:**

| Anode-to-Grid-No.1 Voltage# | 75000 volts |
| Grid-No.3-to-Grid-No.1 Voltage | 16000 – 18000 volts |
| Grid-No.2-to-Grid-No.1 Voltage for Pattern Cutoff. | 400 – 600 volts |
| Cathode-to-Grid-No.1 Voltage | 125 volts |
| Cathode-to-Grid-No.1 Video Voltage: |
| Peak positive value (Black level). | 0 volts |
| Peak negative value (White Level). | 125 volts |
| Max. Grid-No.3 Current | 15 μamp |
| Max. Grid-No.2 Current Range | -15 to +15 μamp |

**GRID-DRIVE** SERVICE

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

**Maximum Ratings, Absolute Values:**

| ANODE 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 ANODE 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 |

**Grid drive is the operating condition in which the video signal varies the grid-No.1 potential.**

® The product of anode-to-grid-no.1 voltage, or anode voltage, and average anode current should be limited to 160 watts.

ø Cathode drive is the operating condition in which the video signal varies the cathode potential.

©: See next page.

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

Anode Voltage ........................................ 75000 volts
Grid-No. 3 Voltage ...................................... 16000 - 18000 volts
Grid-No. 2 Voltage for Pattern Cutoff ............. 400 - 600 volts
Grid-No. 1 Voltage ...................................... -155 volts
Grid-No. 1 Video Voltage:
  Peak negative value (Black level) .................. 0 volts
  Peak positive value (White level) ................. 155 volts
Max. Grid-No. 3 Current ............................... 15 μamp
Max. Grid-No. 2 Current Range ................. -15 to +15 μamp

Maximum Circuit Values:

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

# Brilliance and definition decrease with decreasing anode-to-grid-No. 1 voltage or anode voltage. In general, the anode-to-grid-No. 1 voltage or the anode voltage should not be less than 70000 volts.

OPERATING NOTES

X-ray radiation is produced at the face of the 7NP4 when it is operated at its normal anode voltage. These rays can constitute a health hazard unless the tube is adequately shielded. Make sure that the shielding provides the required protection against personal injury.

The air-cooling system required to cool the face of the 7NP4 consists of a blower 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 anode power supply to prevent operation of the tube without cooling.

Darkening of face occurs during normal operation of the 7NP4 with resulting decrease in the light transmitted by the face. The rate of darkening increases rapidly with increase in anode voltage, is proportional to the beam current, and is inversely proportional to the scanned area. The darkening develops rapidly during initial operation; thereafter, a gradual increase in the amount of darkening will be observed during the life of the tube. The darkening, however, can be decreased periodically throughout the life of the tube by bleaching the face as prescribed in the 7NP4 bulletin.

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

NOTE 4: REFERENCE LINE IS DETERMINED BY POSITION WHERE GAUGE 2.100" ± .001" I.D. AND 3" LONG WILL REST ON BULB CONE.

NOTE 5: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 6: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. SOCKET CONTACTS FOR PINS 5, 6, 7, 8, 10, 11, 12, AND 13 SHOULD BE REMOVED IN ORDER TO PROVIDE MAXIMUM INSULATION FOR PIN NO. 9.

NOTE 7: EFFECTIVE DEFLECTING FIELD MUST BE WITHIN THIS SPACE.
AVERAGE DRIVE CHARACTERISTICS

**CATHODE-DRIVE SERVICE**
- $E_C = 6.6$ VOLTS
- ANODE-TO-GRID-N°1 VOLTS: 70000-80000
- GRID-N°3-TO-GRID-N°1 VOLTS ADJUSTED TO GIVE FOCUS
- GRID-N°2-TO-GRID-N°1 VOLTS ADJUSTED TO PATTERN CUTOFF
- CATHODE BIASED POSITIVE WITH RESPECT TO GRID N°1 (VOLTS) = 125

**GRID-DRIVE SERVICE**
- $E_C = 6.6$ VOLTS
- ANODE VOLTS = 70000-80000
- GRID N°3 VOLTS ADJUSTED TO GIVE FOCUS
- GRID N°2 VOLTS ADJUSTED TO PATTERN CUTOFF
- GRID-N°1 BIAS VOLTS = -155
7NP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE DRIVE SERVICE
\[ E_f = 6.6 \text{ VOLTS} \]
\[ \text{ANODE-TO-GRID-N\#1 VOLTS} = 75000 \]
\[ \text{GRID-N\#3-TO-GRID-N\#1 VOLTS} \text{ ADJUSTED TO GIVE FOCUS} \]
\[ \text{GRID-N\#2-TO-GRID-N\#1 VOLTS} \text{ ADJUSTED TO PATTERN CUTOFF} \]
\[ \text{CATHODE BIASED POSITIVE WITH RESPECT TO GRID N\#1 (VOLTS)} = 125 \]
\[ \text{RASTER SIZE: } 5'' \times 3\frac{3}{4}'' \]

GRID DRIVE SERVICE
\[ E_f = 6.6 \text{ VOLTS} \]
\[ \text{ANODE VOLTS} = 75000 \]
\[ \text{GRID-N\#3 VOLTS ADJUSTED TO GIVE FOCUS} \]
\[ \text{GRID-N\#2 VOLTS ADJUSTED TO PATTERN CUTOFF} \]
\[ \text{GRID-N\#1 BIAS VOLTS} = -155 \]
\[ \text{RASTER SIZE: } 5'' \times 3\frac{3}{4}'' \]
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE

E_c = 6.6 VOLTS
ANODE-TO-GRID-NR1 VOLTS = 75000
GRID-NR3-TO-GRID-NR1 VOLTS ADJUSTED TO GIVE FOCUS
GRID-NR2-TO-GRID-NR1 VOLTS ADJUSTED TO PATTERN CUTOFF
CATHODE BIASED POSITIVE
WITH RESPECT TO GRID NR1 (VOLTS) = 125
RASTER SIZE: 5" x 3 3/4"

GRID-DRIVE SERVICE

E_c = 6.6 VOLTS
ANODE VOLTS = 75000
GRID-NR3 VOLTS ADJUSTED TO GIVE FOCUS
GRID-NR2 VOLTS ADJUSTED TO PATTERN CUTOFF
GRID-NR1 BIAS VOLTS = -155
RASTER SIZE: 5" x 3 3/4"

TRANSFER CHARACTERISTICS

TRANSFER CHARACTERISTICS ON BASIS OF CONTRAST RATIO OF 100:1
**MONITOR KINESCOPE**

**DATA**

**General:**

Heater, for Unipotential Cathode:

- Voltage: 6.3 ac or dc volts
- Current: 0.6 amp

Direct Interelectrode Capacitances (Approx.):

- Grid No.1 to All Other Electrodes: 6 µµf
- Cathode to All Other Electrodes: 5 µµf

Phosphor (For Curves, See front of this Section). No.4-Sulfide Type

- Fluorescence: White
- Phosphorescence: White
- Persistence: Short

Focusing Method: Magnetic

Deflection Method: Magnetic

Deflection Angle (Approx.): 52°

Ion-Trap Gun: Requires External, Single-Field Magnet

Overall Length: 12-7/8" ± 3/8"

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

Screen Diameter: 6-1/4"

Mounting Position: Recessed Small Cavity

Base: Small-Shell Duodecal 5-Pin

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

**ANODE VOLTAGE**: 10000 max. volts

**GRID-No.2 VOLTAGE**: 410 max. volts

**GRID-No.1 VOLTAGE**:

- Negative bias value: 125 max. volts
- Positive bias value: 0 max. volts
- Positive peak value: 2 max. volts

**PEAK HEATER-CATHODE VOLTAGE**:

- Heater negative with respect to cathode: 410 max. volts
- After equipment warm-up period: 150 max. volts
- Heater positive with respect to cathode: 150 max. volts

**Typical Operation:**

Anode Voltage: 8000 .. volts

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

** Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 6000 volts.

**JAN. 1, 1951**

**TENTATIVE DATA**
**MONITOR KINESCOPE**

**Grid-No.2 Voltage** ............................... 300 volts
**Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot** ........................... -33 to -77 volts
**Focusing-Coil Current (DC, approx.)** .. 80 ma
**Field Strength of Single-Field Ion-Trap Magnet** ........................... 35 gauss

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

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

<table>
<thead>
<tr>
<th>Circuit Type</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1</td>
<td>150 min. ohms</td>
</tr>
<tr>
<td>Grid-No.2</td>
<td>470 min. ohms</td>
</tr>
<tr>
<td>Anode</td>
<td>11000 min. ohms</td>
</tr>
</tbody>
</table>

The resistors used should be capable of withstanding the applied voltage.

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# For specimen focusing coil similar to JETEC Focusing Coil No.109, positioned with air gap toward kinescope screen, and center line of air gap 3 inches from Reference Line (see Outline Drawing). The indicated current is for condition with combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 40 Foot-lamberts on a 5-3/8" x 4" picture area sharply focused at center of screen.

o Measured at center of field with General Electric Gauss Meter, Cat. No.409X51.
NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No. 3 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF 10°. ANODE TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION No. 3.

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

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

NOTE 4: DISTANCE FROM REFERENCE LINE FOR LOCATING CENTER OF ION-TRAP MAGNETIC FIELD. DIRECTION OF FIELD OF THE ION-TRAP MAGNET SHOULD BE SUCH THAT NORTH POLE IS ADJACENT TO VACANT PIN POSITION No. 8 AND SOUTH POLE TO PIN No. 2.
NOTE 5: LOCATION OF DEFLECTING YOKE MUST BE WITHIN THIS SPACE.

NOTE 6: KEEP THIS SPACE CLEAR FOR SINGLE-FIELD, ION-TRAP MAGNET.

NOTE 7: FOR TUBE SUPPORT WHICH MUST BE KEPT AT LEAST 2" AWAY FROM ANODE CAVITY CAP.
AVERAGE GRID-DRIVE CHARACTERISTICS

E_c = 6.3 VOLTS
ANODE VOLTS = 8000
GRID NO. 1 BIASED TO CUTOFF OF UNDEFOCTED FOCUSED SPOT
RASTER SIZE = 5 3/8" x 4" (FOCUSED FOR AVERAGE BRIGHTNESS)

VIDEO SIGNAL VOLTS FROM CUTOFF

HIGHLIGHT BRIGHTNESS—FOOT-LAMBERTS

AUGUST 22, 1950  TUBE DEPARTMENT  92CM-7529
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_g = 6.3$ VOLTS

ANODE VOLTS = 8000 - 10000

GRID NO. 1 BIASED TO CUTOFF
OF UNDEFLECTED FOCUSED SPOT

AUGUST 22, 1950  TUBE DEPARTMENT  92CM-7530
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 µuf
Cathode to All Other Electrodes ........ 5 µuf
Faceplate ................ Clear Glass
Phosphor, Metal-Backed* .......... P4—Sulfide Type
Fluorescence and Phosphorescence .... White
Persistence of Phosphorescence ........ Short
Focusing Method ............. Electrostatic
Deflection Method .......... Magnetic
Deflection Angle (Approx.) ......... 50°
Overall Length ................ 13-1/8" ± 3/8"
Greatest Diameter of Bulb .......... 7-3/16" ± 1/8"
Minimum Useful Screen Diameter .... 6"
Picture Size (Within minimum-useful-screen area) 5-3/8" x 4"
Cap ................ Recessed Small Cavity (JETEC No. J1-21)
Base ................ Small-Shell Duodecal 6-Pin (JETEC No. B6-63)

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

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
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 ultimo 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
Ultro 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
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 ultimo voltage of 10000 volts and grid-No. 2 voltage of 200 volts
Grid-No.3 Voltage for Focus with
Ultro 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 ultimo voltage. In general, the ultimo voltage should not be less than 10000 volts.
** Grid-No.3 Current increases as the ultimo voltage is decreased.

FEB. 1, 1952 TENTATIVE DATA
TUBE DEPARTMENT RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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

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

VIDEO SIGNAL VOLTS FROM CUTOFF

HIGHLIGHT BRIGHTNESS—FOOT-LAMBERTS

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

$E_f = 6.3$ 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

---

$I_u = I_u$

---

$I_c = I_c$

---

**Graph**

- **Y-axis**: ULTOR (I_u) OR GRID-N° 3 (I_c) MICROAMPERES
- **X-axis**: VIDEO SIGNAL VOLTS FROM CUTOFF

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OCT. 3, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7888
General:
Heater, for Unipotential Cathode:
  Voltage .................. 6.3 .................. ac or dc volts
  Current .................. 0.6 .................. amp
Direct Interelectrode Capacitances (Approx.):
  Grid No.1 to All Other Electrodes .................. 6 .................. μuf
  DJ1 to DJ2 .................. 3 .................. μuf
  DJ3 to DJ4 .................. 2 .................. μuf
  DJ1 to All Other Electrodes .................. 9 .................. μuf
  DJ2 to All Other Electrodes .................. 9 .................. μuf
  DJ3 to All Other Electrodes .................. 7 .................. μuf
  DJ4 to All Other Electrodes .................. 7 .................. μuf
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 Dheptal 12-Pin (JETEC No.B12-37)

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

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

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

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

*: See next page.

NOV. 1, 1952
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Maximum Ratings, Design-Center Values:

ULTOR* VOLTAGE ........................................ 4000 max. volts
GRID-No.3 VOLTAGE ..................................... 2000 max. volts
GRID-No.1 VOLTAGE:
   Negative bias value ..................................... 200 max. volts
   Positive bias value ..................................... 0 max. volts
   Positive peak value .................................. 2 max. volts
PEAK VOLTAGE BETWEEN ULTOR AND
   ANY DEFLECTING ELECTRODE ...................... 750 max. volts
PEAK HEATER-CATHODE VOLTAGE:
   Heater negative with respect to cathode ........ 125 max. volts
   Heater positive with respect to cathode ......... 125 max. volts

Equipment Design Ranges:

For any ultor voltage \(E_u\) between 1000# and 4000 volts

Grid-No.3 Voltage for Focus  27% to 40% of \(E_u\) volts
Maximum Grid-No.1 Voltage
   for Visual Extinction of
   Undeflected Focused Spot  2.8% of \(E_u\) volts
Grid-No.3 Current .......... -15 to +10 µamp
Deflection Factors:
   DJ\,1 \& DJ\,2 .......... 31 to 41 v dc/in./kv of \(E_u\)
   DJ\,3 \& DJ\,4 .......... 25 to 34 v dc/in./kv of \(E_u\)
Spot Position ............ ##

Examples of Use of Design Ranges:

For ultor voltage of  1500  3000  volts

Grid-No.3 Voltage
   for Focus  400 to 600  800 to 1200 volts
Maximum Grid-No.1 Volt-
   age for Visual Extinc-
   tion of Undeflected
   Focused Spot .......... -42  -84 volts
Deflection Factors:
   DJ\,1 \& DJ\,2 .......... 47 to 62  93 to 123 volts dc/in.
   DJ\,3 \& DJ\,4 .......... 38 to 51  75 to 102 volts dc/in.

Maximum Circuit Values:

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

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

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

# # # # # # #: see next page.

NOV. 1, 1952  TUBE DEPARTMENT  TENTATIVE DATA 1
# 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 7JPi in all equipment where the high-voltage supply does not provide more than 4000 volts.

---

92CM-6667RI

92CM-6667RI

92CM-6667RI

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

$E_f = 6.3 \text{ VOLTS}$
GRID-$\# 3$ 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>

\[ 800 \quad 600 \quad 400 \quad 200 \quad 50 \quad 100 \quad 150 \quad 200 \quad 250 \quad 300 \quad \text{FLUORESCENT SCREEN MICROAMPERES} \]

\[ -60 \quad -50 \quad -40 \quad -30 \quad -20 \quad -10 \quad 0 \quad \text{GRID-$\# 1$ VOLTS} \]

DECEMBER 17, 1951
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM - 7721
**PROJECTION KINESCOPE**

**METAL-BACKED FLUORESCENT SCREEN**

**FORCED-AIR COOLED**

**DATA**

### General:

Heater, for Unipotential Cathode:

- **Voltage** ....... 6.6±5% .... ac or dc volts
- **Current** ........ 0.62 .... amp

Direct Interelectrode Capacitances (Approx.):

- Grid No.1 to All Other Electrodes ....... 12 \( \mu F \)
- Cathode to All Other Electrodes ....... 6 \( \mu F \)

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

- Fluorescence and Phosphorescence .... White
- Persistence of Phosphorescence .... Medium

Focusing Method ........ Electrostatic

Deflection Method ....... Magnetic

Deflection Angle (Approx.) .... 35°

Overall Length .... 19-7/16"±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 Outline Drawing) .... 5" x 3-3/4"

Refractive Index for Faceplate Glass .... 1.469

Cap .... Medium (JETEC No.C1-5)

Mounting Position .... Any

Base .... Plastic-Filled, Small-Shell Dineptal 14-Pin (JETEC No.B14-45)

### BOTTOM VIEW

![Diagram](attachment:Diagram.png)

- **Pin 1** - Heater
- **Pin 2** - Cathode
- **Pin 3** - Grid No.1
- **Pin 4** - Grid No.2
- **Pin 5** - No Conn.
- **Pin 6** - No Conn.
- **Pin 7** - No Conn.
- **Pin 8** - No Conn.
- **Pin 9** - Grid No.3
- **Pin 10** - No Conn.
- **Pin 11** - No Conn.
- **Pin 12** - No Conn.
- **Pin 13** - Int. Conn.– Do Not Use
- **Pin 14** - Heater Cap–Ultor (Grid No.4, Collector)

**NOTE:** Socket Contacts for pins No.5, 6, 7, 8, 10, 11, 12, and 13 should be removed so that maximum insulation is provided for pin No.9.

**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

---

**JULY 1, 1952**

**TUBE DEPARTMENT**

**TENTATIVE DATA**

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

CATHODE-DRIVE* SERVICE

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

Maximum Ratings, Absolute Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Voltage Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR-to-GRID-No.1 Voltage</td>
<td>80000 max. volts</td>
</tr>
<tr>
<td>GRID-No.3-to-GRID-No.1 Voltage</td>
<td>20000 max. volts</td>
</tr>
<tr>
<td>GRID-No.2-to-GRID-No.1 Voltage</td>
<td>850 max. volts</td>
</tr>
<tr>
<td>GRID-No.2-to-CATHODE Voltage</td>
<td>600 max. volts</td>
</tr>
<tr>
<td>CATHODE-to-GRID-No.1 Voltage:</td>
<td></td>
</tr>
<tr>
<td>Positive bias value</td>
<td>250 max. volts</td>
</tr>
<tr>
<td>Negative bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Peak negative value</td>
<td>2 max. volts</td>
</tr>
<tr>
<td>AVERAGE ULTOR CURRENT</td>
<td>2 max. ma</td>
</tr>
</tbody>
</table>

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode:
- During equipment warm-up period: 410 max. volts
- After equipment warm-up period: 150 max. volts

HEATER VOLTAGE:

Heater positive with respect to cathode: 150 max. volts

Typical Operation:

<table>
<thead>
<tr>
<th>Component</th>
<th>Voltage Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultor-to-Grid-No.1 Voltage</td>
<td>75000 volts</td>
</tr>
<tr>
<td>Grid-No.3-to-Grid-No.1 Voltage</td>
<td>16000 - 18000 volts</td>
</tr>
<tr>
<td>Grid-No.2-to-Grid-No.1 Voltage</td>
<td>125 volts</td>
</tr>
<tr>
<td>Cathode-to-Grid-No.1 Voltage</td>
<td>125 volts</td>
</tr>
<tr>
<td>Cathode-to-Grid-No.1 Video Voltage:</td>
<td></td>
</tr>
<tr>
<td>Peak positive value (Black level)</td>
<td>0 volts</td>
</tr>
<tr>
<td>Peak negative value (White level)</td>
<td>125 volts</td>
</tr>
<tr>
<td>Max. Grid-No.3 Current</td>
<td>15 μamp</td>
</tr>
<tr>
<td>Max. Grid-No.2 Current Range</td>
<td>-15 to +15 μamp</td>
</tr>
</tbody>
</table>

GRID-DRIVE** SERVICE

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

Maximum Ratings, Absolute Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Voltage Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR VOLTAGE**</td>
<td>80000 max. volts</td>
</tr>
</tbody>
</table>

* In the 7WP4, 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.
* Cathode drive is the operating condition in which the video signal varies the cathode potential.
** Grid drive is the operating condition in which the video signal varies the grid-No.1 potential.
O The product of ultor-to-grid-No.1 voltage, or ultor voltage, and average ultor current should be limited to 160 watts.
# See next page.

JULY 1, 1952
TENTATIVE DATA 1
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

Typical Operation:
ULTOR Voltage# ...................... 75000 volts
Grid-No.3 Voltage ...................... 16000 – 18000 volts
Grid-No.2 Voltage for Pattern Cutoff .... 400 – 600 volts
Grid-No.1 Voltage ...................... –155 volts
Grid-No.1 Video Voltage:
  Peak negative value (Black level) .... 0 volts
  Peak positive value (White level) .... 155 volts
Max. Grid-No.3 Current ............... 15 µamp
Max. Grid-No.2 Current Range .......... –15 to +15 µamp

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

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 70000 volts.

OPERATING NOTES

X-ray radiation is produced at the face of the 7WP4 when it is operated at its normal ultor voltage. For x-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section.

The air-cooling system required to cool the face of the 7WP4 consists of a blower 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.
OPERATING NOTES (Cont'd)

Darkening of face occurs during normal operation of the 7WP4 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. The darkening, however, can be decreased periodically throughout the life of the tube by bleaching the face as prescribed in the bulletin.

![Diagram of 7WP4 projection kinescope with dimensions and labels.]

NOTE 2: INSIDE SURFACE OF FACEPLATE WITHIN THE QUALITY RECTANGLE MAY VARY ± 0.006" FROM THE SPHERICAL SURFACE HAVING A 20.3" RADIUS.


NOTE 4: REFERENCE LINE IS DETERMINED BY POSITION WHERE GAUGE 2.100" ± 0.001" I.D. AND 3" LONG WILL REST ON BULB CONE.

NOTE 5: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 6: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. SOCKET CONTACTS FOR PINS 6, 7, 8, 10, 11, 12, AND 13 SHOULD BE REMOVED IN ORDER TO PROVIDE MAXIMUM INSULATION FOR PIN No.9.

NOTE 7: EFFECTIVE DEFLECTING FIELD MUST BE WITHIN THIS SPACE.
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE

$E_\xi = 6.6 \text{ VOLTS}$

ULTOR - TO - GRID-N\#1 VOLTS = 70000 - 80000

GRID-N\#3 TO GRID-N\#1 VOLTS ADJUSTED TO GIVE FOCUS

GRID-N\#2 TO GRID-N\#1 VOLTS ADJUSTED TO PATTERN CUTOFF

CATHODE BIASED POSITIVE WITH RESPECT TO GRID N\#1 (VOLTS) = 125

GRID-DRIVE SERVICE

$E_\xi = 6.6 \text{ VOLTS}$

ULTOR VOLTS = 70000 - 80000

GRID N\#3 VOLTS ADJUSTED TO GIVE FOCUS

GRID N\#2 VOLTS ADJUSTED TO PATTERN CUTOFF

GRID-N\#1 BIAS VOLTS = -155

JULY 26, 1950
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM - 7514
AVERAGE DRIVE CHARACTERISTICS

**CATHODE-DRIVE SERVICE**
- \( E_c = 6.6 \text{ VOLTS} \)
- **ULTOR-TO-GRID-N1 VOLTS** = 75000
- **GRID-N2-TO-GRID-N2 VOLTS** ADJUSTED TO GIVE FOCUS
- **GRID-N3-TO-GRID-N1 VOLTS** ADJUSTED TO PATTERN CUTOFF
- CATHODE BIASSED POSITIVE WITH RESPECT TO GRID N1 (VOLTS) = 125
- RASTER SIZE: 5' x 3\( \frac{3}{4} \)''

**GRID-DRIVE SERVICE**
- \( E_c = 6.6 \text{ VOLTS} \)
- **ULTOR VOLTS** = 75000
- **GRID-N3 VOLTS ADJUSTED TO GIVE FOCUS**
- **GRID-N2 VOLTS ADJUSTED TO PATTERN CUTOFF**
- **GRID-N1 BIAS VOLTS** = -155
- RASTER SIZE: 5' x 3\( \frac{3}{4} \)''

JULY 26, 1950
TUBE DEPARTMENT
92CM-7515
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE

Eₜ = 6.6 VOLTS
ULTOR-TO-GRID-N₂₁ VOLTS = 75000
GRID-N₁₃-TO-GRID-N₁₁ VOLTS ADJUSTED TO GIVE FOCUS
GRID-N₂₂-TO-GRID-N₁₁ VOLTS ADJUSTED TO PATTERN CUTOFF
CATHODE BIASED POSITIVE WITH RESPECT TO GRID N₁₁ (VOLTS) = 125
RASTER SIZE: 5" x 3 3/4"

GRID-DRIVE SERVICE

Eₜ = 6.6 VOLTS
ULTOR VOLTS = 75000
GRID-N₁₃ VOLTS ADJUSTED TO GIVE FOCUS
GRID-N₁₂ VOLTS ADJUSTED TO PATTERN CUTOFF
GRID-N₁₁ BIAS VOLTS = -155
RASTER SIZE: 5" x 3 3/4"

TRANSFER CHARACTERISTICS

TRANSFER CHARACTERISTICS ON BASIS OF CONTRAST RATIO OF 100:1

JULY 28, 1950

92CL-7519
### DATA

#### General:

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

**Direct Interelectrode Capacitances:**
- Grid No.1 to all other electrodes: 6 μf
- Cathode to all other electrodes: 5 μf
- External conductive coating to ultor: (350 max. μf 250 min. μf)

**Faceplate, Spherical.** Filterglass
- Light transmission (Approx.): 80%
- Phosphor (for curves, see front of this section). P4—Sulfide Type
- Fluorescence: White
- Phosphorescence: White
- Persistence: Short

**Deflection Angles (Approx.):**
- Diagonal: 90°
- Horizontal: 85°
- Vertical: 68°

**Ion-Trap Gun.** Requires 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"

**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.)**: 3 lbs

**Mounting Position**: Any

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

**Bulb**: J67-1/2

**Base**: Dwarf-Shell Duodecal 6-Pin (JETEC No. 66-158)

**Basing Designation for BOTTOM VIEW**: 12AB

---

**Diagram:**
- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 3—Grid No.4
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater

---

**Notes:**
- 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. .......................... 8000 max. volts
GRID-No.4 VOLTAGE:
  Positive value .......................... 500 max. volts
  Negative value .......................... 500 max. volts
GRID-No.2 VOLTAGE. .................... 300 max. volts
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

Equipment Design Ranges:

With any ultor voltage ($E_{ck}$) between 4000 and 8000 volts and grid-No.2 voltage ($E_{ck}$) between 85 and 300 volts

Grid-No.4 Voltage Required for Focus:
Chances directly with $E_{ck}$ at the rate of approximately 30 volts for each 1000-volt change in $E_{ck}$.
Changes inversely with $E_{ck}$ at the rate of approximately 25 volts for each 100-volt change in $E_{ck}$.
Changes inversely with ultor current at the rate of approximately 22.5 volts for each 50-μamp change in ultor current.

For typical values, see Examples of Use of Design Ranges.

Grid-No.1 Voltage ($E_{ck}$) for Visual Extinction of Focused Raster .......................... See Cutoff Design Chart for Grid-Drive Service

Grid-No.1 Video Drive from Raster Cutoff:
(Black Level):
  White-level value ..................... Same value as determined for $E_{ck}$ except video drive is positive voltage

Grid-No.4 Current ................. -25 to +25 μamp
Grid-No.2 Current ................. -15 to +15 μamp
Ion-Trap Magnet Current (Average) ................. $\sqrt{E_{ck}/8000} \times 32$ ma

Minimum Field Strength of PM Ion-Trap Magnet§ ................. $\sqrt{E_{ck}/8000} \times 36$ gausses
Field Strength of Adjusatable Centering Magnet .................. 0 to 5 gausses

§: See next page.
### Examples of Use of Design Ranges:

<table>
<thead>
<tr>
<th>With ultor voltage of</th>
<th>6000</th>
<th>8000</th>
<th>volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>and grid-No. 2 voltage of</td>
<td>150</td>
<td>200</td>
<td>volts</td>
</tr>
</tbody>
</table>

- **Grid-No. 4 Voltage for**
  - Focus with Ultor
    - Current of 100 µamp: ... +15 to +315 +60 to +360 volts
  - Visual Extinction of
    - Focused Raster: ... -13 to -35 -17 to -46 volts
  - Grid-No. 1 Video Drive from Raster Cutoff
    - (Black Level):
      - White-level value (Peak positive): ... 13 to 35 17 to 46 volts
      - Minimum Field Strength of PM Ion-Trap Magnet: ... 31 36 gausses

### Maximum Circuit Values:

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

### CATHODE-DRIVE® SERVICE

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

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

- **ULTOR-TO-GRID-No. 1 VOLTAGE:** ... 8000 max. volts
- **GRID-No. 4-TO-GRID-No. 1 VOLTAGE:**
  - Positive value: ... 500 max. volts
  - Negative value: ... 500 max. volts
- **GRID-No. 2-TO-GRID-No. 1 VOLTAGE:** ... 400 max. volts
- **CATHODE-TO-GRID-No. 1 VOLTAGE:**
  - Positive peak value: ... 130 max. volts
  - Positive bias value: ... 100 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

1. Grid drive is the operating condition in which the video signal varies the grid-No. 1 potential with respect to cathode.
2. Brilliance and definition decrease with decreasing ultor voltage or ultor-to-grid-No. 1 voltage. In general, the ultor voltage or ultor-to-grid-No. 1 voltage should not be less than 4000 volts.
3. 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.
Equipment Design Ranges:

With any ultor-to-grid-No. 1 voltage \( E_{cg1} \) between 4000 and 8000 volts, and grid-No. 2-to-grid-No. 1 voltage \( E_{cg2} \) between 100 and 400 volts.

Grid-No. 4-to-Grid-No. 1
Voltage Required for Focus:
Changes directly with \( E_{cg1} \) at the rate of approximately 30 volts for each 1000-volt change in \( E_{cg1} \).
Changes inversely with \( E_{cg2} \) at the rate of approximately 25 volts for each 100-volt change in \( E_{cg2} \).
Changes inversely with ultor current at the rate of approximately 22.5 volts for each 50-µamp change in ultor current.

For typical values, see Examples of Use of Design Ranges.

Cathode-to-Grid-No. 1
Voltage \( E_{kg} \) for Visual Extinction of Focused Raster . . . . . . . . . . . . See Cutoff Design Chart for Cathode-Drive Service

Cathode-to-Grid-No. 1
Video Drive from Raster Cutoff
(Black Level):
White-level value (Peak negative) . . . . . . . . . , Same value as determined for \( E_{kg} \).
Grid-No. 4 Current . . . . . . . . -25 to +25 µamp
Grid-No. 2 Current . . . . . . . . -15 to +15 µamp
Ion-Trap Magnet Current
(Average) ** . . . . . . . . . \( \sqrt{E_{cg1}/8000} \times 32 \) ma
Minimum Field Strength of PM Ion-Trap Magnet§ . . . . \( \sqrt{E_{cg1}/8000} \times 36 \) gausses
Field Strength of Adjustable Centering Magnet . . . . 0 to 5 gausses

Examples of Use of Design Ranges:

With ultor-to-grid-No. 1 voltage of 6000 8000 volts
and grid-No. 2-to-grid-No. 1 voltage of 150 200 volts

Grid-No. 4-to-Grid-No. 1
Voltage for Focus with Ultor Current of 100 µamp . . . . . . . . +15 to +315 +60 to +360 volts

** For JETEC Ion-Trap Magnet No. 117, or equivalent, located with the trailing edge of the pole pieces located over the gap between grid No. 1 and grid No. 2 and rotated to give maximum brightness.

§ Brilliance and definition decrease with decreasing ultor voltage or ultor-to-grid-No. 1 voltage. In general, the ultor voltage or ultor-to-grid-No. 1 voltage should not be less than 4000 volts.

§: See next page.
### Cathode-to-Grid-No.1
- **Voltage for Visual Extinction of Focused Raster:** 14 to 30 volts
- **Video Drive from Raster Cutoff (Black Level):** 17 to 39 volts

### Minimum Field Strength of PM Ion-Trap Magnet
- 31 to 36 gausses

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

§ For specimen PM ion-trap magnet, such as Heppner Model No. E437 or equivalent, located in optimum position and rotated to give maximum brightness. For a given equipment application, the tolerance range for the strength of the PM ion-trap magnet should be added to the minimum value. The maximum strength of this magnet should not exceed the specified minimum value by more than 6 gausses. This procedure will insure use of a PM ion-trap magnet allowing adequate adjustment to permit satisfactory performance without loss of highlight brightness.

_For X-ray shielding considerations, see sheet _X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section_
8DP4
KINESCOPE

REFERENCE LINE
(NOTE 2)

ULTOR
RECESSED SMALL
CAVITY CAP
JETEC NO J1-21
(NOTE 1)

1/4" R.

1 3/16" ± 1/8"

10 7/16" ± 5/16"

3 15/16" ± 1/8"

6 1/2" ± 3/16"

1 15/16" ± 1/8"

6 1/16" ± 1/16"

2 3/4" R.

27° R.

92CL-887b

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No. 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 30°. ULTOR TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION No. 6.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No. 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 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 FACE PANEL JUST ABOVE THE MOLD MATCH IS 0.040" WHEN THE TUBE IS ROTATED ABOUT THE AXIS OF THE NECK AND SUPPORTED AT THE REFERENCE LINE.

NOTE 6: BULGE AT SPLICE-LINE SEAL WILL NOT PROTRUDE BEYOND THE MAXIMUM ENVELOPE SURFACE AT THE MOLC-MATCH LINE.
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.
FOR MAXIMUM SPACE REQUIREMENTS

SHORT-SIDE VIEW

REFERENCE LINE

3/4"R.

D' C' B' A'

2 3/4"R.

DIAGONAL VIEW

REFERENCE LINE

1/2"R. D C B A

18"R. A'

3/4"R.

FROM THE REFERENCE LINE, WHEN DIMENSIONED FROM THE FACEPLATE, THE AXIAL POSITIONS OF PLANES AA', BB', CC', AND DD' WILL VARY BY ±0.125".
Average Drive Characteristics

**Grid-Drive Service**
- \( E_f = 6.3 \text{ Volts} \)
- Ultor Volts = 6000
- Grid No. 1 biased negative with respect to cathode to give focused raster cutoff
- Raster focused at average brightness
- Raster size = 7" x 5-1/4"

**Cathode-Drive Service**
- \( E_f = 6.3 \text{ Volts} \)
- Ultor-to-Grid No. 1 Volts = 6000
- Cathode biased positive with respect to Grid No. 1 to give focused raster cutoff
- Raster focused at average brightness
- Raster size = 7" x 5-1/4"
GRID-DRIVE SERVICE

$E_f = 6.3$ VOLTS
ULTOR VOLTS = 4000 TO 8000
GRID No. 1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF

ULTOR MILLIAMPERES

0 10 20 30 40 50
VIDEO SIGNAL VOLTS FROM RASTER CUTOFF

92CS-9116T

CATHODE-DRIVE SERVICE

$E_f = 6.3$ VOLTS
ULTOR-TO-GRID-No. 1 VOLTS = 4000 TO 8000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID No. 1 TO GIVE FOCUSED RASTER CUTOFF

ULTOR MILLIAMPERES

0 10 20 30 40 50
VIDEO SIGNAL VOLTS FROM RASTER CUTOFF

92CS-8888T
### KINESCOPE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
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<tr>
<td>Heater</td>
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<tr>
<td>Voltage</td>
<td>2.5 a-c or d-c volts</td>
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<td>Current</td>
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<td>Deflection</td>
<td>Magnetic</td>
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<td>Phosphor</td>
<td>No. 4</td>
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<tr>
<td>Fluorescence</td>
<td>White</td>
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<td>Persistence</td>
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<td>Direct Interelectrode Capacitance:</td>
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<td>Grid No. 1 to All Other Electrodes</td>
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<tr>
<td>Overall Length</td>
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<tr>
<td>Diameter</td>
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<td>Bulb</td>
<td>J-72</td>
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<tr>
<td>Cap</td>
<td>Medium Metal</td>
</tr>
<tr>
<td>Base</td>
<td>Medium 6-Pin</td>
</tr>
</tbody>
</table>

**MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS**

Maximum Ratings Are Based on a Line-Voltage Design Center of 117 Volts

- **High-Voltage Electrode (Anode No. 2) Volt.** 7000 max. volts
- **Focusing Electrode (Anode No. 1) Volt.** 2000 max. volts
- **Accelerating Electrode (Grid No. 2) Volt.** 250 max. volts
- **Control Electrode (Grid No. 1) Volt.** Never positive

**Fluorescent Screen Input Power/sq cm:**
- Fixed Pattern: 2.5 max. mw
- Moving Pattern: 5.0 max. mw
- Grid Circuit Resistance: 1.5 max. megohms

**Typical Operation:**
- Cathode Voltage: Should be connected to one side or to mid-tap of heater winding
- Anode No. 2 Voltage: 5000 volts
- Anode No. 1 Voltage: 1225 approx. volts
- Grid No. 2 Voltage: 250 volts
- Grid No. 1 Voltage: Adjusted to give suitable luminous spot
- Grid No. 1 Signal-Swing Volt: 25 approx. volts

**NOTE:** Brilliance and definition decrease with decreasing anode voltages. In general the anode No. 2 voltage should not be less than 5000 volts.

- Supply should be adjustable to ± 20% of the value shown.
- Approximately 35% of Grid No. 2 voltage is required for current cut-off when, in some applications, it is necessary to use the maximum permissible grid-circuit resistance.
- Peak-to-peak value for good brilliance with good resolution. For greater brilliance, up to twice this value should be available.

**The Characteristic Curves for the 9AP4 are the same as those for the 12AP4.**

Indicates a change.

Jan. 30, 1942

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.
**General:**

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

Direct Interelectrode Capacitances (Approx.):
- Grid No.1 to All Other Electrodes: 6.5 \(\mu\)f
- Cathode to All Other Electrodes: 5.0 \(\mu\)f
- External Conductive Coating to Anode No.2: 2500 max. \(\mu\)f, 500 min. \(\mu\)f

Phosphor (For Curves, see front of this Section): No.4
- Fluorescence and Phosphorescence: White
- Persistence of Phosphorescence: Medium

Focusing Method: Magnetic
Deflection Method: Magnetic
Deflection Angle (Approx.): 50°
Ion Trap: Magnetic
External Coating: Conductive
Overall Length: 17-5/8" ± 3/8"
Greatest Diameter of Bulb: 10-1/2" ± 1/8"
Minimum Useful Screen Diameter: 9"
Raster Size (Approx.): 6" x 8"
Mounting Position: Any
Cap.: Recessed Small Cavity
Base: Small-Shell Duodecal 7-Pin

**Bottom View**

| Pin 1 - Heater | Pin 10 - Grid No.2 |
| Pin 2 - Grid No.1 | Pin 11 - Cathode |
| Pin 6 - No Connection | Pin 12 - Heater |
| Pin 7 - No Connection | Cap - Anode, Grid No.3 |

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

| ANODE VOLTAGE | 10000 max. volts |
| GRID-No.2 VOLTAGE | 410 max. volts |

GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:
- Negative bias value: 125 max. volts
- Positive bias value: 0 max. volts
- Positive peak value: 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:
- Heater negative with respect to cathode:
  - During equipment warm-up period not exceeding 15 seconds: 410 max. volts
- After equipment warm-up period: 125 max. volts
- Heater positive with respect to cathode: 125 max. volts

* See next page.
← indicates a change.
Typical Operation:

Anode Voltage* ................................................ 9000 . volts
Grid-No.2 Voltage ............................... 250 . volts
Grid-No.1 Voltage* .......................................................... -27 to -63 volts

Maximum Circuit Values:

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

Minimum Circuit Values:

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

Grid-No.1-Circuit Resistance .............. 150 min. ohms
Grid-No.2-Circuit Resistance .............. 470 min. ohms
Anode-Circuit Resistance .................. 11000 min. ohms

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

Components:

Ion-Trap Magnet* ........................................ RCA Type No.203D1
Deflection Yoke* ........................................ RCA Type No.201D1
Focusing Coil** ........................................ RCA Type No.202D1

* The anode and grid No.3 which are connected together within tube are referred to herein as anode.
* Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 8000 volts.
# Visual extinction of undeflected focused spot.
* The dc current required by this magnet is approx. 109 ma. for the typical operating conditions shown.
* The horizontal deflecting-coil current required by this yoke to produce 8" picture width is approx. 470 ma. peak-to-peak under the typical operating conditions shown. The current varies directly as the square root of the anode voltage.
** The dc current required by this coil is approx. 115 ma. for the typical operating conditions shown and using combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 20 foot-lamberts on a 6" x 8" picture area. Distance from reference line (see Outline Drawing) to center line of air gap is approx. 3-1/4".

Note: Indicates a change.

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

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

NOTE 4: APPROX. DISTANCE TO CENTER OF FOCUSING-COIL AIR GAP.

NOTE 5: DISTANCE TO INTERNAL POLE PIECES. PLANE THROUGH PIN NO. 6 AND TUBE AXIS PASSES THROUGH LINE JOINING CENTERS OF POLE PIECES. DIRECTION OF PRINCIPAL FIELD OF ION-TRAP MAGNET SHOULD BE SUCH THAT NORTH POLE IS ADJACENT TO PIN NO. 6 AND SOUTH POLE TO PIN NO. 12.
NOTE 6: LOCATION OF DEFLECTING YOKE AND FOCUSING-COIL AIR GAP MUST BE WITHIN THIS SPACE.

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

NOTE 8: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 9: FOR TUBE SUPPORT WHICH MUST NOT COVER SPECIFIED AREA AROUND ANODE CAP.

92CM-6663R2
KINESCOPE

DATA

General:

Heater, for Unipotential Cathode:

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

Direct Inter-electrode Capacitances (Approx.):

Grid No.1 to All Other Electrodes .......... 6 ........... µµf
Cathode to All Other Electrodes .......... 5 ........... µµf

External Conductive Coating to Anode: { 2000 max. µµf
{ 500 min. µµf

Face Plate (Transmission of about 65%) ..... RCA "Filterglass"
Phosphor (For Curves, see front of this Section) No.4–Sulfide Type
Fluorescence and Phosphorescence .......... White
Persistence of Phosphorescence .......... Medium

Focusing Method .......... Magnetic
Deflection Method .......... Magnetic
Deflection Angle (Approx.) .......... 52°

Ion-Trap Gun .......... Requires External Double-Field Magnet
Overall Length .......... 17-5/8" ± 3/8"
Greatest Diameter of Bulb .......... 10-1/2" ± 1/8"
Screen Diameter .......... 9-3/8"
Mounting Position .......... Any

Cap. .......... Recessed Small Cavity
Base .......... Small-Shell Duodecal 5-Pin
Basing Designation for BOTTOM VIEW .......... 12D1

Pin 1–Heater
Pin 2–Grid No.1
Pin 10–Grid No.2

Pin 11–Cathode
Pin 12–Heater
Cap – Anode, Grid No.3

Maximum Ratings, Design-Center Values:

ANOODEVOLTAGEd .......... 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

\(d\) Anode and grid No.3, which are connected together within tube, are referred to herein as anode.
\(\circ\) The product of anode voltage and average anode current should be limited to 6 watts.

MAY 1, 1950
Typical Operation:

Anode Voltage* .......................... 9000 11000 volts
Grid-No.2 Voltage .......................... 250 250 volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot .......................... -27 to -63 volts

Focusing-Coil Current

(DC, Approx.)† .......................... 115 125 ma
Ion-Trap-Magnet Current

(DC, Approx.)# .......................... 155 180 ma

Maximum Circuit Values:

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

Minimum Circuit Values:

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

Grid-No.1-Circuit Resistance ............... 150 min. ohms
Grid-No.2-Circuit Resistance ............... 470 min. ohms
Anode-Circuit Resistance .................. 15000 min. ohms

The resistors used should be capable of withstanding the applied voltage.

Components:

Horizontal-Deflection-Output & High-Voltage Transformer:

For use with pulse-operated high-voltage supply giving 10000-12000 volts .......................... RCA-217T1

Horizontal Linearity Control .......................... RCA-207R1
Width Control. .................. RCA-206R1
Vertical-Deflection Output Transformer .......................... RCA-204T9
Deflecting Yoke. .................. RCA-205D1
Ion-Trap Magnet (Permanent-Magnet Type) .......................... RCA-203D3
Focusing Coil .......................... RCA-202D1

* Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 8000 volts.
† For JETEC Focusing coil No.106, or equivalent, positioned with center line of air gap approximately 3-1/4 inches from Reference Line (See Outline Drawing). The indicated currents are for the condition with the combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 25 foot-lamberts for 9000 volts, or 30 foot-lamberts for 11000 volts, on an 8" x 6" picture area.
# For JETEC Ion-Trap Magnet No.108, or equivalent, located with main pole pieces longitudinally opposite internal pole pieces, and rotated to give maximum brightness.
00 Renewal Sales item only.

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 MORE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING DIAMETER OF 1-7/8".

NOTE 4: DISTANCE TO INTERNAL POLE PIECES. PLANE THROUGH VACANT PIN POSITION NO. 6 AND TUBE AXIS PASSES THROUGH LINE JOINING CENTERS OF POLE PIECES. DIRECTION OF PRINCIPAL FIELD OF ION-TRAP MAGNET SHOULD BE SUCH THAT NORTH POLE IS ADJACENT TO VACANT PIN POSITION NO. 6 AND SOUTH POLE TO PIN NO. 12.

NOTE 5: LOCATION OF DEFLECTING YOKE AND FOCUSING-COIL MUST BE WITHIN THIS SPACE.
NOTE 6: KEEP THIS SPACE CLEAR FOR ION-TRAP MAGNET.

NOTE 7: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 8: FOR TUBE SUPPORT WHICH MUST NOT COVER SPECIFIED CLEAR AREA AROUND ANODE CAP.
The following Grid-Drive Characteristics Curves are for the condition with grid No.1 biased to give visual extinction of the undeflected, focused spot. In viewing television pictures, it will be found that the actual cutoff voltage corresponding to black in the picture is approximately 5 volts less negative than shown on the curves; similarly, the grid-No.1 drive to obtain a given anode current or light output is also about 5 volts less.

**AVERAGE GRID-DRIVE CHARACTERISTICS**

\[ E_{f} = 6.3 \text{ VOLTS} \]

\[ \text{ANODE VOLTS} = 9000 \]

\[ \text{GRID NO.1 BIASED TO CUTOFF OF UNDEFLECTED FOCUSED SPOT} \]

\[ \text{RASTER SIZE} = 8" \times 6" \text{ (FOCUSED FOR AVERAGE BRIGHTNESS)} \]

---

**Diagram:**

- Highlight Brightness (Foot-Lamberts) vs. Peak Grid-No.1 Drive from Cutoff-Volts

---

May 1, 1950

Tube Department

Radio Corporation of America, Harrison, New Jersey
$E_p = 6.3$ VOLTS

ANODE VOLTS = 11000

GRID NO. BIASED TO CUTOFF OF UNDEFOCUSED FOCUSED SPOT

RASTER SIZE = 8" x 6" (FOCUSED FOR AVERAGE BRIGHTNESS)
AVERAGE GRID-DRIVE CHARACTERISTICS

E_c = 6.3 VOLTS
ANODE VOLTS = 9000 TO 12000
GRID N21 BIASED TO CUTOFF OF UNDEFFECTED FOCUSED SPOT

FEB. 21, 1950
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-7454
AVERAGE CHARACTERISTICS

- $E_f = 6.3$ VOLTS
- ANODE VOLTS = 9000
- GRID-NR2 VOLTS = 250
- GRID-NR1 BIASED TO CUTOFF
- RASTER SIZE 6"X8" (FOCUSED)

OCT. 9, 1947
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6675R2
MAGNETIC FOCUS

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 μuf
Cathode to all other electrodes . 5 μuf
Faceplate . Filterglass
Light transmission (Approx.) . 77%
Phosphor (for curves, see front of this section). . . P7
Fluorescence . Blue
Phosphorescence . Greenish-Yellow
Persistence . Long
Focusing Method . Magnetic
Deflection Method . Magnetic
Deflection Angle (Approx.) . 50°
Overall Length . 17-5/8" ± 1/16" ±
Greatest Diameter of Bulb . 10-1/2" ± 1/16" ±
Minimum Useful Screen Diameter . 9"
Weight (Approx.). . . . . 10 lbs
Mounting Position . Any
Cap . . . . . Recessed Small Cavity (JETEC No.J1-21)
Bulb . . . . . Small-Shell Duodecal 5-Pin (JETEC No.B5-57)
Base . . . . . Small-Shell Duodecal 5-Pin (JETEC No.B5-57)
Basing Designation for BOTTOM VIEW . . . . . 120

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)

Maximum Ratings, Design-Center Values:
ULTOR* VOLTAGE . . . . . . . . . . . 10000 max. volts
GRDL-No.2 VOLTAGE:
Positive value (DC or Peak AC) . . . . . . . . 700 max. volts
Negative value (DC or Peak AC) . . . . . . . . 180 max. volts
GRGL-No.1 VOLTAGE:
Negative bias value . . . . . . . . . . . . . . . . 180 max. volts
Positive bias value . . . . . . . . . . . . . . . . 0 max. volts
Positive peak value . . . . . . . . . . . . . . . . 2 max. volts

* The "ultor" in a cathode-ray tube is the electrode to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection. In the 10KP7, the ultor function is performed by grid No. 3. Since grid No. 3 and collector are connected together within the 10KP7, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.

*: See next page.

Indicates a change.

NOV. 1, 1955
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
OSCILLOGRAPH TUBE

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

Equipment Design Ranges:

For any ultor voltage \( E_C \) between 7000 and 10000 volts
and grid-No.2 voltage \( E_C^2 \) between 150 and 700 volts

Grid-No.1 Voltage for Visual
Extinction of Undeflected
Focused Spot . . . . . . . -10.8% to -25.2% of \( E_C \) volts

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

Focusing-Coil Current (DC)\(^\text{oo}\) \[ \left( \frac{E_C^2}{7000} \times 99 \right) \pm 15\% \text{ ma} \]

Spot Position. . . . . . . . .

Examples of Use of Design Ranges:

For ultor voltage of
grid-No.2 voltage of
7000  
9000  
250  
250  
volts  
volts  
volts  
volts

Grid-No.1 Voltage for Visual
Extinction of Undeflected
Focused Spot . . . . . . . -27 to -63 -27 to -63 volts

Focusing-Coil Current (DC). 99 \pm 15\% 112 \pm 15\% ma

Maximum Circuit Values:

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

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

\( \uparrow \) Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 7000 volts.

\( \text{oo} \) For specimen focusing coil similar to JETEC Focusing Coil No.106 positioned with air gap toward faceplate and center line of air gap 3-1/2" from Reference Line (See Dimensional Outline) and ultor current of 200 microamperes.

\( \#\# \) The center of the undeflected, unfocused spot will fall within a circle having an 18-mm radius concentric with the center of the tube face.

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: FOR TUBE SUPPORT WHICH MUST BE KEPT AT LEAST 2" AWAY FROM ULTOR CAP.

NOTE 5: LOCATION OF DEFLECTING YOKE AND FOCUSING COIL OR MAGNET MUST BE WITHIN THIS SPACE.
AVERAGE GRID-DRIVE CHARACTERISTICS

ULTOR CURRENT

$E_C = 6.3$ VOLTS
ULTOR VOLTS = 7000 - 10000
GRID N=1 BIASED TO CUTOFF OF UNDEFLECTED FOCUSED SPOT

HIGHLIGHT BRIGHTNESS

$E_C = 6.3$ VOLTS
ULTOR VOLTS = 8000
GRID N=2 VOLTS = 250
GRID N=1 BIASED TO CUTOFF OF UNDEFLECTED FOCUSED SPOT
RASTER SIZE = 14 CM x 14 CM
## 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, Spherical:
- **Light Transmission (Approx.)**: 66%
- **Filterglass**: White
- **Persistence of Phosphorescence**: Short

### Focusing Method:
- **Electrostatic Deflection Method**
- **Magnetic Deflection Method**

### Deflection Angle (Approx.)
- **Overall Length**: 16-5/8" ± 3/8"
- **Greater Diameter of Bulb**: 10-1/2" ± 1/8"
- **Minimum Useful Screen Diameter**: 9-1/8" 
- **Picture Size (Within minimum-useful-screen area)**: 8" x 6"

### Mounting Position
- **Recessed Small Cavity (JETEC No. J1-21)***
- **Small-Shell Duodecal 6-Pin (JETEC No. B6-63)***

### Maximum Ratings, Design-Center Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ULTOR</strong></td>
<td>14000 max. volts</td>
</tr>
<tr>
<td>GRID-No.3</td>
<td>2700 max. volts</td>
</tr>
<tr>
<td>GRID-No.2</td>
<td>410 max. volts</td>
</tr>
<tr>
<td>GRID-No.1</td>
<td>125 max. volts</td>
</tr>
<tr>
<td><strong>Positive bias value</strong></td>
<td>0 max. volts</td>
</tr>
<tr>
<td><strong>Positive peak value</strong></td>
<td>2 max. volts</td>
</tr>
</tbody>
</table>

* For curves, see front of this Section.

**In the 10SP4, 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, which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection.**
PEAK HEATER–CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period
not exceeding 15 seconds . 410 max. volts
After equipment warm-up period . . . 180 max. volts
Heater positive with respect to cathode . 180 max. volts

Equipment Design Ranges:
For any ultor voltage ($E_u$) between 10000" and 14000 volts
and grid-No.2 voltage ($E_{c2}$) between 150 and 410 volts
Grid-No.3 Voltage for Focus with
Ultor Current of 100 μamp 11.7% to 15.9% of $E_u$ volts
Grid-No.1 Voltage for
Visual Extinction of
8" x 6" Raster . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 9% to 24% of $E_{c2}$ volts
Max. Grid-No.3 Current** . . . . See Curves
Grid-No.2 Current . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . -15 to +15 μamp
Field Strength of Adjustable
Centering Magnet . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 0 to 8 gauss

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 μamp . 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 10000 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
MONITOR KINESCOPE

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

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

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

NOTE 4: TUBE SUPPORT MUST BE KEPT AT LEAST 2" AWAY FROM BULB TERMINAL.

JULY 1, 1952 TUBE DEPARTMENT CE-7729
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE GRID-DRIVE CHARACTERISTIC

$E_C = 6.3$ 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 $= 6' \times 6'$

Highlight brightness: Foot-Lamberts

Video signal Volts from cutoff

Mar. 21, 1952
Tube Department
Radio Corporation of America, Harrison, New Jersey
92CM-7774
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_C = 6.3$ 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 = $6' \times 6'$

MAR. 21, 1952
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-7773
GRID-DRIVE CHARACTERISTICS

$E_p = 6.3$ VOLTS
ULTOR (GRID-N94 AND COLLECTOR) VOLTS = 12000
GRID-N93 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS
GRID N91 BIASED TO CUTOFF OF RASTER
RASTER SIZE = 8" x 8"

MAR. 21, 1952
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
# DATA

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

Direct Interelectrode Capacitances (Approx.):
- Grid No.1 to all other electrodes: 9 μf
- Cathode to all other electrodes: 6 μf

Faceplate, Spherical: Filterglass
- Light transmission (Approx.): 76%

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

Focusing Method: Magnetic Focus

Deflection Method: Magnetic Deflection

Deflection Angle (Approx.): 50°

Overall Length: 19-5/8" ± 1/2"

Greatest Diameter of Bulb: 12" ± 3/16"

Minimum Useful Screen Diameter: 10" ±

Weight (Approx.): 8 lbs

Mounting Position: Any

Cap.: Medium (JETEC No. C1-5)

Bulb: 5AM

Base: Long Medium-Shell Octal 8-Pin (JETEC No. B8-65), or Long Medium-Shell Octal 5-Pin (JETEC No. B5-80)

### Basing Designation for BOTTOM VIEW

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

## Maximum Ratings, Design-Center Values:

**ULTOR VOLTAGE**: 10000 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

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

Equipment Design Ranges:
For any ultor voltage \( E_{c1} \) between 4000* and 10000 volts
and grid-No.2 voltage \( E_{c2} \) between 150 and 750 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)\( \circ \) . \[ \sqrt{\frac{E_{c2}}{4000}} \times 88.5 \] \( \pm \) 15% ma
Spot Position ........... ##

Examples of Use of Design Ranges:
For ultor voltage of 4000 7000 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) . 75 to 102 99 to 135 ma

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.
\( \circ \) For specimen focusing coil similar to JETEC Focusing Coil No.10A positioned with air gap toward faceplate and center line of air gap 4-1/8" from Reference Line (See Dimensional Outline) and ultor current of 200 microamperes.
## The center of the undeflected, unfocused spot will fall within a circle having a 20-mm radius concentric with the center of the tube face.

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

$E_f = 6.3$ VOLTS
ULTOR VOLTS = 4000 - 10000
GRID N&I BIASED TO CUTOFF
OF UNDEFLCTED FOCUSED SPOT

ULTOR MICROAMPERES

VIDEO SIGNAL VOLTS FROM CUTOFF

APRIL 9, 1952
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6943RI
The 12DP7-B is the same as the 12DP7-A except for the following items:

**General:**
- Faceplate, Spherical
- Filterglass
- Light transmission (Approx.)

Light transmission: 76%

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

92CM-6375R5
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_c = 8.3$ VOLTS
ULTOR VOLTS $= 4000$-$10000$
GRID N$^8$ I BIASED TO CUTOFF
OF UNDEФLECTED FOCUS€D SPOT

VIDEO SIGNAL VOLTS FROM CUTOFF

ULTOR MICROAMPERES

APRIL 9, 1952
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6943RI
**KINESCOPE**

**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
- External Conductive Coating to Anode: 1) 3000 max. 2) 750 min. μf

Phosphor (For Curves, see front of this Section): No.4
- Fluorescence: White
- Phosphorescence: White
- Persistence: Medium

Focusing Method: Magnetic
Deflection Method: Magnetic
Deflection Angle (Approx.): 57°

Ion-Trap Gun: Requires External Double-Field Magnet

Overall Length: 18-3/4 x 3/8"
Greatest Diameter of Bulb: 12-7/16 x 1/8"
Screen Diameter: 11-3/8"
Raster Size (Approx.): 7-1/2" x 10"
Mounting Position: Recessed Small Cavity
Base: Small-Shell Duodecal 7-Pin

Basing Designation for BOTTOM VIEW: 12D

Pin 1-Heater
Pin 2-Grid No.1
Pin 6-No Connection
Pin 7-No Connection
Pin 10-Grid No.2
Pin 11-Cathode
Pin 12-Heater
Cap -Anode, Grid No.3

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANODE VOLTAGE</td>
<td>12000 max. volts</td>
</tr>
<tr>
<td>GRID-No.2 VOLTAGE</td>
<td>410 max. volts</td>
</tr>
<tr>
<td>GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max. volts</td>
</tr>
<tr>
<td>PEAK HEATER-CATHODE VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode:</td>
<td></td>
</tr>
<tr>
<td>During equipment warm-up period not exceeding 15 seconds</td>
<td>410 max. volts</td>
</tr>
<tr>
<td>After equipment warm-up period</td>
<td>150 max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>150 max. volts</td>
</tr>
</tbody>
</table>

* Anode and grid No.3, which are connected together within tube, are referred to herein as anode.

SEPT. 15, 1949
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Typical Operation:

Anode Voltage* ................ 9000 11000 volts
Grid-No.2 Voltage, ............ 250 250 volts
Grid-No.1 Voltage for Visual Extinction of Undelected Focused Spot ...... -27 to -63 -27 to -63 volts
Focusing-Coil Current (DC, Approx.)**. 115 125 ma
Ion-Trap Magnet Current (DC)#. 155 180 ma

Maximum Circuit Values:

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

Minimum Circuit Values:

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

Grid-No.1 - Circuit Resistance. .... 150 min. ohms
Grid-No.2 - Circuit Resistance. .... 470 min. ohms
Anode-Circuit Resistance ........ 15000 min. ohms

The resistors should be capable of withstanding the applied voltages.

* Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 9000 volts.
** For JETEC Focusing coil No.106, or equivalent, positioned with center line of air gap approximately 3-1/4" from Reference Line (See Outline Drawing). The indicated currents are for the condition with the combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 25 foot-lamberts for 9000 volts, or 30 foot-lamberts for 11000 volts, on a 7-1/2" x 10" picture area.
# For JETEC Ion-Trap Magnet No.108, or equivalent, located with main pole pieces longitudinally opposite internal pole pieces, and rotated to give good line focus with maximum brightness.

CURVES

The following Grid-Drive Characteristics Curves are for the condition with grid No.1 biased to give visual extinction of the undeflected, focused spot. In viewing television pictures, it will be found that the actual cutoff voltage corresponding to black in the picture is approximately 5 volts less negative than shown on the curves; similarly, the grid-No.1 drive to obtain a given anode current or light output is also about 5 volts less negative.

SEPT. 15, 1949
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No. 3 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF 10°. ANODE TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION No. 3.

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

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

NOTE 4: DISTANCE OF INTERNAL POLE PIECES. PLANE THROUGH PIN No. 6 AND TUBE AXIS PASSES THROUGH LINE JOINING CENTERS OF POLE PIECES. DIRECTION OF PRINCIPAL FIELD OF ION-TRAP MAGNET SHOULD BE SUCH THAT NORTH POLE IS ADJACENT TO PIN No. 6 AND SOUTH POLE TO PIN No. 12.

NOTE 5: LOCATION OF DEFLECTING YOKE AND FOCUSING-COIL MUST BE WITHIN THIS SPACE.

NOTE 6: KEEP THIS SPACE CLEAR FOR ION-TRAP MAGNET.

NOTE 7: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

92CM-7276
AVERAGE GRID-DRIVE CHARACTERISTICS

\[ E_p = 6.3 \text{ VOLTS} \]
ANODE VOLTS = 9000
GRID N21 BIASED TO CUTOFF
RASTER SIZE = 7.5 \times 10^5 (FOCUSED)

PEAK GRID-N\#1 DRIVE FROM CUTOFF - VOLTS

JUNE 28, 1949
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_c = 6.3$ VOLTS
ANODE VOLTS $= 11000$
GRID NO. 1 BIAS TO CUTOFF
RASTER SIZE $= 7.5'' \times 10''$ (FOCUSED)
AVERAGE GRID-DRIVE CHARACTERISTICS

\[ E_p = 6.3 \text{ VOLTS} \]
\[ \text{ANODE VOLTS} = 9000 \text{ TO } 12000 \]
\[ \text{GRID N2I BIASED TO CUTTOFF} \]
\[ \text{RASTER SIZE: 7.5”x10” (FOCUSED)} \]
I2LP4-A
KINESCOPE
MAGNETIC FOCUS

DATA

MAGNETIC DEFLECTION

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
External Conductive Coating to Anode: 2000 max. μf
750 min. μf
Face Plate (Transmission of about 65%): RCA "Filterglass"
Phosphor (For Curves, see front of this Section): No.4-Sulfide Type
Fluorescence and Phosphorescence: White
Persistence of Phosphorescence: Medium
Focusing Method: Magnetic
Deflection Method: Magnetic
Deflection Angle (Approx.): 57°
Ion-Trap Gun: Requires External Double-Field Magnet
Overall Length: 18-3/4 ± 3/8"
Greatest Diameter of Bulb: 12-7/16 ± 1/8"
Screen Diameter: 11-3/8"
Mounting Position: Any
Cap.: Recessed Small Cavity
Base: Small-Shell Duodecal 5-Pin
Basing Designation for BOTTOM VIEW: 1201

Pin 1-Heater
Pin 2-Grid No.1
Pin 10-Grid No.2
Pin 11-Cathode

Pin 12-Heater
Cap -Anode,
Grid No.3

Maximum Ratings, Design-Center Values:
ANODE VOLTAGE*: 12000 max. volts
GRID-No.2 VOLTAGE: 410 max. volts
GRID-No.1 VOLTAGE:
Negative bias value: 125 max. volts
Positive bias value: 0 max. volts
Positive peak value: 2 max. volts
PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period not exceeding 15 seconds: 410 max. volts
After equipment warm-up period: 150 max. volts
Heater positive with respect to cathode: 150 max. volts

* Anode and grid No.3, which are connected together within tube, are referred to herein as anode.
• The product of anode voltage and average anode current should be limited to 6 watts.

MAY 1, 1950
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Typical Operation:

Anode Voltage* .................. 9000 11000 volts
Grid-No.2 Voltage. ............. 250 250 volts
Grid-No.1 Voltage for Visual Extinction of Undecflected Focused Spot .............. -27 to -63 -27 to -63 volts
Focusing-Coil Current (DC, Approx.)** 115 125 ma
Ion-Trap Magnet Current (DC)# 155 180 ma

Maximum Circuit Values:

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

Minimum Circuit Values:

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

Grid-No.1—Circuit Resistance ........ 150 min. ohms
Grid-No.2—Circuit Resistance ........ 470 min. ohms
Anode—Circuit Resistance ........... 15000 min. ohms

The resistors should be capable of withstanding the applied voltages.

Components:

Horizontal-Deflection-Output & High-Voltage Transformer: For use with pulse-operated high-voltage supply giving 10000-12000 volts ........ RCA-217T1
Horizontal Linearity Control .......... RCA-207R1
Width Control .................... RCA-206R1
Vertical-Deflection Output Transformer ... RCA-204T9
Deflecting Yoke ........................ RCA-205D1
Ion-Trap Magnet (Permanent-Magnet Type) .. RCA-203D3
Focusing Coil 00 .................... RCA-202D1

* Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 9000 volts.
** For JETEC Focusing Coil No.106, or equivalent, positioned with center line of air gap approximately 3-1/8" from Reference Line (see Outline Drawing). The indicated currents are for the condition with the combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 17 foot-lamberts for 9000 volts, or 20 foot-lamberts for 11000 volts, on a 10" x 7-1/2" picture area.
# For JETEC Ion-Trap Magnet No.108, or equivalent, located with main pole pieces longitudinally opposite internal pole pieces, and rotated to give maximum brightness.
00 Renewal Sales item only.

MAY 1, 1950
NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No.3 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF 10°. ANODE TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION No.3.

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

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

NOTE 4: DISTANCE TO INTERNAL POLE PIECES. PLANE THROUGH VACANT PIN POSITION No.6 AND TUBE AXIS PASSES THROUGH LINE JOINING CENTERS OF POLE PIECES. DIRECTION OF PRINCIPAL FIELD OF ION-TRAP MAGNET SHOULD BE SUCH THAT NORTH POLE IS ADJACENT TO VACANT PIN POSITION No.6 AND SOUTH POLE TO PIN No.12.

NOTE 5: LOCATION OF DEFLECTING YOKE AND FOCUSING-COIL MUST BE WITHIN THIS SPACE.

NOTE 6: KEEP THIS SPACE CLEAR FOR ION-TRAP MAGNET.

NOTE 7: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.
The following Grid-Drive Characteristics Curves are for the condition with grid No.1 biased to give visual extinction of the undeflected, focused spot. In viewing television pictures, it will be found that the actual cutoff voltage corresponding to black in the picture is approximately 5 volts less negative than shown on the curves; similarly, the grid-No.1 drive to obtain a given anode current or light output is also about 5 volts less.

**AVGAGE GRID-DRIVE CHARACTERISTICS**

- $E_F = 6.3$ VOLTS
- ANODE VOLTS = 9000
- GRID NO.1 BIASED TO CUTOFF OF UNDEFLECTED FOCUSED SPOT
- RASTER SIZE = 10" x 7.5" (FOCUSED FOR AVERAGE BRIGHTNESS)

![Graph](image-url)
AVGAGE GRID-DRIVE CHARACTERISTICS

$E_g = 6.3 \text{ VOLTS}$

ANODE VOLTS = 11000

GRID N°1 BIASED TO CUTOFF OF UNDEFFLECTED FOCUSED SPOT

RASTER SIZE = 10" x 7.5" (FOCUSED FOR AVERAGE BRIGHTNESS)
E_F = 6.3 VOLTS
ANODE VOLTS = 9000 TO 12000
GRID N=1 BIASED TO CUTOFF OF UNDEFOCUSED FOCUSED SPOT
**KINESCOPE**

**RECTANGULAR GLASS TYPE**

**DATA**

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

Direct Interelectrode Capacitances:
- Grid No.1 to all other electrodes: 6 μf
- Cathode to all other electrodes: 5 μf
- External conductive coating to ultor: 2000 max. μf
- 750 min. μf

Faceplate, Spherical: Filterglass
- Light transmission (Approx.): 66%

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

Focusing Method: Magnetic
- Deflection Method: Magnetic

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

Ion-Trap Gun: Requires External Single-Field Magnet

**Tube Dimensions:**
- Overall length: 16-5/8" ± 1/4"
- Greatest width: 12-17/32" ± 1/8"
- Greatest height: 9-23/32" ± 1/8"
- Diagonal: 13-11/16" ± 1/8"
- Neck length: 7-5/16" ± 1/8"

**Screen Dimensions (Minimum):**
- Greatest width: 11-3/8" ± 1/8"
- Greatest height: 8-1/2" ± 1/8"
- Diagonal: 12-1/2" ± 1/8"
- Projected area: 93 sq. in.
- Weight (Approx.): 10 lbs

Mounting Position: Any

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

**Bulb**
- Small-Shell Duodecal 5-Pin (JETEC 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

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 ultor voltage \( (E_{C2}) \) between 10000 and 14000 volts and grid-No.2 voltage \( (E_{C2}) \) between 200 and 410 volts

Grid-No.1 Voltage for
- Visual Extinction of Focused Raster: -9.3\% to -24\% of \( E_{C2} \) volts
- Grid-No.1 Video Drive from Raster Cutoff (Black Level):
  - White-level value (Peak positive): \( -15 \) to \( +15 \) \( \mu \)amp
  - Focusing-Coil Current (DC): \( \left( \sqrt{\frac{E_{C3}}{14000}} \times 107 \right) \pm 10\% \) ma
  - Ion-Trap Magnet Current (Average)**: \( \sqrt{\frac{E_{C3}}{14000}} \times 28 \) ma
  - Minimum Field Strength of PM Ion-Trap Magnet§: \( \sqrt{\frac{E_{C5}}{14000}} \times 31 \) gausses
  - Field Strength of Adjustable Centering Magnet: 0 to 8 gausses

Examples of Use of Design Ranges:

With ultor voltage of 12000 and grid-No.2 voltage of 300

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
  - Focusing-Coil Current (DC): 99 \( \pm \) 10\% to 107 \( \pm \) 10\% ma
  - Minimum Field Strength of PM Ion-Trap Magnet: 29 to 31 gausses

\*\*, \*\*: See next page.
Maximum Circuit Values:
Grid-No.1-Circuit Resistance ........ 1.5 max. megohms

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

O For specimen focusing coil similar to JETEC Focusing Coil No.109 positioned with air gap toward kinescope screen and center line of air gap 3 inches from Reference Line (See Dimensional Outline). The indicated current is for condition with sharp focus at center of picture area and combined grid-No.1 voltage and video-signal voltage adjusted to produce a highlight brightness of 30 foot-lamberts measured on an Indian Head Test Pattern set for a 11-1/8" x 8-5/16" picture size.

** For JETEC Ion-Trap Magnet No.117, or equivalent, located with the trailing edge of the pole pieces located over the gap between grid No.1 and grid No.2 and rotated to give maximum brightness.

§ For specimen PM ion-trap magnet, such as Heppner Model No. E437, or equivalent, located in optimum position and rotated to give maximum brightness. For a given equipment application, the tolerance range for the strength of the PM ion-trap magnet should be added to the minimum value. The maximum strength of this magnet should not exceed the specified minimum value by more than 6 gausses. This procedure will insure use of a PM ion-trap magnet allowing adequate adjustment to permit satisfactory performance without loss of highlight brightness.

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section.
NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No. 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 30°. ULTOR TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION No. 6.

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

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-1/2".


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

\[ E_F = 6.3 \text{ VOLTS} \]
\[ U_{LTOR} = 12000 \]
GRID NR. 1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF
RASTER FOCUSED AT AVERAGE BRIGHTNESS
RASTER SIZE = 11" x 8½"
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ULTOR VOLTS = 10000 TO 14000
GRID NOT BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF

ULTOR MILLIAMPERES

VIDEO SIGNAL VOLTS FROM RASTER CUTOFF

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY 92CM-8856
KINESCOPE
RECTANGULAR GLASS TYPE
LOW-VOLTAGE FOCUS MAGNETIC DEFLECTION

DATA

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

Direct Interelectrode Capacitances:
Grid No.1 to all other electrodes: .... 6 μf
Cathode to all other electrodes: ....... 5 μf
External conductive coating to ultor*: (2000 max. μf)
........... 750 min. μf

Faceplate, Spherical: Filterglass
Light Transmission (Approx.): .... 75%

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

Focusing Method: Electrostatic
Deflection Method: Magnetic

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

Ion-Trap Gun: Requires External Single-Field Magnet

Tube Dimensions:
Overall length: ........... 16-25/32" ± 3/8"
Greatest width: .......... 12-17/32" ± 1/8"
Greatest height: .......... 9-23/32" ± 1/8"
Diagonal: ............... 13-11/16" ± 1/8"

Screen Dimensions (Minimum):
Greatest width: .......... 11-1/8"
Greatest height: .......... 8-5/16"
Diagonal: ............... 12-1/4"

Weight (Approx.): .... 10 lbs
Mounting Position: Recessed Small Cavity (JETEC No.J1-21)

Cap. .................. Any
Bulb .................. J109-1/2
Base .................. Small-Shell Duodecal 6-Pin (JETEC No.B6-63)

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

*: See next page.

NOV. 5, 1954
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE DATA 1
Maximum Ratings, Design-Center Values:

ULTOR\(^*\) VOLTAGE ........................................ 14000 max. volts
GRID-No.4 VOLTAGE:
  Positive value ............................................ 500 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

PEAK HEATER–CATHODE VOLTAGE:
  Heater negative with respect to cathode:
    During equipment warm-up period
      not exceeding 15 seconds .......................... 410 max. volts
    After equipment warm-up period ................... 180 max. volts
  Heater positive with respect to cathode. .......... 180 max. volts

Equipment Design Ranges:

  For any ultor voltage \(E_{c5}\) between 12000 and 14000 volts
  and grid-No.2 voltage \(E_{c2}\) between 200 and 500 volts

Grid-No.4 Voltage for Focus
with Ultor Current of
100 \(\mu\)amp ........................................... -0.4\% to +2.2\% of \(E_{c5}\) volts

Grid-No.1 Voltage for Visual
Extinction of Focused
Raster ..................................................... -9.3\% to -24\% of \(E_{c2}\) volts

Grid-No.4 Current ................................. -25 to +25 \(\mu\)amp
Grid-No.2 Current ................................. -15 to +15 \(\mu\)amp

Field Strength of Single-Field
Ion-Trap Magnet (Approx.).
\[
\sqrt{\frac{E_{c5}}{12000}} \times 32
\]
  gausses

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

Examples of Use of Design Ranges:

  For ultor voltage of
  
<table>
<thead>
<tr>
<th>12000</th>
<th>14000</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>300</td>
</tr>
</tbody>
</table>

Grid-No.4 Voltage for Focus
with Ultor Current of
100 \(\mu\)amp ........................................... -50 to +265 -55 to +310 volts

Grid-No.1 Voltage for Visual
Extinction of Focused
Raster ....................................................... -28 to -72 -28 to -72 volts

Field Strength of
Ion-Trap Magnet .......................... 32 35 gausses

Maximum Circuit Values:

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

\(^*\): see next page.
The \textit{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 14HP4, the \textit{ultor} function is performed by grid No. 5. Since grid No. 5, grid No. 3, and collector are connected together within the 14HP4, they are collectively referred to simply as \textit{ultor} for convenience in presenting data and curves.

Brilliance and definition decrease with decreasing \textit{ultor} voltage. In general, the \textit{ultor} voltage should not be less than 12000 volts.

\textit{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 (NOTE 3)

JETEC NSB6-63

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

NOV. 5, 1954

CE-8335R1A

92CL-8335R1

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

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-1/2".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT, DRY, LINTLESS CLOTH.
AVERAGE GRID-DRIVE CHARACTERISTICS

- $E_C = 6.3$ VOLTS
- ULTOR VOLTS = 14000
- GRID #1 BIASED TO CUTOFF OF FOCUSED RASTER
- RASTER FOCUSED AT AVERAGE BRIGHTNESS
- RASTER SIZE = 11'' x 8''

Highlight Brightness - Foot-Lamberts

Video Signal Volts from Raster Cutoff

AUG. 19, 1954
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ULTOR VOLTS = 12000 TO 14000
GRID NO. 1 BIASED TO CUTOFF OF FOCUSED RASTER

OCT. 27, 1954
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
## 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 \( \mu \text{f} \)
   Cathode of Blue Gun + Cathode of
   Green Gun + Cathode of Red Gun
   to All Other Electrodes ........... 17.5 \( \mu \text{f} \)
   Grid No. 3 (Of Each Gun Tied within
   Tube to No. 3 Grids of Other Two
   Guns) to All Other Electrodes .... 12 \( \mu \text{f} \)
   Grid No. 4 (Common to the Three
   Guns) to All Other Electrodes .... 7 \( \mu \text{f} \)

External Conductive Coating to Uitor*: \{3000 max. \( \mu \text{f} \)
                                           \( \text{min.} \ 1500 \text{ min.} \( \mu \text{f} \)

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

Screen, Flat:
   Type .................. Metal-Backed, Tricolor, Phosphor-Dot
   Plate .................. Filterglass
   Light Transmission (Approx.) ............. \( \cdot 70\% \)
   Size (Rounded Sides—See Dimensional
   Outline) .................. \( 11-1/2" \times 8-5/8" \)
   Area .................. \( 88.5 \text{ sq. in.} \)

Phosphor (Three Separate Phosphors, collectively) .................. P22
   Fluorescence and Phosphorescence of
   Separate Phosphors, respectively Blue, Green, Red
   Persistence of Group Phosphorescence .... Medium

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

Focusing Method .................. Electrostatic
Convergence Method .................. Electrostatic
Deflection Method .................. Magnetic

Deflection Angles (Approx.):
   Horizontal .......................... 45\(^\circ\)
   Vertical ............................ 35\(^\circ\)

Tube Dimensions:
   Maximum Overall Length ........... 26-1/8"
   Greatest Diameter:
     At faceplate .................. 14-5/8" \( \pm 5/32" \)
     At metal flange ................. 15-3/4" max.

Weight .................. 25 lbs

---

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

Screen, Flat:
   Type .................. Metal-Backed, Tricolor, Phosphor-Dot
   Plate .................. Filterglass
   Light Transmission (Approx.) ............. \( \cdot 70\% \)
   Size (Rounded Sides—See Dimensional
   Outline) .................. \( 11-1/2" \times 8-5/8" \)
   Area .................. \( 88.5 \text{ sq. in.} \)

Phosphor (Three Separate Phosphors, collectively) .................. P22
   Fluorescence and Phosphorescence of
   Separate Phosphors, respectively Blue, Green, Red
   Persistence of Group Phosphorescence .... Medium

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

Focusing Method .................. Electrostatic
Convergence Method .................. Electrostatic
Deflection Method .................. Magnetic

Deflection Angles (Approx.):
   Horizontal .......................... 45\(^\circ\)
   Vertical ............................ 35\(^\circ\)

Tube Dimensions:
   Maximum Overall Length ........... 26-1/8"
   Greatest Diameter:
     At faceplate .................. 14-5/8" \( \pm 5/32" \)
     At metal flange ................. 15-3/4" max.

Weight .................. 25 lbs

---

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

Screen, Flat:
   Type .................. Metal-Backed, Tricolor, Phosphor-Dot
   Plate .................. Filterglass
   Light Transmission (Approx.) ............. \( \cdot 70\% \)
   Size (Rounded Sides—See Dimensional
   Outline) .................. \( 11-1/2" \times 8-5/8" \)
   Area .................. \( 88.5 \text{ sq. in.} \)

Phosphor (Three Separate Phosphors, collectively) .................. P22
   Fluorescence and Phosphorescence of
   Separate Phosphors, respectively Blue, Green, Red
   Persistence of Group Phosphorescence .... Medium

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

Focusing Method .................. Electrostatic
Convergence Method .................. Electrostatic
Deflection Method .................. Magnetic

Deflection Angles (Approx.):
   Horizontal .......................... 45\(^\circ\)
   Vertical ............................ 35\(^\circ\)

Tube Dimensions:
   Maximum Overall Length ........... 26-1/8"
   Greatest Diameter:
     At faceplate .................. 14-5/8" \( \pm 5/32" \)
     At metal flange ................. 15-3/4" max.

Weight .................. 25 lbs
Mounting Position ........................................... Any
Ultor Terminal ........................................... Metal Flange
Bulb ................................................................... J126
Base .................................................................. Small-Shell Bidecal 14-Pin (JETEC No.B14-103)

BOTTOM VIEW

Pin 1: Heater
Pin 2: Cathode of Red Gun
Pin 3: Grid No.1 of Red Gun
Pin 4: Grid No.2 of Red Gun
Pin 5: No Connection
Pin 6: Grids No.3
Pin 7: Cathode of Green Gun
Pin 8: Grid No.1 of Green Gun
Pin 9: Grid No.2 of Green Gun
Pin 13: Grid No.4
Pin 17: Grid No.2 of Blue Gun
Pin 18: Grid No.1 of Blue Gun
Pin 19: Cathode of Blue Gun
Pin 20: Heater

Maximum Ratings, Design-Center Values:

ULTOR VOLTAGE ........................................... 20000 max. volts
ULTOR INPUT ............................................. 15#max. watts
GRID-No.4 VOLTAGE ................................. 11000 max. volts
GRID-No.3 VOLTAGE ......................... 5000 max. volts
GRID-No.2 VOLTAGE (Each Gun) .... 500 max. volts
GRID-No.1 VOLTAGE (Each Gun):
  Negative bias value ......................... 200 max. volts
  Positive bias value ........................ 0 max. volts
  Positive peak value ..................... 2 max. volts
PEAK HEATER-CATHODE VOLTAGE (Each Gun):
  Heater negative with respect to cathode:
    During equipment warm-up period
    not exceeding 15 seconds ... 410 max. volts
    After equipment warm-up period 180 max. volts
  Heater positive with respect to cathode 180 max. volts

Equipment Design Ranges:

For ultor voltage (\(E_{c5}\)) of 18000 to 20000 volts

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

† The "ultor" in a cathode-ray tube is the electrode to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection. In the 15GP22, the ultor function is performed by grid No.5. Since grid No.5, grid No.6, and collector are connected together within the tube, they are collectively referred to simply as "ultors," 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.

MARCH 1, 1954

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
TRICOLOR KINESCOPE

Grid-No.2 Voltage (Each Gun)
when circuit design utilizes grid-No.1 Voltage
\( (E_{c1}) \) at fixed value for
raster cutoff (each gun) ... 2 to 4.5 times \( E_{c1} \) volts

Grid-No.1 Voltage for
Visual Extinction of Focused Raster (Each Gun)
when circuit design utilizes grid-No.2 voltage
\( (E_{c2}) \) at fixed value
(each gun) .............. 22.5% to 50% of \( E_{c2} \) volts

Grid-No.4 Current ............. -5 to +5 \( \mu \)amp
Maximum Grid-No.3 Current .... 300 \( \mu \)amp
Grid-No.2 Current ............. -15 to +15 \( \mu \)amp
Beam-Current Ratio to
Produce Illuminant-C White:
Red Gun to Green Gun ........ 4:1 to 1:1
Blue Gun to Green Gun ....... 1.5:1 to 0.5:1

Maximum Raster Shift in
Any Direction from
Screen Centera .......... 1-1/4 inches

Examples of Use of Design Ranges:

For ultor voltage of 20000 volts

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

Circuit Values:

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

\( ^{\dagger} \) This range does not include the dc component of the dynamic converging voltage.
\( ^{a} \) Centering of the raster on the screen is accomplished by passing direct current of the required value through each pair of deflecting coils to compensate for the raster shift resulting from optimum adjustments for convergence, color purity, and concentricity.

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

March 1, 1954
Tube Department
Radio Corporation of America, Harrison, New Jersey
NOTE 1: REFERENCE LINE IS DETERMINED BY POSITION WHERE A CYLINDRICAL GAUGE 2.400" ± 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.
TYPICAL DRIVE CHARACTERISTIC

$E_e = 6.3 \text{ VOLTS}$
ULTOR (GRIDS-$N^5$ & $N^6$ AND COLLECTOR) VOLTS = 20000
GRID-$N^4$ VOLTS = ADJUSTED FOR CONVERGENCE
GRID-$N^3$ VOLTS = ADJUSTED FOR FOCUS
GRID-$N^2$ VOLTS OF EACH GUN = 200
GRID-$N^1$ OF EACH GUN IS BIASED TO RASTER CUTOFF
RASTER SIZE $1\frac{1}{2} \times 8\frac{3}{8}$

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
TYPICAL LIGHT-OUTPUT CHARACTERISTIC

\[ E_p = 6.3 \text{ VOLTS} \]
\[ \text{ULTOR VOLTS} = 20000 \]
\[ \text{GRID-N\#4 VOLTS} = \text{ADJUSTED FOR CONVERGENCE} \]
\[ \text{GRID-N\#3 VOLTS} = \text{ADJUSTED FOR FOCUS} \]
\[ \text{GRID-N\#2 VOLTS OF EACH GUN} = 200 \]
\[ \text{GRID-N\#1 OF EACH GUN IS BIASED TO RASTER CUTOFF} \]
\[ \text{GRID-N\#1 DRIVE FROM RASTER CUTOFF OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ULTOR CURRENT TO PRODUCE ILLUMINANT-C WHITE LIGHT OUTPUT} \]
\[ \text{BEAM-CURRENT RATIO TO PRODUCE ILLUMINANT-C WHITE:} \]
\[ \text{RED GUN TO GREEN GUN} = 3:1 \]
\[ \text{BLUE GUN TO GREEN GUN} = 0.85:1 \]
\[ \text{RASTER SIZE} = 11\frac{1}{2}'' \times 8\frac{5}{6}'' \]

\[ \begin{align*}
\text{ULTOR MICROAMPERES} & \quad \text{ILLUMINANT-C WHITE LIGHT OUTPUT—FOOT—LAMBERTS} \\
0 & \quad 0 \\
100 & \quad 2 \\
200 & \quad 4 \\
300 & \quad 6 \\
400 & \quad 8 \\
500 & \quad 10 \\
600 & \quad 12 \\
700 & \quad 14 \\
800 & \quad 16 \\
900 & \quad 18 \\
\end{align*} \]
**RCA**

**16ADP7**

**OSCILLOGRAPH TUBE**

**METAL-SHELL ENVELOPE**

**MAGNETIC FOCUS**

**MAGNETIC DEFLECTION**

**DATA**

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

Direct Interelectrode Capacitances (Approx.):
- Grid No.1 to All Other Electrodes: 6 μf
- Cathode to All Other Electrodes: 5 μf

Faceplate, Spherical: Filterglass
Light Transmission (Approx.): 66%
Phosphor (For Curves, see front of this Section): P7
Phosphorescence: Greenish-Yellow
Persistence: Long
Focusing Method: Magnetic
Deflection Method: Magnetic
Deflection Angle (Approx.): 53°
Maximum Overall Length: 22"
Greatest Diameter at Lip: 15-7/8" + 1/8"
Minimum Useful Screen Diameter: 14-3/8"
Ultor® Terminal: Metal-Shell Lip
Mounting Position: Any
Base: Small-Shell Duodecal 7-Pin (JETEC No.B7-51)

**Bottom View**

Pin 1—Heater
Pin 2—Grid No.1
Pin 6—No. Connection
Pin 7—No. Connection
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater
Cap—Ultron (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 ultron function, and collector are connected together within the tube and are conveniently referred to collectively as "ultron". The "ultron" 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 ultron supply should be adequate to limit the ultron input power to 6 watts.

**FEB. 1, 1952**

**TUBE DEPARTMENT**

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

**TENTATIVE DATA**
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 ..................... -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.

FEB. 1, 1952
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 ULTOR VOLTAGE.

FEB. 1, 1952

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

$E_C = 8.3 \text{ VOLTS}$

ULTOR (GRID - NR 3 AND)
COLLECTOR VOLTS = 8000 TO 14000
GRID NR 1 BIASED TO CUTOFF OF
UNDEFOCUSED FOCUSED SPOT
### 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

Face Plate (Transmission of about 65%): RCA "Filterglass"

Phosphor (For Curves, see front of this Section) No.4-Sulfide Type
- Fluorescence and Phosphorescence: White
- Persistence of Phosphorescence: Medium

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

Ion-Trap Gun: Requires External Double-Field Magnet

Maximum Overall Length: 22-5/16"
Greatest Diameter of Bulb: 15-7/8" ±1/8"
Screen Diameter: 14-5/8"
Mounting Position: Any
Anode Terminal: Metal-Cone Lip

Base: Small-Shell Duodecal 5-Pin
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:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>14000 max. volts</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>410 max. volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage:</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>125 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: 150 max. volts
- Heater positive with respect to cathode: 150 max. volts

- Anode and grid no. 3, which are connected together within tube, are referred to herein as anode.
- The product of anode voltage and average anode current should be limited to 6 watts.

**MAY 1, 1950**

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**Diagram:**
- Pin layout for the kinescope, showing connections and labels.

**Tube Department**
- **Radio Corporation of America, Harrison, New Jersey**
Typical Operation:
Anode Voltage* .................................. 9000 12000 volts
Grid-No.2 Voltage......................... 300 300 volts
Grid-No.1 Voltage for Visual Extinction of Undeflected
Focused Spot ................................ -33 to -77 -33 to -77 volts
Focusing-Coil Current (DC)*. 75 90 ma
Ion-Trap Magnet Current (DC, approx.#) ........... 155 200 ma

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

Minimum Circuit Values:
The power supply should be of the limited-energy type with inherent regulation to limit the continuous short-circuit current to 5 ma. If the supply permits the instantaneous short-circuit current to exceed 1 ampere, or is capable of storing more than 250 microcoulombs, the effective resistance in circuit between indicated electrode and the output capacitor should be as follows:
Grid-No.1-Circuit Resistance ............... 150 min. ohms
Grid-No.2-Circuit Resistance ............... 470 min. ohms
Anode-Circuit Resistance .................... 16000 min. ohms
The resistors used should be capable of withstanding the applied voltage.

Components:
Horizontal-Deflection-Output and High-Voltage Transformer:
For use with pulse-operated high-voltage supply giving 11500-13500 volts .................................. RCA-211T5
Horizontal Linearity Control ................ RCA-201R5
Width Control .................................. RCA-201R4
Vertical-Deflection Output Transformer ....... RCA-204T9
Deflecting Yoke .................................. RCA-201D12
Ion-Trap Magnet (Permanent-Magnet Type) ... RCA-203D3
Focusing Coil190 .................................. RCA-202D2

* Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 9000 volts.
▲ For JETEC Focusing Coil No.109, or equivalent, positioned with air gap toward kinescope screen, and center line of air gap about 3 inches from reference line (see Outline Drawing). The indicated currents are for the condition with the combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 30 foot-lamberts on a 15-1/4" x 10" picture area.
# For JETEC Ion-Trap Magnet No.108, or equivalent, located with main pole pieces longitudinally opposite internal pole pieces, and rotated to give maximum brightness.
OO Renewal Sales item only.

MAY 1, 1950

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
NOTE 1: REFERENCE LINE IS DETERMINED BY POSITION WHERE HINGED GAUGE 1.500" + .003" - .000" I.D. AND 2" LONG WILL REST ON CONE.

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 CONE AXIS AND HAVING DIAMETER OF 3".

NOTE 3: DISTANCE TO INTERNAL POLE PIECES. PLANE THROUGH VACANT PIN POSITION NO. 6 AND TUBE AXIS PASSES THROUGH LINE JOINING CENTERS OF POLE PIECES. DIRECTION OF PRINCIPAL FIELD OF ION-TRAP MAGNET SHOULD BE SUCH THAT NORTH POLE IS ADJACENT TO VACANT PIN POSITION NO. 6 AND SOUTH POLE TO PIN NO. 12.

NOTE 4: LOCATION OF DEFLECTING YOKE AND FOCUSING-COIL MUST BE WITHIN THIS SPACE.
NOTE 5: KEEP THIS SPACE CLEAR FOR ION-TRAP MAGNET.

NOTE 6: METAL CONE AND GLASS FACE OPERATE AT HIGH VOLTAGE. ANY MATERIAL IN CONTACT WITH THE CONE OR THE FACE MUST HAVE INSULATING PROPERTIES ADEQUATE FOR 15500 VOLTS.

CURVES

The following Grid-Drive Characteristics Curves are for the condition with grid No.1 biased to give visual extinction of the undeflected, focused spot. In viewing television pictures, it will be found that the actual cutoff voltage corresponding to black in the picture is approximately 5 volts less negative than shown on the curves; similarly, the grid-No.1 drive to obtain a given anode current or light output is also about 5 volts less.
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_C = 6.3$ VOLTS
ANODE VOLTS = 12000
GRID NO. 1 BIASED TO CUTOFF OF
UNDEFOCTED FOCUSED SPOT
RASERT SIZE = $13\frac{3}{4}'' \times 10''$ (FOCUSED
FOR AVERAGE BRIGHTNESS)
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_g = 6.3$ VOLTS
ANODE VOLTS = 12000
GRID N°1 BIASED TO CUTOFF OF UNDEФLECTED FOCUSED SPOT
MAGNETIC FOCUS
KINESCOPE
ROUND GLASS TYPE
MAGNETIC DEFORMATION

**DATA**

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

Direct Interelectrode Capacitances (Approx.):
- Grid No.1 to All Other Electrodes: 6 \( \mu f \)
- Cathode to All Other Electrodes: 5 \( \mu f \)

Faceplate, Spherical: Filterglass

Light Transmission (Approx.): 66%

Phosphor (For Curves, see front of this Section): P4-Sulfide Type

Fluorescence and Phosphorescence: White

Persistence of Phosphorescence: Short

Focusing Method: Magnetic

Deflection Method: Magnetic

Deflection Angle (Approx.): 60°

Ion-Trap Gun: Requires External Double-Field Magnet

Overall Length: 20-3/4" ± 1/4"

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

Minimum Screen Diameter: 14-1/2"


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

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

- **Anode 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

**Typical Operation:**
- Anode Voltage*: 12000 volts

*Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 9000 volts.

FEB. 1, 1952
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
I6DP4-A

KINESCOPE

Grid-No.2 Voltage. .......................... 250 volts
Grid-No.1 Voltage† ..................... -27 to -63 volts
Focusing-Coil Current (DC, Approx.)‡ . . 115 ma
Ion-Trap-Magnet Current (DC, Approx.)# . . 110 ma

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

† For specimen focusing coil similar to JETEC Focusing Coil No.109 positioned with air gap toward kinescope screen and center line of air gap 3-1/4 inches from Reference Line (see Outline Drawing). The indicated current is for condition with combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 20 foot-lamberts on a 14-1/2" x 10-1/4" picture area sharply focused at center of screen.

‡ For specimen ion-trap magnet similar to JETEC Ion-Trap Magnet No.108 located in optimum position and rotated to give maximum brightness.

OPERATING NOTES

X-Ray Warning. When operated at anode voltages up to 16 kilovolts, the I6OP4-A does not produce any harmful x-ray radiation. However, because the rating of the tube permits operation at voltages as high as 16.5 kilovolts (absolute value), shielding of the I6OP4-A 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.

NOTE 1: REFERENCE LINE IS DETERMINED BY POSITION WHERE REFERENCE LINE GAUGE (JETEC No.112) 1.500" + 0.003" - 0.000" L.D. AND 2" LONG WILL REST ON BULB BASE.


FEB. 1, 1952

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
I6GP4-B
KINESCOPE
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
Direct Interelectrode Capacitances:
   Grid No.1 to all other electrodes ........ 6 \mu f
   Cathode to all other electrodes .......... 5 \mu f
Faceplate, Spherical .......................... Frosted Filterglass
   Light transmission (Approx.) ............. 66%
Phosphor (for curves, see front of this section). P4—Sulfide Type
   Fluorescence .................................. White
   Phosphorescence .............................. White
   Persistence .................................... Short
Focusing Method .................................. Magnetic
Deflection Method .............................. Magnetic
Deflection Angle (Approx.) .................... 70°
Ion-Trap Gun ................................. Requires External Single-Field Magnet
Tube Dimensions:
   Maximum overall length .................... 17-11/16”
   Greatest diameter ........................... 15-7/8” ± 1/8”
Minimum Useful Screen Diameter ............ 14-3/8”
Weight (Approx.) .............................. 11 lbs
Mounting Position ............................. Any
Ultor Terminal ................................. Metal-Shell Lip
Base ............................................. Small-Shell Duodecal 5-Pin (JETEC 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

* Indicates a change.
Equipment Design Ranges:

With any ultor voltage \((E_c)\) between 12000* and 14000 volts and grid-No.2 voltage \((E_c)\) between 200 and 410 volts

Grid-No.1 Voltage for Visual Extinction of Focused Raster . . . . . . . . . . -9.3% to -24% of \(E_c\) volts

Grid-No.1 Video Drive from Raster Cutoff (Black Level):

White-level value (Peak positive) 9.3% to 24% of \(E_c\) volts

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

Focusing-Coil Current (DC)\(^0\) . . . . \(\sqrt{\frac{E_c}{14000}} \times 107\) ± 10% ma

Ion-Trap Magnet Current (Average)\(^*\) . . . . \(\sqrt{\frac{E_c}{14000}} \times 28\) ma

Minimum Field Strength of PM Ion-Trap Magnet\(^\|$\) . . . . \(\sqrt{\frac{E_c}{14000}} \times 31\) gauss

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

Examples of Use of Design Ranges:

With ultor voltage of 12000 volts and grid-No.2 voltage of 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

Focusing-Coil Current (DC). . . . . . . . . . 99 ± 10% ma

Minimum Field Strength of PM Ion-Trap Magnet. . . . . . 29 gauss

* Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 12000 volts.

\(^0\) For specimen focusing coil similar to JETEC Focusing Coil No.109 positioned with air gap toward kinescope screen and center line of air gap 3 inches from Reference Line (See Dimensional Outline). The indicated current is for condition with sharp focus at center of picture area and combined grid-No.1 voltage and video-signal voltage adjusted to produce a highlight brightness of 30 foot-lamberts measured on an Indian Head Test Pattern set for a 10™ x 13-1/4™ picture size.

\(^*\) For JETEC Ion-Trap Magnet No.117, or equivalent, located with the trailing edge of the pole pieces located over the gap between grid No.1 and grid No.2 and rotated to give maximum brightness.

\(^\|$\) See next page. -> Indicates a change.
### Maximum Circuit Values:

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

---

For specimen PM ion-trap magnet, such as Heppner Model No. E437, or equivalent, located in optimum position and rotated to give maximum brightness. For a given equipment application, the tolerance range for the strength of the PM ion-trap magnet should be added to the minimum value. The maximum strength of this magnet should not exceed the specified minimum value by more than 6 gaussies. This procedure will insure use of a PM ion-trap magnet allowing adequate adjustment to permit satisfactory performance without loss of highlight brightness.

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

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2-56

DATA 2

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
NOTE 1: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No.110 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 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 2-1/2".

NOTE 3: METAL SHELL AND GLASS FACE OPERATE AT HIGH VOLTAGE. ANY MATERIAL IN CONTACT WITH THE SHELL OR THE FACE MUST BE INSULATED TO WITHSTAND THE MAXIMUM APPLIED ULTOR VOLTAGE.
I6GP4-B

AVERAGE GRID-DRIVE CHARACTERISTICS

E patrons = 6.3 VOLTS
ULTOR VOLTS = 12000
GRID N & 1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF
RASTER FOCUSED AT AVERAGE BRIGHTNESS
RASTER SIZE = 13 1/4" x 10"

E patrons = 6.3 VOLTS
ULTOR VOLTS = 12000
GRID N & 1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF
RASTER FOCUSED AT AVERAGE BRIGHTNESS
RASTER SIZE = 13 1/4" x 10"

HIGHLIGHT BRIGHTNESS - FOOT-LAMBERTS

0 20 40 60 80
VIDEO SIGNAL VOLTS FROM RASTER CUTOFF

92CM-8875
AVERAGE GRID-DRIVE CHARACTERISTICS

- $E_f = 6.3$ VOLTS
- ULTOR VOLTS = 12000 TO 14000
- GRID #1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF

ULTOR MILLIAMPERES

VIDEO SIGNAL VOLTS FROM RASTER CUTOFF

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
# 16LP4-A KINESCOPE
## MAGNETIC FOCUS
### DATA

**General:**

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

Direct Interelectrode Capacitances:
- Grid No.1 to All Other Electrodes: 6 \(\mu\)f
- Cathode to All Other Electrodes: 5 \(\mu\)f
- External Conductive Coating to Anode: \{2000 max. \(\mu\)f
- \{750 min. \(\mu\)f

Faceplate, Spherical: Filterglass

Light Transmission (Approx.): 66%

Phosphor (For Curves, see front of this Section): P4-Sulfide Type

Fluorescence and Phosphorescence: White

Persistence of Phosphorescence: Short

Focusing Method: Magnetic

Deflection Method: Magnetic

Deflection Angle (Approx.): 52°

Ion-Trap Gun: Requires External Double-Field Magnet

Overall Length: 22-1/4" ± 3/8"

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

Minimum Screen Diameter: 14-1/2"

Mounting Position: Any

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

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

**Bottom View**

<table>
<thead>
<tr>
<th>Pin 1</th>
<th>Pin 2</th>
<th>Pin 10</th>
<th>Pin 11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater</td>
<td>Grid No.1</td>
<td>Grid No.2</td>
<td>Cathode</td>
</tr>
<tr>
<td>Cap</td>
<td>Anode</td>
<td>C</td>
<td>External</td>
</tr>
<tr>
<td>Conduct. Coating</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

- **Anode Voltage:** 14000 max. volts
- **Grid-No.2 Voltage:** 410 max. volts
- **Grid-No.1 Voltage:**
  - Negative bias value: 125 max. volts
  - Positive bias value: 0 max. volts
  - Positive peak value: 2 max. volts
- **Peak Heater-Cathode Voltage:**
  - Heater negative with respect to cathode: During equipment warm-up period not exceeding 15 seconds: 410 max. volts
  - After equipment warm-up period: 125 max. volts
  - Heater positive with respect to cathode: 125 max. volts

**Typical Operation:**

- **Anode Voltage:** 12000 volts

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**Tentative Data**

**February 1, 1952**

**Tube Department**

**Radio Corporation of America, Harrison, New Jersey**
Grid-No.2 Voltage .............................................. 300 volts
Grid-No.1 Voltage ............................................. -33 to -77 volts
Focusing-Coil Current (DC, Approx.)# 110 ma
Ion-Trap-Magnet Current (DC, Approx.)# 120 ma

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 kinescope screen, and center line of air gap about 3-1/4 inches from Reference Line (see Outline Drawing). The indicated current is for the condition with the combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 20 foot-lamberts on a 14-1/2" x 10-1/4" picture area sharply focused at center of screen.

For specimen ion-trap magnet similar to JETEC Ion-Trap Magnet No.10 located in optimum position and rotated to give maximum brightness.

OPERATING NOTES

X-Ray Warning. When operated at or below the maximum anode-voltage rating shown in the tabulated data, the 16LP4-A does not produce any harmful x-ray radiation. All types of picture tubes may be operated at voltages (if ratings permit) up to 16 kilovolts (absolute value) without personal injury on prolonged exposure at close range. Above 16 kilovolts, special shielding precautions for x-ray radiation may be necessary.

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 BULB CONE.

The 16RP4/16KP4 is the same as the 16RP4-A/16KP4-A except that it utilizes a **non-aluminized phosphor** and has a light output as shown by the curves on the back of this sheet.
AVERAGE GRID-DRIVE CHARACTERISTICS

- E_d = 6.3 VOLTS
- ULTOR VOLTS = 14000
- GRID NR. 1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF
- RASTER FOCUSED AT AVERAGE BRIGHTNESS
- RASTER SIZE = 13¼" x 10"

Diagram:

- Highlight Brightness: Foot-Lamberts vs Video Signal Volts from Raster Cutoff
- Curves for different grid voltages:
  - Grid NR. 1: Volts 75-250
  - Grid NR. 2: Volts 75-250

Tube Division
Radio Corporation of America, Harrison, New Jersey

92CM-8858
# 16RP4-A/16KP4-A KINESCOPE

## DATA

### General:
- **Heater, for Unipotential Cathode:**
  - Voltage: 6.3 ac or dc volts
  - Current: 0.6 ± 10% amp
- **Direct Interelectrode Capacitances:**
  - Grid No. 1 to all other electrodes: 6 μf
  - Cathode to all other electrodes: 5 μf
  - External conductive coating to ultor: \[1500 \text{ max.} \quad \mu f\] \[750 \text{ min.} \quad \mu f\]
- **Faceplate, Spherical**
- **Light transmission (Approx.)**
- **Phosphor (For curves, see front of this section):** P4—Sulfide Type
  - Aluminized
- **Fluorescence**
- **Phosphorescence**
- **Persistence**
- **Focusing Method**
- **Deflection Method**
- **Deflection Angles (Approx.):**
  - Diagonal: 70°
  - Horizontal: 65°
  - Vertical: 50°
- **Ion-Trap Gun**
  - Requires External Single-Field Magnet
- **Tube Dimensions:**
  - Overall length: 18–3/4" ± 3/8"
  - Greatest width: 14–3/4" ± 1/8"
  - Greatest height: 11–1/2" ± 1/8"
  - Diagonal: 16–1/8" ± 1/8"
  - Neck length: 7–1/2" ± 3/16"
- **Screen Dimensions (Minimum):**
  - Greatest width: 13–1/2"
  - Greatest height: 10–1/8"
  - Diagonal: 14–7/8"
  - Projected area: 131 sq. in.
- **Weight (Approx.):** 16 lbs
- **Mounting Position:** Any
- **Cap.**
  - Recessed Small Cavity (JETEC No. J1–21)
  - J129
- **Bulb**
  - Small-Shell Duodecal 5-Pin (JETEC No. B5–57)
- **Basing Designation for BOTTOM VIEW**
  - 12N

### Pin Information:
- **Pin 1—Heater**
- **Pin 2—Grid No. 1**
- **Pin 10—Grid No. 2**
- **Pin 11—Cathode**
- **Pin 12—Heater**

### Diagram:
- Cap — Ultor
- (Grid No. 3, Collector)
- C — External
- Conductive Coating

---

**TUBE DIVISION**

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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 .... 150 max. volts
Heater positive with respect to cathode .......................... 150 max. volts

Equipment Design Ranges:

With any ultor voltage \( (E_c^3) \) between 12000 and 16000 volts
and grid-No.2 voltage \( (E_c^2) \) between 200 and 410 volts

Grid-No.1 Voltage for
Visual Extinction of
Focused Raster ............. -9.3% to -24% of \( E_c^2 \) volts

Grid-No.1 Video Drive
from Raster Cutoff
(Black Level):
White-level value
(Peak positive) 9.3% to 24% of \( E_c^2 \) volts

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

Focusing-Coil Current (DC)\( ^0 \) \[ \sqrt{\frac{E_c^3}{16000}} \times 115 \] \pm 20% ma

Ion-Trap Magnet Current
(Average)\( ^0 \) \[ \sqrt{\frac{E_c^3}{16000}} \times 30 \] ma

Minimum Field Strength of
PM Ion-Trap Magnet\( ^$ \) \[ \sqrt{\frac{E_c^3}{16000}} \times 33 \] gausses

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

Examples of Use of Design Ranges:

With ultor voltage of 12000 14000 volts
and grid-No.2 voltage of 300 300 volts

Grid-No.1 Voltage for
Visual Extinction of
Focused Raster ............. -28 to -72 -28 to -72 volts

Grid-No.1 Video Drive
from Raster Cutoff
(Black Level):
White-level value
(Peak positive) 28 to 72 28 to 72 volts

Focusing-Coil Current (DC)\( ^0 \) \( 100 \pm 20\% \) \( 108 \pm 20\% \) ma

Minimum Field Strength of
PM Ion-Trap Magnet\( ^0 \) 29 31 gausses

\( ^0, ^0, ^0, ^0 \): see next page.
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 12000 volts.

** For specimen focusing coil similar to JETEC Focusing Coil No. 109 positioned with air gap toward kinescope screen and center line of air gap 3-1/2 inches from Reference Line (See Dimensional Outline). The indicated current is for condition with sharp focus at center of picture area and combined grid-No.1 voltage and video-signal voltage adjusted to produce a highlight brightness of 30 foot-lamberts measured on an Indian Head Test Pattern set for a 7-1/2" x 10-1/8" picture size.

§ For JETEC Ion-Trap Magnet No. 117, or equivalent, located with the trailing edge of the pole pieces located over the gap between grid No.1 and grid No.2 and rotated to give maximum brightness.

For specimen PM ion-trap magnet, such as Heppner Model No. E437, or equivalent, located in optimum position and rotated to give maximum brightness. For a given equipment application, the tolerance range for the strength of the PM ion-trap magnet should be added to the minimum value. The maximum strength of this magnet should not exceed the specified minimum value by more than 6 gausses. This procedure will insure use of a PM ion-trap magnet allowing adequate adjustment to permit satisfactory performance without loss of highlight brightness.

* 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 JETEC No. 110 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4".

I6RP4-A

AVERAGE GRID-DRIVE CHARACTERISTICS

$E_C = 6.3$ VOLTS
ULTOR VOLTS = 14000
GRID NO. 1 BIASED NEGATIVE WITH RESPECT TO
CATHODE TO GIVE FOCUSED RASTER CUTOFF
RASTER FOCUSED AT AVERAGE BRIGHTNESS
RASTER SIZE = $13\frac{1}{4}'' \times 10''$

![Graph showing grid-drive characteristics](image-url)
AVG. GRID-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ULTOR VOLTS = 12000 TO 16000
GRID #1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF
**16WP4-A KINESCOPE**

**ROUNO GLASS TYPE**

**DATA**

**MAGNETIC FOCUS**

**MAGNETIC DEFLECTION**

### 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 Anode: 1500 max. μf

*Faceplate, Spherical:*
  - Filterglass
  - Light Transmission: 66%

*Phosphor (for Curves, see front of this Section):*
  - P4-Sulfide Type
  - Fluorescence and Phosphorescence: White
  - Persistence of Phosphorescence: Short

*Focusing Method:*
  - Magnetic

*Deflection Method:*
  - Magnetic

*Deflection Angle (Approx.):* 70°

*Ion-Trap Gun:*
  - Requires External Double-Field Magnet

*Overall Length:*
  - 17-3/4" ± 3/8"

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

*Minimum Screen Diameter:*
  - 14-1/2"

*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:

*ANODE 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

### Typical Operation:

*Anode Voltage:* 12000 volts

*Grid-No. 2 Voltage:* 250 volts

---

**FEB. 1, 1952**

**TENTATIVE DATA**

**RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY**
Grid-No.1 Voltage for Visual Extinction
of Undeflected Focused Spot................ -27 to 63 volts
Focusing-Coil Current (DC, Approx.)°  100 ma
Ion-Trap Current (Approx.)† ................ 120 ma

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

° For specimen focusing coil similar to JETEC Focusing Coil No.106 positioned with air gap toward kinescope screen and center line of air gap 3-1/4 inches from Reference Line (see Outline Drawing). The indicated current is for condition with combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 20 foot-lamberts on a 14-1/2" x 10-1/4" picture area sharply focused at center of screen.

† For specimen ion-trap magnet similar to JETEC Ion-Trap Magnet No.108 located in optimum position and rotated to give maximum brightness.

OPERATING NOTES

X-Ray Warning. When operated at anode voltages up to 16 kilovolts, the I6WP4-A does not produce any harmful x-ray radiation. However, because the rating of the tube permits operation at anode voltages as high as 17.6 kilovolts (absolute value), shielding of the I6WP4-A 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.

NOTE 1: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No.11G (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CL OF THE GAUGE WITH THE GLASS FUNNEL.

**17AVP4/17ATP4**

**KINESCOPE**

**RECTANGULAR GLASS TYPE**

**LOW-VOLTAGE FOCUS**

**MAGNETIC DEFLECTION**

### DATA

#### General:
- Heater, for Unipotential Cathode:
  - Voltage: 6.3 ac or dc volts
  - Current: 0.6 ± 10% amp
- Direct interelectrode Capacitances:
  - Grid No.1 to all other electrodes: 6 μuf
  - Cathode to all other electrodes: 5 μuf
- External conductive coating: 1500 max. μuf
  1200 min. μuf
- Faceplate, Spherical: Filterglass
- Light transmission (Approx.): 74%
- Phosphor (for curves, see front of this section): P4—Sulfide Type
  - Fluorescence: White
  - Phosphorescence: White
  - Persistence: Short
- Focusing Method: Electrostatic
- Deflection Method: Magnetic
- Deflection Angles (Approx.):
  - Diagonal: 90°
  - Horizontal: 85°
  - Vertical: 68°
- Ion-Trap Gun: Requires External Single-Field Magnet

#### Tube Dimensions:
- Overall length: 15-3/8" ± 3/8"
- Greatest width: 15-25/64" ± 1/8"
- Greatest height: 12-9/32" ± 1/8"
- Diagonal: 16-5/8" ± 1/8"
- Neck length: 6-1/2" ± 3/16"

#### Screen Dimensions (Minimum):
- Greatest width: 14-5/16"
- Greatest height: 11-1/8"
- Diagonal: 15-9/16"
- Projected area: 149 sq. in.
- Weight (Approx.): 15 lbs
- Mounting Position: Any
- Cap.: Recessed Small Cavity (JETEC No.J1-21)
- Bulb: Small-Shell Duodecal 6-Pin (JETEC No.B6-63)

**Basing Designation for BOTTOM VIEW:**

**Pin**
- 1 - Heater
- 2 - Grid No.1
- 6 - Grid No.4
- 10 - Grid No.2
- 11 - Cathode
- 12 - Heater

**Cap**
- 6 - Ulter (Grid No.3, Collector)
- 1 - External Conductive Coating

---

**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:

ULTOR VOLTAGE .......................... 16000 max. volts

GRID-No. 4 VOLTAGE:
Positive value .......................... 1000 max. volts
Negative value .......................... 500 max. volts

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

GRID-No. 1 VOLTAGE:
Negative peak value ........................ 200 max. volts
Negative bias value ........................ 140 max. volts
Positive bias value ........................ 0 max. volts
Positive peak value ........................ 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
During equipment warm-up period not exceeding 15 seconds ........................ 410 max. volts
After equipment warm-up period ........................ 180 max. volts
Heater positive with respect to cathode ........................ 180 max. volts

Equipment Design Ranges:

With any utor voltage \( (E_{c2k}) \) between 120000 and 16000 volts and grid-No. 2 voltage \( (E_{c2k}) \) between 200 and 500 volts.

Grid-No. 4 Voltage for Focus with utor
Current of 100 \( \mu \)amp ........................ -0.4% to +2.2% of \( E_{c2k} \) volts

Grid-No. 1 Voltage for Visual Extinction of Focused Raster
-9.3% to -24% of \( E_{c2k} \) volts

Grid-No. 1 Video Drive from Raster Cutoff (Black Level):
White-level value
(Peak positive) 9.3% to 24% of \( E_{c2k} \) volts

Grid-No. 4 Current ........................ -25 to +25 \( \mu \)amp
Grid-No. 2 Current ........................ -15 to +15 \( \mu \)amp

Ion-Trap Magnet Current (Average)\(^{**}\) ........................ \( \sqrt{\frac{E_{c2k}}{16000}} \times 30 \) ma

Minimum Field Strength of PM Ion-Trap Magnet\(^{\S}\) ........................ \( \sqrt{\frac{E_{c2k}}{16000}} \times 33 \) gausses

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

\( \Delta \) Grid drive is the operating condition in which the video signal varies the grid-No. 1 potential with respect to cathode.

\( \#, \**, \S: \) See next page.

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TENTATIVE DATA 1
Examples of Use of Design Ranges:

**With ultor voltage of** 14000 16000 volts

**and grid-No.2 voltage of** 300 300 volts

Grid-No.4 Voltage for
Focus with Ultor
Current of 100 µamp... -55 to +310 -65 to +350 volts

Grid-No.1 Voltage for
Visual Extinction of
Focused Raster... -28 to -72 -28 to -72 volts

Grid-No.1 Video Drive
from Raster Cutoff
(Black Level):
White-level value
(Peak positive) 28 to 72 28 to 72 volts

Minimum Field Strength of
FM Ion-Trap Magnet...
31 33 gausses

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

**CATHODE-DRIVE® SERVICE**

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

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

ULTOR-TO-GRID-No. 1 VOLTAGE...
16000 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

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.

# **$**
**Equipment Design Ranges:**

*With any ultor-to-grid-No. 1 voltage ($E_{c5g1}$) between 12000 volts and 16000 volts and grid-No. 2-to-grid-No. 1 voltage ($E_{c2g1}$) between 220 and 640 volts*

**Grid-No.4-to-Grid-No.1 Voltage**

- for Focus with Ultor
- Current of 100 µamp . . . . . . 0% to 2.6% of $E_{c5g1}$ volts

**Cathode-to-Grid-No.1 Voltage**

- for Visual Extinction of Focused Raster . . . . . . 8.5% to 19.4% of $E_{c2g1}$ volts

**Cathode-to-Grid-No.1 Video Drive from Raster Cutoff**

(Black Level):

- White-level value
- (Peak negative) 8.5% to 19.4% of $E_{c2g1}$ volts

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

- Ion-Trap Magnet Current (Average)** . . . . . . . $\sqrt{\frac{E_{c5g1}}{16000}} \times 30$ mA

- Minimum Field Strength of PM Ion-Trap Magnet§ . . . . . . $\sqrt{\frac{E_{c5g1}}{16000}} \times 33$ gausses

- 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 and 16000 volts and grid-No. 2-to-grid-No. 1 voltage of 300 and 300 volts*

**Grid-No.4-to-Grid-No.1 Voltage**

- for Focus with Ultor
- Current of 100 µamp . . . . . . 0 to 365 0 to 415 volts

**Cathode-to-Grid-No.1 Voltage**

- for Visual Extinction of Focused Raster . . . . . . 25 to 58 25 to 58 volts

**Cathode-to-Grid-No.1 Video Drive from Raster Cutoff**

(Black Level):

- White-level value
- (Peak negative) 25 to 58 25 to 58 volts

**Minimum Field Strength of PM Ion-Trap Magnet**

- 31 33 gausses

**Maximum Circuit Values:**

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

**,§: see next page.
Brilliance and definition decrease with decreasing ultor voltage or ultor-to-grid-No.1 voltage. In general, the ultor voltage or ultor-to-grid-No.1 voltage should not be less than 12000 volts.

** For JETEC Ion-Trap Magnet No.117, or equivalent, located with the trailing edge of the pole pieces located over the gap between grid No.1 and grid No.2 and rotated to give maximum brightness.

§ For specimen PM ion-trap magnet, such as Heppner Model No.E437, or equivalent, located in optimum position and rotated to give maximum brightness. For a given equipment application, the tolerance range for the strength of the PM ion-trap magnet should be added to the minimum value. The maximum strength of this magnet should not exceed the specified minimum value by more than 6 gauss. This procedure will insure use of a PM ion-trap magnet allowing adequate adjustment to permit satisfactory performance without loss of highlight brightness.

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 JETEC NO. 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: 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>$E_C = 6.3$ Volts</td>
<td>$E_C = 6.3$ 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 = 14&quot; x 10 1/2&quot;</td>
<td>Raster size 14&quot; x 10 1/2&quot;</td>
</tr>
</tbody>
</table>

- **Cathode Drive**
- **Grid Drive**

<table>
<thead>
<tr>
<th>Video Signal Volts from Raster Cutoff</th>
<th>Highlight Brightness-Foot-Lamberts</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>50</td>
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<td>40</td>
<td>100</td>
</tr>
<tr>
<td>60</td>
<td>150</td>
</tr>
<tr>
<td>80</td>
<td>200</td>
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</tbody>
</table>

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
<table>
<thead>
<tr>
<th>Rectangular Glass Type</th>
<th>Aluminized Screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-voltage Focus</td>
<td>Magnetic Deflection</td>
</tr>
</tbody>
</table>

The 17AVP4-A/17ATP4-A is the same as the 17AVP4/17ATP4 except that it has an aluminized phosphor and greater light output as shown by the curves on the back of this sheet.
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE
$E_C = 6.3$ VOLTS
ULTOR-TO-GRID-N VOLTS = 16000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID N 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 N VOLTS BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF
RASTER FOCUSED AT AVERAGE BRIGHTNESS
RASTER SIZE = 14" x 10½"
The 17BP4-A is the same as the 17BP4-B except that it utilizes a non-aluminized phosphor and has a light output as shown by the curves on the back of this sheet.
**AVERAGE GRID-DRIVE CHARACTERISTICS**

- $E_{c} = 6.3$ VOLTS
- ULTOR VOLTS = 14000
- GRID No. 1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF
- RASTER FOCUSED AT AVERAGE BRIGHTNESS
- RASTER SIZE = $14'' \times 10\frac{1}{2}''$

<table>
<thead>
<tr>
<th>VIDEO SIGNAL VOLTS FROM RASTER CUTOFF</th>
<th>HIGHLIGHT BRIGHTNESS - FOOT-LAMBERTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>50</td>
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<tr>
<td>20</td>
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<tr>
<td>60</td>
<td>200</td>
</tr>
<tr>
<td>80</td>
<td>250</td>
</tr>
</tbody>
</table>

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

**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
- Direct Inter-electrode Capacitances:
  - Grid No. 1 to all other electrodes: 6 µf
  - Cathode to all other electrodes: 5 µf
- External conductive coating to ultor: 1500 max. µf
  - 750 min. µf
- **Faceplate**, Spherical: Filterglass
- **Light transmission (Approx.)**: 66%
- **Phosphor (For curves, see front of this section)**: Aluminized P4—Sulfide Type
- **Fluorescence**:
  - White
- **Phosphorescence**:
  - White
- **Persistence**:
  - Short
- **Focusing Method**:
  - Magnetic
- **Deflection Method**:
  - Magnetic
- **Deflection Angles (Approx.)**:
  - Diagonal: 70°
  - Horizontal: 65°
  - Vertical: 50°
- **Ion-Trap Gun**: Requires 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"

#### Screen Dimensions (Minimum):
- **Greatest width**: 14–1/4"
- **Greatest height**: 10–3/4"
- **Diagonal**: 15–1/4"
- **Projected area**: 140 sq. in.
- **Weight (Approx.)**: 18 lbs

#### Mounting Position:
- **Recessed Small Cavity** (JETEC No. J1-21)
- **Bulb**: J-133

#### Base:
- Small-Shell Duodecal 5-Pin (JETEC No. 85-57)

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

**Pin 1—Heater**
**Pin 2—Grid No. 1**
**Pin 10—Grid No. 2**
**Pin 11—Cathode**
**Pin 12—Heater**

**Cap—Ultor**
- (Grid No. 3, Collector)
- C—External Conductive Coating
Maximum Ratings, Design-Center Values:

ULTOR VOLTAGE: ........................................... 16000 max. volts
GRID-No.2 VOLTAGE: ...................................... 410 max. volts
GRID-No.1 VOLTAGE:
  Negative bias value: .................................. 125 max. volts
  Positive bias value: .................................. 0 max. volts
  Positive peak value: .................................. 2 max. volts
PEAK HEATER-CATHODE VOLTAGE:
  Heater negative with respect to cathode:
    During equipment warm-up period not exceeding 15 seconds .......... 410 max. volts
    After equipment warm-up period .................................. 150 max. volts
  Heater positive with respect to cathode. 150 max. volts

Equipment Design Ranges:

With any ultor voltage ($E_{C3}$) between 12000* and 16000 volts
and grid-No.2 voltage ($E_{C2}$) between 150 and 410 volts

Grid-No.1 Voltage for
Visual Extinction of Focused Raster ............... $-9.3\%$ to $-24\%$ of $E_{C2}$ volts
Grid-No.1 Video Drive from Raster Cutoff
  (Black Level):
    White-level value (Peak positive) $9.3\%$ to $24\%$ of $E_{C2}$ volts
    Grid-No.2 Current .................. $\left[ \frac{E_{C3}}{16000} \times 106 \right] \pm 10\%$ ma
    Focusing-Coil Current (DC)$^0$. $\sqrt{\frac{E_{C3}}{16000}} \times 30$ ma
    Ion-Trap Magnet Current (Average)$^*$ .................. $\sqrt{\frac{E_{C3}}{16000}} \times 33$ gausses
    Minimum Field Strength of PM Ion-Trap Magnet$^6$. $\sqrt{16000}$ ma
    Field Strength of Adjustable Centering Magnet ........ 0 to 8 gausses

Examples of Use of Design Ranges:

With ultor voltage of 12000 14000 volts
and grid-No.2 voltage of 300 300 volts

Grid-No.1 Voltage for
Visual Extinction of Focused Raster ............... $-28$ to $-72$ $-28$ to $-72$ volts
Grid-No.1 Video Drive from Raster Cutoff
  (Black Level):
    White-level value (Peak positive) $28$ to $72$ $28$ to $72$ volts
    Focusing-Coil Current (DC) $92 \pm 10\%$ $99 \pm 10\%$ ma
    Minimum Field Strength of PM Ion-Trap Magnet .... 29 31 gausses

$^*,^0,^6$: See next page.
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 12000 volts.

0 For specimen focusing coil similar to JETEC Focusing Coil No. 109 positioned with air gap toward kinescope screen and center line of air gap 3 inches from Reference Line (See Dimensional Outline). The indicated current is for condition with sharp focus at center of picture area and combined grid-No. 1 voltage and video-signal voltage adjusted to produce a highlight brightness of 30 foot-lamberts measured on an Indian Head Test Pattern set for a 14-1/4" x 10-3/4" picture size.

" For JETEC Ion-Trap Magnet No. 117, or equivalent, located with the trailing edge of the pole pieces located over the gap between grid No. 1 and grid No. 2 and rotated to give maximum brightness.

$ For specimen PM ion-trap magnet, such as Heppner Model No. E437, or equivalent, located in optimum position and rotated to give maximum brightness. For a given equipment application, the tolerance range for the strength of the PM ion-trap magnet should be added to the minimum value. The maximum strength of this magnet should not exceed the specified minimum value by more than 6 gausses. This procedure will insure use of a PM ion-trap magnet allowing adequate adjustment to permit satisfactory performance without loss of highlight brightness.

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 JETEC NO. 110 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4".


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

E, = 6.3 VOLTS
ULTOR VOLTS = 14000
GRID N&I BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF
RASTER FOCUSED AT AVERAGE BRIGHTNESS
RASTER SIZE = 14" x 10½"

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY 92CM-8861
\[ E_C = 6.3 \text{ VOLTS} \]
\[ \text{ULTOR VOLTS} = 12000 \text{ TO } 16000 \]
\[ \text{GRID} \#1 \text{ BIASED NEGATIVE WITH} \]
\[ \text{RESPECT TO CATHODE TO GIVE} \]
\[ \text{FOCUSED RASTER CUTOFF} \]
KINESCOPE
RECTANGULAR METAL-SHELL TYPE
MAGNETIC FOCUS
MAGNETIC DEFLECTION

DATA

General:
Heater, for Unipotential Cathode:
Voltage ... 6.3 ac or dc volts
Current ... 0.6 amp
Direct Interelectrode Capacitances (Approx.):
   Grid No. 1 to All Other Electrodes ... 6 μf
   Cathode to All Other Electrodes ... 5 μf
Face Plate (Transmission of about 65%) ... Frosted Filterglass
Phosphor (Fluorescence and Phosphorescence): No. 4-Sulfide Type
   White
   Short
   Magnetic
   Magnetic
Deflection Angles (Approx.):
   Diagonal ... 70°
   Horizontal ... 66°
   Vertical ... 50°
Ion-Trap Gun ... Requires External, Single-Field Magnet
Maximum Overall Length ... 19"
Greatest Diagonal of Tube at Lip ... 16-13/16" ± 3/16"
Greatest Width of Tube at Lip ... 15-15/16" ± 1/8"
Greatest Height of Tube at Lip ... 12-1/4" ± 1/8"
Screen Size ... 14-5/8" x 11"
Mounting Position ... Any
Anode Terminal ... Metal-Shell Lip
Base ... Small-Shell Duodecal 5-Pin (JETEC No.B5-57)
       Basing Designation for BOTTOM VIEW ... 12D1

Pin 1-Heater
Pin 2-Grid No.1
Pin 10-Grid No.2
Pin 11-Cathode
Pin 12-Heater
Metal-Shell Lip:
Anode

Maximum Ratings, Design-Center Values:
ANODE VOLTAGE\(^0\) ... 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 ... 180 max. volts
   Heater positive with respect to cathode. ... 180 max. volts
\(^0\) The product of anode voltage and average anode current should be limited to 6 watts.

JAN. 1, 1951
TUBE DEPARTMENT
TENTATIVE DATA
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
### Typical Operation:

| Anode Voltage | 12000 | 14000 | volts |
| Grid-No. 2 Voltage | 300 | 300 | volts |
| Grid-No. 1 Voltage for Visual Extinction of Undeflected Focused Spot | -33 to -77 | -33 to -77 | volts |
| Focusing Coil Current (DC)* | 96 ± 6% | 104 ± 6% | ma |
| Field Strength of Single-Field Ion-Trap Magnet§ | 45 | 50 | gauss |
| Ion-Trap Magnet Current (DC, approx.)# | 70 | - | ma |

### Maximum Circuit Values:

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

### Minimum Circuit Values:

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

| Grid-No. 1-Circuit Resistance | 150 min. ohms |
| Grid-No. 2-Circuit Resistance | 470 min. ohms |
| Anode-Circuit Resistance | 18000 min. ohms |

The resistors used should be capable of withstanding the applied voltage.

- * Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 12000 volts.
- * For specimen focusing coil similar to JETTIC Focusing Coil No. 109, positioned with air gap toward kinescope screen, and center line of air gap about 3 inches from Reference Line (see Outline Drawing). The indicated currents are for the condition with the combined grid-No. 1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 30 foot-lamberts on a 14-3/8" x 10-11/16" picture area sharply focused at center of screen.
- § Measured at center of field with General Electric Gauss Meter, Cat. No. 009X51.
- # For specimen ion-trap magnet similar to JETTIC Ion-Trap Magnet No. 111, located in optimum position and rotated to give maximum brightness.

### OPERATING NOTES

When operated at anode voltages up to 16 kilovolts, the 17CP4 does not produce any harmful x-ray radiation. However, because the rating of the tube permits operation at anode voltages as high as 17.0 kilovolts (absolute value), shielding of the 17CP4 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.

JAN. 1, 1951
REFERENCE-LINE GAUGE

Reference-Line Gauge (JETEC No. 110) with Supplementary Information on Recommended Inside Contour of Yoke to Provide Proper Location of Yoke on Neck-Funnel Section

NOTE: INNER SURFACE OF YOKE MUST NOT EXTEND INTO SHADED REGION

92CS-7391
NOTE 1: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE (JETEC No. 110) 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 2-3/4".

NOTE 3: LOCATION OF DEFLECTING YOKE AND FOCUSING DEVICE MUST BE WITHIN THIS SPACE.

NOTE 4: KEEP THIS SPACE CLEAR FOR SINGLE-FIELD, ION-TRAP MAGNET. DIRECTION OF THE FIELD OF THE ION-TRAP MAGNET SHOULD BE SUCH THAT THE NORTH POLE IS ADJACENT TO VACANT PIN POSITION No. 8 AND THE SOUTH POLE TO PIN No. 2.

NOTE 5: METAL SHELL AND GLASS FACE OPERATE AT HIGH VOLTAGE. ANY MATERIAL IN CONTACT WITH THE SHELL OR THE FACE MUST HAVE INSULATING PROPERTIES ADEQUATE TO WITHSTAND THE APPLIED ANODE VOLTAGE PLUS 10%.


NOTE 7: IN THIS REGION THE ANGULAR VARIATION AROUND PERIPHERY OF SHELL IS 70° TO 180°.

NOTE 8: SUPPORT TUBE BY LIP ONLY AT CORNERS WITHIN THIS SPACE.
AVERAGE GRID-DRIVE CHARACTERISTICS

E_c = 6.3 VOLS
ANODE VOLTS = 14000
GRID № 1 BIASED TO CUTOFF OF UNDEФLECTED FOCUSED SPOT
RASTER SIZE = 14 5/8" x 11" (FOCUSED FOR AVERAGE BRIGHTNESS)

HIGHLIGHT BRIGHTNESS - FOOT-LAMBERTS

VIDEO SIGNAL VOLTS FROM CUTOFF

SEPT. 1, 1950
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_g = 6.3$ VOLTS

ANODE VOLTS = 12000 TO 16000

GRID NR1 BIASED TO CUTOFF OF UNDEFELECTED FOCUSED SPOT

ANODE MILLIAMPERES

VIDEO SIGNAL VOLTS FROM CUTOFF

OCT. 3, 1950

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7548
KINESCOPE
RECTANGULAR METAL-SHELL TYPE
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 µf
Cathode to All Other Electrodes. .... 5 µf

Face Plate (With about 66% light transmission) Frosting Filterglass
Phosphor. .............. No.4-Sulfide Type
Fluorescence and Phosphorescence .......... White
Persistence of Phosphorescence .......... Short

Focusing Method. .......... Electrostatic
Deflection Method. .......... Magnetic

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

Ion-Trap Gun ...... Requires External, Single-Field Magnet

Maximum Overall Length .......... 19-5/16"
Greatest Diagonal of Tube at Lip .......... 16-13/16" ± 3/16"
Greatest Width of Tube at Lip .......... 15-15/16" ± 1/8"
Greatest Height of Tube at Lip .......... 12-1/4" ± 1/8"
Screen Size .......... 14-5/8" x 11"
Mounting Position .......... Any
Ultor® Terminal .......... Metal-Shell Lip
Base .......... Small-Shell Duodecal 6-Pin (JETEC No.B6-63)

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
Grid No.3,
Grid No.5,
Collector

Maximum Ratings, Design-Center Values:
ULTOR® VOLTAGE .......... 16000 max. volts
GRID-No.4 VOLTAGE .......... 5000 max. volts
GRID-No.2 VOLTAGE .......... 500 max. volts
GRID-No.1 VOLTAGE:
Negative bias value .......... 125 max. volts
Positive bias value .......... 0 max. volts
Positive peak value .......... 2 max. volts

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

See next page.

MAY 1, 1951
Equipment Design Ranges:

For any ulti"r voltage \( (E_u) \) between 12000* and 16000 volts and grid-No.2 voltage \( (E_{c2}) \) between 150 and 500 volts

Grid-No.4 Voltage for ulti"r

Current of 100 μamp. . . . . . 19.1% to 25.9% of \( E_u \) volts

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

Grid-No.2 Current . . . . . . . -15 to +15 μamp

Grid-No.2 Current . . . . . . . -15 to +15 μamp

Field Strength of Single-Field Ion-Trap Magnet (Approx.) . . . \( \sqrt{\frac{E_u}{12000}} \times 35 \) gausses

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

Examples of Use of Design Ranges:

For ulti"r voltage of . . . . . 12000 14000 volts

and grid-No.2 voltage of . . . 300 300 volts

Grid-No.4 Voltage for ulti"r

Current of 100 μamp . . . . . . 2290 to 3100 2670 to 3620 volts

Grid-No.1 Voltage† . . . . . . 33 to -77 33 to -77 volts

Ion-Trap Magnet (Rated Strength) . . . 35 40 gausses

Maximum Circuit Values:

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

* In the 17GP4, grid No.5 which has the ulti"r function, grid No.3, and collector are connected together within the tube and are conveniently referred to collectively as "ulti"r". The "ulti"r" 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.

† Brilliance and definition decrease with decreasing ulti"r voltage. In general, the ulti"r voltage should not be less than 12000 volts.

† For visual extinction of undeflected focused spot.
OPERATING NOTES

X-Ray Warning. When operated at ultraviolet voltages up to 16 kilovolts, the 17GP4 does not produce any harmful x-ray radiation. However, because the rating of the tube permits operation at voltages as high as 17.6 kilovolts (absolute value), shielding of the 17GP4 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.

Direction of the field of the ion-trap magnet should be such that the north pole is adjacent to vacant pin position No. 8 and the south pole to pin No. 2.
NOTE 1: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC NO. 110 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 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 2-3/4".

NOTE 3: METAL SHELL AND GLASS FACE OPERATE AT HIGH VOLTAGE. ANY MATERIAL IN CONTACT WITH THE SHELL OR THE FACE MUST BE INSULATED TO WITHSTAND THE MAXIMUM APPLIED ULTOR VOLTAGE.


NOTE 5: IN THIS REGION THE ANGULAR VARIATION AROUND PERIPHERY OF METAL SHELL IS 0° TO 18°.

NOTE 6: SUPPORT TUBE BY LIP ONLY AT CORNERS WITHIN THIS SPACE.
**AVerage Grid-Drive Characteristics**

\[ E_{2} = 6.3 \text{ Volts} \]

ULTOR (GRIDS - Nr 3 & Nr 5 AND COLLECTOR) VOLTS = 14000

GRID-NR 4 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS

GRID Nr 1 BIASED TO CUTOFF OF UNDEFLCTED FOCUSED SPOT

Raster size = 14 5/8" x 11"

---

**Diagram Details**

- Video Signal Volts from Cutoff
- Highlight Brightness - Foot-Lambert

---

FEB. 8, 1951

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7806
AVERAGE GRID-DRIVE CHARACTERISTICS

E_f = 6.3 VOLTS
ULTOR (GRIDS-N° 3 & N° 5 AND COLLECTOR) VOLTS = 12000 TO 16000
GRID N° 1 BIASED TO CUTOFF OF UNDEFLected FOCUSED SPOT

FEB. 8, 1951 TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, MARRISON, NEW JERSEY 92CM-7607
The 17HP4/17RP4 is the same as the 17HP4-B except that it utilizes a non-aluminized phosphor and has a light output as shown by the curves on the back of this sheet.
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_T = 6.3$ VOLTS
ULTOR VOLTS=16000
GRID NO! BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF
RASTER FOCUSED AT AVERAGE BRIGHTNESS
RASTER SIZE $= 14'' \times 10\frac{1}{2}''$
## 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 ultradom: {1500 max, 750 min. μμf

Faceplate, Spherical: Filterglass

Light transmission (Approx.): 66%

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: 70°
- Horizontal: 65°
- Vertical: 50°

Ion-Trap Gun: Requires 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"

### Screen Dimensions (Minimum):
- Greatest width: 14-1/4"
- Greatest height: 10-3/4"
- Diagonal: 15-1/4"
- Projected area: 140 sq. in.

### Weight (Approx.): 18 lbs

### Mounting Position: Any

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

### Bulb: J-133

### 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-Ultradom**
- Grid No. 3, Grid No. 5, Collector
- C-External Conductive Coating

---

**TENTATIVE DATA**

**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>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTOR VOLTAGE</td>
<td>16000 max. 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 bias value</td>
<td>125 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 \( (Ec_1 k) \) between 12000 and 16000 volts and grid-No. 2 voltage \( (Ec_2 k) \) between 150 and 500 volts

<table>
<thead>
<tr>
<th>Description</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.4 Voltage for Focus</td>
<td>(-0.4% \text{ to } +2.2% \text{ of } Ec_5 k ) volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage for Visual Extinction of Focused Raster</td>
<td>(-9.3% \text{ to } -24% \text{ of } Ec_2 k ) volts</td>
</tr>
<tr>
<td>Grid-No.1 Video Drive from Raster Cutoff (Black Level):</td>
<td></td>
</tr>
<tr>
<td>White-level value (Peak positive)</td>
<td>9.3% to 24% of ( Ec_2 k ) volts</td>
</tr>
<tr>
<td>Grid-No.4 Current</td>
<td>(-25 \text{ to } +25 ) ( \mu \text{amp} )</td>
</tr>
<tr>
<td>Grid-No.2 Current</td>
<td>(-15 \text{ to } +15 ) ( \mu \text{amp} )</td>
</tr>
<tr>
<td>Ion-Trap Magnet Current (Average)</td>
<td>( \frac{Ec_5 k}{16000} \times 30 ) ( \mu \text{amp} )</td>
</tr>
<tr>
<td>Minimum Field Strength of PM Ion-Trap Magnet</td>
<td>( \frac{Ec_5 k}{16000} \times 33 ) gausses</td>
</tr>
<tr>
<td>Field Strength of Adjustable Centering Magnet</td>
<td>0 to 8 gausses</td>
</tr>
</tbody>
</table>

\( Ec_2 k \) volts \( / \mu \text{amp} \) \( \mu \text{amp} \) \( \mu \text{amp} \)

Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

#**§: See next page.

TENTATIVE DATA 1

2-56
### Examples of Use of Design Ranges:

<table>
<thead>
<tr>
<th>With ultor voltage of</th>
<th>14000</th>
<th>16000</th>
<th>volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>and grid-No.2 voltage of</td>
<td>300</td>
<td>300</td>
<td>volts</td>
</tr>
</tbody>
</table>

Grid-No.4 Voltage for
Focus with Ultor
Current of 100 μamp ... -55 to +300 -65 to +350 volts

Grid-No.1 Voltage for
Visual Extinction of
Focused Raster ... -28 to -72 -28 to -72 volts

Grid-No.1 Video Drive
from Raster Cutoff
(Black Level):
White-level value
(Peak positive) 28 to 72 28 to 72 volts

Minimum Field Strength of
PM Ion-Trap Magnet ... 31 33 gausses

### Maximum Circuit Values:

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

---

### CATHODE-DRIVE® SERVICE

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

### Maximum Ratings, Design-Center Values:

<table>
<thead>
<tr>
<th>ULTOR-TO-GRID-No.1 VOLTAGE</th>
<th>16000 max. volts</th>
</tr>
</thead>
<tbody>
<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>625 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 bias value</td>
<td>125 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>
</tbody>
</table>

Heater positive with respect to cathode: 180 max. 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.

# See next page.
Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage \( (E_{c5}g) \) between 12000\% and 16000 volts and grid-No.2-to-grid-No.1 voltage \( (E_{c2}g) \) between 165 and 620 volts.

Grid-No.4-to-Grid-No.1 Voltage for Focus with Ultor Current of 100 \( \mu \)amp. . . . . . . 0\% to 2.6\% of \( E_{c5}g \) volts

Cathode-to-Grid-No.1 Voltage for Visual Extinction of Focused Raster. . . . . . . 8.5\% to 19.4\% of \( E_{c2}g \) volts

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

White-level value (Peak negative) 8.5\% to 19.4\% of \( E_{c2}g \) volts

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

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

Ion-Trap Magnet Current (Average)** . . . . . . . . \( \sqrt{\frac{E_{c5}g}{16000}} \times 30 \) ma

Minimum Field Strength of PM Ion-Trap Magnet § . . . . . \( \sqrt{\frac{E_{c5}g}{16000}} \times 33 \) gausses

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 300 300 volts.

Grid-No.4-to-Grid-No.1 Voltage for Focus with Ultor Current of 100 \( \mu \)amp . . . . . . 0 to 365 0 to 415 volts

Cathode-to-Grid-No.1 Voltage for Visual Extinction of Focused Raster . . . . . . 25 to 58 25 to 58 volts

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

White-level value (Peak negative) 25 to 58 25 to 58 volts

Minimum Field Strength of PM Ion-Trap Magnet . . . . . . . . 31 33 gausses

Maximum Circuit Values:

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

\#,**,§: See next page.

2-56 TUBE DIVISION TENTATIVE DATA 2

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Brilliance and definition decrease with decreasing ultor voltage or ultor-to-grid-No.1 voltage. In general, the ultor voltage or the ultor-to-grid-No.1 voltage should not be less than 12000 volts.

** For JETEC Ion-Trap Magnet No.117, or equivalent, located with the trailing edge of the pole pieces located over the gap between grid No.1 and grid No.2 and rotated to give maximum brightness.

§ For specimen PM ion-trap magnet, such as Heppner Model No.E437, or equivalent, located in optimum position and rotated to give maximum brightness. For a given equipment application, the tolerance range for the strength of the PM ion-trap magnet should be added to the minimum value. The maximum strength of this magnet should not exceed the specified minimum value by more than 6 gauss. This procedure will insure use of a PM ion-trap magnet allowing adequate adjustment to permit satisfactory performance without loss of highlight brightness.

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 JETEC No.110 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4".


NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.
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 = 16000</td>
<td>ULTOR VOLTS = 16000</td>
</tr>
<tr>
<td>CATHODE BIASED POSITIVE WITH RESPECT TO GRID N°1 TO GIVE FOCUSED RASTER CUTOFF</td>
<td>GRID N°1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF</td>
</tr>
<tr>
<td>RASTER FOCUSED AT AVERAGE BRIGHTNESS</td>
<td>RASTER FOCUSED AT AVERAGE BRIGHTNESS</td>
</tr>
<tr>
<td>RASTER SIZE = 14&quot; x 10½&quot;</td>
<td>RASTER SIZE = 14&quot; x 10½&quot;</td>
</tr>
</tbody>
</table>

---

**Diagram**

- **Video Signal Volts from Raster Cutoff**
  - 0 to 90

- **Highlight Brightness—Foot-Lamberts**
  - 50 to 500

- **Cathode Drive**
  - Dotted line

- **Grid Drive**
  - Solid line

---

TUBE DIVISION 92CL-8862
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>ULT TOR-TO-GRID-N #1 VOLTS = 12000 TO 16000</td>
<td>ULT TOR VOLTS = 12000 TO 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>
</tbody>
</table>

![Graph showing average drive characteristics](image-url)
### 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*: 750 max. µf, 500 min. µf

**Faceplate, Spherical:** Filterglass
**Light Transmission (Approx.):** 66%
**Phosphor (For Curves, see front of this Section):** P4—Sulfide Type
**Fluorescence and Phosphorescence:** White
**Persistence of Phosphorescence:** Short

**Focusing Method:** Magnetic
**Deflection Method:** Magnetic

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

**Ion-Trap Gun:** Requires External, Single-Field Magnet

**Tube Dimensions:**
- Overall Length: 19-3/16" ± 3/8"
- Greatest Diagonal: 16-5/8" ± 1/8"
- Greatest Width: 15-3/8" ± 1/8"
- Greatest Height: 12-9/32" + 1/8" -7/32"

**Minimum Screen Dimensions:**
- Greatest Width: 14-1/4"
- Greatest Height: 10-3/4"
- Diagonal: 15-1/4"

**Weight (Approx.):** 18 lbs

**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:** 18000 max. volts

---

*In the 17JP4, 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.*
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

Equipment Design Ranges:
For any ultor voltage ($E_u$) between 12000 volts and grid-No.2 voltage ($E_{c2}$) between 150 and 410 volts:

Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot ........ 11% to 25.7% of $E_{c2}$ volts
Grid-No.2 Current ........ -15 to +15 ma
Focusing-Coil Current (DC)OO ........ $\sqrt{\frac{E_u}{12000}} \times 96\pm 10\% \: \text{ma}$
Field Strength of Single-Field Ion-Trap Magnet (Approx.)** ........ $\sqrt{\frac{E_u}{12000}} \times 42 \: \text{gausses}$
Field Strength of Adjustable Centering Magnet ........ 0 to 8 gausses

Examples of Use of Design Ranges:
For ultor voltage of 14000 volts and grid-No.2 voltage of 300 volts:
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot ........ -33 to -77 volts
Focusing-Coil Current (DC) ........ 104 ± 10% ma
Ion-Trap Magnet (Rated Strength) ........ 45 50 gausses

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 12000 volts.

OO For specimen focusing coil similar to JETEC Focusing Coil No.109 positioned with air gap toward kinescope screen, and center line of air gap 3 inches from Reference Line (see Outline Drawing). The indicated current is for condition with combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 30 foot-lamberts on a 14-1/4" x 10-3/4" picture area sharply focused at center of screen.

** With a specimen ion-trap magnet similar to JETEC Ion-Trap Magnet No.111 located in optimum position and rotated to give maximum brightness, the ion-trap magnet current is 82 milliamperes dc when the ultor voltage is 14000 volts and grid-No.2 voltage is 300 volts.

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

JULY 1, 1952
TENTATIVE DATA
AVGGRID-DRIVE CHARACTERISTICS

$E_c = 6.3$ VOLTS

ULTOR (GRID - N.3 AND COLLECTOR)
VOLTS = 16000

GRID N.1 BIASED TO CUTOFF OF
UNDEFELECTED FOCUSED SPOT

RASTER SIZE = $14\frac{1}{2}'' \times 10\frac{3}{4}''$ (FOCUSED
FOR AVERAGE BRIGHTNESS)

HIGHLIGHT BRIGHTNESS - FOOT-LAMBERTS

VIDEO SIGNAL VOLTS FROM CUTOFF

FEB. 13, 1952

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM - 7753

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

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.
AVG GRID-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ULTOR (GRID-N°3 AND COLLECTOR)
VOLTS = 14000 TO 18000
GRID N°1 BIASED TO CUTOFF OF
UNDEФLECTED FOCUSED SPOT

ULTOR MILLIAMPERES

VIDEO SIGNAL VOLTS FROM CUTOFF

NOV. 14, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, MAYSIDE, NEW JERSEY

92CM-7652RT
The 17LP4/17VP4 is the same as the 17LP4-A except that it utilizes a non-aluminized phosphor and has a light output as shown by the curves on the back of this sheet.
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_f = 6.3 \text{ VOLTS}$
ULTOR VOLTS = 16000
GRID Nº1 BIASED NEGATIVE WITH RESPECT TO
CATHODE TO GIVE FOCUSED RASTER CUTOFF
RASTER FOCUSED AT AVERAGE BRIGHTNESS
RASTER SIZE = 14" x 101/2"

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8916
# Kinescope

**Type:** Rectangular Glass Type

**Focus:** Low-voltage Focus

**Screen:** Aluminized Screen

**Deflection:** Magnetic

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

## Direct Inter-electrode Capacitances:
- Grid No. 1 to all other electrodes: 6 μuf
- Cathode to all other electrodes: 5 μuf
- External conductive coating to ultor: 1500 max. μuf, 750 min. μuf

## Face plate, Cylindrical
- Filterglass
- Light transmission (Approx.): 72%

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

## Deflection Method:
- Electrostatic

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

## Ion-Trap Gun:
- Requires 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"

## Screen Dimensions (Minimum):
- Greatest width: 14-1/4"
- Greatest height: 10-3/4"
- Diagonal: 15-5/16"
- Projected area: 140 sq. in.

## Weight (Approx.):
- 19 lbs

## Mounting Position:
- Any

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

## Bulb:
- Small-Shell Duodecal 6-Pin (JETEC No. B6-63)

## Base:
- 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

---

**Note:** Tentative Data for radio Corporation of America, Harrison, New Jersey.
### Maximum Ratings, Design-Center Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR VOLTAGE</td>
<td>16000 max. 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 bias value</td>
<td>125 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 \((E_{c5})\) between 12000 and 16000 volts and grid-No.2 voltage \((E_{c2})\) between 150 and 500 volts

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.4 Voltage for Focus with Ultor</td>
<td>-0.4% to +2.2% of (E_{c5}) volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage for Visual Extinction of Focused Raster</td>
<td>-9.3% to -24% of (E_{c2}) volts</td>
</tr>
<tr>
<td>Grid-No.1 Video Drive from Raster Cutoff (Black Level): White-Level value</td>
<td>(Peak positive) 9.3% to 24% of (E_{c2}) volts</td>
</tr>
<tr>
<td>Grid-No.4 Current</td>
<td>-25 to +25 (\mu)amp</td>
</tr>
<tr>
<td>Grid-No.2 Current</td>
<td>-15 to +15 (\mu)amp</td>
</tr>
<tr>
<td>Ion-Trap Magnet Current (Average)</td>
<td>(\sqrt{\frac{E_{c5}}{16000}} \times 30 ) ma</td>
</tr>
<tr>
<td>Minimum Field Strength of PM Ion-Trap Magnet</td>
<td>(\sqrt{\frac{E_{c5}}{16000}} \times 33 ) gausses</td>
</tr>
<tr>
<td>Field Strength of Adjustable Centering Magnet</td>
<td>0 to 8 gausses</td>
</tr>
</tbody>
</table>

### Notes:

- Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 12000 volts.
- For JETEC Ion-Trap Magnet No.117, or equivalent, located with the trailing edge of the pole pieces located over the gap between grid No.1 and grid No.2 and rotated to give maximum brightness. For a given equipment application, the tolerance range for the strength of the PM ion-trap magnet should be added to the minimum value. The maximum strength of this magnet should not exceed the specified minimum value by more than 6 gausses. This procedure will ensure use of a PM ion-trap magnet allowing adequate adjustment to permit satisfactory performance without loss of highlight brightness.
- For specimen PM ion-trap magnet, such as Heppner Model No.E437, or equivalent, located in optimum position and rotated to give maximum brightness.
- For specimen PM ion-trap magnet, such as Heppner Model No.E437, or equivalent, located in optimum position and rotated to give maximum brightness.
Examples of Use of Design Ranges:

<table>
<thead>
<tr>
<th>Description</th>
<th>Voltage 1</th>
<th>Voltage 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>With ultor voltage of 14000</td>
<td>16000</td>
<td>volts</td>
</tr>
<tr>
<td>and grid-No.2 voltage of 300</td>
<td>300</td>
<td>volts</td>
</tr>
</tbody>
</table>

Grid-No.4 Voltage for Focus with Ultor
- Current of 100 µamp. . . . . -55 to +300 -65 to +350 volts

Grid-No.1 Voltage for Visual Extinction of Focused Raster . . . . . . -28 to -72 -28 to -72 volts

Grid-No.1 Video Drive from Raster Cutoff
- (Black Level): White-level value
  - (Peak positive) 28 to 72 28 to 72 volts
- Minimum Field Strength of PM Ion-Trap Magnet . . . . 31 33 gausses

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

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

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4".


NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.
\[ \epsilon_f = 6.3 \text{ VOLTS} \]
ULTOR VOLTS = 16000
GRID №1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF
RASTER FOCUSED AT AVERAGE BRIGHTNESS
RASTER SIZE = 14" x 10\(\frac{1}{2}\)"

**Diagram:**
- Video Signal Volts from Raster Cutoff
- Highlight Brightness - Foot-Lamberts

**Graph:**
- Video Signal Volts on the x-axis ranging from 0 to 90
- Highlight Brightness - Foot-Lamberts on the y-axis ranging from 0 to 500

*Tube Division*
92CL-8864
AVERAGE GRID-DRIVE CHARACTERISTICS

- $E_f = 6.3$ VOLTS
- ULTorr VOLTS = 12000 TO 16000
- Grid No. 1 biased negative with respect to cathode to give focused raster cutoff.
**KINESCOPE**

**RECTANGULAR GLASS TYPE**

**MAGNETIC FOCUS**

**MAGNETIC DEFLECTION**

### 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 \( \mu \text{f} \)
  - Cathode to All Other Electrodes: 5 \( \mu \text{f} \)
- **External Conductive Coating to Ultor**:
  - Minimum (1500 max. \( \mu \text{f} \))
  - 750 min. \( \mu \text{f} \)

### Faceplate, Cylindrical With Toric
- **Inner Surface**:
  - Filterglass
- **Light Transmission (Approx.)**: 66%
- **Phosphor** (For Curves, see front of this Section)
  - P4—Sulfide Type
- **Fluorescence and Phosphorescence**:
  - White
- **Persistence of Phosphorescence**:
  - Short
- **Focusing Method**:
  - Magnetic
- **Deflection Method**:
  - Magnetic
- **Deflection Angles (Approx.)**:
  - Diagonal: 70°
  - Horizontal: 65°
  - Vertical: 50°
- **Ion-Trap Gun**:
  - Requires External, Single-Field Magnet

### Tube Dimensions:
- **Overall Length**: 19-3/16" ± 3/8"
- **Greatest Diagonal**: 16-5/8" ± 1/8"
- **Greatest Width**: 15-3/8" ± 1/8"
- **Greatest Height**: 12-1/4" ± 1/8"

### Minimum Screen Dimensions:
- **Greatest Width**: 14-1/4"
- **Greatest Height**: 10-3/4"
- **Diagonal**: 15-5/16"

### Weight (Approx.)
- 19 lbs

### Mounting Position
- Any

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

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

---

<table>
<thead>
<tr>
<th>Pin 1 - Heater</th>
<th>Cap - Ultor (Grid No.3, Collector)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin 2 - Grid No.1</td>
<td>C - External Coating</td>
</tr>
<tr>
<td>Pin 3 - Grid No.2</td>
<td>Conductive</td>
</tr>
<tr>
<td>Pin 11 - Cathode</td>
<td></td>
</tr>
<tr>
<td>Pin 12 - Heater</td>
<td></td>
</tr>
</tbody>
</table>

† The toric surface in the 17QP4 is described by a segment of a circle having a radius of about 60° rotated about a straight line which is (1) parallel to the axis of the outer cylindrical surface, (2) positioned in a plane passing through the axis of the cylindrical surface and the center element thereof, and (3) spaced approximately 25° from the cylindrical surface.

*: See next page.

JULY 1, 1952

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE DATA 1
Maximum Ratings, Design-Center Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR* VOLTAGE</td>
<td>16000 max. volts</td>
</tr>
<tr>
<td>GRID-No.2 VOLTAGE</td>
<td>410 max. volts</td>
</tr>
<tr>
<td>GRID-No.1 VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max. volts</td>
</tr>
<tr>
<td>PEAK HEATER–CATHODE VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode:</td>
<td></td>
</tr>
<tr>
<td>During equipment warm-up period not exceeding 15 seconds</td>
<td>410 max. volts</td>
</tr>
<tr>
<td>After equipment warm-up period</td>
<td>150 max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>150 max. volts</td>
</tr>
</tbody>
</table>

Equipment Design Ranges:

For any ultor voltage \( (E_u) \) between 12000 and 16000 volts and grid-No.2 voltage \( (E_{c2}) \) between 150 and 410 volts

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot</td>
<td>11% to 25.7% of ( E_{c2} ) volts</td>
</tr>
<tr>
<td>Grid-No.2 Current</td>
<td>(-15 \text{ to } +15 ) ( \mu \text{amp} )</td>
</tr>
<tr>
<td>Focusing-Coil Current (DC)</td>
<td>( \sqrt{ \frac{E_u}{12000} } \times 96 \pm 6 % ) ma</td>
</tr>
<tr>
<td>Field Strength of Single-Field Ion-Trap Magnet (Approx.)**</td>
<td>( \sqrt{ \frac{E_u}{12000} } \times 42 ) gausses</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:

For ultor voltage of 12000 14000 volts and grid-No.2 voltage of 300 300 volts

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot</td>
<td>-33 to -77 -33 to -77 volts</td>
</tr>
<tr>
<td>Focusing-Coil Current (DC)</td>
<td>96 \pm 6% 104 \pm 6% ma</td>
</tr>
<tr>
<td>Ion-Trap Magnet (Rated Strength)</td>
<td>40 45 gausses</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>

* In the 17QP4, 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 d-c voltage for accelerating the electrons in the beam prior to its deflection.

# Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 12000 volts.
For specimen focusing coil similar to JETEC Focusing Coil No. 109 positioned with air gap toward kinescope screen, and center line of air gap 3 inches from Reference Line (See Outline Drawing). The indicated current is for condition with combined grid-No. 1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 30 foot-lamberts on a 14-1/4" x 10-3/4" picture area sharply focused at center of screen.

With a specimen ion-trap magnet similar to JETEC Ion-Trap Magnet No. 111 located in optimum position and rotated to give maximum brightness, the ion-trap magnet current is 70 milliamperes dc when the ultor voltage is 12000 volts and grid-No. 2 voltage of 300 volts.

For x-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section.
NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No. 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND BULB TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 30°. BULB TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION No. 6.

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

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4″.

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

$E_g = 6.3$ VOLTS

ULTOR (GRID-N$^2$3 AND COLLECTOR) VOLTS = 14000

GRID N$^2$1 BIASED TO CUTOFF OF UNDEФLECTED FOCUSED SPOT

RASTER SIZE = $14\frac{1}{4}'' \times 10\frac{3}{4}''$ (FOCUSED FOR AVERAGE BRIGHTNESS)

---

FEB. 19, 1952

140
120
100
80
60
40
20
0

VIDEO SIGNAL VOLTS FROM CUTOFF

92CM - 7755
AVGERAGE GRID-DRIVE CHARACTERISTICS

$E_C = 6.3\ V$

ULTOR (GRID-N\#3 AND COLLECTOR)
VOLTS = 12000 TO 16000
GRID N\#1 BIASED TO CUTOFF OF UNDEFLECTED FOCUSED SPOT

DEC. 13, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7720
**General:**

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

Direct Interelectrode Capacitances:
- Grid No. 1 to all other electrodes: 6 μf
- Cathode to all other electrodes: 5 μf
- External conductive coating to ulti: (1500 max. μf)
  - 750 min. μf

Faceplate, Cylindrical: Filterglass
- Light transmission (Approx.): 72%

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

Focusing Method: Magnetic
- Deflection Method: Magnetic

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

Ion-Trap Gun: Requires 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"

Screen Dimensions (Minimum):
- Greatest width: 14-1/4"
- Greatest height: 10-3/4"
- Diagonal: 15-5/16"
- Projected area: 140 sq. in.
- Weight (Approx.): 19 lbs

Mounting Position: Any

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

Bulb: Small-Shell Duodecal 5-Pin (JETEC 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 - ulti
(Grid No. 3, Collector)
C - External Conductive Coating

**RCA**

**17QP4-A**

**KINESCOPE**

**RECTANGULAR GLASS TYPE**

**MAGNETIC FOCUS**

**ALUMINIZED SCREEN**

**MAGNETIC DEFLECTION**
**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: ............. 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 ultor voltage ($E_{c3}$) between 14000* and 18000 volts and grid-No.2 voltage ($E_{c2}$) between 150 and 500 volts*

**Grid-No.1 Voltage for Visual Extinction of Focused Raster:** ........... –9.3% to –24% of $E_{c2}$ volts  
**Grid-No.1 Video Drive from Raster Cutoff**  
- (Black Level):  
  - White-level value (Peak positive) 9.3% to 24% of $E_{c2}$ volts  
- Grid-No.2 Current: .................. –15 to +15 µamp  
**Focusing-Coil Current (DC)°** ... \( \sqrt{\frac{E_{c3}}{16000}} \times 111 \pm 10\% \) ma  
**Ion-Trap Magnet Current (Average)"** ... \( \sqrt{\frac{E_{c3}}{16000}} \times 30 \) ma  
**Minimum Field Strength of PM Ion-Trap Magnet§** ... 
**Field Strength of Adjustable Centering Magnet:** ......... 0 to 8 gausses  

**Examples of Use of Design Ranges:**

*With ultor voltage of 14000 volts and grid-No.2 voltage of 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  
  - Focusing-Coil Current (DC)° 104 ± 10% ma  
  - Minimum Field Strength of PM Ion-Trap Magnet: ......... 31 gausses

°, ″, †, §: see next page.
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 14000 volts.

For specimen focusing coil similar to JETEC Focusing Coil No.109 positioned with air gap toward kinescope screen and center line of air gap 3 inches from Reference Line (See Dimensional Outline). The indicated current is for condition with sharp focus at center of picture area and combined grid-No.1 voltage and video-signal voltage adjusted to produce a highlight brightness of 30 foot-lamberts measured on an Indian Head Test Pattern set for a 14-1/4" x 10-3/4" picture size.

For JETEC Ion-Trap Magnet No.117, or equivalent, located with the trailing edge of the pole pieces located over the gap between grid No.1 and grid No.2 and rotated to give maximum brightness.

For specimen PM ion-trap magnet, such as Heppner Model No.E437, or equivalent, located in optimum position and rotated to give maximum brightness. The maximum strength of this magnet should not exceed the specified minimum value by more than 6 gaussies. This procedure will insure use of a PM ion-trap magnet allowing adequate adjustment to permit satisfactory performance without loss of highlight brightness.

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

DIMENSIONAL OUTLINE

for Type 17QP4-A is the same as that shown for Type 17LP4-A, except that the 17QP4-A has a Small-Shell Duodecal 5-Pin Base

HIGHLIGHT BRIGHTNESS vs DRIVE CURVES

for Type 17QP4-A are the same as those shown for Type 17LP4-A
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ULTOR VOLTS = 14000 TO 18000
GRID NO1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF
**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

Face Plate (With about 66% light transmission) Frosted Interglass

Phosphor (For Curves, see front of this Section) No.4- Sulfide Type
Fluorescence and Phosphorescence: White
Persistence of Phosphorescence: Short

Focusing Method: Electrostatic
Deflection Method: Magnetic

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

Ion-Trap Gun: Requires External, Single-Field Magnet

Maximum Overall Length: 19-5/16" 

Greatest Diagonal of Tube at Lip: 16-13/16" ± 3/16"

Greatest Width of Tube at Lip: 15-15/16" ± 1/8"

Greatest Height of Tube at Lip: 12-1/4" ± 1/8"

Screen Size: 14-5/8" x 11"

Mounting Position: Any

Ultor® Terminal: Metal-Shell Lip

Base: Small-Shell Duodecal 6-Pin (JETEC No.B6-63)

### 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

**Ultor® Voltage**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6000 max. volts</td>
</tr>
<tr>
<td>2</td>
<td>500 max. volts</td>
</tr>
<tr>
<td>6</td>
<td>500 max. volts</td>
</tr>
</tbody>
</table>

**Grid-No.4 Voltage**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>5</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>10</td>
<td>2 max. volts</td>
</tr>
</tbody>
</table>

**Grid-No.2 Voltage**

**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

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OCTOBER 1, 1951

TENTATIVE DATA 1
Equipment Design Ranges:

For any ultor voltage ($E_u$) between 12000* and 16000 volts and grid-No. 2 voltage ($E_c$) between 150 and 500 volts

Grid-No.4 Voltage for Focus
With Ultor Current of 100 μamp 0% to 2.5% of $E_u$ volts

Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot
11% to 25.7% of $E_c$ volts

Grid-No.1 Voltage†
-33 to -77 volts

Field Strength of Single-Field Ion-Trap Magnet (Approx.)** $\sqrt{\frac{E_u}{12000}} \times 33$ gausses

Field Strength of Adjustable Centering Magnet
0 to 8 gausses

Examples of Use of Design Ranges:

For ultor voltage of... 14000 16000 volts
and grid-No. 2 voltage of... 300 300 volts

Grid-No.4 Voltage for Focus
With Ultor Current of
100 μamp 0 to 350 0 to 400 volts

Grid-No.1 Voltage†
-33 to -77 -33 to -77 volts

Ion-Trap Magnet (Rated Strength) 35 40 gausses

Maximum Circuit Values:

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

In the 17TP4, grid No. 5 which has the ultor function, grid No. 3, 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, which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection.

Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 12000 volts.

With a specimen ion-trap magnet similar to JETEC Ion-Trap Magnet No. 111 located in optimum position and rotated to give maximum brightness, the ion-trap magnet current is 65 milliamperes dc when the ultor voltage is 14000 volts.

† For visual extinction of undeflected focused spot.
OPERATING NOTES

X-Ray Warning. When operated at ultor voltages up to 16 kilovolts, the 17TP4 does not produce any harmful x-ray radiation. However, because the rating of the tube permits operation at voltages as high as 17.6 kilovolts (absolute value), shielding of the 17TP4 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.

Direction of the field of the ion trap magnet should be such that the north pole is adjacent to vacant pin position No. 8 and the south pole to pin No. 2.
NOTE 1: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No.110 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 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 2-3/4".

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.


NOTE 5: SUPPORT TUBE BY LIP ONLY AT CORNERS WITHIN THIS SPACE.
AVERAGE GRID-DRIVE CHARACTERISTICS

E_c = 6.3 VOLTS
ULTOR (GRIDS-NR 3 & NR 5 AND COLLECTOR) VOLTS = 14000
GRID-NR 4 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS
GRID NR 1 BIASED TO CUTOFF OF UNDEFLECTED FOCUSED SPOT
RASTER SIZE = 14 5/8" x 11"

FEB. 8, 1951
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7606
AVG. GRID-DRIVE CHARACTERISTICS

E_f = 6.3 VOLTS
ULTOR (GRIDS - № 3 & № 5 AND COLLECTOR) VOLTS = 12000 TO 16000
GRID № 1 BIASED TO CUTOFF OF UNDEFL. FOCUSED SPOT

ULTOR MILLIAMPERES

VIDEO SIGNAL VOLTS FROM CUTOFF

FEB. 8, 1951
The 19AP4 is like the 19AP4-B except that it has a face plate made of unfrosted, clear glass. As a result, the light output is about 30% greater than shown by the curves under Type 19AP4-B.

**19AP4-A KINESCOPE**

The 19AP4-A is like the 19AP4-B except that it has an unfrosted Filterglass face plate. The light output is essentially the same as that of the Type 19AP4-B.

As soon as feasible, the 19AP4-B will supersede the 19AP4 and 19AP4-A.
19AP4-B KINESCOPE
METAL-CONE ENVELOPE
MAGNETIC FOCUS  MAGNETIC DEFLECTION

Supersedes Type 19AP4-A

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 ........ 7 μf
Cathode to All Other Electrodes ........ 5 μf

Face Plate .................................. Frosted RCA "Filterglass"

Phosphor (For Curves, see front of this Section) No.4—Sulfide Type
Fluorescence and Phosphorescence .......... White
Persistence of Phosphorescence .......... Medium

Focusing Method ........................ Magnetic
Deflection Method ........................ Magnetic
Deflection Angle (Approx.) ........ 66°

Ion-Trap Gun ............................... Requires External Single-Field Magnet

Overall Length .................................. 21-1/2" ± 1/2"
Greatest Diameter of Envelope ........ 18-5/8" ± 1/8"
Screen Diameter ............................ 17-3/8"

Mounting Position ........................ Any

Anode Terminal ........................ Metal-Cone Lip

Base .......................................... Small-Shell Duodecal 5-Pin

Basing Designation for BOTTOM VIEW ........ 12D1

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

Pin 12—Heater
Metal-Cone Lip:
Anode,
Grid No.3

Maximum Ratings, Design-Center Values:

ANODE VOLTAGE* .......................... 19000 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

* Anode and grid No.3, which are connected together within tube, are referred to herein as anode.
• The product of anode voltage and average anode current should be limited to 6 watts.
• Has transmission of about 65%.
Typical Operation:

<table>
<thead>
<tr>
<th>Component</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage</td>
<td>12000</td>
<td>14000</td>
</tr>
<tr>
<td>Grid-No. 2 Voltage</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>Grid-No. 1 Voltage for Visual Extinction of Undeflected Focused Spot</td>
<td>-33 to -77</td>
<td>-33 to -77</td>
</tr>
<tr>
<td>Focusing-Coil Current (DC, Approx.)</td>
<td>140</td>
<td>150</td>
</tr>
<tr>
<td>Ion-Trap Magnet Current (DC, Approx.)</td>
<td>75</td>
<td>80</td>
</tr>
</tbody>
</table>

Field Strength of Single-Field, Ion-Trap Magnet (Approx.)

<table>
<thead>
<tr>
<th>Minimum Circuit Values:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No. 1 Circuit Resistance</td>
</tr>
</tbody>
</table>

Maximum Circuit Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No. 1 Circuit Resistance</td>
<td>150 min.</td>
<td>ohms</td>
</tr>
<tr>
<td>Grid-No. 2 Circuit Resistance</td>
<td>470 min.</td>
<td>ohms</td>
</tr>
<tr>
<td>Anode Circuit Resistance</td>
<td>22000 min.</td>
<td>ohms</td>
</tr>
</tbody>
</table>

Minimum Circuit Values:

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No. 1 Circuit Resistance</td>
<td>150 min.</td>
<td>ohms</td>
</tr>
<tr>
<td>Grid-No. 2 Circuit Resistance</td>
<td>470 min.</td>
<td>ohms</td>
</tr>
<tr>
<td>Anode Circuit Resistance</td>
<td>22000 min.</td>
<td>ohms</td>
</tr>
</tbody>
</table>

The resistors used should be capable of withstanding the applied voltage.

* Brilliancy and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 12000 volts.

* For JETEC Focusing Coil No. 106, or equivalent, positioned with air gap toward kinescope screen, and center line of air gap about 3 inches from Reference Line (see Outline Drawing). The indicated currents are for the condition with the combined grid-No. 1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 18 foot-lamberts for 12000 volts, or 22 foot-lamberts for 14000 volts, on a 15-5/8" x 11-3/4" picture area.

* For JETEC Ion-Trap Magnet No. 111, or equivalent, located in optimum position and rotated to give maximum brightness.

* Measured at center of field with General Electric Gauss Meter, Cat. No. 809X51.
NOTE 1: REFERENCE LINE IS DETERMINED BY POSITION WHERE HINGED GAUGE 1.500" ± .003" - .000" I.D. AND 2" LONG WILL REST ON CONE.

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 CONE AXIS AND HAVING DIAMETER OF 3".

NOTE 3: LOCATION OF DEFLECTING YOKE AND FOCUSING COIL MUST BE WITHIN THIS SPACE.

NOTE 4: METAL CONE AND GLASS FACE OPERATE AT HIGH VOLTAGE. ANY MATERIAL IN CONTACT WITH THE CONE OR THE FACE MUST HAVE INSULATING PROPERTIES ADEQUATE TO WITHSTAND THE APPLIED ANODE VOLTAGE PLUS 10%.
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ANODE VOLTS = 14000
GRID N°1 BIASED TO CUTOFF OF
UNDEFLCTED FOCUSED SPOT
RASTER SIZE = $15\frac{3}{8} \times 11\frac{3}{4}$ (FOCUSED
FOR AVERAGE BRIGHTNESS)

JULY 5, 1950
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-7508
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ANODE VOLTS = 12000 TO 14000
GRID N81 BIASED TO CUTOFF OF UNDEFFLECTED FOCUSED SPOT

- Video Signal Volts from Cutoff
  - 0
  - 10
  - 20
  - 30
  - 40
  - 50
  - 60
  - 70

- Anode Milliamperes
  - 0
  - 0.5
  - 1.0
  - 1.5
  - 2.0

JULY 3, 1950
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-7506
The 19AP4-D is like the 19AP4-B except that it has a face plate made of frosted, clear glass. As a result, the light output is about 30% greater than shown by the curves under Type 19AP4-B.

As soon as feasible, the 19AP4-B will supersede the 19AP4-D.
**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

Face Plate (with about 66% light transmission): Filterglass

Phosphor (for Curves, see front of this Section) No.4-Sulfide Type

- Fluorescence and Phosphorescence: White
- Persistence of Phosphorescence: Short

Focusing Method: Magnetic

Deflection Method: Magnetic

Deflection Angles (Approx.):

- Diagonal: 70°
- Horizontal: 66°
- Vertical: 50°

Ion-Trap Gun: Requires External, Single-Field Magnet

**Overall Length**: 21-7/16" ± 3/8"

**Greatest Diagonal of Tube at Face**: 20-3/32" ± 3/16"

**Greatest Width of Tube at Face**: 18-11/16" ± 3/16"

**Greatest Height of Tube at Face**: 14-15/16" ± 3/16"

**Screen Size**: 17-1/4" x 13-1/4"

**Mounting Position**: Recessed Small Cavity (JETEC No.J1-21)

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

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

- **ANODE VOLTAGE**: 18000 max. volts
- **GRID-No.2 VOLTAGE**: 410 max. volts
- **GRID-No.1 VOLTAGE**:
  - Negative bias value: 125 max. volts
  - Positive bias value: 0 max. volts
  - Positive peak value: 2 max. volts

**Peak Heater-Cathode Voltage**:

Heater negative with respect to cathode:

- During equipment warm-up period not exceeding 15 seconds: 410 max. volts
- After equipment warm-up period: 150 max. volts

Heater positive with respect to cathode: 150 max. volts
Typical Operation:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Voltage*</td>
<td>14000 to 16000</td>
</tr>
<tr>
<td>Grid-No. 2 Voltage</td>
<td>300 to 300</td>
</tr>
<tr>
<td>Grid-No. 1 Voltage for Visual</td>
<td></td>
</tr>
<tr>
<td>Extinction of Undeflected Focused Spot</td>
<td>-33 to -77</td>
</tr>
<tr>
<td>Focusing-Coil Current (DC)</td>
<td>104 ± 10%</td>
</tr>
<tr>
<td>Field Strength of Single-Field Ion-Trap</td>
<td>50 to 55</td>
</tr>
<tr>
<td>Magnet (Approx.)</td>
<td>110 ± 10%</td>
</tr>
</tbody>
</table>

Maximum Circuit Values:

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

* Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14000 volts.

For specimen focusing coil similar to JETEC Focusing Coil No. 109, positioned with air gap toward kinescope screen, and center line of air gap about 3 inches from Reference Line (see Outline Drawing). The indicated currents are for the condition with the combined grid-No. 1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 30 foot-lamberts on a 17" x 12-3/4" picture area sharply focused at center of screen.

† Measured at center of field with General Electric Gauss Meter, Cat. No. 409X51.
OPERATING NOTES

X-Ray Warning. When operated at or below 16000 volts, the 20CP4 does not produce any harmful x-ray radiation. In general, picture tubes may be operated at voltages (if ratings permit) up to 16000 volts without personal injury on prolonged exposure at close range. Above 16000 volts, special shielding precautions for x-ray radiation may be necessary.

Direction of the field of the ion-trap magnet should be such that the north pole is adjacent to vacant pin position No.8 and the south pole to pin No.2.
**NOTE 1:** THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION NO. 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 30°. ANODE TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION NO. 6.

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

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

**NOTE 4:** LOCATION OF DEFLECTING YOKE AND FOCUSING DEVICE MUST BE WITHIN THIS SPACE.

**NOTE 5:** KEEP THIS SPACE CLEAR FOR SINGLE-FIELD, ION-TRAP MAGNET.

MAY 1, 1951

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

$E_{g} = 6.3$ VOLTS
ANODE VOLTS = 16000
GRID NO. 1 BIASED TO CUTOFF OF UNDEFLICTED FOCUSED SPOT
RASTER SIZE $17 \frac{1}{4}'' \times 13 \frac{1}{4}''$ (FOCUSED FOR AVERAGE BRIGHTNESS)
$E_F = 6.3$ VOLTS
ANODE VOLTS = 14000 TO 18000
GRID N81 BIASED TO CUTOFF OF UNDEFLECTED FOCUSED SPOT
The 20DP4-A/20CP4-A is the same as the 20DP4-C/20CP4-D except that it utilizes a non-aluminized phosphor and has a light output as shown by the curves on the back of this sheet.
AVGARDE GRID-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ULTOR VOLTS = 16000
GRID NO. 1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUT-OFF
RASTER FOCUSED AT AVERAGE BRIGHTNESS
RASTER SIZE = $16\frac{3}{4}'' \times 12\frac{1}{2}''$
20DP4-C/20CP4-D
KINESCOPE

RECTANGULAR GLASS TYPE
MAGNETIC FOCUS

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 ultor: (750 max. µuf
                                              500 min. µuf
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: Magnetic
Deflection Method: Magnetic
Deflection Angles (Approx.):
  Diagonal: 70°
  Horizontal: 66°
  Vertical: 50°
Ion-Trap Gun: Requires External Single-Field Magnet
Tube Dimensions:
  Overall length: 21-9/16" ± 5/16"
  Greatest width: 18-11/16" ± 1/8"
  Greatest height: 14-15/16" ± 1/8"
  Diagonal: 20-3/32" ± 1/8"
  Neck length: 7-5/16" ± 1/8"
Screen Dimensions (Minimum):
  Greatest width: 17"
  Greatest height: 12-3/4"
  Diagonal: 18-3/8"
  Projected area: 199 sq.in.
  Weight (Approx.): 30 lbs
Mounting Position: Any
Cap.: Recessed Small Cavity (JETEC No. J1-21)
Bulb: Small-Shell Duodecal 5-Pin (JETEC 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
(12N)
(10)
(1)
(9)
(8)
(7)
(6)
(5)
(4)
(3)
(2)

Cap – Ultr
(12N)
(10)
(1)
(9)
(8)
(7)
(6)
(5)
(4)
(3)
(2)

C – External
Conductive Coating

2-56
TENTATIVE DATA 1
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Maximum Ratings, Design-Center Values:

ULTOR VOLTAGE. .............................................. 18000 max. volts
GRID-No.2 VOLTAGE. ......................................... 410 max. volts
GRID-No.1 VOLTAGE:
  Negative bias value. ..................................... 125 max. volts
  Positive bias value. ..................................... 0 max. volts
  Positive peak value. ..................................... 2 max. volts
PEAK HEATER-CATHODE VOLTAGE:
  Heater negative with respect to cathode:
    During equipment warm-up period
      not exceeding 15 seconds............ 410 max. volts
  After equipment warm-up period.... 180 max. volts
  Heater positive with respect to cathode. 180 max. volts

Equipment Design Ranges:

With any ultor voltage \( (E_{c2}) \) between 14000* and 18000 volts
and grid-No.2 voltage \( (E_{c2}) \) between 150 and 410 volts

Grid-No.1 Voltage for
  Visual Extinction of
  Focused Raster. ............ -9.3% to -24% of \( E_{c2} \) volts
Grid-No.1 Video Drive from Raster Cutoff
  (Black Level):
    White-level value
      (Peak positive) 9.3% to 24% of \( E_{c2} \) volts
  Grid-No.2 Current ........... \[ \frac{E_{c2}}{16000} \times 110 \] \pm 10% \( \mu \)amp
  Focusing-Coil Current (DC)\(^O\) \[ \frac{E_{c2}}{16000} \times 30 \] \( \mu \)amp
  Ion-Trap Magnet Current
    (Average)** \[ \frac{E_{c2}}{16000} \times 33 \] gausses
  Minimum Field Strength of
    PM Ion-Trap Magnet \§ \[ \frac{E_{c2}}{16000} \times 33 \] gausses
  Field Strength of Adjustable
    Centering Magnet. ......... 0 to 8 gausses

Examples of Use of Design Ranges:

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

Grid-No.1 Voltage for
  Visual Extinction of
  Focused Raster. ............ -28 to -72 -28 to -72 volts
Grid-No.1 Video Drive from Raster Cutoff
  (Black Level):
    White-level value
      (Peak positive) 28 to 72 28 to 72 volts
    Focusing-Coil Current (DC) . 103 \pm 10% 110 \pm 10% \( \mu \)amp
    Minimum Field Strength of
      PM Ion-Trap Magnet. ......... 31 33 gausses

* \( \), ** \( \), § See next page.
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 14000 volts.

For specimen focusing coil similar to JETEC Focusing Coil No.109, positioned with air gap toward kinescope screen and center line of air gap 3 inches from Reference Line (See Dimensional Outline). The indicated current is for condition with sharp focus at center of picture area and combined grid-No.1 voltage and video-signal voltage adjusted to produce a highlight brightness of 30 foot-lamberts measured on an Indian Head Test Pattern set for a 17" x 12-3/4" picture size.

** For JETEC Ion-Trap Magnet No.117, or equivalent, located with the trailing edge of the pole pieces located over the gap between grid No.1 and grid No.2 and rotated to give maximum brightness.

For specimen PM ion-trap magnet, such as Heppner Model No.E437, or equivalent, located in optimum position and rotated to give maximum brightness. For a given equipment application, the tolerance range for the strength of the PM ion-trap magnet should be added to the minimum value. The maximum strength of this magnet should not exceed the specified minimum value by more than 6 gausses. This procedure will insure use of a PM ion-trap magnet allowing adequate adjustment to permit satisfactory performance without loss of highlight brightness.

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section
NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No. 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTORIZ TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 30°. ULTORIZ TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION No. 6.

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

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


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

- $E_F = 6.3$ 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 = $16\frac{3}{4}'' \times 12\frac{1}{2}''$

Diagram showing the relationship between highlight brightness (foot-lamberts) and video signal volts from raster cutoff.
AVERAGE GRID-DRIVE CHARACTERISTICS

- \( E_f = 6.3 \) VOLTS
- ULTOR VOLTS = 14000 to 18000
- GRID N-1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF

ULTOR MILLIAMPERES

VIDEO SIGNAL VOLTS FROM RASTER CUTOFF

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
The 20HP4-A/20MP4 is the same as the 20HP4-D except that it utilizes a *non-aluminized phosphor* and has a light output as shown by the curves on the back of this sheet.
AVERAGE GRID-DRIVE CHARACTERISTICS

\[ E_C = 6.3 \text{ VOLTS} \]
\[ \text{ULTOR VOLTS} = 16000 \]
\[ \text{GRID N8} \text{ BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF} \]
\[ \text{RASTER FOCUSED AT AVERAGE BRIGHTNESS} \]
\[ \text{RASTER SIZE} = 16\frac{3}{4}'' \times 12\frac{1}{2}'' \]
**GENERAL**

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

Direct Interelectrode Capacitances:
- Grid No. 1 to all other electrodes: 6 µf
- Cathode to all other electrodes: 5 µf
- External conductive coating to ultor: (1500 max. µf)
  - 750 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: 70°
- Horizontal: 66°
- Vertical: 50°

Ion-Trap Gun: Requires External Single-Field Magnet

**TUBE DIMENSIONS**
- Overall length: 21-3/4" ± 3/8"
- Greatest width: 18-11/15" ± 1/8"
- Greatest height: 14-15/16" ± 1/8"
- Diagonal: 20-3/32" ± 1/8"
- Neck length: 7-1/2" ± 3/16"

**SCREEN DIMENSIONS (MINIMUM):**
- Greatest width: 17"
- Greatest height: 12-3/4"
- Diagonal: 18-3/8"
- Projected area: 199 sq. in.

**WEIGHT (APPROX.):** 30 lbs

**MOUNTING POSITION:** Any

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

**BULB:** J-161

**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, Collector)
**C** — External Conductive Coating

**DATA**

**RECTANGULAR GLASS TYPE**

**LOW-VOLTAGE FOCUS**

**ALUMINIZED SCREEN**

**MAGNETIC DEFLECTION**

2-56

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE DATA 1
## Maximum Ratings, Design-Center Values:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ULTOR VOLTAGE</strong></td>
<td>16000 max. volts</td>
</tr>
<tr>
<td><strong>GRID-No.4 VOLTAGE</strong></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><strong>GRID-No.2 VOLTAGE</strong></td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>500 max. volts</td>
</tr>
<tr>
<td><strong>GRID-No.1 VOLTAGE</strong></td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>125 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></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 voltage \((E_c)\) between 14000 volts and 16000 volts and grid-No.2 voltage \((E_{c2})\) between 150 and 500 volts*

- Grid-No.4 Voltage for Focus with Ultor Current of 100 \(\mu\)amp. \(-0.4\% \text{ to } +2.2\% \text{ of } E_c\) volts
- Grid-No.1 Voltage for Visual Extinction of Focused Raster \(-9.3\% \text{ to } -24\% \text{ of } E_{c2}\) volts
- Grid-No.1 Video Drive from Raster Cutoff (Black Level):
  - White-level value (Peak positive) \(9.3\% \text{ to } 24\% \text{ of } E_{c2}\) volts
- Grid-No.4 Current \(-25 \text{ to } +25 \mu\)amp
- Grid-No.2 Current \(-15 \text{ to } +15 \mu\)amp

### Ion-Trap Magnet Current (Average)**

\[
\frac{E_c}{16000} \times 30 \text{ ma}
\]

### Minimum Field Strength of PM Ion-Trap Magnet $\S$

\[
\frac{E_{c2}}{16000} \times 33 \text{ gausses}
\]

### Field Strength of Adjustable Centering Magnet

0 to 8 gausses

---

# Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 14000 volts.

** For JETEC Ion-Trap Magnet No.117, or equivalent, located with the trailing edge of the pole pieces located over the gap between grid No.1 and grid No.2 and rotated to give maximum brightness.

§ For specimen PM ion-trap magnet, such as Heppner Model No.E437, or equivalent, located in optimum position and rotated to give maximum brightness. For a given equipment application, the tolerance range for the strength of the PM ion-trap magnet should be added to the minimum value. The maximum strength of this magnet should not exceed the specified minimum value by more than 6 gausses. This procedure will insure use of a PM ion-trap magnet allowing adequate adjustment to permit satisfactory performance without loss of highlight brightness.
Examples of Use of Design Ranges:

- With ultor voltage of 14,000 volts and grid-No. 2 voltage of 300 volts.
- Grid-No. 4 Voltage for Focus with Ultor Current of 100 μamp. . . . -55 to +300 volts to -65 to +350 volts.
- Grid-No. 1 Voltage for Visual Extinction of Focused Raster . . . . -28 to -72 volts to -28 to -72 volts.
- Grid-No. 1 Video Drive from Raster Cutoff (Black Level):
  - White-level value: 28 to 72 volts to 28 to 72 volts.
  - (Peak positive) Minimum Field Strength of PM Ion-Trap Magnet . . . 31 gaus.

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.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No.110 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC1 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 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_f = 6.3$ VOLTS
ULLOR VOLTS=16000
GRID NO 1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF
RASTER FOCUSED AT AVERAGE BRIGHTNESS
RASTER SIZE $16\frac{3}{4}'' \times 12\frac{1}{2}''$
Average Grid-Drive Characteristics

- **$E_f = 6.3$ Volts**
- **Ultor Volts = 14000 to 16000**
- **Grid No. 1 biased negative with respect to cathode to give focused raster cutoff**

**Graph:**
- **X-axis:** Video signal volts from raster cutoff
- **Y-axis:** Ultor milliamperes

**Grid Lines:**
- Grid-1 & 2, Volts = 200

**Additional Information:**
- **TUBE DIVISION**
- **Radio Corporation of America, Harrison, New Jersey**
- **92CM-8871**
The 21ACP4-A is the same as the 21AMP4-A except that it has a maximum ultraviolet rating of 20000 volts and has ULTOR CURRENT vs DRIVE curves as shown on the back of this sheet.
## General:

Heater, for Unipotential Cathode:

<table>
<thead>
<tr>
<th>Voltage</th>
<th>6.3 ac or dc volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>0.6 ± 10% amp</td>
</tr>
</tbody>
</table>

Direct Interelectrode Capacitances:

- Grid No.1 to all other electrodes: 6 µf
- Cathode to all other electrodes: 5 µf
- External conductive coating to ultor*: 750 max. µf
- *500 min. µf

Faceplate, Spherical: Filterglass

Light transmission (Approx.): 75%

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

### Data

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluorescence</td>
<td>White</td>
</tr>
<tr>
<td>Phosphorescence</td>
<td>White</td>
</tr>
<tr>
<td>Persistence</td>
<td>Short</td>
</tr>
<tr>
<td>Focusing Method</td>
<td>Electrostatic</td>
</tr>
<tr>
<td>Deflection Method</td>
<td>Magnetic</td>
</tr>
<tr>
<td>Deflection Angles (Approx.)</td>
<td></td>
</tr>
<tr>
<td>Diagonal</td>
<td>90°</td>
</tr>
<tr>
<td>Horizontal</td>
<td>85°</td>
</tr>
<tr>
<td>Vertical</td>
<td>68°</td>
</tr>
<tr>
<td>Ion-Trap Gun</td>
<td>Requires External Single-Field Magnet</td>
</tr>
</tbody>
</table>

### Tube Dimensions:

- Overall length: 20" ± 3/8"
- Greatest width: 20-1/4" ± 1/8"
- Greatest height: 16-3/8" ± 1/8"
- Diagonal: 21-3/8" ± 1/8"

### Screen Dimensions (Minimum):

- Greatest width: 19-1/8"
- Greatest height: 15"
- Diagonal: 20-1/4"
- Projected area: 255 sq. in.

### Weight (Approx.)

- 24 lbs

### Mounting Position

- Any

### Cap

- Recessed Small Cavity (JETEC No. 1-21)

### Bulb

- J171 (90°)

### Base

- Small-Shell Duodecal 6-Pin (JETEC No. B6-63)

### Basing Designation

- BOTTOM VIEW

#### Pinout:

- Pin 1 - Heater
- Pin 2 - Grid No.1
- Pin 6 - Grid No.4
- Pin 10 - Grid No.2
- Pin 11 - Cathode
- Pin 12 - Heater

#### Diagram:

- Cap - Ultor
- Grid No.3
- Grid No.5
- Collector
- C - External
- Conductive Coating

*Indicates a change.

---

© RCA

2IALP4-A

KINESCOPE

RECTANGULAR GLASS TYPE

ALUMINIZED SCREEN

LOW-VOLTAGE FOCUS

MAGNETIC DEFLECTION

NOV. 1, 1955

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><strong>ULTOR® VOLTAGE</strong></td>
<td>18000 max. volts</td>
</tr>
<tr>
<td><strong>GRID-No.4 VOLTAGE:</strong></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><strong>GRID-No.2 VOLTAGE:</strong></td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>500 max. volts</td>
</tr>
<tr>
<td><strong>GRID-No.1 VOLTAGE:</strong></td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>125 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 \(E_{C5k}\) between 14000 and 18000 volts and grid-No.2 voltage \(E_{C2k}\) between 200 and 500 volts.

- Grid-No.4 Voltage for Focus with Ultor: Current of 100 \(\mu\)amp. 
  - \(-0.4\% \text{ to } +2.2\% \text{ of } E_{C5k} \) volts

- Grid-No.1 Voltage for Visual Extinction of Focused Raster: 
  - \(-9.3\% \text{ to } -24\% \text{ of } E_{C2k} \) volts

- Grid-No.1 Video Drive from Raster Cutoff (Black Level):
  - White-level value (Peak positive): \(9.3\% \text{ to } 24\% \text{ of } E_{C2k} \) volts
  - Grid-No.4 Current: \(-25 \text{ to } +25 \mu\)amp
  - Grid-No.2 Current: \(-15 \text{ to } +15 \mu\)amp
  - Ion-Trap Magnet Current (Average): \(\sqrt{\frac{E_{C5k}}{16000}} \times 30 \) ma
  - Minimum Field Strength of PM Ion-Trap Magnet: 
    - \(\sqrt{\frac{E_{C5k}}{16000}} \times 33 \) gausses
  - 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.

---

**Notes:**
- \*: See next page.
- Indicates a change.

NOV. 1, 1955
Examples of Use of Design Ranges:

With ultor voltage of 16000, 18000 volts
and grid-No.2 voltage of 300, 400 volts

Grid-No.4 Voltage for Focus with Ultor
Current of 100 µamp. . . . . . . . . . . . . -65 to +350 -75 to +400 volts

Grid-No.1 Voltage for Visual Extinction of Focused Raster . . . . . . -28 to -72 -37 to -96 volts

Grid-No.1 Video Drive from Raster Cutoff (Black Level):
White-level value (Peak positive) 28 to 72 37 to 96 volts

Minimum Field Strength of PM Ion-Trap Magnet . . . . . . 33 35 gausses

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

CATHODE-DRIVE® SERVICE

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

Maximum 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 . . . . . . 625 max. volts
GRID-No.2-TO-CATHODE VOLTAGE . . . . . . 500 max. volts
CATHODE-TO-GRID-No.1 VOLTAGE:
Positive bias value . . . . . . . . . . . . . . . . . . . . . . . . 125 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

* 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 2IALP4-A, the ultor function is performed by grid No.5. Since grid No.5, grid No.3, and collector are connected together within the 2IALP4-A, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.

This value has been specified to take care of the condition where an ac voltage is provided for dynamic focusing.

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.

Indicates a change.

NOV. 1, 1955

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

DATA 2
Equipment Design Ranges:

With any ultor-to-grid-No. 1 voltage \( (E_{c591}) \) between 14000 and 18000 volts and grid-No. 2-to-grid-No. 1 voltage \( (E_{c2g1}) \) between 220 and 620 volts

Grid-No. 4-to-Grid-No. 1 Voltage
for Focus with Ultor Current of 100 \( \mu \)amp. ........ 0% to 2.6% of \( E_{c591} \) volts

Cathode-to-Grid-No. 1 Voltage
for Visual Extinction
of Focused Raster. ........ 8.5% to 19.4% of \( E_{c2g1} \) volts

Cathode-to-Grid-No. 1 Video
Drive from Raster Cutoff
(Black Level):
White-level value (Peak negative) 8.5% to 19.4% of \( E_{c2g1} \) volts

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

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

Ion-Trap Magnet Current
(Average) ** ............ \( \sqrt{\frac{E_{c591}}{16000}} \times 30 \) ma

Minimum Field Strength of PM Ion-Trap Magnet \( \S \) ........ " \( \sqrt{\frac{E_{c591}}{16000}} \times 33 \) gauss

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

Examples of Use of Design Ranges:

With ultor-to-grid-No. 1 voltage of 16000 18000 volts
and grid-No. 2-to-grid-No. 1 voltage of 300 400 volts

Grid-No. 4-to-Grid-No. 1 Voltage
for Focus with Ultor Current of 100 \( \mu \)amp. .... 0 to 415 0 to 470 volts

Cathode-to-Grid-No. 1 Voltage
for Visual Extinction
of Focused Raster. ........ 25 to 58 34 to 78 volts

Cathode-to-Grid-No. 1 Video
Drive from Raster Cutoff
(Black Level):
White-level value (Peak negative) 25 to 58 34 to 78 volts

Minimum Field Strength of PM Ion-Trap Magnet ........ 33 35 gauss

Maximum Circuit Values:

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

* ** §: See next page.

⇒ Indicates a change.

NOV. 1, 1955
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Brilliance and definition decrease with decreasing ultor voltage or ultor-to-grid-No.1 voltage. In general, the ultor voltage or ultor-to-grid-No.1 voltage should not be less than 14000 volts.

For JETEC Ion-Trap Magnet No.117, or equivalent, located with the trailing edge of the pole pieces located over the gap between grid No.1 and grid No.2 and rotated to give maximum brightness.

For specimen PM ion-trap magnet, such as Heppner Model No. E497, or equivalent, located in optimum position and rotated to give maximum brightness. For a given equipment application, the tolerance range for the strength of the PM ion-trap magnet should be added to the minimum value. The maximum strength of this magnet should not exceed the specified minimum value by more than 6 gausses. This procedure will insure use of a PM ion-trap magnet allowing adequate adjustment to permit satisfactory performance without loss of highlight brightness.

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 JETEC NO. 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 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.
2IALP4-A

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$\text{\textdegree}$ VOLTS = 16000</td>
<td>ULTOR VOLTS = 16000</td>
</tr>
<tr>
<td>CATHODE BIASED POSITIVE WITH RESPECT TO GRID N$\text{\textdegree}$ TO GIVE FOCUSED RASTER CUTOFF</td>
<td>GRID N$\text{\textdegree}$ 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>

- CATHODE DRIVE
- GRID DRIVE

VOLTS

VIDEO SIGNAL VOLTS FROM RASTER CUTOFF

AUG. 24, 1955

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CL-8771
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE
- E_C = 6.3 VOLTS
- ULTOR-TO-GRID-N#1 VOLTS = 14000 TO 18000
- CATHODE BIASED POSITIVE WITH RESPECT TO GRID N#1 TO GIVE FOCUSED RASTER CUTOFF

GRID-DRIVE SERVICE
- E_C = 6.3 VOLTS
- ULTOR VOLTS = 14000 TO 18000
- GRID N#1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF

---

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

92CM-8625
The 21ALP4-B is the same as the 21ALP4-A except that it has a maximum ultior voltage rating of 20000 volts and has ULTOR CURRENT vs DRIVE curves as shown on the back of this sheet.
<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-#1 Volts = 12000 to 16000</td>
<td>Ultor Volts 12000 to 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>
</tbody>
</table>

**Average Drive Characteristics**

- **Cathode Drive**
- **Grid Drive**

Parameters:
- Voltage range: 0 to 80
- Milliamperes range: 0.5 to 3.0

Graph showing the relationship between video signal volts from raster cutoff and ultor milliamperes.
General:
Heater, for Unipotential Cathode:
Voltage .................. 6.3 .............. ac or dc volts
Current .................. 0.6 ± 10% ............... amp
Direct Interelectrode Capacitances:
Grid No. 1 to all other electrodes. ..... 6 μμf
Cathode to all other electrodes. ..... 5 μμf
External conductive coating to ultor* 750 max. μμf
500 min. μμf
Faceplate, Spherical ................ Filterglass
Light transmission (Approx.) ........ 75%
Phosphor (For curves, see front of this section). P4—Sulfide Type Aluminized
Persistence .................... White
Focusing Method ................ Magnetic
Deflection Method ................ Magnetic
Deflection Angles (Approx.):
Diagonal .................... 90°
Horizontal ................... 85°
Vertical ..................... 68°
Ion-Trap Gun ................ Requires External Single-Field Magnet
Tube Dimensions:
Overall length ................ 20" ± 3/8"
 Greatest width ................ 20-1/4" ± 1/8"
 Greatest height .............. 16-3/8" ± 1/8"
 Diagonal ..................... 21-3/8" ± 1/8"
Screen Dimensions (Minimum):
Greatest width ................ 19-1/8"
Greatest height .............. 15"
Diagonal ..................... 20-1/4"
Projected area ............... 255 sq. in.
Weight (Approx.) .............. 24 lbs
Mounting Position ............. Any
Cap ........................ Recessed Small Cavity (JETEC No.J1-21)
Bulb ........................ J171 (90°)
Base ........................ Small-Shell Duodecal 5-Pin (JETEC No.B5-57)
Basing Designation for BOTTOM VIEW ........ 12N
Pin 1 — Heater (Grid No.3, Collector)
Pin 2 — Grid No.1
Pin 10 — Grid No.2
Pin 11 — Cathode
Pin 12 — Heater
Cap — Utor
C — External Conductive Coating

* 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 21AMP4-A, the ultor function is performed by grid No. 3. Since grid No. 3 and collector are connected together within the 21AMP4-A, they are collectively referred to as "ultor*" for convenience in presenting data and curves.

NOV. 1, 1955 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:

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

Equipment Design Ranges:

With any ultor voltage \( (E_{c2k}) \) between 14000* and 18000 volts and grid-No. 2 voltage \( (E_{c2k}) \) between 200 and 500 volts

Grid-No. 1 Voltage for Visual Extinction of Focused Raster. . . . -9.3% to -24% of \( E_{c2k} \) volts

Grid-No. 1 Video Drive from Raster Cutoff (Black Level):
  White-level value (Peak positive) 9.3% to 24% of \( E_{c2k} \) volts
  Grid-No. 2 Current . . . . . . . \( \left[ \frac{E_{c3k}}{16000} \times 108 \right] \pm 20\% \) \( \mu \)amp
  Focusing-Coil Current (DC)\(^0\) . . . \( \frac{E_{c3k}}{16000} \times 30 \) ma
  Ion-Trap Magnet Current (Average)\(^\text{**} \) . . . \( \frac{E_{c3k}}{16000} \times 33 \) gauss
  Minimum Field Strength of PM Ion-Trap Magnet\(^\text{§} \) . . . \( \frac{E_{c3k}}{16000} \times 33 \) gauss
  Field Strength of Adjustable Centering Magnet . . . . . . . . . 0 to 8 gauss

Examples of Use of Design Ranges:

With ultor voltage of 16000 18000 volts and grid-No. 2 voltage of 300 400 volts

Grid-No. 1 Voltage for Visual Extinction of Focused Raster. . . . -28 to -72 -37 to -96 volts

\(^*\), \(^\text{**} \), \(^\text{§} \): See next page.

TENTATIVE DATA 1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Grid-No.1 Video Drive
from Raster Cutoff
(Black Level):
White-level value
(Peak positive) 28 to 72 37 to 96 volts
Focusing-Coil Current (DC)... 108 ± 20% 115 ± 20% ma
Minimum Field Strength of
PM Ion-Trap Magnet .... 33 35 gauss

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

CATHEODRIVE® 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.2-TO-GRID-No.1 VOLTAGE ........ 625 max. volts
GRID-No.2-TO-CATHODE VOLTAGE ........ 500 max. volts
CATHODE-TO-GRID-No.1 VOLTAGE:
Positive bias value ........ 125 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 (Ec29) between
14600° and 18000 volts
and grid-No.2-to-grid-No.1 voltage (Ec29) between
220 and 620 volts

Cathode-to-Grid-No.1 Voltage
for Visual Extinction
of Focused Raster .... 8.5% to 19.4% of Ec29 volts
Cathode-to-Grid-No.1 Video
Drive from Raster Cutoff
(Black Level):
White-level value
(Peak negative) 8.5% to 19.4% of Ec29 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.
• Brilliance and definition decrease with decreasing ultor voltage or
  ultor-to-grid-No.1 voltage. In general, the ultor voltage or the ultor-
  to-grid-No.1 voltage should not be less than 14000 volts.

0.5° S: see next page.

NOV. 1, 1955
TUBE DIVISION
TENTATIVE DATA
Grid-No. 2 Current

-15 to +15 \(\mu\)amp

Focusing-Coil Current (DC)\(^0\)

\[
\sqrt{\frac{E_{c391}}{16000} \times 108} \pm 20\%
\]

Ion-Trap Magnet Current (Average)\(^**\)

\[
\sqrt{\frac{E_{c391}}{16000} \times 30}
\]

Minimum Field Strength of PM Ion-Trap Magnet\(^$\)

\[
\sqrt{\frac{E_{c391}}{16000} \times 33}
\]

gausses

Field Strength of Adjustable Centering Magnet

0 to 8 gaussles

Examples of Use of Design Ranges:

**With cathode-to-grid-No. 1 voltage of 16000 18000 volts and grid-No. 2-to-grid-No. 1 voltage of 300 400 volts**

Cathode-to-Grid-No. 1 Voltage for Visual Extinction of Focused Raster 25 to 58 34 to 78 volts

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

White-level value

(Peak negative) 25 to 58 34 to 78 volts

Focusing-Coil Current (DC) 108 \(\pm\) 20\% 115 \(\pm\) 20\% ma

Minimum Field Strength of PM Ion-Trap Magnet 33 35 gaussles

Maximum Circuit Values:

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

\(^0\) For specimen focusing coil similar to JETEC Focusing Coil No. 109 positioned with air gap toward kinescope screen and center line of air gap 3 inches from Reference Line (See Dimensional Outline). The indicated current is for condition with sharp focus at center of picture area and combined grid-No. 1 voltage and video-signal voltage adjusted to produce a highlight brightness of 30 foot-lamberts measured on an Indian Head Test Pattern set for a 19-1/8\(\times\)15 inch picture size.

\(^**\) For JETEC Ion-Trap Magnet No. 117, or equivalent, located with the trailing edge of the pole pieces located over the gap between grid No. 1 and grid No. 2 and rotated to give maximum brightness.

\(^$\) For specimen PM ion-trap magnet, such as Heppner Model No. EU37, or equivalent, located in optimum position and rotated to give maximum brightness. For a given equipment application, the tolerance range for the strength of the PM ion-trap magnet should be added to the minimum value. The maximum strength of this magnet should not exceed the specified minimum value by more than 6 gaussles. This procedure will insure use of a PM ion-trap magnet allowing adequate adjustment to permit satisfactory performance without loss of highlight brightness.

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

NOV. 1, 1955

TENTATIVE DATA 2
DIMENSIONAL OUTLINE

for Type 2IAMP4-A is the same as that shown for Type 2IALP4-A, except that the 2IAMP4-A has a Small-Shell Duodecal 5-Pin Base

CURVES

for Type 2IAMP4-A are the same as those shown for Type 2IALP4-A

NOV. 1, 1955

TUBE DIVISION

RADIO CORPORATION OF AMERICA, MARRISON, NEW JERSEY
MAGNETIC FOCUS

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

Faceplate (With about 66% light transmission) Frosted Filterglass
Phosphor (For Curves, see front of this Section), No.4—Sulfide Type
Fluorescence and Phosphorescence: White
Persistence of Phosphorescence: Short

Focusing Method: Magnetic
Deflection Method: Magnetic

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

Ion-Trap Gun: Requires External, Single-Field Magnet

Maximum Overall Length: 22-5/16"

Greatest Diagonal of Tube at Lip: 20-3/4" ± 1/4"
Greatest Width of Tube at Lip: 19-23/32" ± 1/8"
Greatest Height of Tube at Lip: 15-5/16" ± 1/8"

Screen Size: 18-3/8" x 13-15/16"

Mounting Position: Any

Ultor® Terminal: Metal-Shell Lip Base

Bottom View

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: 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

In the 21AP4, 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.

MAY 1, 1951
TUBE DEPARTMENT
TENTATIVE DATA 1
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

Typical Operation:
  Ultor Voltage* .......... 14000 16000 volts
  Grid-No.2 Voltage. ....... 300 300 volts
  Grid-No.1 Voltage for Visual
    Extinction of Undeflected
      Focused Spot .......... -33 to -77 -33 to -77 volts
  Focusing–Coil Current (DC)00 104 ± 6% 110 ± 6% ma
  Field Strength of Single–
    Field Ion-Trap Magnet ... 45 50 gausses
  Ion–Trap Magnet Current
    (DC, approx.)# ....... 90 – ma
  Field Strength of Adjustable
    Centering Magnet. ....... 0 to 8 0 to 8 gausses

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 14000 volts.
00 For specimen focusing coil similar to JETEC Focusing Coil No.109
positioned with air gap toward kinescope screen and center line of
air gap 3 inches from Reference Line (see Outline Drawing). The
indicated current is for condition with combined grid-No.1 bias volt-
age and video-signal voltage adjusted to produce a highlight bright-
ness of 30 foot-lamberts on a 18-3/8" x 13-15/16" picture area sharply
focused at center of screen.
# For specimen ion-trap magnet similar to JETEC Ion-Trap Magnet No.111
located in optimum position and rotated to give maximum brightness.
**OPERATING NOTES**

*I-Ray Warning.* When operated at ultraviolet voltages up to 16 kilovolts, the 2IAP4 does not produce any harmful x-ray radiation. However, because the rating of the tube permits operation at voltages as high as 19.8 kilovolts (absolute value), shielding of the 2IAP4 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.

*Direction of the field of the ion-trap magnet should be such that the north pole is adjacent to vacant pin position No. 8 and the south pole to pin No. 2.*
NOTE 1: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No.110 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 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 3-1/4".

NOTE 3: METAL SHELL AND GLASS FACE OPERATE AT HIGH VOLTAGE. ANY MATERIAL IN CONTACT WITH THE SHELL OR THE FACE MUST BE INSULATED TO WITHSTAND THE MAXIMUM APPLIED ULTOR VOLTAGE.


NOTE 5: SUPPORT TUBE IN LIP REGION ONLY AT CORNERS WITHIN THIS SPACE.

NOTE 6: LOCATION OF DEFLECTING YOKE AND FOCUSING DEVICE MUST BE WITHIN THIS SPACE.
AVERAGE GRID-DRIVE CHARACTERISTICS

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

ULTOR (GRID-N\#3 AND COLLECTOR)

\[ \text{VOLTS} = 16000 \]

GRID-N\#4 VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS

GRID N\#1 BIASED TO CUTOFF OF UN-DEFLECTED FOCUSED SPOT

Raster Size = 18 \( \frac{3}{8}'' \times 13\frac{3}{8}'' \)

Highlight Brightness - Foot-Lamberts

Video Signal Volts from Cutoff

MAY 18, 1951

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7653
AVERAGE GRID-DRIVE CHARACTERISTICS

\( E_{g} = 6.3 \text{ VOLTS} \)

ULTOR (GRID-N\#3 AND COLLECTOR) VOLTS = 14000 TO 18000

GRID N\#1 BIASED TO CUTOFF OF UNDEFLCTED FOCUSED SPOT

\begin{align*}
\text{VIDEO SIGNAL VOLTS FROM CUTOFF} & & & & & & & & & & & & & & & & & & & & & & & \\
\end{align*}

MAY 11, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, MARRISON, NEW JERSEY

92CM-7652
The 21ATP4 is the same as the 21ALP4-A except for the following items:

<table>
<thead>
<tr>
<th>Direct Interelectrode Capacitances:</th>
<th>1500 max.</th>
<th>1200 min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>External conductive coating to ultor</td>
<td>$\mu f$</td>
<td>$\mu f$</td>
</tr>
</tbody>
</table>
2IAVP4/2IAUP4
KINESCOPE
RECTANGULAR GLASS TYPE
LOW-VOLTAGE FOCUS
MAGNETIC DEFLECTION

DATA

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

Direct Interelectrode Capacitances:
  Grid No. 1 to all other electrodes ........................................ 6 μf
  Cathode to all other electrodes ........................................ 5 μf
  External conductive coating to ultor* .................................. 1500 max. μf
                                                               1200 min. μf

Faceplate, Spherical......................................................... Filterglass
Light transmission (Approx.)............................................... 71%
Phosphor (for curves, see front of this section).............. P4—Sulfide Type
  Fluorescence......................................................... White
  Phosphorescence...................................................... White
  Persistence.............................................................. Short

Focusing Method............................................................. Electrostatic
Deflection Method.......................................................... Magnetic

Deflection Angles (Approx.):
  Diagonal......................................................... 72°
  Horizontal......................................................... 67°
  Vertical............................................................... 53°

Ion-Trap Gun................................................................. Requires 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"

Screen Dimensions (Minimum):
  Greatest width......................................................... 19-1/8"
  Greatest height......................................................... 15"
  Diagonal................................................................. 20-1/4"
  Projected area........................................................... 255 sq. in.
  Weight (Approx.)........................................................ 24 lbs

Mounting Position.......................................................... Any

Cap.......................................................... Recessed Small Cavity (JETEC No.J1-21)
Bulb............................................................... J171 (72°)
Base.......................................................... Small-Shell Duodecal 6-Pin (JETEC No.B6-63)

Basing Designation for BOTTOM VIEW.......................... 12L

Pin 1 — Heater Cap — Ultor
Pin 2 — Grid No. 1 (Grid No.3, Pin 6 — Grid No.4 Grid No.5, Pin 10 — Grid No.2 Collector)
Pin 11 — Cathode Pin 12 — Heater

*: See next page.

NOV. 1, 1955
TUBE DIVISION TENTATIVE DATA 1
GRID-DRIVE SERVICE

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

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

<table>
<thead>
<tr>
<th>ULTOR VOLTAGE</th>
<th>18000 max. volts</th>
</tr>
</thead>
<tbody>
<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 bias value</td>
<td>125 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 \((E_{c_k})\) between 14000 and 18000 volts and grid-No. 2 voltage \((E_{c_2k})\) between 200 and 500 volts

<table>
<thead>
<tr>
<th>Grid-No. 4 Voltage for Focus with Ultor</th>
<th>Current of 100 µamp... -0.4% to +2.2% of (E_{c_5k}) volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No. 1 Voltage for Visual Extinction of Focused Raster</td>
<td>-9.3% to -24% of (E_{c_2k}) volts</td>
</tr>
<tr>
<td>Grid-No. 1 Video Drive from Raster Cutoff (Black Level):</td>
<td>White-level value (Peak positive) 9.3% to 24% of (E_{c_2k}) volts</td>
</tr>
<tr>
<td>Grid-No. 4 Current</td>
<td>-25 to +25 µamp</td>
</tr>
<tr>
<td>Grid-No. 2 Current</td>
<td>-15 to +15 µamp</td>
</tr>
<tr>
<td>Ion-Trap Magnet Current (Average)*</td>
<td>(\frac{E_{c_5k}}{16000} \times 30) ma</td>
</tr>
<tr>
<td>Minimum Field Strength of PM Ion-Trap Magnet§</td>
<td>(\frac{E_{c_5k}}{16000} \times 33) gausses</td>
</tr>
<tr>
<td>Field Strength of Adjustable Centering Magnet</td>
<td>0 to 8 gausses</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.

---

*§: see next page.
### Examples of Use of Design Ranges:

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

<table>
<thead>
<tr>
<th>Grid-No. 4 Voltage for Focus with Ultor</th>
<th>Current of 100 μamp</th>
<th>-65 to +350</th>
<th>-75 to +400 volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No. 1 Voltage for Visual Extinction of Focused Raster</td>
<td>-28 to -72</td>
<td>-37 to -96 volts</td>
<td></td>
</tr>
<tr>
<td>Grid-No. 1 Video Drive from Raster Cutoff (Black Level): White-level value</td>
<td>28 to 72</td>
<td>37 to 96 volts</td>
<td></td>
</tr>
<tr>
<td>Minimum Field Strength of PM Ion-Trap Magnet</td>
<td>33</td>
<td>35 gausses</td>
<td></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 Ratings, Design-Center Values:

**ULTOR®-TO-GRID-No. 1 VOLTAGE**: 18000 max. volts

<table>
<thead>
<tr>
<th>GRID-No. 4-TO-GRID-No. 1 VOLTAGE:</th>
<th>Positive value</th>
<th>1000 max. volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No. 2-TO-GRID-No. 1 VOLTAGE:</td>
<td>625 max. volts</td>
<td></td>
</tr>
<tr>
<td>Grid-No. 2-TO-CATHODE VOLTAGE:</td>
<td>500 max. volts</td>
<td></td>
</tr>
<tr>
<td>CATHODE-TO-GRID-No. 1 VOLTAGE:</td>
<td>Positive bias value</td>
<td>125 max. volts</td>
</tr>
<tr>
<td></td>
<td>Negative bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td></td>
<td>Negative peak value</td>
<td>2 max. volts</td>
</tr>
<tr>
<td>PEAK HEATER-CATHODE VOLTAGE:</td>
<td>Heater negative with respect to cathode: During equipment warm-up period not exceeding 15 seconds</td>
<td>410 max. volts</td>
</tr>
<tr>
<td></td>
<td>After equipment warm-up period</td>
<td>180 max. volts</td>
</tr>
<tr>
<td></td>
<td>Heater positive with respect to cathode.</td>
<td>180 max. volts</td>
</tr>
</tbody>
</table>

### Notes:
- 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 21AVP4, the ulti function is performed by grid No. 5. Since grid No. 5, grid No. 3, and collector are connected together within the 21AVP4, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.
- This value has been specified to take care of the condition where an ac voltage is provided for dynamic focusing.
- 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.
KINESCOPE

Equipment Design Ranges:

With any ultor-to-grid-No. 1 voltage \( (E_{5g1}) \) between 14000 and 18000 volts and grid-No. 2-to-grid-No. 1 voltage \( (E_{2g1}) \) between 220 and 620 volts

Grid-No. 4-to-Grid-No. 1 Voltage
for Focus with Ultor
Current of 100 \( \mu \)amp . . . . . . . 0% to 2.6% of \( E_{5g1} \) volts
Cathode-to-Grid-No. 1 Voltage for Visual Extinction of Focused Raster . . . . . 8.5% to 19.4% of \( E_{2g1} \) volts
Cathode-to-Grid-No. 1 Video Drive from Raster Cutoff (Black Level):
White-level value (Peak negative) 8.5% to 19.4% of \( E_{2g1} \) volts
Grid-No. 4 Current . . . . . . -25 to +25 \( \mu \)amp
Grid-No. 2 Current . . . . . . -15 to +15 \( \mu \)amp
Ion-Trap Magnet Current (Average)* . . . . . . . \( \sqrt{\frac{E_{5g1}}{16000}} \times 30 \) ma
Minimum Field Strength of PM Ion-Trap Magnet$ . . . . . \( \sqrt{\frac{E_{2g1}}{16000}} \times 33 \) gausses
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 300 400 volts

Grid-No. 4-to-Grid-No. 1 Voltage for Focus with Ultor
Current of 100 \( \mu \)amp . . . . . . . 0 to 415 0 to 470 volts
Cathode-to-Grid-No. 1 Voltage for Visual Extinction of Focused Raster . . . . . 25 to 58 34 to 78 volts
Cathode-to-Grid-No. 1 Video Drive from Raster Cutoff (Black Level):
White-level value (Peak negative) 25 to 58 34 to 78 volts
Minimum Field Strength of PM Ion-Trap Magnet . . . . . 33 35 gausses

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

#, \( \mu \), $: See next page.

NOV. 1, 1955

TENTATIVE DATA 2
Brilliance and definition decrease with decreasing ultor voltage or ultor-to-grid-No. 1 voltage. In general, the ultor voltage or ultor-to-grid-No. 1 voltage should not be less than 14000 volts.

** For JETEC Ion-Trap Magnet No. 117, or equivalent, located with the trailing edge of the pole pieces located over the gap between grid No. 1 and grid No. 2 and rotated to give maximum brightness.

§ For specimen PM ion-trap magnet, such as Heppner Model No. EU37, or equivalent, located in optimum position and rotated to give maximum brightness. For a given equipment application, the tolerance range for the strength of the PM ion-trap magnet should be added to the minimum value. The maximum strength of this magnet should not exceed the specified minimum value by more than 6 gausses. This procedure will insure use of a PM ion-trap magnet allowing adequate adjustment to permit satisfactory performance without loss of highlight brightness.

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 JETEC No. 110 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

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


NOTE 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.

NOV. 1, 1955

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-8604C
# Average Drive Characteristics

**Cathode-Drive Service**
- $E_F = 6.3$ 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 = 18” x 13 1/2”

**Grid-Drive Service**
- $E_F = 6.3$ 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 = 18” x 13 1/2”

---

**Diagram**

Video Signal Volts from Raster Cutoff vs. Highlight Brightness—Foot-Lambert's

AUG. 26, 1955  
TUBE DIVISION  
92CM-8773  
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE DRIVE CHARACTERISTICS

<table>
<thead>
<tr>
<th>CATHODE-DRIVE SERVICE</th>
<th>GRID-DRIVE SERVICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E_C = 6.3$ VOLTS</td>
<td>$E_C = 6.3$ VOLTS</td>
</tr>
<tr>
<td>ULTOR-TO-GRID-N°1 VOLTS = 14000 TO 18000</td>
<td>ULTOR VOLTS = 14000 TO 18000</td>
</tr>
<tr>
<td>CATHODE BIASED POSITIVE WITH RESPECT TO GRID N°1 TO GIVE FOCUSED RASTER CUTOFF</td>
<td>GRID N°1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF</td>
</tr>
</tbody>
</table>

---

**Graph**

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

**Axes:**
- **ULTOR MILLIAMPERES**
- **VIDEO SIGNAL VOLTS FROM RASTER CUTOFF**

**Grid Coordinates:**
- 0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

**Dates:**
- Nov. 2, 1955

**Company:**
- Radio Corporation of America, Harrison, New Jersey

**Documentation:**
- 92CM-8839
The 21AVP4-A/21AUP4-A is the same as the 21AVP4/21AUP4 except for the following item:

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

CURVES
for Type 21AVP4-A/21AUP4-A are the same as those shown for Type 21ALP4-A
**21AWP4**

**KINESCOPE**

**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*: 1500 max. μμf
  1200 min. μμf

**Faceplate, Spherical:** Filterglass
- Light transmission (Approx.): 71%

**Phosphor (For curves, see front of this section):** Sulfide Type
- Aluminized

**Fluorescence:** White
- Phosphorescence: White
- Persistence: Short

**Focusing Method:** Magnetic
**Deflection Method:** Magnetic

**Deflection Angles (Approx.):**
- Diagonal: 72°
- Horizontal: 67°
- Vertical: 53°

**Ion-Trap Gun:** Requires 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"

**Screen Dimensions (Minimum):**
- Greatest width: 19-1/8"
- Greatest height: 15"
- Diagonal: 20-1/4"
- Projected area: 255 sq. in.
- Weight (Approx.): 24 lbs

**Mounting Position:** Any
- Cap: Recessed Small Cavity (JETEC No.J1-21)
- Bulb: J171 (720)
- Base: Small-Shell Duodecal 5-Pin (JETEC No.B5-57)

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

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

*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 21AWP4, the ultor function is performed by grid No.3. Since grid No.3 and collector are connected together within the 21AWP4, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.*

**NOV. 1, 1955**

**TUBE DIVISION**

**TENTATIVE DATA 1**
GRID-DRIVE SERVICE

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

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

<table>
<thead>
<tr>
<th>Voltage Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultor Voltage</td>
<td>18000 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 bias value</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>- Positive bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>- Positive peak value</td>
<td>2 max. volts</td>
</tr>
<tr>
<td>Peak Heater-Cathode Voltage:</td>
<td></td>
</tr>
<tr>
<td>- Heater negative with respect to cathode:</td>
<td></td>
</tr>
<tr>
<td>During equipment warm-up period not exceeding 15 seconds</td>
<td>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 \((E_{C2k})\) between 14000 and 18000 volts and grid-No.2 voltage \((E_{C2k})\) between 200 and 500 volts.

<table>
<thead>
<tr>
<th>Voltage Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1 Voltage for Visual Extinction of Focused Raster</td>
<td>(-9.3% \text{ to } -24% \text{ of } E_{C2k}) volts</td>
</tr>
<tr>
<td>Grid-No.1 Video Drive from Raster Cutoff (Black Level):</td>
<td></td>
</tr>
<tr>
<td>- White-level value (Peak positive)</td>
<td>(-15 \text{ to } +15) \mu\text{amp}</td>
</tr>
<tr>
<td>Grid-No.2 Current</td>
<td>(\sqrt{\frac{E_{C3k}}{16000}} \times 108 \pm 20%) ma</td>
</tr>
<tr>
<td>Focusing-Coil Current (DC)</td>
<td>(\sqrt{\frac{E_{C3k}}{16000}} \times 30) ma</td>
</tr>
<tr>
<td>Ion-Trap Magnet Current (Average)</td>
<td>(\sqrt{\frac{E_{C3k}}{16000}} \times 33) gaussies</td>
</tr>
<tr>
<td>Minimum Field Strength of PM Ion-Trap Magnet</td>
<td>0 to 8 gaussies</td>
</tr>
<tr>
<td>Field Strength of Adjustable Centering Magnet</td>
<td>0 to 8 gaussies</td>
</tr>
</tbody>
</table>

**Examples of Use of Design Ranges:**

With ultor voltage of 16000 18000 volts and grid-No.2 voltage of 300 400 volts.

Grid-No.1 Voltage for Visual Extinction of Focused Raster | -28 to -72 -37 to -96 volts

\(\triangle\) Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

\(\ast, \ast, \ast\), \(\ast\): see next page.

NOV. 1, 1955
KINESCOPE

Grid-No.1 Video Drive from Raster Cutoff

(Black Level):

White-level value

(Peak positive) 28 to 72  37 to 96 volts

Focusing-Coil Current (DC) . . . . 108 ± 20%  115 ± 20% ma

Minimum Field Strength of
PM Ion-Trap Magnet . . . . . . 33  35 gausses

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

CATHODE-DRIVE® SERVICE

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

Maximum Ratings, Design-Center Values:
ULTOR-TO-GRID-No.1 VOLTAGE . . . . . . . . . . 18000 max. volts
GRID-No.2-TO-GRID-No.1 VOLTAGE . . . . . . . . . 625 max. volts
GRID-No.2-TO-CATHODE VOLTAGE . . . . . 500 max. volts
CATHODE-TO-GRID-No.1 VOLTAGE:
Positive bias value . . . . . . . . . . . . . . . . 125 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 ($E_{2g1}$) between
14000* and 18000 volts
and grid-No.2-to-grid-No.1 voltage ($E_{2g1}$) between
220 and 620 volts

Cathode-to-Grid-No.1 Voltage
for Visual Extinction of Focused Raster . . . . . 8.5% to 19.4% of $E_{2g1}$ volts

Cathode-to-Grid-No.1 Video Drive from Raster Cutoff
(Black Level):
White-level value
(Peak negative) 8.5% to 19.4% of $E_{2g1}$ 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.

** Brilliance and definition decrease with decreasing ultor voltage or ultor-to-grid-No.1 voltage. In general, the ultor voltage or the ultor-to-grid-No.1 voltage should not be less than 14000 volts.

O, **, §: See next page.

NOV. 1, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Grid-No. 2 Current ........ -15 to +15 µamp
Focusing-Coil Current (DC) \(0 \sqrt{\frac{E_{391}}{16000}} \times 108\) ± 20% ma
Ion-Trap Magnet Current (Average) ** ........ \(\sqrt{\frac{E_{391}}{16000}} \times 30\) ma
Minimum Field Strength of PM Ion-Trap Magnet § .... \(\sqrt{\frac{E_{391}}{16000}} \times 33\) gausses
Field Strength of Adjustable Centering Magnet ....... 0 to 8 gausses

Examples of Use of Design Ranges:

Withulator-to-grid-No. 1 voltage of 16000 18000 volts
and grid-No. 2-to-grid-No. 1 voltage of 300 400 volts

Cathode-to-Grid-No. 1 Voltage for Visual Extinction
of Focused Raster ........ 25 to 58 34 to 78 volts
Cathode-to-Grid-No. 1 Video Drive from Raster Cutoff
(Black Level):
White-level value
(Peak negative) 25 to 58 34 to 78 volts
Focusing-Coil Current (DC) ........ 108 ± 20% 115 ± 20% ma
Minimum Field Strength of PM Ion-Trap Magnet .... 33 35 gausses

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

For specimen focusing coil similar to JETEC Focusing Coil No. 109 positioned with air gap toward kinescope screen and center line of air gap 3 inches from Reference Line (See Dimensional Outline). The indicated current is for condition with sharp focus at center of picture area and combined grid-No. 1 voltage and video-signal voltage adjusted to produce a highlight brightness of 30 foot-lamberts measured on an Indian Head Test Pattern set for a 19-1/8" x 15" picture size.

** For JETEC Ion-Trap Magnet No. 117, or equivalent, located with the trailing edge of the pole pieces located over the gap between grid No. 1 and grid No. 2 and rotated to give maximum brightness.

§ For specimen PM ion-trap magnet, such as Heppner Model No. E437, or equivalent, located in optimum position and rotated to give maximum brightness. For a given equipment application, the tolerance range for the strength of the PM ion-trap magnet should be added to the minimum value. The maximum strength of this magnet should not exceed the specified minimum value by more than 6 gausses. This procedure will insure use of a PM ion-trap magnet allowing adequate adjustment to permit satisfactory performance without loss of highlight brightness.

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

for Type 2IAWP4 is the same as that shown for Type 2IAVP4/2IAUP4, except that the 2IAWP4 has a Small-Shell Duodecal 5-Pin Base

CURVES

for Type 2IAWP4 are the same as those shown for Type 2IALP4-A
## DATA

### General:
- **Electron Guns, Three with Axes Tilted**
  - Toward Tube Axis: Blue, Green, Red
- **Heater, for Unipotential Cathode of**
  - Each Gun, Paralleled with Each of the Other Two Heaters within Tube:
  - Voltage: 6.3 ac or dc volts
  - Current: 1.8 amp
- **Direct Interelectrode Capacitances (Approx.):**
  - Grid No. 1 of any gun to all other electrodes except the No. 1 grids of the other two guns: 7 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**: Metal-Backed, Tricolor, Phosphor-Dot
  - **Phosphor (Three separate phosphors, collectively)**: P22
  - Fluorescence and phosphorescence of separate phosphors, respectively: Blue, Green, Red
  - Persistence of group phosphorescence: Medium
  - **Dot arrangement**: Triangular group consisting of blue dot, green dot, and red dot
- **Spacing between centers of adjacent dot trios (Approx.)**: 0.029".

### Size (Minimum):
- **Greatest width**: 19-1/16"
- **Height**: 15-1/4"
- **Projected area**: 255 sq. in.

### Focusing Method: Electrostatic

### Convergence Method: Magnetic

### Deflection Method: Magnetic

### Deflection Angles (Approx.):
- **Horizontal**: 70°
- **Vertical**: 55°

### Tube Dimensions:
- **Maximum overall length**: 25-5/16"
- **Diameter:**
  - At lip: 20-9/16" ± 1/8"
  - At flange: 21-1/4" max.
- **Weight (Approx.)**: 28 lbs
- **Mounting Position**: Any
- **Ultor® Terminal**: Metal-Shell Lip
- **Base**: Small-Shell Neodisheptal 12-Pin (JETEC No. B12-131)

* See next page.
Socket ............... Alden Nos.214NM/SC (Radial leads),
214NM/NC (Axial leads), or equivalent
Basing Designation for Bottom View ............... 14W

Pin 1—Heater
Pin 2—Grid No.1 of Red Gun
Pin 3—Grid No.2 of Red Gun
Pin 4—Cathode of Red Gun
Pin 5—Cathode of Green Gun
Pin 6—Grid No.1 of Green Gun
Pin 7—Grid No.2 of Green Gun
Pin 9—Grids No.3
Pin 11—Grid No.2 of Blue Gun
Pin 12—Grid No.1 of Blue Gun
Pin 13—Cathode of Blue Gun
Pin 14—Heater

METAL-SHELL LIP:
Ultor (Grid No.4, Collector)
Green Gun

Maximum Ratings, Design-Center Values:
ULTOR*—TO—CATHODE (of each gun) VOLTAGE... 25000 max. volts
ULTOR CURRENT, (Average, each gun) ........... 500*max. µamp
GRID-No.3—TO—CATHODE (of each gun) VOLTAGE 6000 max. volts
GRID-No.2—TO—CATHODE VOLTAGE (Each gun). . 800 max. volts
GRID-No.1—TO—CATHODE VOLTAGE (Each gun):
Negative bias value............................. 400 max. volts
Positive bias value............................ 0 max. volts
Positive peak value........................... 2 max. volts
PEAK HEATER—CATHODE VOLTAGE (Each gun):
Heater negative with respect to cathode:
During equipment warm-up period not exceeding 15 seconds ....... 410 max. volts
After equipment warm-up period ......... 180 max. volts
Heater positive with respect to cathode. 180 max. volts

Equipment Design Ranges:
For ultor voltage \( E_{C4k}\) of each gun of 25000 volts
Grid-No.3 (Focusing electrode)—to—Cathode (Of each gun) Voltage. 15.2% to 21.2% of \( E_{C4k}\) volts
Grid-No.2-to-Cathode Voltage (Each gun) when circuit design utilizes grid-No.1—
to—cathode voltage \( E_{C1k} \) at fixed’ value for raster
cutoff .................. See Cutoff Design Chart

* A value of average ultor current per gun higher than 500 microamperes will increase picture brightness but may impair resolution and shorten cathode life.

* See next page.
Grid-No.1-to-Cathode Voltage (Each gun) for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2-to-cathode voltage \((E_{c2k})\) at fixed value . . . . . . See Cutoff Design Chart

Variation in Raster

Cutoff Between Guns

in Any Tube . . . . . . . \(\pm\) 21\% of average of highest and lowest cutoff values

Grid-No.3 Current for ultor current of 800 \(\mu\)amp. . . . . . . -45 to +75 \(\mu\)amp

Grid-No.2 Current (Each gun) . . . -5 to +5 \(\mu\)amp

Percentage of Total Ultor Current Supplied by Each Gun:

To produce Illuminant-C White (I.C.I. Coordinates \(x = 0.310, y = 0.316\)):

Red gun . . . . . . . . . . . . . 47 to 67 per cent
Blue gun . . . . . . . . . . . . 11 to 24 per cent
Green gun . . . . . . . . . . . 20 to 33 per cent

To produce White of 8500\(^\circ\)K + 27M.P.C.D. (I.C.I. Coordinates \(x = 0.287, y = 0.316\)):

Red gun . . . . . . . . . . . . . 42 to 60 per cent
Blue gun . . . . . . . . . . . . 12 to 27 per cent
Green gun . . . . . . . . . . . 23 to 38 per cent

Maximum Raster Shift in Any Direction from Screen Center . 1 inch

Maximum Compensation to be Provided by the Following Components:

Purifying coil or magnet . . . . . Raster shift of 1" in any direction from screen center

Converging component (Each gun):

For static convergence—

After adjustment has been made for optimum color purity and dynamic convergence . . . . . . . Shift of spot by \(\pm\) 5/8"

\* The "ultor" in a cathode-ray tube is the electrode to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection. In the 21AXP22, the ultor function is performed by grid No.4. Since grid No.4, grid No.5, and collector are connected together within the 21AXP22, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.

\(\text{\(\mu\)amp} = \text{microamps}\)

\(\text{\(\%\) = per cent}\)

\(\text{\(\pm\) = plus or minus}\)
For dynamic convergence:

Effected by mmf of approximately parabolic waveshape synchronized with scanning

**Horizontal:**
- Red spot and green spot ........... Shift of 1/4"
- Blue spot ....................... Shift of 1/2"

**Vertical:**
- Red spot and green spot ........... Shift of 3/8"
- Blue spot .......................... Shift of 1/8"

Blue-positioning magnet (Blue gun):
- After adjustment has been made for color purity and dynamic convergence ........... Shift of blue spot by ±1/2"

**Examples of Use of Design Ranges:**

For uktor voltage of 25000 volts

**Grid-No.3** (Focusing electrode) - to-Cathode (Of each gun)
- Voltage .......................... 3800 to 5300 volts

**Grid-No.2-to-Cathode Voltage**
- (Each gun) when circuit design utilizes grid-No.1-to-cathode voltage of -70 volts for raster cutoff .......................... 130 to 370 volts

**Grid-No.1-to-Cathode Voltage**
- (Each gun) for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2-to-cathode voltage of 200 volts .... -45 to -100 volts

**Limiting Circuit Values:**

**High-Voltage Circuits:**

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the uktor power supply and the grid-No.3 power supply be of the limited-energy type with inherent regulation to limit the continuous short-circuit current to 50 milliamperes. In addition, to prevent cathode damage with resultant decrease in tube life, the effective resistance between the uktor power supply output capacitor and the uktor, and the effective resistance between grid-No.3 power supply output capacitor and the grid-No.3 electrode should not be less than 50000 ohms. These resistances should be capable of withstanding the maximum instantaneous currents and voltages in their

† Indicated values apply when RCA test yoke is used with the 21AXP22.
respective circuits. It is to be noted that the effectiveness of the resistance between the ulti
power supply output capacitor and the ulti may be impaired if capacitance in ex-
cess of 750 μf is introduced between the kinescope and ground by the mounting arrangement of the kinescope.

In equipment utilizing a well-regulated ulti power supply, the grid-No.3-circuit resistance should be limited to 7.5
megohms.

Low-Voltage Circuits:

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

When the cathode of each gun is not connected directly to its associated heater, the grid-No.2-to-heater circuit, the grid-
No.1-to-heater circuit, and the cathode-to-heater circuit, should each have an impedance such that their respective power sources in combination will not supply an instantaneous or continuous short-circuit current of more than 300 milli-
amperes total. Such current limitation will prevent heater burnout in case of a momentary internal arc within the tube.

When the cathode is connected directly to the heater, the grid-No.2-to-heater circuit, and the grid-No.1-to-heater circuit should have an impedance such that their respective power sources in combination will not supply an instantaneous or continuous short-circuit current of more than 300 milli-
amperes total. Such current limitation will prevent heater burnout in case of a momentary internal arc within the tube.

X-RAY WARNING

X-ray radiation is produced by the 21AXP22 when it is operated at its normal ulti 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 ulti 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 ulti 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.
COLOR KINESCOPE

LOCATION OF BEAM-CONVERGING POLE PIECES
LOCATION OF BLUE-POSITIONING POLE PIECES

BLUE GUN
GREEN GUN
RED GUN

HORIZONTAL % OF SCREEN

PLANE THROUGH % OF PIN NO.2 AND TUBE AXIS

BASE BOTTOM VIEW

DETAIL OF LIP

EXTERNAL VIEW AT B-B'

DETAIL OF FLANGE BOSSES

CE-8399R3B

MAR. 1, 1955
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
NOTE 1: REFERENCE LINE IS DETERMINED BY POSITION WHERE A CYLINDRICAL GAUGE 2.465" ± 0.001" I.D. CONCENTRIC WITH NECK AXIS, WILL REST ON ENVELOPE FUNNEL.

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

NOTE 3: METAL SHELL AND GLASS FACE OPERATE AT HIGH VOLTAGE. ANY MATERIAL IN CONTACT WITH THE SHELL OR THE FACE MUST BE INSULATED TO WITHSTAND THE MAXIMUM APPLIED ULTOR VOLTAGE.
**TYPICAL DRIVE CHARACTERISTICS**

**CURVES** | **DRIVE** | **EC₂K**
---|---|---
--- | GRID N°1 | CATHODE | MEASURED WITH ZERO VIDEO DRIVE

**ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 25000**

**GRID-N°2-TO-CATHODE (OF EACH GUN) VOLTS = EC₂K**

**Eₙ = 6.3 VOLTS**

**ULTOR MICROAMPERES PER GUN**

**VIDEO SIGNAL VOLTS FROM ULTOR-CURRENT CUTOFF PER GUN**

---

MAR. 18, 1955  
TUBE DIVISION  
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY  
92CM-8566
TYPICAL LIGHT-OUTPUT CHARACTERISTIC

$E_c = 6.3 \text{ VOLTS}$
ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 25000
GRID-№3-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ULTOR CURRENT TO PRODUCE ILLUMINANT-C WHITE LIGHT OUTPUT PERCENTAGE OF TOTAL ULTOR CURRENT SUPPLIED BY EACH GUN TO PRODUCE ILLUMINANT-C WHITE:
- RED GUN: 57% 
- BLUE GUN: 17% 
- GREEN GUN: 26%

RASTER SIZE = 19 1/16" $\times$ 14 1/2"

MAR. 18, 1955
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-8426R2
**General:**

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

<table>
<thead>
<tr>
<th>Direct Interelectrode Capacitances:</th>
<th>6 ( \mu_f )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid No. 1 to all other electrodes.</td>
<td>5 ( \mu_f )</td>
</tr>
<tr>
<td>Cathode to all other electrodes.</td>
<td>2500 max. ( \mu_f )</td>
</tr>
<tr>
<td>External conductive coating to ultor.</td>
<td>2000 min. ( \mu_f )</td>
</tr>
</tbody>
</table>

- 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: 60°

**Electron Gun: Type requiring No Ion-Trap Magnet**

**Tube Dimensions:**
- Overall length: 18" ± 3/8"
- Greatest width: 20-1/4" ± 1/8"
- Greatest height: 16-3/8" ± 1/8"
- Diagonal: 21-3/8" ± 1/8"
- Neck length: 5-1/2" ± 3/16"
- Radius of curvature of faceplate (External surface): 33"

**Screen Dimensions (Minimum):**
- Greatest width: 19-1/16"
- Greatest height: 15-1/16"
- Diagonal: 20-1/4"
- Projected area: 262 sq. in.
- Weight (Approx.): 24 lbs
- Operating Position: Any
- Cap.: Recessed Small Cavity (JEDEC No.J1-21)
- Bulb: J171D2/E1
- Base: Small-Shell Duodecal 6-Pin, Arrangement 1 (JEDEC Group 4, No.B6-63), or Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-203)
Basing Designation for BOTTOM VIEW .............. 12L

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 Ratings, Design-Center Values:

ULTOR-TO-GRID-No.1 VOLTAGE ............ \[20000 \text{ max. volts} \]
\[12000 \text{ min. volts} \]
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 \( (E_{C5G1}) \) between 12000 and 20000 volts and grid-No.2-to-grid-No.1 voltage \( (E_{C2G1}) \) between 40 and 64 volts

Grid-No.4-to-Grid-No.1 Voltage for focus* ....... 0 to 350 volts
Cathode-to-Grid-No.1 Voltage \( (E_{Kg1}) \) for visual extinction of focused raster* .......... See Raster-Cutoff-Range Chart
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level):
White-level value \( (\text{Peak negative}) \) ........ Same value as determined for \( E_{Kg1} \) except video drive is a negative voltage

* See next page.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Grid-No.4 Current.............................. -25 to +25 μA
Grid-No.2 Current.............................. -15 to +15 μA
Field Strength of Adjustable Centering Magnet*.......................... 0 to 8 gauss

Examples of Use of Design Ranges:
With ultor-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.
- 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 2ICXP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor-to-grid-No.1 voltage is never less than 11,000 volts.
- The grid-No.4-to-grid-No.1 voltage required for focus of any individual tube 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 (Ek1) 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 2-1/2". 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

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC NO.G-116 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4".

NOTE 4: THE DRAWING SHOWS THE MINIMUM SIZE AND LOCATION OF THREE OF FOUR CONTACT AREAS OF THE EXTERNAL CONDUCTIVE COATING. IN ADDITION TO THE 2" x 2" MIN. CONTACT AREA SHOWN, A 6-1/2" x 1" MIN. CONTACT AREA IS PROVIDED IN THE VICINITY OF THE SPLICE LINE ON EACH LONG SIDE OF THE BULB AND ON AT LEAST ONE SHORT SIDE OF THE BULB AS SHOWN. THE ACTUAL AREA OF EXTERNAL CONDUCTIVE COATING WHICH CONNECTS ALL THE CONTACT AREAS WILL BE GREATER THAN THE CONTACT AREAS SO AS TO PROVIDE THE REQUIRED CAPACITANCE. 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.
$E_c = 6.3 \text{ VOLTS}$

ULTOR-TO-GRID-N\#1 VOLTS = 18000

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.
CATHODE-DRIVE CHARACTERISTICS

E:F = 6.3 VOLTS
ULTOR-TO-GRID-N21 VOlTS = 18000
GRID-N22-TO-GRID-N21 VOLTS = 50
CATHODE BIASED POSITIVE WITH RESPECT TO GRID N21 TO GIVE FOCUSED RASTER CUTOFF.
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

92CM-9904
CATHODE-DRIVE CHARACTERISTICS

E_C = 6.3 VOLTS
ULTOR-TO-GRID-NO. 1 VOLTS = 18000
GRID-NO. 2-TO-GRID-NO. 1 VOLTS = 50
CATHODE BIASED POSITIVE WITH
RESPECT TO GRID NO. 1 TO GIVE
FOCUSED RASTER CUTOFF.

Video Signal Volts from Raster Cutoff

Ultor Microamperes

High Cutoff
Low Cutoff
PICTURE TUBE

General:
Heater, for Unipotential Cathode:
Voltage .................. 6.3 ............ ac or dc volts
Current ................. 0.6 ................ amp
Warm-up time (Average) 11 ................ sec

Direct Interelectrode Capacitances:
Grid No.1 to all other electrodes ... 6 \mu F
Cathode to all other electrodes ... 5 \mu F
External conductive coating to ultor... [2500 max. \mu F]

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

Electrostatic
Deflection Method ........ Electrostatic
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" ± 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.) ............. 20 lbs

Operating Position ........... Any
Cap .................. Recessed Small Cavity (JEDEC No.J1-21)
Bulb .................. J171G1/K1
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, 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

\[
\begin{align*}
18000 & \text{ max. volts} \\
12000^* & \text{ min. volts}
\end{align*}
\]

GRID-No.4 (FOCUSING) VOLTAGE:

- Positive value: 1000 max. volts
- Negative value: 500 max. volts

GRID-No.2 VOLTAGE: 500 max. volts

GRID-No.1 VOLTAGE:

- Negative-peak value: 200 max. volts
- Negative-bias value: 140 max. volts
- Positive-bias value: 0 max. volts
- Positive-peak value: 2 max. volts

PEAK HEATER-CATHODE VOLTAGE:

- Heater negative with respect to cathode:
  - During equipment warm-up period not exceeding 15 seconds: 410 max. volts
  - After equipment warm-up period: 180 max. volts
- Heater positive with respect to cathode: 180 max. volts

Equipment Design Ranges:

With any ultor voltage \((E_{c4k})\) between 12000\(^*\) and 18000 volts and grid-No.2 voltage \((E_{c2k})\) between 200 and 500 volts

Grid-No.4 Voltage for focus\(^*\): 0 to 400 volts

Grid-No.1 Voltage \((E_{c1k})\) for visual extinction of focused raster. See Raster-Cutoff-Range Chart for Grid-Drive Service

Grid No.1 Video Drive
From Raster Cutoff (Black Level):
- White-level value
- (Peak positive): Same value as determined for \(E_{c1k}\) except video drive is a positive voltage

\*\*: See next page.
**2IEP4-A**

**KINESCOPE**

**RECTANGULAR GLASS TYPE**

**MAGNETIC FOCUS**

**MAGNETIC DEFLECTION**

---

**DATA**

**General:**

Heater, for Unpotential Cathode:

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

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*: \(750 \text{ max. } \mu\text{f}\)
- \(500 \text{ min. } \mu\text{f}\)

Faceplate, Cylindrical: Filterglass

Light transmission (Approx.): 71%

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

- Fluorescence: White
- Phosphorescence: White
- Persistence: Short

Focusing Method: Magnetic

Deflection Method: Magnetic

Deflection Angles (Approx.):

- Diagonal: 70°
- Horizontal: 65°
- Vertical: 50°

Ion-Trap Gun: Requires External Single-Field Magnet

**Tube Dimensions:**

- **Overall length**: 23” \(\pm 3/8”\)
- **Greatest width**: 20-1/4” \(\pm 1/8”\)
- **Greatest height**: 15-9/16” \(\pm 1/8”\)
- **Diagonal**: 21-7/32” \(\pm 1/8”\)

**Screen Dimensions (Minimum):**

- **Greatest width**: 19-1/8”
- **Greatest height**: 13-7/8”
- **Diagonal**: 20-1/16”
- **Projected area**: 238 sq. in.

**Weight (Approx.):** 29 lbs

**Mounting Position:** Any

**Cap:** Recessed Small Cavity (JETEC No.1J-21)

**Bulb:** J170

**Base:** Small-Shell Duodecal 5-Pin (JETEC No.8S-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

---

*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 2IEP4-A, the ultor function is performed by grid No.3. Since grid No.3 and collector are connected together within the 2IEP4-A, they are collectively referred to simply as "ultor* for convenience in presenting data and curves.*

---

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

---

**NOV. 1, 1955**

**TUBE DIVISION**

**DATA 1**

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

Equipment Design Ranges:

For any ultor voltage \( E_{c2} \) between 14000 volts and 18000 volts
and grid-No.2 voltage \( E_{c2} \) between 200 and 500 volts

Grid-No.1 Voltage for
Visual Extinction of
Focused Raster: ................... -9.3% to -24% of \( E_{c2} \) volts
Grid-No.2 Current: ................ -15 to +15 \( \mu \)amp

Focusing-Coil Current (DC)\(^{oo}\): \( \sqrt{\frac{E_{c2}}{16000}} \times 110 \) \( \pm 20\% \) ma

Ion-Trap Magnet Current (Average)\(^{oo}\): \( \sqrt{\frac{E_{c2}}{16000}} \times 30 \) ma

Minimum Field Strength of
PM Ion-Trap Magnet\(^{\S}\): \( \sqrt{\frac{E_{c2}}{16000}} \times 33 \) gausses

Field Strength of Adjustable Centering Magnet: ........ 0 to 8 gausses

Examples of Use of Design Ranges:

For ultor voltage of 14000 volts
and grid-No.2 voltage of 300 volts

Grid-No.1 Voltage for
Visual Extinction of
Focused Raster: ................... -28 to -72 -28 to -72 volts
Focusing-Coil Current (DC): 103 \( \pm 20\% \) 110 \( \pm 20\% \) ma

Minimum Field Strength of
PM Ion-Trap Magnet: ........ 31 33 gausses

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 14000 volts.

\** For JETEC Ion-Trap Magnet No.117, or equivalent, located with the
  trailing edge of the pole pieces located over the gap between grid No.1
  and grid No.2 and rotated to give maximum brightness.

\(oo\),\(\S\): See next page.  \(\rightarrow\) indicates a change.

NOV. 1, 1955
For specimen focusing coil similar to JETEC Focusing Coil No. 109 positioned with air gap toward kinescope screen and center line of air gap 3 inches from Reference Line (See Dimensional Outline). The indicated current is for condition with sharp focus at center of picture area and combined grid-No. 1 voltage and video-signal voltage adjusted to produce a highlight brightness of 30 foot-lamberts measured on an Indian Head Test Pattern set for a 19-1/8" x 13-7/8" picture size.

§ For specimen PM ion-trap magnet, such as Heppner Model No. E437, or equivalent, located in optimum position and rotated to give maximum brightness. For a given equipment application, the tolerance range for the strength of the PM ion-trap magnet should be added to the minimum value. The maximum strength of this magnet should not exceed the specified minimum value by more than 6 gausses. This procedure will insure use of a PM ion-trap magnet allowing adequate adjustment to permit satisfactory performance without loss of highlight brightness.

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

AVERAGE GRID-DRIVE CHARACTERISTICS for Type 2IEP4-A are the same as those shown for Type 2IAVP4/2IAUP4
NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No. 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 30°. ULTOR TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION No.6.

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

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


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.
The 21EP4-B is the same as the 21EP4-A except for the following item:
Phosphor (for curves, see front of this section). P4—Sulfide Type Aluminized

**HIGHLIGHT BRIGHTNESS vs DRIVE CURVES**
for Type 21EP4-B are the same as those shown for Type 21ALP4-A

---

**21EP4-B**
KINESCOPE

<table>
<thead>
<tr>
<th>RECTANGULAR GLASS TYPE</th>
<th>ALUMINIZED SCREEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAGNETIC FOCUS</td>
<td>MAGNETIC DEFLECTION</td>
</tr>
</tbody>
</table>

NOV. 1, 1955  
TUBE DIVISION  
RADIO CORPORATION OF AMERICA, MELROSE, NEW JERSEY
The 21FP4-A is the same as the 21FP4-C except that it utilizes a non-aluminized phosphor and has a light output as shown by the curves on the back of this sheet.
AVERAGE GRID-DRIVE CHARACTERISTICS

$E_f = 6.3$ 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" x 13\(\frac{1}{2}\)"

![Graph showing video signal volts from raster cutoff versus highlight brightness in foot-lamberts.](image)
**KINESCOPE**

**DATA**

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

Direct Interelectrode Capacitances:
- Grid No.1 to all other electrodes: 6 μμf
- Cathode to all other electrodes: 5 μμf
- External conductive coating to ultor: 750 max. μμf
- 500 min. μμf

Faceplate, Cylindrical: Filterglass
Light transmission (Approx.): 71%
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: 70°
- Horizontal: 65°
- Vertical: 50°

Ion-Trap Gun: Requires External Single-Field Magnet

**Tube Dimensions:**
- Overall length: 23" ± 3/8"
- Greatest width: 20-1/4" ± 1/8"
- Greatest height: 15-9/16" ± 1/8"
- Diagonal: 21-7/32" ± 1/8"
- Neck length: 7-15/32" ± 3/16"

**Screen Dimensions (Minimum):**
- Greatest width: 19-1/8"
- Greatest height: 13-7/8"
- Diagonal: 20-1/16"
- Projected area: 238 sq.in.
- Weight (Approx.): 29 lbs
- Mounting Position: Any
- Cap: Recessed Small Cavity (JETEC No.J1-21)
- Bulb: J-170
- Base: Small-Shell Duodecal 6-Pin (JETEC No.B6-63)
- Basing Designation for BOTTOM VIEW: 12L

**Pinouts:**
- 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
- Grid No.5

**C - External**
- Conductive Coating
### Maximum Ratings, Design-Center Values:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Voltage Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR VOLTAGE</td>
<td>18000 max. volts</td>
</tr>
<tr>
<td>GRID-No.4 VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>1000 max. volts</td>
</tr>
<tr>
<td>Negative value</td>
<td>500 max. volts</td>
</tr>
<tr>
<td>GRID-No.2 VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>500 max. volts</td>
</tr>
<tr>
<td>GRID-No.1 VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2 max. volts</td>
</tr>
<tr>
<td>PEAK HEATER–CATHODE VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode:</td>
<td></td>
</tr>
<tr>
<td>During equipment warm-up period not exceeding 15 seconds</td>
<td>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 ($E_{c5}$) between 14000* and 18000 volts and grid-No.2 voltage ($E_{c2}$) between 200 and 500 volts

- **Grid-No.4 Voltage for**
  - Focus with Ultor Current of 100 μamp: -0.4% to +2.2% of $E_{c5}$ volts
- **Grid-No.1 Voltage for**
  - Visual Extinction of Focused Raster: -9.3% to -24% of $E_{c2}$ volts
- **Grid-No.1 Video Drive from**
  - Raster Cutoff (Black Level):
    - White-level value (Peak positive) 9.3% to 24% of $E_{c2}$ volts
- **Grid-No.4 Current** -25 to +25 μamp
- **Grid-No.2 Current** -15 to +15 μamp
- **Ion-Trap Magnet Current (Average)**
  - $\sqrt{\frac{E_{c5}}{16000}} \times 30$ ma
- **Minimum Field Strength of PM Ion-Trap Magnet**
  - $\sqrt{\frac{E_{c5}}{16000}} \times 33$ gausses
- **Field Strength of Adjustable Centering Magnet**
  - 0 to 8 gausses

*# Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 14000 volts.

**For JETEC Ion-Trap Magnet No.117, or equivalent, located with the trailing edge of the pole pieces located over the gap between grid No.1 and grid No.2 and rotated to give maximum brightness.*

§ For specimen PM ion-trap magnet, such as Heppner Model No.EM37, or equivalent, located in optimum position and rotated to give maximum brightness. For a given equipment application, the tolerance range for the strength of the PM ion-trap magnet should be added to the minimum value. The maximum strength of this magnet should not exceed the specified minimum value by more than 6 gausses. This procedure will insure use of a PM ion-trap magnet allowing adequate adjustment to permit satisfactory performance without loss of highlight brightness.
## Examples of Use of Design Ranges:

<table>
<thead>
<tr>
<th>With ultor voltage of</th>
<th>14000</th>
<th>16000</th>
<th>volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>and grid-No.2 voltage of</td>
<td>300</td>
<td>300</td>
<td>volts</td>
</tr>
</tbody>
</table>

Grid-No.4 Voltage for
- Focus with Ultor
  - Current of 100 μamp: -55 to +300 -65 to +350 volts

Grid-No.1 Voltage for
- Visual Extinction of
  - Focused Raster: -28 to -72 -28 to -72 volts
- Video Drive from Raster Cutoff
  - (Black Level):
    - White-level value
      - (Peak positive): 28 to 72 28 to 72 volts
    - Minimum Field Strength of
      - PM Ion-Trap Magnet: 31 33 gauss

### 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*

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

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


NOTE 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 GRID-DRIVE CHARACTERISTICS

- \( E_f = 6.3 \text{ VOLTS} \)
- ULTOR VOLTS = 16000
- GRID No. 1 BIAS ED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF
- RASTER FOCUSED AT AVERAGE BRIGHTNESS
- RASTER SIZE = 18" x 13 1/2"

Tube Division
Radio Corporation of America, Harrison, New Jersey
92CM-8868
E_r = 6.3 Volts
ULTOR VOLTS = 14000 to 18000
GRID NO. 1 BIAS ED NEGATIVE WITH
RESPECT TO CATHODE TO GIVE
FOCUSED RASTER CUTOFF

ULTOR MILLIAMPERES

VIDEO SIGNAL VOLTS FROM RASTER CUTOFF

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-8920
## RCA

### 21MP4 KINESCOPE

**Rectangular Metal-Shell Type**

**Low-Voltage Focus**

**Magnetic Deflection**

### DATA

#### General:

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

- **Direct Interelectrode Capacitances:**
  - Grid No.1 to All Other Electrodes: 6 μuf
  - Cathode to All Other Electrodes: 5 μuf

- **Faceplate, Spherical:** Frosted Filterglass

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

- **Focusing Method:** Electrostatic

- **Deflection Method:** Magnetic

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

- **Ion-Trap Gun:** Requires External, Single-Field Magnet

#### Tube Dimensions:

- **Maximum Overall Length:** 22-5/8"
- **Greatest Diagonal:** 20-3/4" ± 1/4"
- **Greatest Width:** 19-23/32" ± 1/8"
- **Greatest Height:** 15-5/16" ± 1/8"

#### Screen Dimensions:

- **Greatest Width:** 18-3/8"
- **Greatest Height:** 14"
- **Diagonal:** 19-3/8"

- **Weight (Approx.):** 18 lbs

- **Mounting Position:** Any

- **Ultor® Terminal:** Metal-Shell Lip

- **Base:** Small-Shell Duodecal 6-Pin (JETEC No.B6-63)

#### Pin Configuration:

- **Pin 1—Heater**
- **Pin 2—Grid No.1**
- **Pin 6—Grid No.4**
- **Pin 10—Grid No.2**
- **Pin 11—Cathode**

- **Pin 12—Heater**
- **Pin 13—Metal-Shell Lip**
- **Pin 14—Grid No.3**
- **Pin 15—Grid No.5**
- **Pin 16—Collector**

### Maximum Ratings, Design-Center Values:

- **ULTOR® VOLTAGE:** 16000 max. volts

In the 21MP4, grid No.5 which has the ultior function, grid No.3, and collector are connected together within the tube and are conveniently referred to collectively as "ultior." The "ultior" 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.

**MAY 1, 1952**

**TENTATIVE DATA**

**RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY**
GRID-No.4 VOLTAGE:
- Positive value: 1000 max. volts
- Negative value*: 500 max. volts

GRID-No.2 VOLTAGE: 500 max. volts

GRID-No.1 VOLTAGE:
- Negative 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

Equipment Design Ranges:
For any ultor voltage \( (E_u) \) between 14000\(^\text{±}\) and 16000 volts and grid-No.2 voltage \( (E_c^2) \) between 150 and 500 volts

Grid-No.4 Voltage for Focus
- with Ultron Current of
  - 100 \( \mu \)amp: \(-0.4\% \) to \(+2.2\%\) of \( E_u \) volts

Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot:
- 11\% to 25.7\% of \( E_c^2 \) volts

Grid-No.4 Current: -25 to +25 \( \mu \)amp
Grid-No.2 Current: -15 to +15 \( \mu \)amp

Field Strength of Single-Field Ion-Trap Magnet (Approx.):
\[ \sqrt{\frac{E_u}{14000 \times 45}} \text{ gausses} \]

Field Strength of Adjustable Centering Magnet:
- 0 to 8 gausses

Examples of Use of Design Ranges:
For ultor voltage of...

- 14000 16000 volts
- 300 300 volts

Grid-No.4 Voltage for Focus
- with Ultron Current of
  - 100 \( \mu \)amp: -55 to +300 -65 to +350 volts

Grid-No.1 Voltage\(\dagger\):
- -33 to -77 -33 to -77 volts

Ion-Trap Magnet (Rated Strength):
- 45 50 gausses

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

* This value has been specified to take care of the condition where an ac voltage is provided for dynamic focusing.

# Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 14000 volts.

\(\dagger\) For visual extinction of undeflected focused spot.

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

MAY 1, 1952

TENTATIVE DATA

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
$E_F = 8.3$ VOLTS
ULTOR (GRIDS - N$\#3$ & N$\#5$ AND COLLECTOR) VOLTS = 16000
GRID - N$\#4$ VOLTS ADJUSTED TO GIVE FOCUS AT AVERAGE RASTER BRIGHTNESS
GRID N$\#1$ BIASED TO CUTOFF OF UN-DEFLECTED FOCUSED SPOT
Raster size = 18" x 13 1/2"

NOV. 29, 1951  Tube Department  Radio Corporation of America, Harrison, New Jersey  92CM-7713
NOTE 1: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC NO. 110 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 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 3-1/4".

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 VOLTAGE.


NOTE 5: SUPPORT TUBE IN LIP REGION ONLY AT CORNERS WITHIN THIS SPACE.
AVerage Grid-Drive Characteristics

$E_F = 6.3 \text{ Volts}$

Ultor (Grinds - No. 3 & No. 5 and Collector) Volts = 14000 to 16000

Grid No. 1 Biased to Cutoff of Undelected Focused Spot

 Ultor Milliamperes

Video Signal Volts from Cutoff

Nov. 29, 1951
Tube Department
Radio Corporation of America, Harrison, New Jersey
2IWP4, 2IWP4-A
PICTURE TUBES
RECTANGULAR GLASS TYPES
MAGNETIC FOCUS MAGNETIC DEFLECTION

DATA

General:
Heater, for Unipotential Cathode:
Voltage: 6.3 ac or dc volts
Current: 0.6 ± 10% amp
Capacitance between External Conductive
Coating and Ultor: 750 max. µf
Faceplate, Spherical: 500 min. µf
Phosphor (For curves, see front of this Section), P4—Sulfide Type
Aluminized Tube

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 Duodec 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

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

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
# 21XP4-A Picture Tube

**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 Ultor:**
  - 2500 max. μuf
  - 2000 min. μuf
- **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

### 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
- Grid No.5

### C-External
- Conductive Coating

### Maximum Ratings, Design-Center Values:
- **ULTOR VOLTAGE:** 18000 max. volts
- **GRID-No.4 (FOCUSING) VOLTAGE:**
  - Positive value: 1000 max. volts
  - Negative value: 500 max. volts
- **GRID-No.2 VOLTAGE:** 500 max. volts
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

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
KINESCOPE
RECTANGULAR GLASS TYPE

LOW-VOLTAGE FOCUS MAGNETIC DEFLECTION

General:
Heater, for Unipotential Cathode:
Voltage .................. 6.3 ............ ac or dc volts
Current .................. 0.6 ............ amp
Direct Interelectrode Capacitances:
Grid No. 1 to all other electrodes 6 \( \mu f \)
Cathode to all other electrodes 5 \( \mu f \)
External conductive coating to ultor 750 max. \( \mu f \)
[500 min. \( \mu f \)]

Faceplate, Spherical ....................... Filterglass
Light Transmission (Approx.) .................. 75% 
Phosphor (For curves, see front of this Section) ., P4—Sulfide Type
Fluoresence .......................... White
Phosphorescence .......................... White
Persistence .......................... Short
Focusing Method ......................... Electrostatic
Deflection Method ........................ Magnetic
Deflection Angles (Approx.):
Diagonal .......................... 70°
Horizontal .......................... 65°
Vertical .......................... 50°
Ion-Trap Gun ........................ Requires External Single-Field Magnet

Tube Dimensions:
Overall length .................. 23-1/32" \( \pm \) 3/8" 
Greatest width .................. 20-1/4" \( \pm \) 1/8" 
Greatest height .................. 15-9/16" \( \pm \) 1/8" 
Diagonal .................. 21-7/32" \( \pm \) 1/8" 

Screen Dimensions (Minimum):
Greatest width .................. 19-1/8" 
Greatest height .................. 14-3/16" 
Diagonal .................. 20-1/8" 
Projected area .................. 245 sq. in.

Weight (Approx.) .................. 24 lbs

Mounting Position .................. Any

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

Bulb .......................... J170

Base .......................... Small-Shell Duodecal 6-Pin (JETEC No. B6-63)

BOTTOM VIEW

Pin 1—Heater
Pin 2—Grid No. 1
Pin 6—Grid No. 4
Pin 10—Grid No. 2
Pin 11—Cathode
Pin 12—Heater

Cap—Ultor
( GRID No. 3,
GRID No. 5,
Collector)

C—External
Conductive
Coating

\( ^0 \) 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 power to its deflection. In the 21YP4, the ultor function is performed by grid No. 5. Since grid No. 5, grid No. 3, and collector are connected together within the 21YP4, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.
GRID-DRIVE SERVICE

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

Maximum Ratings, Design-Center Values:

ULTOR VOLTAGE ........................................ 18000 max. volts
GRID-No.4 VOLTAGE:
  Positive value ........................................ 1000 max. volts
  Negative value ...................................... 500 max. volts
GRID-No.2 VOLTAGE .................................... 500 max. volts
GRID-No.1 VOLTAGE:
  Negative 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

Equipment Design Ranges:

With any ultor voltage \( (E_{CK}) \) between 14000* and 18000 volts and grid-No.2 voltage \( (E_{C2k}) \) between 200 and 500 volts

Grid-No.4 Voltage for Focus with Ultor
  Current of 100 \( \mu \text{amp} \) .... -0.4% to +2.2% of \( E_{CK} \) volts

Grid-No.1 Voltage for Visual Extinction of Focused Raster .... -9.3% to -24% of \( E_{C2k} \) volts

Grid-No.1 Video Drive from Raster Cutoff
  (Black Level):
    White-level value
      (Peak positive) . 9.3% to 24% of \( E_{C2k} \) volts

Grid-No.4 Current .... -25 to +25 \( \mu \text{amp} \)
Grid-No.2 Current .... -15 to +15 \( \mu \text{amp} \)

Field Strength of Single-Field Ion-Trap Magnet (Approx.) \( \sqrt{\frac{E_{CK}}{14000}} \times 40 \) gausses

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.

AUG. 16, 1954  TUBE DIVISION  TENTATIVE DATA 1
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Examples of Use of Design Ranges:

With ulti voltage of 16000 to 18000 volts and grid-No. 2 voltage of 300 to 300 volts

Grid-No. 4 Voltage for Focus with ulti
Current of 100 µamp .. -65 to +350 -70 to +395 volts

Grid-No. 1 Voltage for Visual Extinction of Focused Raster .. -28 to -72 -28 to -72 volts

Grid-No. 1 Video Drive from Raster Cutoff
(Black Level):
White-level value
(Peak positive) .. 28 to 72 28 to 72 volts

Field Strength of Ion-Trap Magnet .. 43 45 gausses

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

CATHODE-DRIVE® SERVICE

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

Maximum 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 .. 625 max. volts
GRID-No. 2-TO-CATHODE VOLTAGE .. 500 max. volts
CATHODE-TO-GRID-No. 1 VOLTAGE:
Positive bias value ............... 125 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

* 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 has been specified to take care of the condition where an ac voltage is provided for dynamic focusing.

*: See next page.
Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage \( (E_{CG1}) \) between 14000 and 18000 volts and grid-No.2-to-grid-No.1 voltage \( (E_{CG2}) \) between 220 and 620 volts

Grid-No.4-to-Grid-No.1 Voltage for Focus with Ultor
Current of 100 μamp . . . . . . . 0% to +2.6% of \( E_{CG1} \) volts

Cathode-to-Grid-No.1 Voltage for Visual Extinction of Focused Raster . . . . . . . 8.5% to 19.4% of \( E_{CG1} \) volts

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

White-level value
(Peak negative) . . . . . . . 8.5% to 19.4% of \( E_{CG2} \) volts

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

Grid-No.2 Current . . . . . . . -15 to +15 μamp

Field Strength of Single-Field Ion-Trap Magnet (Approx.) . \( \sqrt{E_{CG1}} \times 40 \) gausses

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 to 18000 volts and grid-No.2-to-grid-No.1 voltage of 300 to 300 volts

Grid-No.4-to-Grid-No.1 Voltage for Focus with Ultor Current of 100 μamp . . . . . . . 0 to 415 0 to 470 volts

Cathode-to-Grid-No.1 Voltage for Visual Extinction of Focused Raster . . . . . . . 25 to 58 25 to 58 volts

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

White-level value
(Peak negative) . . . . . . . 25 to 58 25 to 58 volts

Field Strength of Ion-Trap Magnet . . . . . . . 43 45 gausses

Maximum Circuit Values:

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

*Brilliance and definition decrease with decreasing ultor voltage or ultor-to-grid-No.1 voltage. In general, the ultor voltage or the ultor-to-grid-No.1 voltage should not be less than 14000 volts.

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

AUG. 16, 1954

TENTATIVE DATA 2
# AVERAGE DRIVE CHARACTERISTICS

<table>
<thead>
<tr>
<th>CATHODE-DRIVE SERVICE</th>
<th>GRID-DRIVE SERVICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E_C = 6.3$ VOLTS</td>
<td>$E_C = 6.3$ VOLTS</td>
</tr>
<tr>
<td>ULTOR-TO-GRID-N® VOLTS = 16000</td>
<td>ULTOR VOLTS = 16000</td>
</tr>
<tr>
<td>CATHODE BIASED POSITIVE WITH RESPECT TO GRID N® TO GIVE FOCUSED RASTER CUTOFF</td>
<td>GRID N® 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; $\times$ 13½&quot;</td>
<td>RASTER SIZE = 18&quot; $\times$ 13½&quot;</td>
</tr>
</tbody>
</table>

![Graph showing video signal volts from raster cutoff vs. highlight brightness-foot-lamberts for cathode and grid drive.]

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No.110 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC1 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: SEAL BULGE MAY PROTRUDE NOT MORE THAN 1/8" BEYOND MAXIMUM INDICATED VALUE FOR ENVELOPE WIDTH, DIAGONAL, OR HEIGHT.
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-N81 VOLTS = 14000 TO 18000</td>
<td>ULTOR VOLTS = 14000 TO 18000</td>
</tr>
<tr>
<td>CATHODE BIASED POSITIVE WITH RESPECT TO GRID N81 TO GIVE FOCUSED RASTER CUTOFF</td>
<td>GRID N81 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF</td>
</tr>
</tbody>
</table>

---

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

---

AUG. 9, 1954

TUBE DIVISION

RADIO CORPORATION OF AMERICA, MARRION, NEW JERSEY

92CM-8224R1
The 21YP4-A is like the 21YP4 except that it has a metal-backed screen and greater light output as shown by the curves on the back of this page.
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE
- GRID-DRIVE SERVICE
E_C = 6.3 VOLTS
ULTOR-VOLTAGE = 18000
CATHODE I-BASED POSITIVE
- RESPECT TO CATHODE TO GIVE
- FOCUSED RASTER CUTOFF
- RASTER FOCUSED AT AVERAGE
- BRIGHTNESS
RASTER SIZE = 10" x 13 1/2"

- CATHODE DRIVE
- GRID DRIVE

HIGHLIGHT BRIGHTNESS - FOOT-LAMBERTS
0 20 40 60 80
VIDEO SIGNAL VOLTS FROM RASTER CUTOFF
AUG. 5, 1954
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-8367
**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: 750 max. μf

Faceplate, Spherical: Filterglass
Light Transmission (Approx.): 75%

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

Focusing Method: Magnetic
Deflection Method: Magnetic

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

Ion-Trap Gun: Requires External Single-Field Magnet

**Tube Dimensions:**
- Overall length: 23-1/32" ± 3/8"
- Greatest width: 20-1/4" ± 1/8"
- Greatest height: 15-9/16" ± 1/8"
- Diagonal: 21-7/32" ± 1/8"

**Screen Dimensions (Minimum):**
- Greatest width: 19-1/8"
- Greatest height: 14-3/16"
- Diagonal: 20-1/8"
- Projected area: 245 sq in
- Weight (Approx.): 24 lbs

**Mounting Position:** Any
**Cap:** Recessed Small Cavity (JETEC No.1J-21)
**Bulb:** J170
**Base:** Small-Shell Duodecal 5-Pin (JETEC No.B5-57)

**Bottom View:**
- Pin 1—Heater
- Pin 2—Grid No.1
- Pin 10—Grid No.2
- Pin 11—Cathode
- Pin 12—Heater
- Cap—Ultror (Grid No.3, Collector)
- C—External Conductive Coating

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 21ZP4-A, the ultor function is performed by grid No.3. Since grid No.3 and collector are connected together within the 21ZP4-A, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.

AUG. 16, 1954
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>Description</th>
<th>Voltage Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTOR VOLTAGE</td>
<td>18000 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 bias value</td>
<td>125 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>410 max. volts</td>
</tr>
<tr>
<td>cathode:</td>
<td></td>
</tr>
<tr>
<td>During equipment warm-up period</td>
<td></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 (EC1k) between 14000° and 18000 volts and grid-No.2 voltage (EC2k) between 200 and 500 volts

Grid-No.1 Voltage for Visual Extinction of Focused Raster: -9.3% to -24% of EC2k volts

Grid-No.1 Video Drive from Raster Cutoff (Black Level):

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>White-level value</td>
<td>9.3% to 24% of EC2k</td>
</tr>
<tr>
<td>(Peak positive)</td>
<td>-15 to +15 μamp</td>
</tr>
</tbody>
</table>

Focusing-Coil Current (DC): \( \sqrt{\frac{EC3k}{14000}} \times 104 \pm 10\% \) mA

Field Strength of Single-Field Ion-Trap Magnet (Approx.): \( \sqrt{\frac{EC3k}{14000}} \times 42 \) gausses

Field Strength of Adjustable Centering Magnet: 0 to 8 gausses

**Examples of Use of Design Ranges:**

With ultor voltage of 16000 18000 volts and grid-No.2 voltage of 300 300 volts

Grid-No.1 Voltage for Visual Extinction of Focused Raster: -28 to -72 -28 to -72 volts

* Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

*°: See next page.
Grid-No.1 Video Drive from Raster Cutoff

(Black Level):
White-level value
(Peak positive) 28 to 72 28 to 72 volts

Focusing-Coil Current (DC) . . . . . . . . 110 ± 10% 118 ± 10% ma

Field Strength of Ion-Trap Magnet . . . . . . 45 48 gaussess

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.2-TO-GRID-No.1 VOLTAGE . . . . . . . 625 max. volts
GRID-No.2-TO-CATHODE VOLTAGE . . . . . . . . 500 max. volts
CATHODE-TO-GRID-No.1 VOLTAGE:
Positive bias value . . . . . . . . . . . . . . 125 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 ($E_{c3g1}$) between 14000* and 18000 volts
and grid-No.2-to-grid-No.1 voltage ($E_{c2g1}$) between 220 and 620 volts

Cathode-to-Grid-No.1 Voltage
for Visual Extinction of Focused Raster . . . . . 8.5% to 19.4% of $E_{c2g1}$ volts

Cathode-to-Grid-No.1 Video Drive from Raster Cutoff
(Black Level):
White-level value
(Peak negative) 8.5% to 19.4% of $E_{c2g1}$ 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.

Brilliance and definition decrease with decreasing ultor voltage or ultor-to-grid-No.1 voltage. In general, the ultor voltage or the ultor-to-grid-No.1 voltage should not be less than 14000 volts.

*: See next page.

AUG. 16, 1954 TUBE DIVISION TENTATIVE DATA 2
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Grid-No.2 Current ........... -15 to +15 μamp

Focusing-Coil Current (DC)* \[ \sqrt{\frac{E_c}{14000 \times 104}} \] \( \pm 10\% \)

Field Strength of Single-Field Ion-Trap Magnet (Approx.) \( \sqrt{\frac{E_c}{14000 \times 42}} \) gausses

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 300 300 volts

Cathode-to-Grid-No.1 Voltage for Visual Extinction of Focused Raster ........ 25 to 58 25 to 58 volts

Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level):
White-level value (Peak negative) 25 to 58 25 to 58 volts

Focusing-Coil Current (DC) .... 110 ± 10% 118 ± 10% ma
Field Strength of Ion-Trap Magnet ........... 45 48 gausses

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

* For specimen focusing coil similar to JETEC Focusing Coil No.109 positioned with air gap toward kinescope screen and center line of air gap 3 inches from Reference Line (See Dimensional Outline). The indicated current is for condition with combined grid-No.1 bias voltage and video signal voltage adjusted to produce a highlight brightness of 30 foot-lamberts on a 19-1/8' x 14-3/16' picture area sharply focused at center of screen.

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

Ultor current vs Drive Curves are the same as shown for Type 21YP4
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE

- $E_c = 6.3$ Volts
- ULTOR-TO-GRID-NR 1 VOLTS = 16000
- CATHODE BIASED POSITIVE WITH RESPECT TO GRID NR 1 TO GIVE FOCUSED RASTER CUTOFF
- RASTER FOCUSED AT AVERAGE BRIGHTNESS
- RASTER SIZE = 18" x 13 1/2"

GRID-DRIVE SERVICE

- $E_c = 6.3$ Volts
- ULTOR VOLTS = 16000
- GRID NR 1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF
- RASTER FOCUSED AT AVERAGE BRIGHTNESS
- RASTER SIZE = 18" x 13 1/2"

---

- CATHODE DRIVE
- GRID DRIVE

---

VIDEO SIGNAL VOLTS FROM RASTER CUTOFF

---

AUG. 9, 1954

TUBE DIVISION

RADIO CORPORATION OF AMERICA, MARIPOSA, NEW JERSEY

92CM-8391

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC NO. 110 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC1 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: SEAL BULGE MAY PROTRUDE NOT MORE THAN 1/8" BEYOND MAXIMUM INDICATED VALUE FOR ENVELOPE WIDTH, DIAGONAL, OR HEIGHT.
The 21ZP4-B is like the 21ZP4-A except that it has a metal-backed screen and greater light output as shown by the curves on the back of this page.
### Average Drive Characteristics

<table>
<thead>
<tr>
<th>Cathode-Drive Service</th>
<th>Grid-Drive Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>E&lt;sub&gt;c&lt;/sub&gt; = 6.3 VOLTS</td>
<td>E&lt;sub&gt;c&lt;/sub&gt; = 6.3 VOLTS</td>
</tr>
<tr>
<td>ULTOR-TO-GRID-N&lt;sup&gt;®&lt;/sup&gt; VOLTS = 16000</td>
<td>ULTOR VOLTS = 16000</td>
</tr>
<tr>
<td>Cathode biased positive with respect to Grid N&lt;sup&gt;®&lt;/sup&gt; to give focused raster cutoff</td>
<td>Grid N&lt;sup&gt;®&lt;/sup&gt; 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 13½&quot;</td>
<td>Raster size 18&quot; x 13½&quot;</td>
</tr>
</tbody>
</table>

![Graph showing video signal volts from raster cutoff vs. highlight brightness-foots-lamberts for cathode and grid drive](attachment:image.png)
## DATA

**General:**

Heater, for Unipotential Cathode:

<table>
<thead>
<tr>
<th>Voltage</th>
<th>6.3</th>
<th>ac or dc volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>0.6 ± 5%</td>
<td>amp</td>
</tr>
<tr>
<td>Warm-up time (Average)</td>
<td>11 sec</td>
<td></td>
</tr>
</tbody>
</table>

*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:

<table>
<thead>
<tr>
<th>Capacitance</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid No. 1 to all other electrodes</td>
<td>6 μf</td>
</tr>
<tr>
<td>Cathode to all other electrodes</td>
<td>5 μf</td>
</tr>
<tr>
<td>External conductive coating to electron tubes</td>
<td>(2500 max.)</td>
</tr>
<tr>
<td></td>
<td>(1700 min.)</td>
</tr>
</tbody>
</table>

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:**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall length</td>
<td>18-1/8&quot; ± 3/8&quot;</td>
</tr>
<tr>
<td>Greatest width</td>
<td>22-11/16&quot; ± 1/8&quot;</td>
</tr>
<tr>
<td>Greatest height</td>
<td>18-7/16&quot; ± 1/8&quot;</td>
</tr>
<tr>
<td>Diagonal</td>
<td>24&quot; ± 1/8&quot;</td>
</tr>
<tr>
<td>Neck length</td>
<td>4-1/2&quot; ± 3/16&quot;</td>
</tr>
<tr>
<td>Radius of curvature of faceplate</td>
<td>40&quot;</td>
</tr>
</tbody>
</table>

**Screen Dimensions (Minimum):**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greatest width</td>
<td>21-7/16&quot;</td>
</tr>
<tr>
<td>Greatest height</td>
<td>16-7/8&quot;</td>
</tr>
<tr>
<td>Diagonal</td>
<td>22-13/16&quot;</td>
</tr>
<tr>
<td>Projected area</td>
<td>332 sq. in.</td>
</tr>
<tr>
<td>Weight (Approx.)</td>
<td>32-1/2 lbs</td>
</tr>
<tr>
<td>Operating Position</td>
<td>Any</td>
</tr>
</tbody>
</table>

**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  
 Short Small-Shell Duodecal 6-Pin, Arrangement 1 (JEDEC Group 4, No. B6-63)
**PICTURE TUBE**

Basing Designation for BOTTOM VIEW ............... 12L

- Pin 1 – Heater
- Pin 2 – Grid No. 1
- Pin 6 – Grid No. 4
- Pin 10 – Grid No. 2
- Pin 11 – Cathode
- Pin 12 – Heater

**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 (FOCUSBING) VOLTAGE:**
  - Positive value: 1000 max. volts
  - Negative value: 500 max. volts

- **GRID-No.2 VOLTAGE:**
  - 500 max. volts

- **GRID-No.1 VOLTAGE:**
  - Negative-peak value: 200 max. volts
  - Negative-bias value: 140 max. volts
  - Positive-bias value: 0 max. volts
  - Positive-peak value: 2 max. volts

- **PEAK HEATER-CATHODE VOLTAGE:**
  - Heater negative with respect to cathode:
    - During equipment warm-up period not exceeding 15 seconds: 410 max. volts
    - After equipment warm-up period: 180 max. volts
  - Heater positive with respect to cathode: 180 max. volts

**Equipment Design Ranges:**

*With any ultor voltage (Ec4k) between 12000 and 20000 volts and grid-No.2 voltage (Ec2k) between 200 and 500 volts*

- **Grid-No.4 Voltage for focus:**
  - 75 to +400 volts

- **Grid-No.1 Voltage (Ec4k) 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 Ec4k except video drive is a positive voltage

- **Grid-No.4 Current:**
  - -25 to +25 μA

**Notes:**

- See next page.

_Radio Corporation of America, Harrison, New Jersey_
Grid-No.2 Current. .................. -15 to +15 µa
Field Strength of Adjustable Centering Magnet† ............... 0 to 8 gausses
Examples of Use of Design Ranges:

- With ultor voltage of 18000 volts
  and grid-No.2 voltage of 300 volts
- Grid-No.4 Voltage for focus ................ -75 to +400 volts
- Grid-No.1 Voltage for visual extinction of focused raster. ... -35 to -72 volts
- Grid-No.1 Video Drive from Raster Cutoff (Black Level):
  White-level value ..................... 35 to 72 volts

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

CATHODE-DRIVE® SERVICE

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

Maximum Ratings, Design-Center Values:
ULTOR-TO-GRID-No.1 VOLTAGE ................ \[20000\text{ max. volts}\]
\[12000^* \text{ min. volts}\]
GRID-No.4-TO-GRID-No.1 VOLTAGE:
  Positive value ................................ 1000 max. volts
  Negative value ............................  500 max. volts
GRID-No.2-TO-GRID-No.1 VOLTAGE ............. 640 max. volts
GRID-No.2-TO-CATHODE VOLTAGE .............. 500 max. volts
CATHODE-TO-GRID-No.1 VOLTAGE:
  Positive-peak value ........................ 200 max. volts
  Positive-bias value ........................ 140 max. volts
  Negative-bias value ......................  0 max. volts
  Negative-peak value ......................  2 max. volts
PEAK HEATER-CATHODE VOLTAGE:
  Heater negative with respect to cathode:
    During equipment warm-up period not exceeding 15 seconds .... 410 max. volts
    After equipment warm-up period ........ 180 max. volts
  Heater positive with respect to cathode . 180 max. volts

Equipment Design Ranges:

- With any ultor-to-grid-No.1 voltage \(E_{c1}\) between 12000 and 20000 volts and grid-No.2-to-grid-No.1 voltage \(E_{c2}\) between 225 and 640 volts
- Grid-No.4-to-Grid-No.1 Voltage for focus ........ -75 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

† 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 $E_{k1}$ 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 gauss

Examples of Use of Design Ranges:

With ultor-to-grid-
No.1 voltage of 18000 volts
and grid-No.2-to-grid-
No.1 voltage of 300 volts

Grid-No.4-to-Grid-No.1 Voltage for focus . . . . . . -75 to +400 volts
Cathode-to-Grid-No.1 Volt-
age for visual extinction
of focused raster . . . . . . 33 to 60 volts
Cathode-to-Grid-No.1 Video
Drive from Raster Cutoff
(Black Level):
White-level value . . . . . . -33 to -60 volts

Maximum Circuit Values:

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

† Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

§ This value is a working design-center minimum. The equivalent 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

4-59

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

TENTATIVE DATA 2
RASTER-CUTOFF-RANGE CHARTS
GRID-DRIVE SERVICE

$E_f = 6.3 \text{ VOLTS}$
ULTOR VOLTS = 12000 TO 20000
GRID-N4 VOLTS ADJUSTED FOR FOCUS.

CATHODE-DRIVE SERVICE

$E_f = 6.3 \text{ VOLTS}$
ULTOR-TO-GRID-N1 VOLTS = 12000 TO 20000
GRID-N4-TO-GRID-N1 VOLTS ADJUSTED FOR FOCUS.

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


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

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

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

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

<table>
<thead>
<tr>
<th>CATHODE-DRIVE SERVICE</th>
<th>GRID-DRIVE SERVICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E_f = 6.3\text{ VOLTS}$</td>
<td>$E_f = 6.3\text{ VOLTS}$</td>
</tr>
<tr>
<td>ULTOR-TO-GRID-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 = 21”x 16”</td>
<td>RASTER SIZE = 21”x 16”</td>
</tr>
</tbody>
</table>

---

**Graph:**
- **CATHODE DRIVE**
- **GRID DRIVE**

**Axes:**
- **X-axis:** VIDEO SIGNAL VOLTS FROM RASTER CUTOFF
- **Y-axis:** HIGHLIGHT BRIGHTNESS — FOOT-LAMBERTS

**Legend:**
- Grid lines for reference.
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE
$E_F = 6.3$ VOLTS
ULTOR-TO-GRID-NR1 VOLTS = 12000 TO 20000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID NR1 TO GIVE FOCUSED RASTER CUTOFF.

GRID-DRIVE SERVICE
$E_F = 6.3$ VOLTS
ULTOR VOLTS = 12000 TO 20000
GRID NR1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.

---

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

92CM-9351
24CP4-A  
KINESCOPE

**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

Direct Interelectrode Capacitances:
- Grid No.1 to all other electrodes: 6 µuf
- Cathode to all other electrodes: 5 µuf
- External conductive coating to ultor: [750 max. µuf, 500 min. µuf]

Faceplate, Spherical: Filterglass

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

Fluorescence: White
Phosphorescence: White
Persistence: Short

**Focusing Method:** Magnetic
**Deflection Method:** Magnetic

Deflection Angles (Approx.):
- Diagonal: 90°
- Horizontal: 85°
- Vertical: 68°

Ion-Trap Gun: Requires External Single-Field Magnet

**Device Dimensions:**
- Overall length: 21-1/8" ± 3/8"  
- Greatest width: 22-11/16" ± 1/8"  
- Greatest height: 18-7/16" ± 1/8"  
- Diagonal: 24" ± 1/8"

**Screen Dimensions (Minimum):**
- Greatest width: 21-1/4"  
- Greatest height: 16-3/4"  
- Diagonal: 22-5/8"  
- Projected area: 319 sq. in.

Weight (Approx.): 35 lbs

Mounting Position: Any

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

Bulb: Small-Shell Duodecal 5-Pin (JETEC No.BS-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

"Ultor" in a cathode-ray tube is the electrode to which the highest dc voltage is applied for accelerating the electrons in the beam prior to its deflection. In the 24CP4-A, the ultor function is performed by grid No.3. Since grid No.3 and collector are connected together within the 24CP4-A, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.

**Notes:**
- Indicates a change.

Nov. 1, 1955
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. volts</td>
</tr>
<tr>
<td>GRID-No.2 VOLTAGE</td>
<td>500 max. volts</td>
</tr>
</tbody>
</table>

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

Equipment Design Ranges:

With any ultor voltage \( E_{C2k} \) between 16000* and 20000 volts and grid-No.2 voltage \( E_{C2k} \) between 200 and 500 volts

Grid-No.1 Voltage for Visual Extinction of Focused Raster...
- \( -9.3\% \) to \(-24\% \) of \( E_{C2k} \) volts

Grid-No.1 Video Drive from Raster Cutoff (Black Level):
- White-level value (Peak positive) \( 9.3\% \) to \( 24\% \) of \( E_{C2k} \) volts
- Grid-No.2 Current...
  - \(-15\) to \(+15\) \( \mu \)amp

- Focusing-Coil Current (DC)*
  \( \sqrt{\frac{E_{C3k}}{16000}} \times 108 \) \( \pm 20\% \) ma

- Ion-Trap Magnet Current (Average)**...
  \( \sqrt{\frac{E_{C3k}}{16000}} \times 30 \) ma

- Minimum Field Strength of PM Ion-Trap Magnet§...
  \( \sqrt{\frac{E_{C3k}}{16000}} \times 33 \) gausses

Field Strength of Adjustable Centering Magnet...
- 0 to 8 gausses

Examples of Use of Design Ranges:

With ultor voltage of 16000 18000 volts
- and grid-No.2 voltage of 300 400 volts

Grid-No.1 Voltage for Visual Extinction of Focused Raster...
- \(-28\) to \(-72\) -37 to \(-96\) volts

Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

* 0, ** §: See next page.

Indicates a change.

NOV. 1, 1955

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Grid-No.1 Video Drive
from Raster Cutoff
(Black Level):
White-level value
(Peak positive) 28 to 72 37 to 96 volts
Focusing-Coil Current (DC)...
108 ± 20% 115 ± 20% ma
Minimum Field Strength of
PM Ion-Trap Magnet...
33 35 gauss

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

CATHODE-DRIVE® SERVICE
Unless otherwise specified, voltage values are positive with respect to grid No.1

Maximum Ratings, Design-Center Values:
ULTOR-TO-GRID-No.1 VOLTAGE.... 20000 max. volts
GRID-No.2-TO-GRID-No.1 VOLTAGE.... 625 max. volts
GRID-No.2-TO-CATHODE VOLTAGE.... 500 max. volts
CATHODE-TO-GRID-No.1 VOLTAGE: Positive bias value .... 125 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 16000* and 20000 volts
and grid-No.2-to-grid-No.1 voltage \( E_{c2g1} \) between 220 and 620 volts

Cathode-to-Grid-No.1 Voltage for Visual Extinction
of Focused Raster ... 8.5% to 19.4% of \( E_{c2g1} \) volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff
(Black Level):
White-level value
(Peak negative) 8.5% to 19.4% of \( E_{c2g1} \) 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.

Brilliance and definition decrease with decreasing ultor voltage or ultor-to-grid-No.1 voltage. In general, the ultor voltage or the ultor-to-grid-No.1 voltage should not be less than 16000 volts.

* Brilliance and definition decrease with decreasing ultor voltage or ultor-to-grid-No.1 voltage. In general, the ultor voltage or the ultor-to-grid-No.1 voltage should not be less than 16000 volts.

- Indicates a change.
Grid-No.2 Current .................. -15 to +15 μamp

Focusing-Coil Current (DC) \( \sqrt{\frac{E_{c391} \times 108}{16000}} \) ± 20% ma

Ion-Trap Magnet Current (Average) \( \sqrt{\frac{E_{c391}}{16000}} \) 30 ma

Minimum Field Strength of PM Ion-Trap Magnet$ \( \sqrt{\frac{E_{c391}}{16000}} \) 33 gausses

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 300 400 volts

Cathode-to-Grid-No.1 Voltage for Visual Extinction of Focused Raster ........ 25 to 58 34 to 78 volts

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

White-level value (Peak negative) 25 to 58 34 to 78 volts

Focusing-Coil Current (DC) 108 ± 20% 115 ± 20% ma

Minimum Field Strength of PM Ion-Trap Magnet ............ 33 35 gausses

Maximum Circuit Values:

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

For specimen focusing coil similar to JETEC Focusing Coil No.109 positioned with air gap toward kinescope screen and center line of air gap 3 inches from Reference Line (See Dimensional Outline). The indicated current is for condition with sharp focus at center of picture area and combined grid-No.1 voltage and video-signal voltage adjusted to produce a highlight brightness of 30 foot-lamberts measured on an Indian Head Test Pattern set for a 21" x 16" picture size.

For JETEC Ion-Trap Magnet No.117, or equivalent, located with the trailing edge of the pole pieces located over the gap between grid No.1 and grid No.2 and rotated to give maximum brightness.

For specimen PM ion-trap magnet, such as Heppner Model No.E437, or equivalent, located in optimum position and rotated to give maximum brightness. For a given equipment application, the tolerance range for the strength of the PM ion-trap magnet should be added to the minimum value. The maximum strength of this magnet should not exceed the specified minimum value by more than 6 gausses. This procedure will insure use of a PM ion-trap magnet allowing adequate adjustment to permit satisfactory performance without loss of highlight brightness.

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

Indicates a change.

NOV. 1, 1955

DATA 2

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
## AVERAGE DRIVE CHARACTERISTICS

<table>
<thead>
<tr>
<th>CATHODE-DRIVE SERVICE</th>
<th>GRID-DRIVE SERVICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eₖ = 6.3 VOLTS</td>
<td>Eₖ = 6.3 VOLTS</td>
</tr>
<tr>
<td>ULTOR-TO-GRID-N₁ VOLTS = 16000</td>
<td>UTLOR 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 = 2¹&quot; x 16&quot;</td>
<td>RASTER SIZE = 2¹&quot; x 16&quot;</td>
</tr>
</tbody>
</table>

### Diagram

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

- **Highlight Brightness — Foot-Lamberts**
  - 0
  - 50
  - 100
  - 150
  - 200
  - 250
  - 300

- **Video Signal Volts from Raster Cutoff**
  - 0
  - 20
  - 40
  - 60
  - 80

---

**JUNE 17, 1955**

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8648

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No. 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 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.
24CP4-A

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-N 1 VOLTS = 16000 TO 20000</td>
<td>ULTOR VOLTS = 16000 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>

---

![Graph](image-url)

**MAY 24, 1955**

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8626
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 .......... 5 µf
Cathode to all other electrodes .......... 6 µf
External conductive coating to ultor* . . . . . . . . {750 max. µf
{500 min. µf
Faceplate, Spherical Filterglass
Light transmission (Approx.) .......... 71%
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°
Ion-Trap Gun Requires External Single-Field Magnet
Tube Dimensions:
Overall length .......... 21-1/8" ± 3/8"
Greatest width .......... 22-11/16" ± 1/8"
Greatest height .......... 18-7/16" ± 1/8"
Diagonal .............. 24" ± 1/8"
Screen Dimensions (Minimum):
Greatest width .......... 21-1/4"
Greatest height .......... 16-3/4"
Diagonal .............. 22-5/8"
Projected area .............. 319 sq. in.
Weight (Approx.) .............. 35 lbs
Mounting Position .............. Any
Bulb .......... J192
Base .......... Small-Shell Duodecal 6-Pin (JETEC No.B6-63)
Basing Designation for BOTTOM VIEW .......... 12L

*: See next page.

TUBE DIVISION
TENTATIVE DATA 1

RADIO CORPORATION OF AMERICA, MABISON, NEW JERSEY
GRID-DRIVE* SERVICE

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

Maximum Ratings, Design-Center Values:

ULTOR® VOLTAGE: 20000 max. volts
GRID-No.4 VOLTAGE:
  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

PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode:
  During equipment warm-up period not exceeding 15 seconds... 410 max. volts
  After equipment warm-up period... 180 max. volts
Heater positive with respect to cathode: 180 max. volts

Equipment Design Ranges:
With any ultor voltage \((E_{c5k})\) between 16000\(^6\) and 20000 volts
and grid-No.2 voltage \((E_{c2k})\) between 200 and 500 volts

Grid-No.4 Voltage for Focus with Ultor
Current of 100 \(\mu\)amp: \(-0.4\%\) to \(+2.2\%\) of \(E_{c5k}\) volts

Grid-No.1 Voltage for Visual Extinction of Focused Raster
\(-9.3\%\) to \(-24\%\) of \(E_{c2k}\) volts

Grid-No.1 Video Drive from Raster Cutoff (Black Level):
White-level value
(Peak positive) \(9.3\%\) to \(24\%\) of \(E_{c2k}\) volts

Grid-No.4 Current: \(-25\) to \(+25\) \(\mu\)amp
Grid-No.2 Current: \(-15\) to \(+15\) \(\mu\)amp

Ion-Trapping Magnet Current
(Average)**\(\ldots\ldots\) \(\sqrt{\frac{E_{c5k}}{16000}} \times 30\) ma

Minimum Field Strength of PM Ion-Trapping Magnet§\(\ldots\ldots\) \(\sqrt{\frac{E_{c5k}}{16000}} \times 33\) gausses

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.

NOV. 1, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Examples of Use of Design Ranges:

With ultor voltage of 16000 18000 volts
and grid-No.2 voltage of 300 400 volts

Grid-No.4 Voltage for
Focus with Ultor
Current of 100 μamp... -65 to +350 -75 to +400 volts

Grid-No.1 Voltage for
Visual Extinction of
Focused Raster...... -28 to -72 -37 to -96 volts

Grid-No.1 Video Drive
from Raster Cutoff
(Black Level):
White-level value
(Peak positive) 28 to 72 37 to 96 volts

Minimum Field Strength of
FM Ion-Trap Magnet...
33 35 gausses

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

CATHODE-DRIVE® SERVICE

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

Maximum 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 . . 625 max. volts
GRID-No.2-TO-CATHODE VOLTAGE . . 500 max. volts
CATHODE-TO-GRID-No.1 VOLTAGE:
Positive bias value. . . . . . . . 125 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

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
and the other electrodes.

to its deflection. In the 24DP4-A, the ultor function is performed by
grid No.5. Since grid No.5, grid No.3, and collector are connected to-
gether within the 24DP4-A, they are collectively referred to simply as
'ultor' for convenience in presenting data and curves.

This value has been specified to take care of the condition where an ac
voltage is provided for dynamic focusing.

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.

NOV. 1, 1955

TENTATIVE DATA 2

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Equipment Design Ranges:

With any ultor-to-grid-No. 1 voltage \((E_{c1})\) between 16000 and 20000 volts and grid-No. 2-to-grid-No. 1 voltage \((E_{c21})\) between 220 and 620 volts

Grid-No. 4-to-Grid-No. 1 Voltage for Focus with Ultor Current of 100 \(\mu\)amp.

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 (Peak negative) 8.5% to 19.4% of \(E_{c21}\) volts

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

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

Ion-Trap Magnet Current (Average)** ......... \(\sqrt{E_{c591}} \times 30\) ma

Minimum Field Strength of PM Ion-Trap Magnet§ ......... \(\sqrt{E_{c591}} \times 33\) gausses

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 300 400 volts

Grid-No. 4-to-Grid-No. 1 Voltage for Focus with Ultor Current of 100 \(\mu\)amp.

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 (Peak negative) 25 to 58 34 to 78 volts

Minimum Field Strength of PM Ion-Trap Magnet ......... 33 35 gausses

Maximum Circuit Values:

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

* **§: See next page.

NOV. 1, 1955 TUBE DIVISION RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Brilliance and definition decrease with decreasing ultor voltage or ultor-to-grid-No.1 voltage. In general, the ultor voltage or ultor-to-grid-No.1 voltage should not be less than 16000 volts.

** For JETEC Ion-Trap Magnet No.117, or equivalent, located with the trailing edge of the pole pieces located over the gap between grid No.1 and grid No.2 and rotated to give maximum brightness.

§ For specimen PM ion-trap magnet, such as Heppner Model No.EU37, or equivalent, located in optimum position and rotated to give maximum brightness. For a given equipment application, the tolerance range for the strength of the PM ion-trap magnet should be added to the minimum value. The maximum strength of this magnet should not exceed the specified minimum value by more than 6 gausses. This procedure will insure use of a PM ion-trap magnet allowing adequate adjustment to permit satisfactory performance without loss of highlight brightness.

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

DIMENSIONAL OUTLINE
for Type 24DP4-A is the same as that shown for Type 24CP4-A, except that the 24DP4-A has a Small-Shell Duodecal 6-Pin Base

CURVES
for Type 24DP4-A are the same as those shown for Type 24CP4-A
The 24YP4 is the same as the 24DP4-A except for the following items:

<table>
<thead>
<tr>
<th>Direct Interelectrode Capacitances:</th>
<th>1500 max. μμf</th>
<th>1200 min. μμf</th>
</tr>
</thead>
<tbody>
<tr>
<td>External conductive coating to ultor</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
27MP4
KINESCOPE

RECTANGULAR METAL-SHELL TYPE METAL-BACKED SCREEN
MAGNETIC_FOCUS MAGNETIC_DEFLECTION

DATA

General:

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

Direct Interelectrode Capacitances (Approx.):
Grid No.1 to All Other Electrodes ........ 6 \mu f
Cathode to All Other Electrodes ........ 5 \mu f

Faceplate, Spherical ....... Frosted Filterglass
Light Transmission (Approx.) ......... 66%

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

Fluorescence .............. White
Phosphorescence .......... White
Persistence ............... Short

Focusing Method .... Magnetic
Deflection Method ...... Magnetic

Deflection Angles (Approx.):
Diagonal .................. 90°
Horizontal ................. 85°
Vertical .................... 69°

Ion-Trap Gun .... Requires External, Single-Field Magnet

Tube Dimensions:
Maximum Overall Length ........ 22-3/16"
Greatest Diagonal ............. 26-7/8" ± 1/16"
Greatest Width ................. 25-1/4" ± 3/16"
Greatest Height .............. 19-15/16" ± 3/16"

Screen Dimensions (Minimum):
Greatest Width ............. 23-7/16"
Greatest Height ............. 18-1/8"
Diagonal .................... 25-1/16"

Weight (Approx.) ............ 30 lbs
Mounting Position .... Any
Ultor® Terminal .......... Metal-Shell Lip
Base ........ Small-Shell Duodecal 5-Pin (JETEC No.B5-57)

Pin 1—Heater
Pin 2—Grid No.1
Pin 10—Grid No.2
Pin 11—Cathode
Pin 12—Heater

GRID-DRIVE® SERVICE

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

Maximum Ratings, Design-Center Values:

ULTOR® VOLTAGE .................. 18000 max. volts

* : See next page.

TUBE DEPARTMENT
TENTATIVE DATA 1

AUG. 1, 1953
RADIO CORPORATION OF AMERICA, MERRILL, NEW JERSEY
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

Equipment Design Ranges:
With any ultor voltage \( (E_{c3k}) \) between 16000 and 18000 volts and grid-No.2 voltage \( (E_{czkl}) \) between 200 and 500 volts

Grid-No.1 Voltage for
Visual Extinction of Focused Raster: 12.3% to 24.3% of \( E_{c2k} \) volts

Grid-No.1 Video Drive from Raster Cutoff (Black Level):
  White-level value (Peak positive) 12.3% to 24.3% of \( E_{c2k} \) volts
  Grid-No.2 Current: \(-\frac{\sqrt{E_{c3k}} \times 110}{16000} \pm 10\% \) \( \mu \text{amp} \)

Focusing-Coil Current (DC): \( \frac{\sqrt{E_{c3k}}}{16000} \times 50 \) gauss.
Field Strength of Single-Field Ion-Trap Magnet (Approx.):
Field Strength of Adjustable Centering Magnet:
  0 to 8 gauss

Examples of Use of Design Ranges:
With ultor voltage \( (E_{c3k}) \) of 16000 volts and grid-No. voltage \( (E_{c2k}) \) of 300 volts

Grid-No.1 Voltage for
Visual Extinction of Focused Raster: -37 to -73 volts
Grid-No.1 Video Drive from Raster Cutoff (Black Level):
  White-level value (Peak positive) 37 to 73 volts
  Focusing-Coil Current (DC): 110 \( \pm 10\% \) \( \mu \text{amp} \)
  Ion-Trap Magnet (Rated Strength): 50 gauss

\( E_{c3k} \) is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

*\( \text{See next page.} \)
**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>ULTOR*-TO-GRID-No.1 VOLTAGE</th>
<th>18000 max. volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRID-No.2-TO-GRID-No.1 VOLTAGE</td>
<td>625 max. volts</td>
</tr>
<tr>
<td>GRID-No.2-TO-CATHODE VOLTAGE</td>
<td>500 max. volts</td>
</tr>
</tbody>
</table>

**CATHODE-TO-GRID-No.1 VOLTAGE:**

- Positive bias value: 125 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: 410 max. volts
  - After equipment warm-up period: 180 max. volts
- Heater positive with respect to cathode: 180 max. volts

**Equipment Design Ranges:**

With any ultor-to-grid-No.1 voltage \(E_{c_2g_1}\) between 16000* and 18000 volts and grid-No.2-to-grid-No.1 voltage \(E_{c_2g_1}\) between 220 and 620 volts

- Cathode-to-Grid-No.1 Voltage for Visual Extinction of Focused Raster: 11% to 19.7% of \(E_{c_2g_1}\) volts
- Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level):
  - White-level value
  - (Peak negative) 11% to 19.7% of \(E_{c_2g_1}\) volts
- Grid-No.2 Current: \([-15\text{ to +15}] \mu\text{amp}\)

- Focusing-Coil Current (DC)
  \[ \sqrt{\frac{E_{c_2g_1}}{16000}} \times 110 \pm 10\% \text{ ma} \]

*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 27MP4, the ultor function is performed by grid No.3. Since grid No.3 and collector are connected together within the 27MP4, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.

* 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.

* Brilliance and definition decrease with decreasing ultor voltage or ultor-to-grid-No.1 voltage. In general, the ultor voltage or the ultor-to-grid-No.1 voltage should not be less than 16000 volts.

---

AUG. 1, 1953
TUBDEPARTMENT
TENTATIVE DATA 2
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Field Strength of Single-Field Ion-Trap Magnet (Approx.) .. \( \sqrt{\frac{E_{3g1}}{16000}} \times 50 \) gausses

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

Examples of Use of Design Ranges:

*With ultor-to-grid-No.1 voltage \( (E_{C3g1}) \) of 16000 volts*

*and grid-No.2-to-grid-No.1 voltage \( (E_{C2g1}) \) of 300 volts*

Cathode-to-Grid-No.1 Voltage for Visual Extinction of Focused Raster ........ 33 to 59 volts

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

White-level value

(Peak negative) -33 to -59 volts

-44 to -79 volts

Focusing-Coil Current (DC) .. 110 ± 10% ma

Ion-Trap Magnet (Rated Strength) 50 gausses

Maximum Circuit Values:

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

For specimen focusing coil similar to JETEC Focusing Coil No.109 positioned with air gap toward kinescope screen and center line of air gap 3 inches from Reference Line (see Dimensional Outline). The indicated current is for condition with combined bias voltage and video signal voltage adjusted to produce a highlight brightness of 30 foot-lamberts on a 23-7/16" x 18-1/8" picture area sharply focused at center of screen.

For x-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section.
Shape of Neck-Funnel Section with Indication of Recommended Approximate Inside Contour of Yoke Based on Dimensions of Reference-Line Gauge (JETEC No. 116) Shown at Front of this Section.

NOTE 2: FACEPLATE SHAPE AT PERIMETER OF SCREEN CONFORMS TO SURFACE OF SPHERE HAVING 50" RADIUS.

NOTE 3: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No. 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 4: 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 3-1/4".

NOTE 5: METAL SHELL AND GLASS FACE OPERATE AT HIGH VOLTAGE. ANY MATERIAL IN CONTACT WITH THE SHELL OR THE FACE MUST BE INSULATED TO WITHSTAND THE MAXIMUM APPLIED ULTOR VOLTAGE.


NOTE 7: SUPPORT TUBE IN LIP REGION ONLY AT CORNERS WITHIN THIS SPACE.
### Average Drive Characteristics

**Cathode-Drive Service**
- $E_F = 6.3$ Volts
- Ultor-to-Grid-$N_2$ Volts = 16000 to 18000
- Cathode biased positive with respect to Grid $N_2$ to give focused raster cutoff

**Grid-Drive Service**
- $E_F = 6.3$ Volts
- Ultor Volts = 16000 to 18000
- Grid $N_2$ biased negative with respect to cathode to give focused raster cutoff

**Graph:**
- X-axis: Video Signal Volts from Raster Cutoff
- Y-axis: Ultor Milliamperes

---

**RCA**

**27MP4**

**MAR. 25, 1953**

**Radio Corporation of America, Harrison, New Jersey**
AVERAGE DRIVE CHARACTERISTICS

**CATHODE-DRIVE SERVICE**
- $E_c = 6.3$ 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 = 23 7/16" x 18 1/8"

**GRID-DRIVE SERVICE**
- $E_c = 6.3$ VOLTS
- ULTOR VOLTS = 16000
- GRID N01 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF
- RASTER FOCUSED AT AVERAGE BRIGHTNESS
- RASTER SIZE = 23 7/16" x 18 1/8"

MAR. 26, 1953

RADIO CORPORATION OF AMERICA
HARRISON, NEW JERSEY
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE
\[ E_C = 6.3 \text{ VOLTS} \]

GRID-DRIVE SERVICE
\[ E_F = 6.3 \text{ VOLTS} \]

ULTOR-TO-GRID-\( \text{N}_1 \) VOLTS = 16000
ULTOR VOLTS = 16000

GRID-\( \text{N}_2 \)-TO-GRID-\( \text{N}_1 \) VOLTS = 300
GRID-\( \text{N}_2 \)-TO-CATHODE VOLTS = 300

CATHODE BIASED POSITIVE WITH RESPECT TO GRID \( \text{N}_1 \) TO GIVE FOCUSED RASTER CUTOFF
RASHER FOCUSED AT AVERAGE BRIGHTNESS
RASHER SIZE: 23\( \frac{\text{7}}{\text{16}} \)" x 18\( \frac{\text{1}}{\text{8}} \)"

GRID \( \text{N}_1 \) BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF
RASHER FOCUSED AT AVERAGE BRIGHTNESS
RASHER SIZE: 23\( \frac{\text{7}}{\text{16}} \)" x 18\( \frac{\text{1}}{\text{8}} \)"

TRANSFER CHARACTERISTICS

TRANSFER CHARACTERISTICS FOR LARGE-AREA CONTRAST RATIO OF 100:1

VIDEO SIGNAL VOLTS FROM RASTER CUTOFF

HIGHLIGHT BRIGHTNESS—FOOT-LAMBERTS

MAR. 30, 1953
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7902
### General:

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

### Direct Interelectrode Capacitances (Approx.):
- Grid No. 1 to All Other Electrodes: $7.5 \mu F$
- DJ₁ to All Other Electrodes: $8.5 \mu F$
- DJ₂ to All Other Electrodes: $6.0 \mu F$

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

### Focusing Method:
- Electrostatic

### Deflection Method:
- Electrostatic

### Overall Length:
- $7-7/16" \pm 3/16"$

### Greatest Diameter of Bulb:
- $2" \pm 1/16"$

### Minimum Useful Screen Diameter:
- $1-3/4"$

### Mounting Position:
- Any

### Base:
- Medium Shell Octal 8-Pin

### Basing Designation for BOTTOM VIEW:
- 8CD

### Pin Distribution:

<table>
<thead>
<tr>
<th>Pin 1</th>
<th>Pin 2</th>
<th>Pin 3</th>
<th>Pin 4</th>
<th>Pin 5</th>
<th>Pin 6</th>
<th>Pin 7</th>
<th>Pin 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid No. 2</td>
<td>Heater</td>
<td>Anode No. 1</td>
<td>Anode No. 2</td>
<td>Deflecting</td>
<td>Deflecting</td>
<td>Deflecting</td>
<td>Heater</td>
</tr>
<tr>
<td>Electrode DJ₂</td>
<td>Electrode DJ₃</td>
<td>Pin 4</td>
<td>Pin 5</td>
<td>Pin 6</td>
<td>Pin 7</td>
<td>Pin 8</td>
<td></td>
</tr>
</tbody>
</table>

**KEY:**
- 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 $90° \pm 40°$.

### Maximum Ratings, Absolute Values:

<table>
<thead>
<tr>
<th>ANODE-No. 2 &amp; GRID No. 2 VOLTAGE</th>
<th>ANODE-No. 1 VOLTAGE</th>
<th>GRID-No. 1 (CONTROL ELECTRODE) VOLTAGE</th>
<th>PEAK VOLTAGE BETWEEN ANODE No. 2 AND DEFLECTING ELECTRODE DJ₁ OR DJ₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>$660 \text{ max. volts}$</td>
<td>$330 \text{ max. volts}$</td>
<td>$125 \text{ max. volts}$</td>
<td>$385 \text{ max. volts}$</td>
</tr>
</tbody>
</table>

### Reference:

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
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.
▲ See curve for average values.
** Individual tubes may vary from these values by ± 20%.

Spot Position:

The undeflected focused spot will fall within a 10-mm square centered at the geometric center of the tube face and having one side parallel to the trace produced by DJ1 and DJ2. Suitable test conditions are: anode-No.2 voltage, 600 volts; anode-No.1 voltage, adjusted for focus; deflecting-electrode resistors, 1 megohm each for DJ1 and DJ4, connected to anode No.2; the tube shielded from all extraneous fields. To avoid damage to the tube, grid-No.1 voltage should be near cutoff before application of anode voltages.

Maximum Circuit Values:

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

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

TYPICAL OSCILLOGRAPH CIRCUIT

C1: 0.1 μf  
C2: 1.0 μf  
C3 C4 C5 C6: 0.05-μf Blocking Capacitors* 
R1 R2: 1.0 Megohm  
R3: 1.3 Megohms  
R4: 1-Megohm Potentiometer  
R5: 0.3 Megohm  
R6: 0.5-Megohm Potentiometer  
R7 R8: Dual 2-Megohm Potentiometer  
R9 R10: 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
7/6" MIN.

188" R.

12° 37'

6° R.

3 1/16"

7 7/16" ± 3/16"

1 3/6" ± 1/16"

MEDIUM SHELL OCTAL 8-PIN BASE

92CM-6879R2

Ø 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
### 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>600</td>
</tr>
<tr>
<td>B</td>
<td>Anode No. 1</td>
<td>400</td>
</tr>
<tr>
<td>C</td>
<td>Anode No. 2 &amp; Grid No. 2</td>
<td>600</td>
</tr>
<tr>
<td>D</td>
<td>Anode No. 2 &amp; Grid No. 2</td>
<td>400</td>
</tr>
</tbody>
</table>

![Graph showing anode and grid characteristics](image-url)
908-A
OSCILLOGRAPH TUBE
Supersedes Type 908

General:
Heater, for Unipotential Cathode:
Voltage: 2.5 ± 10% ac or dc volts
Current: 2.1 amp.

Direct Interelectrode Capacitances (Approx.):
Grid No.1 to All Other Electrodes ..... 9.0 μf
DJ1 to All Other Electrodes ..... 8.5 μf
DJ3 to All Other Electrodes ..... 6.5 μf

Phosphor (For Curves, see front of this Section) No.5
Fluorescence: Blue
Persistence: Very Short

Focusing Method: Electrostatic
Deflection Method: Electrostatic

Overall Length: 11-1/2" ± 3/8"
Greatest Diameter of Bulb: 3" ± 1/16"
Minimum Useful Screen Diameter: 2-3/4"

Mounting Position: Any
Base: Medium 7-Pin
Basing Designation for BOTTOM VIEW: 7CE
Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Deflecting Electrode DJ3
Pin 4 - Anode No.1
Pin 5 - Deflecting Electrode DJ1
Pin 6 - Grid No.2
Pin 7 - Anode No.2, Deflecting Electrode DJ4

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

With DJ2 positive with respect to DJ1, the spot is deflected toward pin 1. With DJ4 positive with respect to DJ3, the spot is deflected toward pin 6.
The angle between the trace produced by DJ3 and DJ4 and its intersection with the plane through the tube axis and pin 6 does not exceed 10°.
The angle between the trace produced by DJ3 and DJ4 and the trace produced by DJ1 and DJ2 is 90° ± 30°.

Maximum Ratings, Design-Center Values:

ANODE-No.2 & GRID No.2 VOLTAGE ..... 1500 max. volts
ANODE-No.1 VOLTAGE ..... 1000 max. volts
GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:
Negative Value ..... 125 max. volts
Positive Value ..... 0 max. volts
PEAK VOLTAGE BETWEEN ANODE No.2 AND DEFLECTING ELECTRODE DJ1 OR DJ3 500 max. volts

JUNE 20, 1946
DATA 1
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Typical Operation:

Anode No. 2 & Grid No. 2 Voltage* ........................................... 1000 1500 ... volts
Anode No. 1 Voltage for Focus at 75% of Grid-No. 1 Voltage for Cutoff* ........................................... 287 430 ... volts
Grid-No. 1 Volt. for Visual Cutoff*: -33 -50 ... volts
Max. Anode-No. 1 Current Range*: Between -50 and +100 µamp.

Deflection Sensitivity:
DJ1 and DJ2 ........................................... 0.334 0.223 mm/v dc
DJ3 and DJ4 ........................................... 0.348 0.233 mm/v dc

Deflection Factor:***
DJ1 and DJ2 ........................................... 76 114 v dc/in.
DJ3 and DJ4 ........................................... 73 109 v dc/in.

* Brilliance and definition decrease with decreasing anode-No. 2 voltage. In general, anode-No. 2 voltage should not be less than 1000 volts.

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

† Visual extinction of stationary focused spot. Supply should be adjustable to ±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 for DJ1 and DJ3, 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.
TYPICAL OSCILLOGRAPH CIRCUIT

C1: 0.1 μf
C2: 1.0 μf
C3 C4 C5 C6: 0.05-μf Blocking Capacitors*
R1 R2: 1.5 Megohms
R3: 4 Megohms

R4: 2-Megohm Potentiometer
R5: 1.0 Megohm
R6: 0.5-Megohm Potentiometer
R7 R8: Dual 3-Megohm Potentiometer
R9 R10: 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.

JUNE 20, 1946

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Ụ OF BULB WILL NOT DEVIATE MORE THAN 2°
IN ANY DIRECTION FROM PERPENDICULAR
ERECTED AT CENTER OF BOTTOM OF BASE
AVERAGE CHARACTERISTICS

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>1500</td>
</tr>
<tr>
<td>B</td>
<td>Anode No. 1</td>
<td>1000</td>
</tr>
<tr>
<td>C</td>
<td>Anode No. 2 &amp; Grid No. 2</td>
<td>1500</td>
</tr>
<tr>
<td>D</td>
<td>Anode No. 2 &amp; Grid No. 2</td>
<td>1000</td>
</tr>
</tbody>
</table>

GRID NO. 1 VOLTS

-60 -40 -20 0

GRID NO. 2 & GRID NO. 2 MICROAMPERES

0.1

ANODE NO. 1 MICROAMPERES

-60 -40 -20 0

ANODE NO. 2 & GRID NO. 2 MICROAMPERES

2000 1600 1200 800 400

APR. 18, 1945
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-5415RS
**HIGH-VACUUM CATHODE-RAY TUBE**

**HIGH-INTENSITY ELECTROSTATIC-DEFLECTION TYPE**

**WITH 5" MEDIUM-PERSISTENCE SCREEN FOR OSCILLOGRAPHIC USE**

<table>
<thead>
<tr>
<th><strong>Heater</strong></th>
<th>Coated Unipotential Cathode</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Voltage</strong></td>
<td>2.5 a-c or d-c volts</td>
</tr>
<tr>
<td><strong>Current</strong></td>
<td>2.1 amp.</td>
</tr>
</tbody>
</table>

**Fluorescent Screen:**

- **Material:** Phosphor No.1
- **Pattern Color:** Greenish

**Direct Interelectrode Capacitances:**

- **Grid to all other electrodes:** 14 max. \( \mu \text{F} \)
- **DJ\(_1\) to DJ\(_2\):** 3 max. \( \mu \text{F} \)
- **DJ\(_3\) to DJ\(_4\):** 1.5 max. \( \mu \text{F} \)

**Overall Length:** 16-1/2" ± 3/8"

**Maximum Diameter:** 5-1/4" + 1/16" - 3/32"

**Bulb:** J-42

**Caps:**

- **Anode No.2:** Medium Metal
- **Deflecting Electrodes (Four):** Small Metal
- **Base:** Medium 5-Pin Micanol

**MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS**

*Maximum Ratings Are Based on a Line-Voltage Design Center of 117 Volts*

- **High-Voltage Electrode (Anode #2) Voltage:** 15000 max. volts
- **Focusing Electrode (Anode #1) Voltage:** 4500 max. volts
- **Accelerating Electrode (Grid #2) Voltage:** 250 max. volts
- **Control Electrode (Grid #1) Voltage:** Never positive
- **Grid Voltage for Current Cut-off:** 125 approx. volts
- **Peak Voltage Between Anode #2 and any deflecting electrode:** 7000 max. volts

**Typical Operation:**

- **Heater Voltage:** 2.5 2.5 2.5 volts
- **Anode #2 Voltage:** 5000 10000 15000 volts
- **Anode #1 Voltage:** 1000 2000 3000 approx. volts
- **Grid #2 Voltage:** 250 250 250 volts
- **Grid #1 Voltage:** Adjusted to give suitable luminous spot

**Deflection Sensitivity:**

- **DJ\(_1\) to DJ\(_2\):** 0.083 0.041 0.028 mm/volt d.c.
- **DJ\(_3\) to DJ\(_4\):** 0.102 0.051 0.034 mm/volt d.c.

*With maximum voltages on Anode #1 and Grid #2.*

† Indicates a change.

JUNE 20, 1947
TYPICAL OSCILLOGRAPH CIRCUIT USING THE 912 WITH VOLTAGE-DOUBLING POWER SUPPLY

\[ C_1, C_2 = 0.5 \, \mu F, \, 10000 \, V. \]
\[ C_3 = 1.0 \, \mu F, \, 5000 \, V. \]
\[ C_4 = 16 \, \mu F, \, 200 \, V. \]
\[ R_1 = 2.3 \, \text{MEGOMHS}, \, 75\text{-WATT} \]
\[ R_2 = 0.2 \, \text{MEGOMHS}, \, 10\text{-WATT} \]
\[ R_3 = 0.55 \, \text{MEGOMHS}, \, 20\text{-WATT} \]
\[ R_4 = 50\,000 \, \text{OHMS}, \, 2\text{-WATT} \]
\[ R_5 = 35\,000 \, \text{OHMS}, \, 2\text{-WATT} \]
\[ R_6, R_7, R_8, R_9 = 2 \text{ TO } 5 \, \text{MEGOMHS} \]
\[ R_{10} = 10 \, \text{OHMS}, \, 800\text{-WATT} \]

\[ \text{NOTE: AS THE TOTAL VOLTAGE ACROSS THE BLEEDER IS REDUCED BY MEANS OF } R_{10}, \text{ THE ELECTRODE VOLTAGES ARE REDUCED IN CORRECT PROPORTION, EXCEPT FOR GRID NO.2 VOLTAGE; THIS MAY HAVE TO BE READJUSTED BY THE USE OF DIFFERENT VALUES FOR } R_6 \text{ AND } R_9. \text{ THEIR TOTAL RESISTANCE BEING KEPT THE SAME. CONDENSERS } C_3 \text{ AND } C_4 \text{ CAN BE OMITTED IF GRID-VOLTAGE SWITCHING (FOR HIGH-SPEED PHOTOGRAPHY) IS NOT CONTEMPLATED. FILAMENT WINDINGS NOS. 1 AND 2 SHOULD BE INSULATED FOR 20000 VOLTS.} \]

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

FLUORESCENT-SCREEN CHARACTERISTICS

CURVES SHOWING THE AVERAGE CHARACTERISTICS, SPECTRAL ENERGY CHARACTERISTIC, AND PERSISTENCE CHARACTERISTIC OF PHOSPHOR NO.1 ARE SHOWN AT THE BEGINNING OF THIS SECTION.

\[ \rightarrow \text{Indicates a change.} \]

AUG. 15, 1946

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

912

SCREEN RADIUS 2 1/4" MIN.

5 1/4" + 1/16" - 3/32"

1/2 R.

11 1/16"

22°12'

8" R.

1 3/16" ± 1/16"

4 SMALL CAPS

ANODE N° 2

MEDIUM CAP

15 7/8" ± 3/8"

7 15/16" ± 1/4"

4 9/16" ± 1/4"

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

ANGLE BETWEEN DJ1 - DJ2 TRACE AND DJ3 - DJ4 TRACE IS 90° ± 6°.

DJ1 AND DJ2 ARE NEARER THE SCREEN; DJ3 AND DJ4 ARE NEARER THE BASE.

AUG. 15, 1946

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-4619R3
AVERAGE CHARACTERISTICS

$E_f = 2.5$ VOLTS

ACCELERATING ELECTRODE (GRID NO. 2) VOLTS = 250

FOCUSING ELECTRODE (ANODE NO. 1) VOLTS ADJUSTED TO GIVE FOCUS
### HIGH-VACUUM CATHODE-RAY TUBE

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater</td>
<td>Coated Unipotential Cathode</td>
</tr>
<tr>
<td>Voltage</td>
<td>6.3 a-c or d-c volts</td>
</tr>
<tr>
<td>Current</td>
<td>0.6 amp.</td>
</tr>
<tr>
<td>Focus</td>
<td>Electrostatic</td>
</tr>
<tr>
<td>Electrodes DJ₁ and DJ₂ (upper):</td>
<td>nearest to screen</td>
</tr>
<tr>
<td>Electrodes DJ₃ and DJ₄ (lower):</td>
<td>nearest to base</td>
</tr>
<tr>
<td>DJ₁</td>
<td>on the same side of tube as pins No.2 and No.4</td>
</tr>
<tr>
<td>DJ₃</td>
<td>on the same side of tube as pins No.2 and No.8</td>
</tr>
<tr>
<td>Phosphor</td>
<td>No.1</td>
</tr>
<tr>
<td>Fluorescence</td>
<td>Green</td>
</tr>
<tr>
<td>Persistence</td>
<td>Medium</td>
</tr>
<tr>
<td>Direct Interelectrode Capacitances:</td>
<td></td>
</tr>
<tr>
<td>Control Electrode (Grid) to All Other Electrodes</td>
<td>8 µF</td>
</tr>
<tr>
<td>Deflecting Electrode DJ₁ to Deflecting Electrode DJ₂</td>
<td>2.5 µF</td>
</tr>
<tr>
<td>Deflecting Electrode DJ₃ to Deflecting Electrode DJ₄</td>
<td>2.5 µF</td>
</tr>
<tr>
<td>Maximum Overall Length</td>
<td>4-3/4&quot;</td>
</tr>
<tr>
<td>Maximum Diameter</td>
<td>1-5/8&quot;</td>
</tr>
<tr>
<td>Bulb</td>
<td>Metal Shell, MT-10</td>
</tr>
<tr>
<td>Base</td>
<td>Small Wafer Octal 8-Pin</td>
</tr>
</tbody>
</table>

### MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

**Maximum Ratings Are Based on a Line-Voltage Design Center of 117 Volts**

- High-Voltage Electrode (Anode No.2) Volt. 500 max. volts
- Focusing Electrode (Anode No.1) Volt. 200 max. volts
- Control Electrode (Grid) Volt. Never positive
- Peak Voltage Between Anode No.2 and Any Deflecting Electrode 250 max. volts
- Grid Circuit Resistance 1.5 max. megohms
- Impedance of Any Deflecting-Electrode Circuit at Heater-Supply Frequency 1.0 max. megohm

**Typical Operation:**

- Anode No.2 Voltage 250 500 volts
- Anode No.1 Voltage 50 100 approx. volts
- Grid Voltage Adjusted to give suitable luminous spot

**Deflection Sensitivity:**

- Electrodes DJ₁ & DJ₂ 0.15 0.07 mm/volt d.c.
- Electrodes DJ₃ & DJ₄ 0.21 0.10 mm/volt d.c.

**NOTE 1:** Brilliance and definition decrease with decreasing anode voltages. In general the anode No.2 voltage should not be less than 250 volts.

**NOTE 2:** The d-c potential of each deflecting electrode is maintained essentially equivalent to that of anode No.2 by connecting resistors having values not greater than 10 megohms between each deflecting electrode and anode No.2. This arrangement by suitable choice of resistor values minimizes pattern distortion and pattern drift resulting from unbalanced potentials on the deflecting electrodes. The smaller the resistor values, the less the distortion for a given beam current.

D, o: See next page.

Indicates a change.

Jan. 30, 1942

RCA Radiotron Division
RCA Manufacturing Company, Inc.
Supply should be adjustable to ± 30% of the value shown.

Approximately 80% of Anode No. 1 voltage is required for current cut-off when, in some applications, it is necessary to use the maximum permissible grid-circuit resistance.

Characteristic Curves of phosphor No. 1 are shown at the beginning of this section.

TYPICAL OSCILLOGRAPH CIRCUIT

C1 = FILTER CONDENSER
C2, C3, C4 = SEE NOTE 3
R1 + R2 + R3 + R4 = BLEEDER POTENTIOMETER
R5 = 0.200 MEGOHM
R6 = 0.050 MEGOHM

NOTE 3: When the cathode or the negative end of the cathode-ray high-voltage supply is grounded, blocking condensers C2, C3, and C4 should have a high voltage rating. When anode No. 2 is grounded, C3 may be omitted and C2 and C4 may be low-voltage condensers.

For d-c amplifier service, the deflecting electrodes should be coupled directly to the output of the amplifier by omitting the blocking condensers. In addition, it will usually be preferable to remove the associated deflecting electrode resistor in order to minimize the loading effect of the resistor on the d-c amplifier. With the resistor removed, it is essential, in order to minimize spot defocusing, that anode No. 2 be returned to some point in the d-c amplifier circuit such that the potential difference between anode No. 2 and the average voltage across the deflecting electrodes will be as low as possible.

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

Indicates a change.
THE 913 IS BASED SO THAT THE TRACE PRODUCED ON THE SCREEN BY DEFLECTING ELECTRODES DJ₁ AND DJ₂ SHALL NOT DEVIATE MORE THAN 8° FROM A PLANE PASSING THROUGH PINS NO. 3 AND NO. 7.

DJ₁ to DJ₄ = Deflecting Electrodes
P₁ = Anode No. 2
P₂ = Anode No. 1
G₁ = Grid No. 2
G₂ = Control (Grid No. 1) Electrodes
H = Heater
K = Cathode
S = Shell
NC = No Connection

Bottom View of Socket Connections

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY INC

Jan. 30, 1942 92C-4679R2
AVERAGE CHARACTERISTICS

$E_f = 6.3$ VOLTS

FOCUSING ELECTRODE (ANODE N=1)
VOLTS ADJUSTED TO GIVE FOCUS

HIGH-VOLTAGE ELECTRODE (ANODE N=2) MICROAMPERES

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

CONTROL ELECTRODE (GRID) VOLTS

OCT. 20, 1936
RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92C-4680
**General:**

Heater, for Unipotential Cathode:
- **Voltage:** 2.5 ac or dc volts
- **Current:** 2.1 amp

**Direct Inter-electrode Capacitances (Approx.):**
- Grid No.1 to All Other Electrodes: 10.5 µf
- DJ₁ to DJ₂: 2.0 µf
- DJ₃ to DJ₄: 1.0 µf

**Phosphor (For Curves, see front of this Section):**
- No.1 Fluorescence: Green
- Persistence: Medium
- Focusing Method: Electrostatic
- Deflection Method: Electrostatic
- Overall Length: 20-1/16" ± 3/8"
- Greatest Diameter of Bulb: 9-1/4" ± 1/8"
- Minimum Useful Screen Diameter: 8-1/4"
- Mounting Position: Any

**Caps:**
- Anode No.2: Medium
- Deflecting Electrodes (Four): Small
- Base: Long Medium-Shell Small 6-Pin

**DATA**

BOTTOM VIEW

- **Pin 1-Heater**
- **Pin 2-Anode No.1**
- **Pin 3-Grid No.2**
- **Pin 4-Grid No.1**
- **Pin 5-Cathode**
- **Pin 6-Heater**
- **Single Medium Cap- Anode No.2**
- **Cap**
- **Pin 2**
- **Over**
- **Deflecting Electrode**
- **Over**
- **Electrode**
- **Over**
- **Electrode**
- **Over**
- **Electrode**
- **Over**
- **Electrode**
- **Over**
- **Electrode**

**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 2. With DJ₃ positive with respect to DJ₄, the spot is deflected toward pins 1 and 6.

The angle between the trace produced by DJ₁ and DJ₂ and its intersection with the plane through the tube axis and pin 2 does not exceed 10°.

The angle between the trace produced by DJ₃ and DJ₄ and the trace produced by DJ₁ and DJ₂ is 90° ± 6°.

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

- **ANODE-No.2 VOLTAGE**: 7000 max. volts
- **ANODE-No.1 VOLTAGE**: 1900 max. volts

*The product of anode-No.2 voltage and average anode-No.2 current should never exceed 6 watts.

MAY 1, 1950

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
OSCILLOGRAPH TUBE

GRID No.2 VOLTAGE. ................. 300 max. volts
GRID No.1 VOLTAGE:
  Negative bias value. ................. 125 max. volts
  Positive bias value. .................. 0 max. volts
  Positive peak value. ................. 2 max. volts
PEAK VOLTAGE BETWEEN ANODE No.2
  AND ANY DEFLECTING ELECTRODE .... 3000 max. volts
PEAK HEATER-CATHODE VOLTAGE:
  Heater negative with respect to cathode. 125 max. volts
  Heater positive with respect to cathode. 125 max. volts

Equipment Design Ranges:
For any anode-No.2 voltage (Eb2) between 1500 and 7000 volts
Anode-No.1 Voltage. .... 15% to 26% of Eb2 .... volts
Grid-No.2 Voltage ... 250 .... volts
Max. Grid-No.1 Voltage
  for Visual Cutoff. 30% of Eb2 .... volts
Max. Anode-No.1
  Current Range. -15 to +10 .... μamp
Deflection Factors:
  DJ1 to DJ2. ... 38 to 54 v dc/in./kv of Eb2
  DJ3 to DJ4. ... 30 to 44 v dc/in./kv of Eb2

Examples of Use of Design Ranges:
For Anode-No.2 Volt. of
  1500 2500 5000 7000 volts
Anode-No.1 Voltage. 
  225-390 375-650 750-1300 1050-1800 volts
Grid-No.2 Voltage ...
  250 250 250 250 volts
Max. Grid-No.1 Volt.
  for Visual Cutoff -75 -75 -75 -75 volts
Deflection Factors:
  DJ1 to DJ2. ... 57-81 93-135 190-270 266-378 v dc/in
  DJ3 to DJ4. ... 45-66 75-110 150-220 210-308 v dc/in

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

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

* Brilliance and definition decrease with decreasing anode-No.2 voltage. In general, anode-No.2 voltage should not be less than 1500 volts.
Q It is recommended that the deflecting-electrode-circuit resistances be approximately equal.
• Indicates a change.

MAY 1, 1950
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

DATA 1
capacitor should be as follows:

Grid-No. 1 - Circuit Resistance ........ 150 min. ohms
Grid-No. 2 - Circuit Resistance ........ 330 min. ohms
Anode-No. 1 - Circuit Resistance ....... 2000 min. ohms
Anode-No. 2 - Circuit Resistance ....... 8200 min. ohms

The resistors should be capable of withstanding the applied voltages.
TYPICAL OSCILLOGRAPH CIRCUIT

C1 = FILTER CAPACITOR 0.5 to 2.0 µf
C2, C3, C4, C5 = SEE NOTE
R1 + R2 + R3 + R4 + R5 = BLEEDER POTENTIOMETER
R1 = 2.5 MEGOMMS
R2 = 0.5 MEGOMMS
R3 = 0.375 MEGOHM
R4 = 0.125 MEGOHM
R5 = 0.050 MEGOHM
R6 = SEE ON BACK OF DATA 1
V = VOLTMETER

NOTE: When the cathode or the negative end of the cathode-ray high-voltage supply is grounded, blocking capacitors C2, C3, C4, and C5 should have a high voltage rating. When anode No. 2 is grounded, C2, C3, C4, and C5 may be low-voltage capacitors.

For dc amplifier service, the deflecting electrodes should be coupled direct to the output of the amplifier by omitting the blocking capacitors. In addition, it will usually be preferable to remove the associated deflecting-electrode resistor in order to minimize the loading effect of the resistor on the dc amplifier. With the resistor removed, it is essential, in order to minimize spot defocusing, that anode No. 2 be returned to some point in the dc amplifier circuit such that the potential difference between anode No. 2 and the average voltage across the deflecting electrodes will be as low as possible.
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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

MAY 1, 1950

TUBE DEPARTMENT

CE-4718R3

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MAY 1, 1950

TUBE DEPARTMENT

CE-4718R3
AVERAGE CHARACTERISTICS

$E_F = 2.5 \text{ VOLTS}$

ANODE-N R VOLTS ADJUSTED TO GIVE FOCUS
GRID-N R VOLTS = 250
1848 ICONOSCOPE

For use in portable television cameras

Heater Coated Unipotential Cathode
Voltage 6.3 a-c or d-c volts
Current 0.6 amp.
Deflection Magnetic
Type of Pickup Direct

Direct Interelectrode Capacitance:
- Signal Plate to Collector & Anode No.2
  (with external shielding) 10 approx. µf
- Control Grid to All Other Electrodes 12 max. µf

NOTE: Signal plate-to-collector capacitance is a function of bias light, image brilliance, and beam current, and is in the order of a few megohms for normal operation. Normal beam current is in the order of 0.25 microampere.

- The signal-plate resistive load should be approximately one-tenth of the 
- The design maximum for the 117-volt line. 
- The cathode should not be illuminated. 
- The cathode should be connected to one side or, preferably, to the 
- The mid-tap of the heater winding. 
- Should be adjusted and set at largest negative value which will pro-
- Should be adjusted and set at largest value giving best focus. 

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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: 6.5 μf
Signal Electrode to Grid No. 4°: 10 μf
Mosaic, Photosensitive:
Response: See Curve
Useful Size of Rectangular Image:
(4 x 3 Aspect Ratio): 5.75" max. diagonal
Focusing Method: Electrostatic
Deflection Method: Magnetic
Deflection Angle (Approx.): 55°
Max. Width of Mounted Tube: 8-1/8"
Height of Mounted Tube: 10-3/16" ± 3/4"
Depth of Mounted Tube: 12-13/16" ± 3/4"
Mounting Position: Mosaic in vertical plane
Minimum Deflecting-Coil Inside Diameter: 1-1/2"
Maximum Deflecting-Coil Length: 2-1/4"
Caps (Two): Medium (JETEC No. C1-5)
Base: Long Medium-Shell Small 6-Pin

DIRECTION OF LIGHT IS NORMAL TO MOSAIC

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No. 2
Pin 3 - Grid No. 3
Pin 4 - Grid No. 1
Pin 5 - Cathode
Pin 6 - Heater

Caps {See Outline Drawing
Sj - Signal Electrode
G4 - Grid No. 4 (Collector)

MAXIMUM RATINGS, ABSOLUTE VALUES:

AVERAGE MOSAIC ILLUMINATION* ....... 50 max. ft-c
OPERATING TEMPERATURE OF BULB
AT LARGE END OF TUBE: ....... 40 max. °C
SIGNAL-ELECTRODE VOLTAGE ....... 1200 max. volts
GRID-No. 4 (COLLECTOR) VOLTAGE ....... 1200 max. volts
GRID-No. 3 VOLTAGE ....... 450 max. volts
GRID-No. 2 VOLTAGE ....... 1200 max. volts
GRID-No. 1 VOLTAGE:
Negative bias value ....... 125 max. volts
Positive bias value ....... 0 max. volts
PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode ....... 125 max. volts
Heater positive with respect to cathode ....... 10 max. volts
GRID-No. 4 CURRENT ....... 0.5 max. μamp

* With external shield.

MAY 1, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**Typical Operation and Characteristics:**

Signal-Electrode Voltage ........................................... 1000 volts

Grid-No. 4 Voltage .................................................. 1000 volts

Grid-No. 3 Voltage (Beam Focus) —
24% to 36% of Grid-No. 4 Voltage .................................. 240 to 360 volts

Grid-No. 2 Voltage .................................................. 1000 volts

Max. Grid-No. 1 Voltage for Pattern Cutoff — 7% of Grid-No. 4 Voltage ........................................... -70 volts

Grid-No. 4 Current
(With no illumination on mosaic)* .................................. 0.1 to 0.2 μamp

External Load Resistance ........................................... 0.1 megohm

Illumination on Mosaic:
Steady Highlight Value for Slides ................................... 4 to 6 ft-c
Average Pulsed Highlight Value for Motion-Picture Film ................. 10 to 20 ft-c

Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current (Approx.) .................................. 100

Minimum Peak-to-Peak Blanking Voltage .................................. 20 volts

Deflecting-Coil Current (Approx.):**
Horizontal (Peak to peak) ........................................... 600 ma
Vertical (Peak to peak) ................................................ 140 ma

**Maximum Circuit Values:**

Grid-No. 1 — Circuit Resistance ..................................... 1.0 max. megohm

* Allowance should be made for leakage currents.

** For RCA Deflecting Yoke No. 201076.

Indicates a change.
**ICONOSCOPE**

**ICONOSCOPE**

**RCA**

**1850-A**

**ICONOSCOPE**

**TUBE DEPARTMENT**

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

**MAY 1, 1951**

**CE-4891R3A**

**92CM-4891R3**

"BB' IS THE PLANE THROUGH THE BULB AXIS AA' AND THE IDEAL GUN AXIS.

**Indicates a change.**
NOTE 1: VARIATION OF TIP CENTER FROM PLANE BB' IS 1/2".

NOTE 2: MAXIMUM ROTATION OF LINE THROUGH PINS 2 AND 5 ABOUT IDEAL GUN AXIS IS ± 10°, MEASURED FROM PLANE BB'.

NOTE 3: DEVIATION OF PLANE OF MOSAIC FROM PLANE PERPENDICULAR TO THE BULB AXIS AA' IS 2.5° MAX. Rotation of MOSAIC about the bulb axis AA' with respect to a line of intersection formed by mosaic plane and plane BB' is 2.5° MAX.
SPECTRAL SENSITIVITY CHARACTERISTIC

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS

3000 4000 5000 6000 7000 8000
3000 4000 5000 6000 7000 8000

JUNE 18, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-6404R1
**TYPICAL SIGNAL-OUTPUT CHARACTERISTIC**

- SCENE: BLACKS AND WHITES BALANCED
- BACK LIGHTING: APPROXIMATELY OPTIMUM
- BEAM CURRENT: 0.2 MICROAMPERE
- TYPE OF LIGHTING: DAYLIGHT FLUORESCENT

**Graph Details:***
- **X-axis (Bottom):** SIGNAL OUTPUT - MICROAMPERES
- **Y-axis (Right):** HIGHLIGHT ILLUMINATION OF MOSAIC - 7 FOOT CANDLES

**Date:** JAN. 2, 1951

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

**Model:** 92CM-8581RI
General:
Heater, for Unipotential Cathode:
Voltage ........ 6.3 ± 10% .... ac or dc volts
Current ........ 0.6 .......... amp
Direct Interelectrode Capacitances (Approx.):^A
Grid No.1 to All Other Electrodes .... 7.5 μf
Signal Electrode to All Other Electrodes
and External Shield 5 .... μf
Focusing Method ........ Electrostatic
Deflection Method .......... Electrostatic
Image Size (4 x 3 aspect ratio) ........ 1.4" Diagonal
Overall Length ........ 9" ± 1/4"
Seated Length ........ 8-1/4" ± 1/4"
Maximum Diameter ........ 2-1/4"
Mounting Position .......... Any
Cap .... Medium-Shell Diheptal 12-Pin
Base .......... Medium-Shell Diheptal 12-Pin
Basing Designation for BOTTOM VIEW .......... 14L

Maximum Ratings, Design-Center Values:
SIGNAL-ELECTRODE VOLTAGE .......... 900 max. .... volts
GRID-No.4 & GRID-No.2 VOLTAGE .......... 900 max. .... volts
GRID-No.3 VOLTAGE .......... 450 max. .... volts
GRID-No.1 VOLTAGE:
Negative bias value .......... 100 max. .... volts
Positive bias value .......... 0 max. .... volts
PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect
to cathode .......... 125 max. .... volts
Heater positive with respect
to cathode .......... 10 max. .... volts
AMBIENT TEMPERATURE .......... 40 max. .... 0°C
MOSAIC ILLUMINATION .......... 50 max. foot-candles

^A with external shield.

APRIL 15, 1947       TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**Typical Operation:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal-Electrode Voltage</td>
<td>800</td>
</tr>
<tr>
<td>Grid-No.4 &amp; Grid-No.2 Voltage</td>
<td>800</td>
</tr>
<tr>
<td>Grid-No.3 Voltage for Focus</td>
<td>125 to 250</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td>Adjust for best picture</td>
</tr>
<tr>
<td>Max. Grid-No.1 Voltage for</td>
<td>-75</td>
</tr>
<tr>
<td>Max. Deflecting Voltages (Peak-to-Peak)*</td>
<td></td>
</tr>
<tr>
<td>DJ1 &amp; DJ2 (Vertical)</td>
<td>120</td>
</tr>
<tr>
<td>DJ3 &amp; DJ4 (Horizontal)</td>
<td>100</td>
</tr>
<tr>
<td>Min. Peak-to-Peak Blanking Voltage</td>
<td>30</td>
</tr>
<tr>
<td>Signal-Output Current (Approx.)</td>
<td>0.025</td>
</tr>
<tr>
<td>Output Resistor (Approx.)</td>
<td>1.0</td>
</tr>
</tbody>
</table>

**Maximum Circuit Values:**

<table>
<thead>
<tr>
<th>Circuit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1-Circuit Resistance</td>
<td>1.0 max.</td>
</tr>
<tr>
<td>Resistance in any Deflecting-Electrode Circuit</td>
<td>5.0 max.</td>
</tr>
</tbody>
</table>

* To scan picture of 1.4* diagonal (4 x 3 aspect ratio).

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

The SPECTRAL SENSITIVITY CHARACTERISTIC curve for the 5527 is the same as that shown for Type 1850-A.
The plane through the tube axis and base-plug key may vary from the plane through the tube axis and signal electrode terminal by an angular tolerance (measured about the tube axis) of 20°. Signal electrode terminal is on same side as base-plug key.

DJI and DJ2 are nearer the mosaic; 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 pins 1 and 2. With DJ1 and DJ2 used for vertical deflection, the vertical axis of the scanned area of the mosaic is parallel to vertical plane through pins 5 and 12 within ±15°. The angle between the scanning direction produced by DJ3 and DJ4 and the scanning direction produced by DJ1 and DJ2 is 90° ± 3°.
**General:**

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

Direct Interelectrode Capacitance:
- Anode to All Other Electrodes: $20 \mu$F

Photocathode Spectral Response: See Curve

Image Size (4 x 3 aspect ratio): 1/6" Diagonal

Focusing Method: Magnetic
Deflection Method: Magnetic

Overall Length: 15-1/4" ± 1/4"

Greatest Diameter of Bulb: 3" ± 1/16"

Minimum Deflecting-Coil Inside Diameter: 2-1/8"
Deflecting-Coil Length: 5"
Focusing-Coil Length: 10"
Alignment-Coil Length: 15/16"

Photocathode Distance Inside End of Focusing Coil: 1/2"

Operating Position: Any except with diheptal base up and tube axis at angle of less than 20° from the vertical

End Base: Small-Shell Diheptal 14-Pin

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**Pin Diagram**

- Pin 1 - Heater
- Pin 2 - Grid No. 4
- Pin 3 - Grid No. 3
- Pin 4 - Internal Connection—Do Not Use
- Pin 5 - Dynode No. 2
- Pin 6 - Dynode No. 4
- Pin 7 - Anode
- Pin 8 - Dynode No. 5
- Pin 9 - Dynode No. 3
- Pin 10 - Dynode No. 1, Grid No. 2
- Pin 11 - Internal Connection—Do Not Use
- Pin 12 - Grid No. 1
- Pin 13 - Cathode
- Pin 14 - Heater

Shoulder Base: Keyed Jumbo Annular 7-Pin

- Pin 1 - Grid No. 6
- Pin 2 - Photocathode
- Pin 3 - Internal Connection—Do Not Use
- Pin 4 - Internal Connection—Do Not Use

- Pin 5 - Grid No. 5
- Pin 6 - Target
- Pin 7 - Internal Connection—Do Not Use

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5655

IMAGE ORTHICON

MAGNETIC FOCUS—MAGNETIC DEFLECTION

OCTOBER 15, 1947

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**Maximum Ratings, Absolute Values:**

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<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Photocathode Voltage</td>
<td>-550 max. volts</td>
</tr>
<tr>
<td>Photocathode Illumination</td>
<td>50 max. ft-c</td>
</tr>
<tr>
<td>Operating Temperature of Any Part of Bulb</td>
<td>65 max. °C</td>
</tr>
<tr>
<td>Operating Temperature of Bulb at LARGE END OF TUBE (Target Section)</td>
<td>45 min. °C</td>
</tr>
<tr>
<td>Temperature Difference Between Target Section and Any Part of Bulb Hotter Than Target Section</td>
<td>5 max. °C</td>
</tr>
<tr>
<td>Grid-No. 6 Voltage</td>
<td>-550 max. volts</td>
</tr>
<tr>
<td><strong>Target Voltage:</strong></td>
<td></td>
</tr>
<tr>
<td>Positive value</td>
<td>50 max. volts</td>
</tr>
<tr>
<td>Negative value</td>
<td>50 max. volts</td>
</tr>
<tr>
<td>Grid-No. 5 Voltage</td>
<td>150 max. volts</td>
</tr>
<tr>
<td>Grid-No. 4 Voltage</td>
<td>300 max. volts</td>
</tr>
<tr>
<td>Grid-No. 3 Voltage</td>
<td>400 max. volts</td>
</tr>
<tr>
<td>Grid-No. 2 &amp; Dynode-No. 1 Voltage</td>
<td>350 max. volts</td>
</tr>
<tr>
<td>Grid-No. 1 Voltage</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 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>10 max. volts</td>
</tr>
<tr>
<td><strong>Anode-Supply Voltage</strong>:</td>
<td>1500 max. volts</td>
</tr>
<tr>
<td>Voltage Per Multiplier Stage</td>
<td>350 max. volts</td>
</tr>
</tbody>
</table>

**Typical Operation:**

- Photocathode Voltage (Image Focus) -300 to -500 volts
- Grid-No. 6 Voltage (Accelerator) - 80% of photocathode voltage -240 to -400 volts
- Target Voltage* 0 volts
- Grid-No. 5 Voltage (Decelerator) 0 to 100 volts
- Grid-No. 4 Voltage (Beam Focus) 160 to 240 volts
- Grid-No. 3 Voltage## 225 to 330 volts
- Grid-No. 2 & Dynode-No. 1 Voltage 300 volts
- Grid-No. 1 Voltage (For Picture Cutoff) -35 to -100 volts
- Dynode-No. 2 Voltage 600 volts
- Dynode-No. 3 Voltage 800 volts
- Dynode-No. 4 Voltage 1000 volts
- Dynode-No. 5 Voltage 1200 volts
- Anode Voltage 1250 volts
- Anode Current 100 μA
- Target Temperature Range 45 to 60 °C
- Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current (Approx.) 70
- Minimum Peak-to-Peak Blanking Voltage 10 volts
- Field Strength at Center of Focusing Coil 75 gausses

*##: See next page.
5655
IMAGE ORTHICON

Focusing-Coil Current (Approx. for coil listed below) ... 75 ma
Deflecting-Coil Current (Approx. for assembly listed below):
  Horizontal (Peak to Peak) ....... 625 ma
  Vertical (Peak to Peak) ........ 290 ma
Alignment-Coil Current (Approx. for coil listed below) .... 0 to 30 ma

Components:
Deflecting-Coil Assembly (Includes Keyed Jumbo Annular 7-Pin Socket) ... RCA Type No. 201D75
Focusing-Coil Assembly .................. RCA Type No. 202D75
Alignment-Coil Assembly .............. RCA Type No. 204D75
Hor. Deflection Output Transformer .. RCA Type No. 204T1
Ver. Deflection Output Transformer .. RCA Type No. 204T2

* Ratio of dynode voltages is shown under Typical Operation.
+ Adjustable within ± 3 volts of indicated value, with blanking voltage off.
++ Taps at 0, 30, 60, and 90 volts are recommended. Set at voltage giving most uniform resolution and most uniform background shading over entire picture area.
### Adjust to give the most uniformly shaded picture near maximum signal.
IMAGE ORTHICON

DETAIL OF BOTTOM VIEW OF KEYED JUMBO ANNULAR BASE

CROSS-HATCHED AREA IS FLAT

1.315" R. MIN.

1.185" R. MAX.

.275" MAX.

(NOTE 1)

SEE NOTE 2

1/2" MIN.

NOTE 1: MEASURED AT DISTANCE OF 1/32" BELOW BOTTOM OF ANNULAR BASE.

NOTE 2: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

KEYED ANNULAR BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

b. SIX HOLES HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 1/8" FROM 2-13/16" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

OCTOBER 15, 1947

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, MARISSON, NEW JERSEY

CE-6878
CHARACTERISTIC CURVES

TYPICAL SIGNAL OUTPUT

SCENE: BLACKS AND WHITES
BALANCED
ILLUMINATION: "DAYLIGHT" FLUORESCENT LAMPS

HIGHLIGHT ILLUMINATION ON PHOTOCATHODE - FOOT-CANDLES

SPECTRAL SENSITIVITY CHARACTERISTIC
FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS

RELATIVE SENSITIVITY - ARBITRARY UNITS

WAVELENGTH - ANGSTROMS

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

OCTOBER 15, 1947
CE-6889TV-6877T

92CM-6877T
IMAGE ORTHICON

DATA

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

Direct Interelectrode Capacitance:
Anode to All Other Electrodes 20 μF

Photocathode Spectral Response ........................................ See Curve
Image Size (3 x 4 aspect ratio) ........................................ 1.6" Diagonal

Focusing Method ........................................ Magnetic
Deflection Method ........................................ Magnetic

Overall Length ........................................ 15-1/4" ± 1/4"
Greatest Diameter of Bulb ........................................ 3" ± 1/16"
Minimum Deflecting-Coil Inside Diameter ........................................ 2-1/8"

Deflecting-Coil Length ........................................ 5"
Focusing-Coil Length ........................................ 10"
Alignment-Coil Length ........................................ 15/16"

Photocathode Distance Inside End of Focusing Coil ........................................ 1/2"

Operating Position  Any except with diheptal base up and tube axis at angle of less than 20° from the vertical
End Base ........................................ Small-Shell Diheptal 14-Pin

Pin 1 - Heater
Pin 2 - Grid No. 4
Pin 3 - Grid No. 3
Pin 4 - Internal Connection - Do Not Use
Pin 5 - Dynode No. 2
Pin 6 - Dynode No. 4
Pin 7 - Anode
Pin 8 - Dynode No. 5
Pin 9 - Dynode No. 3
Pin 10 - Dynode No. 1, Grid No. 2
Pin 11 - Internal Connection - Do Not Use
Pin 12 - Grid No. 1
Pin 13 - Cathode
Pin 14 - Heater

Shoulder Base ........................................ Keyed Jumbo Annular 7-Pin

Pin 1 - Grid No. 6
Pin 2 - Photocathode
Pin 3 - Internal Connection - Do Not Use
Pin 4 - Internal Connection - Do Not Use

Pin 5 - Grid No. 5
Pin 6 - Target
Pin 7 - Internal Connection - Do Not Use
### Maximum Ratings, Absolute Values:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photocathode Voltage</td>
<td>-550 max. volts</td>
</tr>
<tr>
<td>Photocathode Illumination</td>
<td>50 max. ft-c</td>
</tr>
<tr>
<td>Operating Temperature of Any Part of Bulb</td>
<td>65 max. °C</td>
</tr>
<tr>
<td>Operating Temperature of Bulb at Large End of Tube</td>
<td>35 min. °C</td>
</tr>
<tr>
<td>Target Temperature Difference Between Target Section</td>
<td>5 max. °C</td>
</tr>
<tr>
<td>Grid-No. 6 Voltage</td>
<td>-550 max. volts</td>
</tr>
<tr>
<td>Target Voltage:</td>
<td></td>
</tr>
<tr>
<td>- Positive Value</td>
<td>50 max. volts</td>
</tr>
<tr>
<td>- Negative Value</td>
<td>50 max. volts</td>
</tr>
<tr>
<td>Grid-No. 5 Voltage</td>
<td>150 max. volts</td>
</tr>
<tr>
<td>Grid-No. 4 Voltage</td>
<td>300 max. volts</td>
</tr>
<tr>
<td>Grid-No. 3 Voltage</td>
<td>400 max. volts</td>
</tr>
<tr>
<td>Grid-No. 2 &amp; Dynode-No. 1 Voltage</td>
<td>350 max. volts</td>
</tr>
<tr>
<td>Grid-No. 1 Voltage</td>
<td></td>
</tr>
<tr>
<td>- Negative Bias Value</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>- Positive Bias Value</td>
<td>0 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>
<tr>
<td>Anode-Supply Voltage</td>
<td>1650 max. volts</td>
</tr>
<tr>
<td>Voltage per Multiplier Stage</td>
<td>350 max. volts</td>
</tr>
</tbody>
</table>

### Typical Operation:

- Photocathode Voltage (Image Focus) ... -300 to -500 volts
- Grid-No. 6 Voltage (Accelerator) — 80% of photocathode voltage ... -240 to -400 volts
- Target Voltage* ... 0 volts
- Grid-No. 5 Voltage (Decelerator)** ... 0 to 100 volts
- Grid-No. 4 Voltage (Beam Focus) ... 160 to 240 volts
- Grid-No. 3 Voltage*** ... 225 to 330 volts
- Grid-No. 2 & Dynode-No. 1 Voltage ... 300 volts
- Grid-No. 1 Voltage (For Picture Cutoff) ... -45 to -115 volts
- Dynode-No. 2 Voltage ... 600 volts
- Dynode-No. 3 Voltage ... 880 volts
- Dynode-No. 4 Voltage ... 1160 volts
- Dynode-No. 5 Voltage ... 1450 volts
- Anode Voltage ... 1500 volts
- Anode Current ... 50 μA
- Target Temperature Range ... 35 to 60 °C

### Highlight Illumination on Photocathode for Maximum Signal Output:

- With 2870°K Tungsten Illumination ... 0.15 ft-c
- With White Fluorescent Illumination or Daylight ... 0.07 ft-c

### Ratio of Peak-to-Peak Highlight Video-Signal Cur. to RMS Noise Current (Approx.) ... 35

©, **, ***: See next page.
**IMAGE ORTHICON**

| Minimum Peak-to-Peak Blanking Voltage | 10 volts |
| Field Strength at Center of Focusing Coil | 75 gausses |
| Focusing-Coil Current (Approx. for coil listed below) | 75 ma |
| **Deflecting-Coil Current (Approx. for assembly listed below):** |
| Horizontal (Peak to Peak) | 625 ma |
| Vertical (Peak to Peak) | 290 ma |
| Alignment-Coil Current (Approx. for coil listed below) | 0 to 30 ma |

**Components:**
- Deflecting-Coil Assembly (Includes Keyed Jumbo Annular 7-Pin Socket) | RCA Type No. 201D75
- Focusing-Coil Assembly | RCA Type No. 202D75
- Alignment-Coil Assembly | RCA Type No. 204D75
- Hor. Deflection Output Transformer | RCA Type No. 204T1
- Ver. Deflection Output Transformer | RCA Type No. 204T2

* Ratio of dynode voltages is shown under Typical Operation.
* Adjustable from -3 to +5 volts with blanking voltage off.

**OPERATING NOTES**

After the 5769 has been inserted in its sockets and the voltages applied, allow it to warm up for 1/2 to 1 hour with the camera lens iris closed. Then, proceed with normal operating adjustments.

When the equipment design or operating conditions are such that the maximum temperature rating or maximum temperature difference will be exceeded, provision should be made to direct a blast of cooling air from the diheptal-base end of the tube along the entire length of the bulb surface, i.e., through the space between the bulb surface and the surrounding deflecting coil and its extension. For this purpose, a small blower is satisfactory, but it should run at low speed to prevent vibration of the 5769 and the associated amplifier equipment. Unless vibration is prevented, distortion of the picture may occur. To keep the operating temperature of the large end of the tube from falling below 35°C, some form of controlled heating should be employed. Ordinarily, adequate heat will be supplied by the focusing coil, deflecting coils, and associated amplifier tubes so that the temperature can be controlled by the amount of cooling air directed along the bulb surface.

Resolution of better than 400 lines at the center of the picture can be produced by the 5769 when the highlight illumination is above the knee of the typical signal-output curve for this type. To utilize such resolution capability in the horizontal direction with the standard scanning rate of 625 lines, it is necessary to use a video amplifier having a bandwidth of at least 6.6 megacycles. The maximum resolution obtainable is limited by the mesh-screen portion of the target.

**OUTLINE DIMENSIONS** for the 5769 are the same as those shown for Type 5655

FEB. 1, 1949

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE DATA 2
CHARACTERISTICS CURVES

TYPICAL SIGNAL OUTPUT

SCENE: BLACKS AND WHITES BALANCED
WHITE FLUORESCENT LIGHT OR DAYLIGHT
TUNGSTEN LIGHT

SPECTRAL SENSITIVITY CHARACTERISTIC
FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS

RELATIVE SENSITIVITY - ARBITRARY UNITS

WAVELENGTH - ANGSTROMS

FEB. 1, 1949
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**General:**

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

Direct Interelectrode Capacitance (Approx.):
- Anode to all other electrodes: 12 µF

Photocathode, Semitransparent:
- Response: See accompanying Spectral Sensitivity curve
- Rectangular image (4 x 3 aspect ratio):
  - Useful size: 1.6" max. Diagonal
  - Orientation of: Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through the center of faceplate and pin No.7 of the shoulder base.

**Focusing Method** ........................................ Magnetic
**Deflection Method** ........................................ Magnetic
**Overall Length** ........................................... 15-3/16" ± 1-4"
**Greatest Diameter of Bulb** ......................... 3" ± 1/16"
**Minimum Deflecting-Coil Inside Diameter** .... 2-3/8"
**Deflecting-Coil Length** ............................... 5"
**Focusing-Coil Length** ................................. 10"
**Alignment-Coil Length** ............................... 15/16"
**Photocathode Distance Inside End of Focusing Coil** . 1/2"

Operating Position: Any except with diheptal base up and tube axis at angle of less than 20° from vertical

**Weight (Approx.)** ................................. 1.4 lbs
**End Base** ........................................ Small-Shell Diheptal 14-Pin (JETEC No.B14-45)

**Pin**
- 1 - Heater
- 2 - Grid No.4
- 3 - Grid No.3
- 4 - Internal Connection—Do Not Use
- 5 - Dynode No.2
- 6 - Dynode No.4
- 7 - Anode
- 8 - Dynode No.5
- 9 - Dynode No.3
- 10 - Dynode No.1, Grid No.2
- 11 - Internal Connection—Do Not Use
- 12 - Grid No.1
- 13 - Cathode
- 14 - Heater

*Indicates a change.*

(Continued on next page)
Shoulder Base .............................................. Keyed Jumbo Annular 7-Pin
Pin 1-Grid No.6 ........................................... Pin 5-Grid No.5
Pin 2-Photocathode ....................................... Pin 6-Target
Pin 3-Internal Connection—Do Not Use .......... Pin 6-Target
Pin 4-Internal Connection—Do Not Use .......... Pin 7-Internal Connection—Do Not Use

**Maximum Ratings, Absolute Values:**

**PHOTOCATHODE:**
- Voltage .............................................. -550 max. volts
- Illumination ........................................ 50 max. ft-c

**OPERATING TEMPERATURE:**
- Of any part of bulb ................................ 50 max. °C
- Of bulb at large end of tube (target section) .. 35 min. °C

**TEMPERATURE DIFFERENCE:**
- Between target section and any part of bulb hotter than target section .. 5 max. °C

**GRID-No.6 VOLTAGE** .................................. -550 max. volts

**TARGET VOLTAGE:**
- Positive value ...................................... 10 max. volts
- Negative value ...................................... 10 max. volts

**GRID-No.5 VOLTAGE** ................................ 150 max. volts
**GRID-No.4 VOLTAGE** ................................ 300 max. volts
**GRID-No.3 VOLTAGE** ................................ 400 max. volts

**GRID-No.2 & DYNODE-No.1 VOLTAGE** .......... 350 max. volts

**GRID-No.1 VOLTAGE:**
- Negative bias value ................................ 125 max. volts
- Positive bias value ................................ 0 max. volts

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

**ANODE-SUPPLY VOLTAGE*** ......................... 1350 max. volts

**VOLTAGE PER MULTIPLIER STAGE** ................. 350 max. volts

**Typical Operation and Characteristics:**

Photocathode Voltage (Image Focus)............. -300 to -500 volts
Grid-No.6 Voltage (Accelerator)—
- 75% of photocathode voltage ................... -225 to -375 volts
- Target Voltage* .................................. 0 to 3 volts
- Grid-No.5 Voltage (Decelerator) ............ 0 to 125 volts
- Grid-No.4 Voltage (Beam Focus) ............ 160 to 220 volts
- Grid-No.3 Voltage# ................................ 225 to 330 volts
- Grid-No.2 & Dynode-No.1 Voltage ........... 300 volts
- Grid-No.1 Voltage for Picture Cutoff .... -45 to -115 volts

* Ratio of dynode voltages is shown under Typical Operation.
* Adjustable from -3 to +5 volts with blanking voltage off.
# Adjust to give the most uniformly shaded picture near maximum signal.

- Indicates a change.

JAN. 3, 1955

**Tube Division**
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**IMAGE ORTHICON**

<table>
<thead>
<tr>
<th>Dynode-No.2 Voltage</th>
<th>600 volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynode-No.3 Voltage</td>
<td>800 volts</td>
</tr>
<tr>
<td>Dynode-No.4 Voltage</td>
<td>1000 volts</td>
</tr>
<tr>
<td>Dynode-No.5 Voltage</td>
<td>1200 volts</td>
</tr>
<tr>
<td>Anode Voltage</td>
<td>1250 volts</td>
</tr>
<tr>
<td>Anode Current (DC)</td>
<td>30 µamp</td>
</tr>
<tr>
<td>Signal-Output Current (Peak to peak)</td>
<td>2 to 15 µamp</td>
</tr>
<tr>
<td>Target Temperature Range</td>
<td>35 to 45°C</td>
</tr>
<tr>
<td>Ratio of Peak-to-Peak Highlight Video-</td>
<td></td>
</tr>
<tr>
<td>Signal Current to RMS Noise Current (Approx.)</td>
<td>35</td>
</tr>
<tr>
<td>Minimum Peak-to-Peak Blanking Voltage</td>
<td>5 volts</td>
</tr>
<tr>
<td>Field Strength at Center of Focusing Coil</td>
<td>75 gausses</td>
</tr>
<tr>
<td>Field Strength of Alignment Coil (Approx.)</td>
<td>0 to 3 gausses</td>
</tr>
</tbody>
</table>

*A Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

**OPERATING CONSIDERATIONS**

When the equipment design or operating conditions are such that the maximum temperature rating or maximum temperature difference as given under Maximum Ratings will be exceeded, provision should be made to direct a blast of cooling air from the dihepal-base end of the tube along the entire length of the bulb surface, i.e., through the space between the bulb surface and the surrounding deflecting-coil assembly and its extension. Any attempt to effect cooling of the tube by circulating even a large amount of air around the focusing coil will do little good, but a small amount of air directly in contact with the bulb surface will effectively drop the bulb temperature. For this purpose, a small blower is satisfactory, but it should be run at low speed to prevent vibration of the 5820 and the associated amplifier equipment. Unless vibration is prevented, distortion of the picture may occur.

To keep the operating temperature of the large end of the tube from falling below 35°C, some form of controlled heating should be employed. Ordinarily, adequate heat will be supplied by the focusing coil, deflecting coils, and associated amplifier tubes so that the temperature can be controlled by the amount of cooling air directed along the bulb surface. If, in special cases, a target heater is required, it should fit between the focusing coil and the bulb near the shoulder of the tube, and be non-inductively wound.

Resolution in excess of 500 lines at the center of the picture can be produced by the 5820. The Amplitude Response Characteristic shows the relative center amplitude response versus television line number for the 5820 when it is operated with the highlights at the knee of the light...
transfer characteristic and at one lens stop above the knee and at a temperature of 35°C. To utilize such resolution capability in the horizontal direction with the standard scanning rate of 525 lines, it is necessary to use a video amplifier having a bandwidth of at least 6 megacycles. The maximum resolution obtainable is limited by the mesh-screen portion of the target.

For very high illumination or for individual tubes with exceptionally high photocathode sensitivity, it may not be possible to stop the lens down far enough to reduce the highlight illumination on the photocathode to a value near the knee of the transfer characteristic. When such a condition is encountered, the use of a Wratten neutral filter selected to give the required reduction in illumination is recommended. Ordinarily, two filters—one having 10% transmission and the other 20%—will give sufficient choice.

**Light Transfer Characteristic**

![Graph showing light transfer characteristic for small-area highlights.](image-url)
IMAGE ORTHICON

DETAILED VIEW OF BOTTOM VIEW OF JUMBO ANNULAR BASE

CROSS-HATCHED AREA IS FLAT

1.315" R. MIN.
1.185" R. MAX.

SEE NOTE 1

NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001".

b. THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26’ ± 5’ ON CIRCLE DIAMETER OF 2.500" ± 0.015".

c. SIX STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

JAN. 3, 1955

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-8293R1
SPECTRAL SENSITIVITY CHARACTERISTIC WITH AND WITHOUT FILTER

FOR INCIDENT RADIANT ENERGY WITHIN NORMAL OPERATING RANGE OF TUBE

CURVE A: WITHOUT FILTER
CURVE B: WITH WRATTEN N°6 FILTER
CURVE C: SPECTRAL CHARACTERISTIC OF AVERAGE HUMAN EYE

WAVELENGTH—ANGSTROMS

RELATIVE SENSITIVITY (CURVE C)

MICROAMPERES FROM PHOTOCATHODE/MICROWATT OF RADIANT ENERGY INCIDENT ON PHOTOCATHODE (CURVES A&B)

ULTRA VIOLET
VIOLET
BLUE
GREEN
YELLOW
RED
INFRARED

SEPT. 20, 1954
TUBE DIVISION
92CM-7295R1
AMPLITUDE RESPONSE CHARACTERISTICS

TEST PATTERN: SQUARE WAVE
OPERATING TEMPERATURE OF BULB ADJACENT TO TARGET: 35°C
RESPONSE MEASURED IN SYSTEM HAVING 10-MC BANDWIDTH

<table>
<thead>
<tr>
<th>CURVE</th>
<th>HIGHLIGHTS IN RELATION TO LIGHT TRANSFER CHARACTERISTIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>AT KNEE</td>
</tr>
<tr>
<td>B</td>
<td>ONE LENS STOP ABOVE KNEE</td>
</tr>
</tbody>
</table>

RELATIVE CENTER AMPLITUDE RESPONSE—ARBITRARY UNITS

TELEVISION LINE NUMBER

SEPT. 23, 1954  TUBE DIVISION  RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
TEMPERATURE EFFECT ON AMPLITUDE RESPONSE

TELEVISION LINE NUMBER = 300

MAR. 15, 1954

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
MAGNETIC FOCUS

VIDICON

DATA

General:
Heater, for Unipotential Cathode:
Voltage ............... 6.3 ± 10% ................ ac or dc volts
Current ............... 0.6 ........................ amp
Direct Interelectrode Capacitance:
Signal Electrode to All
Other Electrodes ........ 4.5 ........................ μF
Spectral Response ............... See Curve
Photoconductive Layer:
Maximum Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio) ....... 0.62 inch
Orientation of Quality Rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the plane passing through the tube axis and short index pin.
Focusing Method ....................... Magnetic
Deflection Method ....................... Magnetic
Overall Length ............... 6-1/4" ± 1/4"
Greatest Diameter (Excluding Side Tip) 1.125" ± 0.010"
Maximum Radius (Including Side Tip) ........ 0.805"
Bulb. ....................... T-6
Operating Position ............... Any
Base. ....................... Small-Button Ditetrar 8-Pin (JETEC No.E8-U)

Pin 1—Heater
Pin 2—Grid No.1
Pin 3—Int. Conn.—Do Not Use
Pin 4—Int. Conn.—Do Not Use
Pin 5—Grid No.2
Pin 6—Grid No.3
Pin 7—Cathode
Pin 8—Heater
Flange (SJ)—Signal Electrode
Short Index Pin—Int. Conn.—Make No Conn.

Direction of Light: INTO FACE END OF TUBE

Maximum Ratings, Absolute Values:
SIGNAL-ELECTRODE VOLTAGE ............... 125 max. volts
GRID-No.4 & GRID-No.3 VOLTAGE ............... 350 max. volts
GRID-No.2 VOLTAGE ....................... 350 max. volts
GRID-No.1 VOLTAGE:
Negative bias value ....................... 125 max. volts
Positive bias value ....................... 0 max. volts
PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode ....................... 125 max. volts
Heater positive with respect to cathode ....................... 10 max. volts
FACEPLATE TEMPERATURE ....................... 60 max. °C

SEPT. 1, 1952

TENTATIVE DATA

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Typical Operation and Characteristics:

| Signal-Electrode Voltage for | Dark Current of 0.02 µamp | 10 to 125 volts |
| Grid-No.4 (Decelerator) & Grid-No.3 (Beam Focus) Voltage | 200 to 300 volts |
| Grid-No.2 (Accelerator) Voltage | 300 volts |
| Grid-No.1 Voltage (For picture cutoff) | -45 to -100 volts |

**Signal-Output Current:**

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Operating Range</td>
<td>0.1 to 0.2 µamp</td>
</tr>
<tr>
<td>Minimum, with 0.6 foot-candle of uniform 2870°K tungsten illumination on tube face</td>
<td>0.02 µamp</td>
</tr>
</tbody>
</table>

**Uniform 2870°K Tungsten Illumination on Tube Face to Produce Signal-Output Current of 0.1 to 0.2 µamp**

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 to 0.2 µamp</td>
<td>3 to 10 ft-c</td>
</tr>
</tbody>
</table>

**Ratio (Approx.) of Tube-Face Illumination Required to Produce Signal-Output Current of 0.2 µamp to That Required to Produce 0.02 µamp**

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Peak-to-Peak Blanking Voltage</td>
<td>30 volts</td>
</tr>
<tr>
<td>When applied to grid No.1</td>
<td>10 volts</td>
</tr>
<tr>
<td>Field Strength at Center of Focusing Device</td>
<td>40 gausses</td>
</tr>
<tr>
<td>Field Strength of Adjustable Alignment Coil</td>
<td>0 to 4 gausses</td>
</tr>
</tbody>
</table>

*Defined as the component of the signal-electrode current after the dark-current component has been subtracted.*

**OPERATING CONSIDERATIONS**

The base pins of the 6198 fit the ditetra 8-pin connector such as Cinch No.54A18088, or equivalent.

Resolution of better than 350 lines at the center of the picture can be produced by the 6198. To utilize the resolution capability of the 6198 in the horizontal direction with the standard scanning rate of 525 lines, it is necessary to use a video amplifier having a bandwidth of at least 6 megacycles per second. The maximum resolution obtainable is limited by the size of the scanning-beam spot.
Base-pin positions are held to tolerances such that pins will fit a flat-plate gauge having thickness of 1/4" and 9 holes 0.0700" ± 0.0005" so located on a 0.6000" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.2052" ± 0.0005". Gauge is provided with center hole having diameter of 0.300" ± 0.001" and same center as the pin circle.
SPECTRAL SENSITIVITY CHARACTERISTIC

**CURVE A:** FOR EQUAL VALUES OF SIGNAL-OUTPUT CURRENT AT ALL WAVELENGTHS SIGNAL-OUTPUT MICROAMPERES FROM SCANNED AREA OF \( \frac{1}{2}'' \times \frac{3}{8}'' = 0.02 \)

**CURVE B:** SPECTRAL CHARACTERISTIC OF AVERAGE HUMAN EYE

**CURVE C:** FOR EQUAL VALUES OF SIGNAL-OUTPUT CURRENT WITH RADIANT FLUX FROM TUNGSTEN SOURCE AT 2870°K
TYPICAL CHARACTERISTICS

CURVE A: WITH 8FT-C OF 2870°K TUNGSTEN ILLUMINATION INCIDENT ON TUBE FACE
CURVE B: WITH NO ILLUMINATION INCIDENT ON TUBE FACE
CURVE C = CURVE A MINUS CURVE B
SCANNED AREA OF PHOTOCONDUCTIVE LAYER: 1/2" x 3/8"

CURRENT - MICROAMPERES

SIGNAL-ELECTRODE VOLTS

JUNE 17, 1952
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
ILLUMINATION: UNIFORM OVER PHOTOCONDUCTIVE LAYER
SCANNED AREA OF PHOTOCONDUCTIVE LAYER: $1/2 \times 3/8''$

2870°K TUNGSTEN ILLUMINATION ON TUBE FACE—FOOT-CANDLES

SCANNED AREA OF PHOTOCONDUCTIVE LAYER: $1/2'' \times 3/8''$
INITIAL VALUE
0.2 MICROAMP

RELATIVE SIGNAL-OUTPUT CURRENT—PERCENT OF INITIAL VALUE

TIME AFTER ILLUMINATION IS REMOVED—MILLI SECONDS

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
### DATA

**General:**

Heater, for Unipotential Cathode:
- Voltage: \(6.3 \pm 10\%\) ac or dc volts
- Current: 0.6 ± 0% amp

Direct Interelectrode Capacitance:
- Signal Electrode to All Other Electrodes: 4.5 \(\mu\)F

Spectral Response: See Curves

Photoconductive Layer:
- Maximum Useable Diagonal of Rectangular Image (4 x 3 Aspect Ratio): 0.62 inch
- Orientation of Quality Rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the plane passing through the tube axis and short index pin.

Focusing Method: Magnetic

Deflection Method: Magnetic

Overall Length: 6-1/4" ± 1/4"

Greatest Diameter (Excluding side tip): 1.125" ± 0.010"

Maximum Radius (Including side tip): 0.805"

Bulb: T-8

Operating Position: Approx. horizontal, or faceplate up

Weight (Approx.): 2 oz

Base: Small-Button Ditetrar 8-Pin (JETEC No. E8-11)

**Bottom View**

<table>
<thead>
<tr>
<th>Pin 1: Heater</th>
<th>Pin 2: Grid No.1</th>
<th>Pin 3: Grid No.3</th>
<th>Pin 4: Int. Conn.—Do Not Use</th>
<th>Pin 5: Grid No.2</th>
<th>Pin 6: Grid No.4, Grid No.5</th>
<th>Pin 7: Cathode</th>
<th>Pin 8: Heater</th>
</tr>
</thead>
</table>

**Maximum Ratings, Absolute Values:**

<table>
<thead>
<tr>
<th>SIGNAL—ELECTRODE VOLTAGE</th>
<th>125 max. volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRID—No.5 &amp; GRID—No.4 VOLTAGE</td>
<td>350 max. volts</td>
</tr>
<tr>
<td>GRID—No.3 VOLTAGE</td>
<td>350 max. volts</td>
</tr>
<tr>
<td>GRID—No.2 VOLTAGE</td>
<td>350 max. volts</td>
</tr>
<tr>
<td>GRID—No.1 VOLTAGE: Negative bias value</td>
<td>125 max. volts</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>PEAK HEATER—CATHODE VOLTAGE: 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>

*This capacitance, which effectively is the output impedance of the 6326, is increased by about 3 \(\mu\)F when the tube is mounted in the RCA deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms.*
FACEPLATE:
Illumination .................. 1000 max. ft-c
Temperature .................. 60 max. °C

Typical Operation with Static Focusing:

Grid No. 3 connected to grids No.4 and No.5:
scanned area of 1/2" x 3/8"

Faceplate Illumination:
Average Highlight*, for
pickup from film ..... 100 to 300 ft-c
Constant, for pickup from trans-
parencies or opaques . 10 ft-c

Signal-Electrode Voltage:
For pickup from film ............. 10 to 30 volts
For pickup from transparencies
or opaques ............. 30 to 60 volts

Grid-No.5 (Decelerator) and
Grids-No.4 & No.3 (Beam-Focus
electrodes*) Voltage . 200 to 300 volts

Grid-No.2 (Accelerator) Voltage . 300 volts

Grid-No.1 Voltage for Picture Cutoff . -45 to -100 volts

Highlight Signal-Electrode Current . 0.3 to 0.4 µamp

Average Signal-Output Current# . 0.1 to 0.2 µamp

Maximum Dark Current:
For pickup from film ............. 0.004 µamp
For pickup from transparencies
or opaques ............. 0.02 µamp

Average "Gamma" of Transfer
Characteristic for signal-output
current between 0.02 µamp and
0.2 µamp ............. 0.65

Visual Equivalent Signal-to-Noise
Ratio (Approx.) © . 300:1

Minimum Peak-to-Peak Blanking Voltage:
When applied to grid No.1 . . . . 40 volts
When applied to cathode . . . . 10 volts

Field Strength of Adjustable
Alignment Coil . . . . 0 to 4 gauss

* Averaged over the time of one TV frame.
* Beam focus is obtained by combined effect of grids-No.4 & No.3 voltage
which should be adjustable over indicated range, and RCA-21701 Focusing
coil with 40 milliamperes passing through it.
# Defined as the component of the signal-electrode current after the dark-
current component has been subtracted.
© For amplifier system of the low-noise cascode type having 8-Mc bandwidth.
Because the noise in such a system is predominately of the high-frequency
type, the visual equivalent signal-to-noise ratio is taken as the ratio
of highlight video-signal current to rms noise current, multiplied by
a factor of 3.

MARCH 1, 1954
TENTATIVE DATA 1
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Typical Operation with Dynamic Focusing:

Grid No. 3 used separately as Dynamic Focusing Electrode; scanned area of 1/2" x 3/8"

Values are the same as shown above for Typical Operation with Static Focusing except as follows:

Grid-No.5 (Decelerator) and
Grid-No.4 (Beam-Focus Electrode**) Voltage .... 200 to 300 volts

Grid-No.3 (Dynamic-Focus Electrode**) Voltage:
- DC value .................. 200 to 300 volts
- Peak-to-peak value (Approx.) .......... 60 volts

** Static beam focus is obtained by combined effect of grid-No. 4 voltage which should be adjustable over indicated range, and RCA-217D1 Focusing Coil with 40 milliamperes passing through it. Dynamic beam focus to give improved edge focus is supplementary to static beam focus and is accomplished by adjusting the dc grid-No.3 voltage to the same value as that of grid No. 4 and by applying to grid No.3 an ac voltage having parabolic waveform.

BASE CONNECTOR

The base pins of the 6326 fit the ditetra 8-contact connector, such as Cinch No. 54A18088, or equivalent.

SPECTRAL SENSITIVITY CHARACTERISTIC, DIMENSIONAL OUTLINE, and
BASE DIMENSIONS are the same as shown for Type 6198

ILLUMINATION: UNIFORM OVER PHOTOCONDUCTIVE LAYER
SCANNED AREA OF PHOTOCONDUCTIVE LAYER: 1/2 x 3/8
TYPICAL CHARACTERISTIC

ILLUMINATION: 2870°K INCANDESCENT
HIGHLIGHT SIGNAL-OUTPUT MICROAMPERES = 0.35
SCANNED AREA OF PHOTOCONDUCTIVE LAYER = \( \frac{1}{2}'' \times \frac{3}{8}'' \)

<table>
<thead>
<tr>
<th>SIGNAL-ELECTRODE VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>20</td>
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<tr>
<td>30</td>
</tr>
<tr>
<td>40</td>
</tr>
<tr>
<td>50</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>HIGHLIGHT ILLUMINATION-FOOT-CANDLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>20</td>
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<td>30</td>
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<td>60</td>
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<td>70</td>
</tr>
<tr>
<td>80</td>
</tr>
<tr>
<td>90</td>
</tr>
<tr>
<td>100</td>
</tr>
</tbody>
</table>

OCT. 12, 1953  TUBE DEPARTMENT  RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8118
PERSISTENCE CHARACTERISTIC

HIGHLIGHT SIGNAL—OUTPUT MICROAMPERES = 0.35
SCANNED AREA OF PHOTOCONDUCTIVE LAYER = $\frac{1}{2}'' \times \frac{3}{8}''$

PER CENT OF INITIAL SIGNAL AFTER DARK PULSE OF $\frac{1}{20}$ SEC.

SIGNAL-ELECTRODE VOLTS

OCT. 12, 1953
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
The 6326-A is an improved version of the 6326 and is unilaterally interchangeable with it.

**DATA**

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

**Direct Interelectrode Capacitance:**
- Signal electrode to all other electrodes: 4.5 μf

**Spectral Response:** See Curves

**Photoconductive Layer:**
- Maximum useful diagonal of rectangular image (4 x 3 aspect ratio): 0.62"
- Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the straight sides of the masked portions of the faceplate. The straight sides are parallel to the plane passing through the tube axis and short index pin. The masking is for orientation only and does not define the proper scanned area of the photoconductive layer.

**Focusing Method:** Magnetic
**Deflection Method:** Magnetic
**Overall Length:** 6-1/4" ± 1/4"
**Greatest Diameter:** 1.125" ± 0.010"
**Weight (Approx.):** 2 oz

**Operating Position:** Approx. horizontal, or faceplate up
**Bulb:** T-8
**Base Connector:** Cinch No. 54A18088, or equivalent

**Basing Designation for BOTTOM VIEW:** 8HL

**Pin 1—Heater**
**Pin 2—Grid No.1**
**Pin 3—Grid No.3**
**Pin 4—Internal Connection—Do Not Use**
**Pin 5—Grid No.2**
**Pin 6—Grid No.4, Grid No.5**
**Pin 7—Cathode**
**Pin 8—Heater**
**Electrode Connection—Internal Short Index Pin—Make No**

**DIRECTION OF LIGHT: INTO FACE END OF TUBE**

**Maximum Ratings, Absolute Values:**
- SIGNAL-ELECTRODE VOLTAGE: 100 max. volts
- GRID-No.5 & GRID-No.4 VOLTAGE: 350 max. volts

*This capacitance, which effectively is the output impedance of the 6326-A, is increased by about 3 μf when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms.*
GRID-No.3 VOLTAGE ............................................ 350 max. volts
GRID-No.2 VOLTAGE ............................................ 350 max. volts
GRID-No.1 VOLTAGE:
  Negative bias value .......................................... 125 max. volts
  Positive bias value .......................................... 0 max. volts
PEAK HEATER-CATHODE VOLTAGE:
  Heater negative with respect to cathode ................. 125 max. volts
  Heater positive with respect to cathode .................. 10 max. volts
FACEPLATE:
  Illumination .................................................... 1000 max. ft-c
  Temperature ..................................................... 60 max. °C

Typical Operation with Static Focusing:

  Grid No. 3 connected to grids No.4 and No.5; scanned area of 1/2" x 3/8"

Faceplate Illumination:
  Average highlight*, for pickup from film .................. 50 to 300 ft-c
  Constant highlight, for pickup from limited-motion live scenes .......................... 20 ft-c

Signal-Electrode Voltage:
  For pickup from film ........................................... 20 to 40 volts
  For pickup from limited-motion live scenes ................. 40 to 70 volts

Grid-No.5 (Decelerator) and Grids-No.4 & No.3 (Beam-Focus Electrodes*) Voltage ............... 200 to 300 volts

Grid-No.2 (Accelerator) Voltage .................................. 300 volts

Grid-No.1 Voltage for Picture Cutoff* ........................ -45 to -100 volts

Highlight Signal-Electrode Current ................................ 0.3 to 0.4 µamp
Average Signal-Output Current# ................................ 0.1 to 0.2 µamp
Peak Signal-Output Current ...................................... 0.3 to 0.4 µamp

Maximum Dark Current:
  For pickup from film .......................................... 0.004 µamp
  For pickup from limited-motion live scenes ................ 0.02 µamp

Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 µamp and 0.2 µamp ............................................... 0.65

Visual Equivalent Signal-to-Noise Ratio (Approx.)° ............ 300:1

Minimum Peak-to-Peak Blanking Voltage:
  When applied to grid No.1 .................................... 40 volts
  When applied to cathode ....................................... 10 volts

Field Strength of Adjustable Alignment Coil ................. 0 to 4 gausses

△, ◊, ∗: see next page.

10-56 TENTATIVE DATA 1
Typical Operation with Dynamic Focusing:

Grid No. 3 used separately as Dynamic Focusing Electrode; scanned area of 1/2" x 3/8"

Values are the same as those shown for Typical Operation with Static Focusing except as follows:

Grid-No.5 (Decelerator) and Grid-No.4 (Beam-Focus Electrode**) Voltage .... 200 to 300 volts

Grid-No.3 (Dynamic-Focus Electrode**) Voltage:
DC value .............................. 140 to 240 volts
Peak-to-peak value (Approx.) ....... 60 volts

* Averaged over the time of one TV frame.
* Beam focus is obtained by combined effect of grids-No.4 & No.3 voltage which should be adjustable over indicated range, and a focusing coil having an average field strength of 40 gauss.
* With no blanking voltage on grid No.1.
# Defined as the component of the signal-electrode current after the dark-current component has been subtracted.
** For an amplifier system of the low-noise cascode type having 8-Mc bandwidth, because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of highlight video-signal current to rms noise current, multiplied by a factor of 3.*** Static beam focus is obtained by combined effect of grid-No.4 voltage which should be adjustable over indicated range, and a focusing coil having an average field strength of 40 gauss. Dynamic beam focus to give improved edge focus is supplementary to static beam focus and is accomplished by adjusting the dc grid-No.3 voltage to a value about 60 volts lower than that of grid No.4 and by applying to grid No.3 an ac voltage having parabolic waveform.

TYPICAL LIGHT TRANSFER CHARACTERISTICS

ILLUMINATION: UNIFORM OVER PHOTOCONEDUCTIVE LAYER. SCANNED AREA OF PHOTOCONEDUCTIVE LAYER=1/2" x 3/8". E_{ms} = SIGNAL-ELECTRODE VOLTS TO GIVE MAX. SENSITIVITY AT MAX. DARK CURRENT OF 0.02 MICROAMP.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE DATA 2
NOTE: STRAIGHT SIDES OF MASKED PORTIONS ARE PARALLEL TO THE PLANE PASSING THROUGH TUBE AXIS AND SHORT INDEX PIN.
SPECTRAL SENSITIVITY CHARACTERISTICS

CURVE A: FOR EQUAL VALUES OF SIGNAL-OUTPUT CURRENT AT ALL WAVELENGTHS
SIGNAL-OUTPUT MICROAMPERES FROM SCANNED AREA OF \( \frac{1}{2}'' \times \frac{3}{8}'' = 0.02 \)

CURVE B: SPECTRAL CHARACTERISTIC OF AVERAGE HUMAN EYE

CURVE C: FOR EQUAL VALUES OF SIGNAL-OUTPUT CURRENT WITH RADIANT FLUX FROM TUNGSTEN SOURCE AT 2870°K
TYPICAL CHARACTERISTIC

ILLUMINATION: 2870°K INCANDESCENT
HIGHLIGHT SIGNAL-OUTPUT MICROAMPERES = 0.35
SCANNED AREA OF PHOTOCONDUCTIVE LAYER = 1/2" x 3/8"

- axes labels and data points
- graph showing relationship between signal-electrode volts and highlight illumination in foot-candies
- units: volts and foot-candies
TYPICAL CHARACTERISTIC

CONSTANT ILLUMINATION
SCANNED AREA OF PHOTOCONDUCTIVE LAYER=$\frac{1}{2}'' \times \frac{3}{8}''$

RATIO OF SIGNAL-OUTPUT CURRENT TO DARK CURRENT

SIGNAL-ELECTRODE VOLTS
PERSISTENCE CHARACTERISTIC

HIGHLIGHT SIGNAL-OUTPUT MICROAMPERES = 0.35
SCANNED AREA OF PHOTOCONDUCTIVE LAYER = \( \frac{1}{2} \, " \times \frac{3}{8} \, " \)
IMAGE ORTHICON
FOR SIMULTANEOUS COLOR PICKUP

MAGNETIC FOCUS

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

Direct Interelectrode Capacitance:
Anode to all other electrodes .................. 20 μf

Photocathode, Semitransparent:
Response ........................................... See accompanying Spectral Sensitivity curve

Rectangular image (4 x 3 aspect ratio):
Useful size of .................................... 1.6" max. Diagonal
Orientation of ...................................

Focusing Method .................................... Magnetic
Deflection Method .................................. Magnetic
Overall Length .................................... 15-3/16" ± 1/4"
Greatest Diameter of Bulb ....................... 3" ± 1/16"
Minimum Deflecting-Coil Inside Diameter ... 2-3/8"
Deflecting-Coil Length ........................... 5"
Focusing-Coil Length ................................ 10"
Alignment-Coil Length .............................. 15/16"
Photocathode Distance Inside End of Focusing Coil ... 1/2"
Operating Position: Any except with diheptal base up and tube
axis at angle of less than 20° from vertical
Weight (Approx.) .................................. 1 lb 6 oz
End Base ........................................... Small-Shell Diheptal 14-Pin Base
(JETEC No.B14-45)

Bottom View
Direction of Light: Perpendicular to Large End of Tube

WHITE INDEX LINE
ON FACE

(Continued on next page)
Shoulder Base ............................................ Keyed Jumbo Annular 7-Pin
Pin 1—Grid No. 6 ......................................... Pin 5—Grid No. 5
Pin 2—Photocathode ...................................... Pin 6—Target
Pin 3—Internal Connection—Do Not Use ............. Pin 6—Target
Pin 4—Internal Connection—Do Not Use ............. Pin 7—Internal Connection—Do Not Use

Maximum Ratings, Absolute Values:
PHOTOCATHODE:
Voltage ...................................................... -550 max. volts
Illumination .................................................. 50 max. ft-c

OPERATING TEMPERATURE:
Of any part of bulb ....................................... 50 max. °C
Of bulb at large end of tube (target section) ...... 35 min. °C

TEMPERATURE DIFFERENCE:
Between target section and any part of bulb hotter than target section ... 5 max. °C

GRID-No. 6 VOLTAGE ..................................... -550 max. volts

TARGET VOLTAGE:
Positive value ............................................. 10 max. volts
Negative value ............................................. 10 max. volts
GRID-No. 5 VOLTAGE ..................................... 150 max. volts
GRID-No. 4 VOLTAGE ..................................... 300 max. volts
GRID-No. 3 VOLTAGE ..................................... 400 max. volts
GRID-No. 2 & DYNODE-No. 1 VOLTAGE ................ 350 max. volts
GRID-No. 1 VOLTAGE:
Negative bias value ...................................... 125 max. volts
Positive bias value ...................................... 0 max. volts

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

ANODE—SUPPLY VOLTAGE* ............................ 1350 max. volts
VOLTAGE PER MULTIPLIER STAGE .................... 350 max. volts

Typical Operation and Characteristics:
Photocathode Voltage (Image Focus) ................ -300 to -500 volts
Grid-No. 6 Voltage (Accelerator)—
75% of photocathode voltage ......................... -225 to -375 volts
Target Voltage* .......................................... 0 to 3 volts
Grid-No. 5 Voltage (Decelerator) .................... 0 to 125 volts
Grid-No. 4 Voltage (Beam Focus) .................... 160 to 220 volts
Grid-No. 3 Voltage# .................................... 225 to 330 volts
Grid-No. 2 & DYNODE-No. 1 Voltage ................. 300 volts
Grid-No. 1 Voltage for Picture Cutoff ............... -45 to -115 volts

* Ratio of dynode voltages is shown under Typical Operation.
* Adjustable from -3 to +5 volts with blanking voltage off.
# Adjust to give the most uniformly shaded picture near maximum signal.
**IMAGE ORTHICON**

<table>
<thead>
<tr>
<th></th>
<th>600</th>
<th>800</th>
<th>1000</th>
<th>1200</th>
<th>1250</th>
<th>30</th>
<th>3 to 20</th>
<th>35 to 45</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynode-No.2 Voltage</td>
<td>volts</td>
<td>volts</td>
<td>volts</td>
<td>volts</td>
<td>volts</td>
<td>μamp</td>
<td></td>
<td>O°C</td>
</tr>
<tr>
<td>Dynode-No.3 Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynode-No.4 Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynode-No.5 Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anode Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anode Current (DC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal-Output Current (Peak to peak)</td>
<td>3 to 20</td>
<td>μamp</td>
<td>35 to 45</td>
<td>O°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current (Approx.)</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum Peak-to-Peak Blanking Voltage</td>
<td>5</td>
<td>volts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Strength at Center of Focusing Coil (Approx.)</td>
<td>75</td>
<td>gauss</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Strength of Alignment Coil (Approx.)</td>
<td>0 to 3</td>
<td>gauss</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.*

**OPERATING CONSIDERATIONS**

When the equipment design or operating conditions are such that the maximum temperature rating or maximum temperature difference as given under Maximum Ratings will be exceeded, provision should be made to direct a blast of cooling air from the diheptal-base end of the tube along the entire length of the bulb surface, i.e., through the space between the bulb surface and the surrounding deflecting-coil assembly and its extension. Any attempt to effect cooling of the tube by circulating even a large amount of air around the focusing coil will do little good, but a small amount of air directly in contact with the bulb surface will effectively drop the bulb temperature. For this purpose, a small blower is satisfactory, but it should be run at low speed to prevent vibration of the 6474 and the associated amplifier equipment. Unless vibration is prevented, distortion of the picture may occur.

To keep the operating temperature of the large end of the tube from falling below 35°C, some form of controlled heating should be employed. Ordinarily, adequate heat will be supplied by the focusing coil, deflecting coils, and associated amplifier tubes so that the temperature can be controlled by the amount of cooling air directed along the bulb surface. If, in special cases, a target heater is required, it should fit between the focusing coil and the bulb near the shoulder of the tube, and be non-inductively wound.
**IMAGE ORTHICON**

**DETAI OF BOTTOM VIEW OF JUMBO ANNULAR BASE**

CROSS-HATCHED AREA IS FLAT

1.315" R.MIN.
1.185" R.MAX.

25° 43'

SEE NOTE I

1/2" MIN.

**NOTE I:** DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

**ANNULAR BASE GAUGE**

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

- **a.** SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51° 26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.015".
- **b.** SIX STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.
- **c.** RIM EXTENDING OUT A MINIMUM OF 1/8" FROM 2-13/16" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".
- **d.** NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

**ENLARGED BOTTOM VIEW**

**SMALL-SHELL DIHEPTAL 14-PIN BASE**

**JECTEC**

**Bi4-45**

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

JUNE 14, 1954

TUBE DIVISION

CE-8293
SPECTRAL SENSITIVITY CHARACTERISTIC

FOR INCIDENT RADIANT ENERGY WITHIN NORMAL OPERATING RANGE OF TUBE
DASHED CURVE SHOWS SPECTRAL CHARACTERISTIC OF AVERAGE HUMAN EYE

MICROAMPERES FROM PHOTOCATHODE/MICROWATTS OF RADIANT ENERGY INCIDENT ON PHOTOCATHODE

WAVELENGTH—ANGSTROMS

ULTRAVIOLET
VIOLET
BLUE
GREEN
YELLOW
RED
INFRARED

RELATIVE SENSITIVITY

MAR. 15, 1954
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
LIGHT TRANSFER CHARACTERISTICS

FOR SMALL-AREA HIGHLIGHTS

TUNGSTEN LIGHT, OR DAYLIGHT

RELATIVE HIGHLIGHT ILLUMINATION ON PHOTOCATHODE—ARBITRARY UNITS

TYPICAL STUDIO LIGHT LEVELS USED FOR COLOR TRANSMISSION VALUES ON CURVES ARE ABOVE TARGET-CUTOFF VALUE

TARGET VOLTS 2

RELATIVE HIGHLIGHT ILLUMINATION ON PHOTOCATHODE—PER CENT

JUNE 14, 1954

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AMPLITUDE RESPONSE CHARACTERISTIC

TEST PATTERN: SQUARE WAVE
OPERATING TEMPERATURE OF BULB
ADJACENT TO TARGET: 35°C
RESPONSE MEASURED IN CHANNEL
HAVING 10-Mc BANDWIDTH
TEMPERATURE EFFECT ON AMPLITUDE RESPONSE

TELEVISION LINE NUMBER = 300

BULB TEMPERATURE ADJACENT TO TARGET - °C

RELATIVE CENTER AMPLITUDE RESPONSE - ARBITRARY UNITS

0 10 20 30 40 50 60 70 80

0 10 20 30 40 50 60 70 80

MAR. 15, 1954

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8272
**COMPUTER STORAGE TUBE**

SINGLE-BEAM, PRIMARY-CURRENT-MODULATION TYPE

**DATA**

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

Direct Interelectrode Capacitances (Approx.):
- Grid No.1 to all other electrodes: 6.5 µf
- Grid No.1 to deflecting electrode D1: 0.2 µf
- Grid No.1 to deflecting electrode D2: 0.2 µf
- Grid No.1 to deflecting electrode D3: 0.2 µf
- Grid No.1 to deflecting electrode D4: 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: 8 µf
- DJ3 to all other electrodes: 7 µf
- DJ4 to all other electrodes: 7 µf

Focusing Method: Electrostatic
Deflection Method: Electrostatic
Deflecting-electrode arrangement: See Dimensional Outline

Storage Surface: On inner surface of faceplate
Signal-Output Electrode: Metal plate or 50-line (minimum) mesh covering external surface of faceplate and capacitively coupled to the storage surface. (This electrode is not supplied with the tube.)

Overall Length: 11-1/2" ± 1/4"
Greatest Diameter of Bulb: 3" ± 1/16"
Weight (Approx.): 9 oz
Mounting Position: Center of tube face must be at same elevation as or at higher elevation than tube base.

Cap.: Recessed Small Cavity (JETEC No.11-21)
Base: Small-Shell Duodecal 10-Pin (JETEC No.B10-75)

**BOTTOM VIEW**

Pin 1-Heater
Pin 2-Grid No.1
Pin 3-Cathode
Pin 4-Grid No.3
Pin 6-Deflecting
- Electrode D1
- Electrode D2
- Electrode D3
- Electrode D4
Pin 7-Deflecting
- Electrode DJ3
- Electrode BJ1
- Electrode BJ2
Pin 8-Ultron (Grids No.2 & No.4)

Pin 9-Deflecting
- Electrode DJ2
- Electrode BJ2
- Electrode BJ3
Pin 10-Deflecting
- Electrode DJ3
Pin 12-Heater
Cap-Collector
SS-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
## Maximum Ratings, Design-Center Values:

<table>
<thead>
<tr>
<th>Rating Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector Voltage</td>
<td>Difference between collector voltage and ultor voltage</td>
</tr>
<tr>
<td>Collector Voltage</td>
<td>95% to 105% of $E_c$</td>
</tr>
<tr>
<td>Grid-No.3 Voltage</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Grid-No.3 Voltage</td>
<td>20% to 28% of $E_c$</td>
</tr>
<tr>
<td>Max. Grid-No.1 Voltage for Beam-Current Cutoff</td>
<td>2.4% of $E_c$</td>
</tr>
<tr>
<td>Max. Grid-No.3 Current Range</td>
<td>-15 to +10 μamp</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>Heater negative with respect to cathode</td>
</tr>
<tr>
<td>Peak Heater-Cathode Voltage</td>
<td>Heater positive with respect to cathode</td>
</tr>
</tbody>
</table>

## Equipment Design Ranges:

For any ultor voltage ($E_c$) between 1000 and 2500 volts:

<table>
<thead>
<tr>
<th>Rating Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector Voltage</td>
<td>95% to 105% of $E_c$</td>
</tr>
<tr>
<td>Grid-No.3 Voltage</td>
<td>20% to 28% of $E_c$</td>
</tr>
<tr>
<td>Max. Grid-No.1 Voltage</td>
<td>2.4% of $E_c$</td>
</tr>
<tr>
<td>Max. Grid-No.3 Current</td>
<td>-15 to +10 μamp</td>
</tr>
<tr>
<td>Deflection Factors</td>
<td>DJ$_4$ &amp; DJ$_2$. 39 to 53 v dc/in./kv of $E_c$</td>
</tr>
<tr>
<td>Deflection Factors</td>
<td>DJ$_3$ &amp; DJ$_4$. 35.5 to 48.5 v dc/in./kv of $E_c$</td>
</tr>
</tbody>
</table>

### Examples of Use of Design Ranges:

For ultor voltage of 1000 to 2500 volts:

<table>
<thead>
<tr>
<th>Rating Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector Voltage</td>
<td>950 to 1050, 2375 to 2625 volts</td>
</tr>
<tr>
<td>Grid-No.3 Voltage</td>
<td>200 to 280, 500 to 700 volts</td>
</tr>
<tr>
<td>Max. Grid-No.1 Voltage for Beam-Current Cutoff</td>
<td>-24 to -60 volts</td>
</tr>
</tbody>
</table>

### Deflection Factors:

DJ$_4$ & DJ$_2$. 39 to 53 v dc/in. 97.5 to 133 volts dc/in.
DJ$_3$ & DJ$_4$. 35.5 to 48.5 v dc/in. 89 to 122 volts dc/in.

The *ultor* in a storage tube is the electrode to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection. In the 6571, the ultor function is performed by grid No.4. Since grid No.4 and grid No.2 are connected together within the 6571, they are collectively referred to simply as *ultor* for convenience in presenting data and curves.

The center of the undeflected focused beam will fall within a circle having a 7.5-mm radius concentric with the center of the tube face.
Storage Characteristics for Ultron Voltage of 2500 Volts:

Storage-Surface Boundary (In terms of deflection voltage):
- In the DJ₁–DJ₂ direction from position of undeflected focused beam . . . ±109 volts
- In the DJ₃–DJ₄ direction from position of undeflected focused beam . . . ±100 volts

Blemish Factor*, for storage surface within indicated boundary . . . . . . . . . . . 0.5 max.

Spill (Determined for Double-Dot Pattern):**

Under conditions involving 255 references to "spill" element and 1 reference to "test" element

Separation Between Storage Elements, in either the DJ₁–DJ₂ or DJ₃–DJ₄ direction in terms of deflection voltage:
- At center of storage surface . . . . . . 8 max. volts
- At midpoint on each side of storage-surface boundary . . . . . . . . . . 10 max. volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance . . . . . . . . . . 1.5 max. megohms
Resistances in Any Deflecting-Electrode Circuit* . . . . . . . . . . 1.0 max. megohm

* Blemish factor is defined as the factor by which the normal positive signal is reduced by the blemish.

** Spill is indicative of the amount of binary information that can be stored by the tube. The storage capability is determined by the separation between two storage elements at which the signal from one element is changed by no more than a specified amount after repeated references to the other element. For the 6571, the separation is measured, in terms of deflection voltage, when the amplitude of the negative signal of the "test" element has decreased to 50% of its maximum negative amplitude. The maximum negative amplitude is determined by separating the two elements far enough to eliminate the effects of secondary electron redistribution from the "spill" element.

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

OPERATING CONSIDERATIONS

Shielding. In typical computer applications, the 6571 is mounted in a compartment having effective magnetic and electrostatic shielding. It is recommended that the bulb be provided with a tight-fitting electrostatic shield extending from the base to the collector coating. (See Dimensional Outline). This external shield supplements the shielding action of the collector in preventing cross-coupling between the electron gun and the external signal electrode.

A signal-output electrode shaped to conform with the external contour of the faceplate and placed in contact with the entire area of the faceplate is required. The signal-output electrode is connected to a low-noise video
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 II.

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°.
AVERAGE CHARACTERISTIC

COLLECTOR VOLTS = 2500
ULTOR VOLTS = 2500
GRID-N2 3 VOLTS = ADJUSTED FOR FOCUS
STORAGE PATTERN: DOUBLE DOT
GRID-N1 PULSE DURATION: 1 μSEC. (APPROX.)

REPLACE AMPLITUDE OF POSITIVE SIGNAL

PEAK GRID-N2 VOLTS FROM BEAM-CURRENT CUTOFF

JAN. 27, 1955
TUBE DIVISION
RADIO CORPORATION OF AMERICA, MARRISON, NEW JERSEY 92CM-8510
# DISPLAY STORAGE TUBE

## DIRECT-VIEW TYPE

**4”-DIAMETER DISPLAY**

**NON-EQUILIBRIUM WRITING**  **GRID-CONTROL READING (VIEWING)**

<table>
<thead>
<tr>
<th>DATA</th>
</tr>
</thead>
</table>

### General:

<table>
<thead>
<tr>
<th>Writing Section</th>
<th>Viewing Section</th>
</tr>
</thead>
</table>

**Heater, for Unipotential Cathode:**

- ** Voltage (AC or DC):** 6.3 volts
- ** Current:** 0.6 amp

**Minimum Cathode Heating Time**

before other electrode voltages are applied.

<table>
<thead>
<tr>
<th>Heating Time</th>
<th>Viewing Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>– sec</td>
<td></td>
</tr>
</tbody>
</table>

**Direct Interelectrode Capacitances (Approx.):**

<table>
<thead>
<tr>
<th>Grid No.</th>
<th>Cathode to all other tube electrodes</th>
<th>6 µf</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cathode to all other tube electrodes</td>
<td>6.5 µf</td>
</tr>
<tr>
<td></td>
<td>Deflecting electrode DJ₁ to</td>
<td>1.8 µf</td>
</tr>
<tr>
<td></td>
<td>deflecting electrode DJ₂</td>
<td>1.8 µf</td>
</tr>
<tr>
<td></td>
<td>to</td>
<td>1.8 µf</td>
</tr>
<tr>
<td></td>
<td>Deflecting electrode DJ₃ to</td>
<td>7.5 µf</td>
</tr>
<tr>
<td></td>
<td>deflecting electrode DJ₄</td>
<td>8 µf</td>
</tr>
<tr>
<td></td>
<td>DJ₅ to all other tube electrodes</td>
<td>6 µf</td>
</tr>
<tr>
<td></td>
<td>DJ₆ to all other tube electrodes</td>
<td>7 µf</td>
</tr>
</tbody>
</table>

**Focusing Method**

Electrostatic

**Deflection Method**

Electrostatic

**Deflecting-Electrode Arrangement.**

See Dimensional Outline

**Phosphor.**

- High-Visual-Efficiency Type, Aluminized

**Fluorescence.**

- Yellow

**Phosphorescence.**

- Yellow

**Minimum Useful Screen Diameter.**

- 4”

**Maximum Overall Length.**

- 15-1/2”

**Seated Length.**

- 14” ± 3/8”

**Maximum Tube Radius.**

- 3-5/32”

**Bulb-Flange Diameter.**

- 5-1/8” ± 1/16”

**Greatest Bulb Diameter.**

- 5” ± 1/16”

**Bulb Terminals:**

Caps (Two). Recessed Small Cavity (JETEC No.J1-21)

Flexible cable. See Dimensional Outline

Ambient-Temperature Range. -65° to +100 °C

Mounting Position. Any

Weight (Approx.). 2 lbs

Socket. Alden Part No.435SBA, or equivalent

Base. Small-Button Thirtyfivar 31-Pin (JETEC No.E31-36)

---

0° Without external shield.
DISPLAY STORAGE TUBE

**Maximum Ratings, Absolute Values:**

**Writing Section**

SCREEN VOLTAGE: 11000 max. volts

**Viewing Section**

PEAK BACKING-ELECTRODE VOLTAGE: 20 max volts

* Pins 23 and 31 are not shown because they are trimmed to the same dimension as the short index pin and are not to be used.

**: See next page.

10-56

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Equivalent Values

<table>
<thead>
<tr>
<th>Writing Section</th>
<th>Viewing Section**</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GRID-No. 4 VOLTAGE</strong></td>
<td>2900 max.*</td>
</tr>
<tr>
<td><strong>GRID-No. 3 VOLTAGE</strong></td>
<td>1000 max.*</td>
</tr>
<tr>
<td><strong>GRID-No. 2 VOLTAGE</strong></td>
<td>2750 max.*</td>
</tr>
<tr>
<td><strong>CATHODE VOLTAGE</strong></td>
<td>-</td>
</tr>
<tr>
<td><strong>GRID-No. 1 VOLTAGE:</strong></td>
<td></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><strong>PEAK VOLTAGE BETWEEN GRID No. 4 AND ANY DEFLECTING ELECTRODE.</strong></td>
<td>500 max.</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.*</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:**

| **Screen Voltage** | 5000 | 10000 | 10000 volts |
| **DC Backing-Electrode** | | | |
| **Voltage** | 5 | 5 | 5 volts |
| **Grid-No. 4 Voltage** | 150 | 210 | 150 volts |
| **Grid-No. 3 Voltage** | 25 to 125 | 50 to 150 | 25 to 125 volts |
| **Grid-No. 2 Voltage** | 50 to 75 | 70 to 105 | 50 to 75 volts |
| **Grid-No. 1 Voltage** | 0 to -50 | 0 to -75 | 0 to -50 volts |
| **Maximum Screen Current.** | 350 | 600 | 350 ma |
| **Maximum Peak Backing-Electrode Current.** | 1.5 | 2 | 1.5 ma |
| **Maximum Grid-No. 4 Current.** | 2 | 3 | 2 ma |
| **Maximum Grid-No. 3 Current.** | 1.5 | 2 | 1.5 ma |
| **Maximum Cathode Current.** | 3 | 4 | 3 ma |
| **Writing Speed.** | 300000 | 300000 | 100000 in./sec |
| **Number of Half-Tone Steps.** | 5 | 5 | 5 |
| **Viewing Duration.** | 40 | 20 | 40 sec |
| **Maximum Erasing-Uniformity Factor.** | 0.5 | 0.5 | 0.5 |
| **Stored-Spot Diameter.** | 0.020 | 0.020 | 0.020 in. |
| **Resolution.** | 50 | 50 | 50 lines/in. |
| **Brightness.** | 175 | 1750 | 950 fl |

**Notes:**

- Voltages are shown with respect to cathode of Viewing Gun.
- 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.
- *Adjusted for brightest, most uniform pattern.
- **See next page.
WRITING SECTION

Range Values for Equipment Design:

With any grid-No.2 voltage \(E_{c2}\) between 500 and 2750 volts

| Grid-No.4 Voltage \(E_{c4}\) | 95% to 105% of \(E_{c2}\) volts |
| Grid-No.3 Voltage for Focus | 14% to 28% of \(E_{c2}\) volts |

Maximum Grid-No.1 Voltage

- for Cutoff of Undellected Focused Spot: \(-4.6\% \text{ of } E_{c2}\) volts
- Maximum Grid-No.3 Current: \(-15\%\) to \(+10\%\) \(\mu\) amp
- Maximum Cathode Current: See Curve

Deflection Factors:

\(DJ_1\) and \(DJ_2\) \(28\% \text{ to } 38\% \text{ v dc/in./kv of } E_{c4}\)
\(DJ_3\) and \(DJ_4\) \(28\% \text{ to } 38\% \text{ v dc/in./kv of } E_{c4}\)

Focused Beam Position

Examples of Use of Design Ranges:

With grid-No.2 voltage of

| Grid-No.4 Voltage \(E_{c4}\) | 1500 to 2500 volts |
| Grid-No.3 Voltage for Focus | 210 to 420 volts |

Maximum Grid-No.1 Voltage

- for Cutoff of Undellected Focused Spot: \(-69\%\) to \(-115\%\) volts

Deflection Factors when \(E_{cv} = E_{c2}\):

\(DJ_1\) and \(DJ_2\): \(42\% \text{ to } 57\% \text{ v dc/in.} \)
\(DJ_3\) and \(DJ_4\): \(42\% \text{ to } 57\% \text{ v dc/in.} \)

Equivalent Values for Examples of Writing-Gun Voltages
Referred to Cathode of Viewing Gun:

| Cathode Voltage | \(-1450\% \text{ to } -1395\% \text{ to } -2450\% \text{ to } -2395\% \text{ volts} |
| Grid-No.2 Voltage | \(-25\% \text{ to } +180\% \text{ to } -75\% \text{ to } +230\% \text{ volts} |
| Grid-No.3 Voltage for Focus | \(-1240\% \text{ to } -975\% \text{ to } -2100\% \text{ to } -1695\% \text{ volts} |
| Grid-No.4 Voltage | \(50\% \text{ to } 105\% \text{ to } 50\% \text{ to } 105\% \text{ volts} |

VIEWING SECTION and WRITING SECTION

Circuit Values:

- Grid-No.1-Circuit Resistance (Either gun): \(1.0 \text{ max. megohm}\)
- Resistance in Any Deflecting-Electrode Circuit: \(0.1 \text{ max. megohm}\)
- Backing-Electrode-Circuit Resistance: \(0.005 \text{ max. megohm}\)
- Series Current-Limiting Resistance in Screen Circuit: \(1.0 \text{ min. megohm}\)

* 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 \(\pm 2500\%\) volts with respect to cathode of Writing Gun.

○ Observed with an RCA-2F21 Monoscope display.

\(^{\bullet"
Expressed in terms of the time required for the brightness of the un-written background to rise from just zero brightness (viewing-beam cutoff) to 10% of the maximum brightness.

Defined as \((t_2 - t_1)/t_2\), where

- \(t_1\) = time measured from start of erasing to instant at which any screen area is reduced to zero brightness.
- \(t_2\) = time measured from start of erasing to instant at which entire screen area is reduced to zero brightness.

Measured by shrinking-raster method 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.
CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 30° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT CENTER OF FACEPLATE.

THE PLANE THROUGH TUBE AXIS AND EACH OF THE FOLLOWING ITEMS MAY VARY FROM THE DEFLECTION PATH PRODUCED BY DJ1 AND DJ2 BY THE FOLLOWING ANGULAR TOLERANCES (MEASURED ABOUT THE TUBE AXIS): PIN 27, ± 10°; EACH CAVITY CAP ON SAME SIDE AS PIN 271, ± 170°; ENCAPSULATED JUNCTION, ± 10°. ANGLE BETWEEN DJ1 - DJ2 DEFLECTION PATH AND DJ3 - DJ4 DEFLECTION PATH IS 90° ± 30°.
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR
AVERAGE CHARACTERISTIC

VIEWING SECTION

$E_t = 6.3$ VOLTS
BACKING-ELECTRODE VOLTS* = 5
GRID-N 2 4 VOLTS* = 210
GRID-N 2 2 VOLTS* = 85
GRID-N 2 3 VOLTS* ADJUSTED FOR BRIGHTEST,
GRID-N 2 1 VOLTS* MOST UNIFORM DISPLAY
*REFERRED TO CATHODE OF VIEWING GUN

WRITING SECTION

NORMAL OPERATION

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

VIEWING SECTION

$E_t = 6.3$ 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

GRID N 4 (VIEWING SECTION) VOLTS

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
TYPICAL ERASURE CHARACTERISTICS

VIEWING SECTION

$E_t = 6.3$ VOLTS
GRID-N° 4 VOLTS* = 210
GRID-N° 3 VOLTS* ADJUSTED FOR BRIGHTEST,
GRID-N° 1 VOLTS* MOST UNIFORM DISPLAY

*REFERRED TO CATHODE OF VIEWING GUN

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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.
CURRENT CHARACTERISTIC
FOR WRITING GUN

WRITING SECTION

\[ E_f = 6.3 \text{ VOLTS} \]
\[ \text{GRID-N}_2 \ 4 \text{ VOLTS}^* = \text{GRID-N}_2 \ 0.2 \text{ VOLTS} \]
\[ \text{GRID-N}_2 \ 3 \text{ VOLTS}^* = \text{ADJUSTED FOR FOCUS} \]
\[ \text{GRID-N}_2 \ 1 \text{ VOLTS}^* = 0 \]

*REFERRED TO CATHODE OF WRITING GUN

VIEWING SECTION

NORMAL OPERATION

MAXIMUM PEAK CATHODE OR GRID-N2 2 MILLIAMPERES

5
4
3
2
1
0

500
1000
1500
2000
2500
GRID-N2 VOLTS

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9046
TYPICAL DRIVE CHARACTERISTIC FOR WRITING GUN

WRITING SECTION

E_f = 6.3 VOLTS
GRID-N0 4 VOLTS* = 2500
GRID-N0 3 VOLTS* = ADJUSTED FOR FOCUS
GRID-N0 2 VOLTS* = 2500
GRID-N0 1* BIASED TO SPOT CUTOFF
*REFERRED TO CATHODE OF WRITING GUN

VIEWING SECTION

NORMAL OPERATION

PEAK GRID-N0 1 DRIVE FROM SPOT CUTOFF — VOLTS

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
This section contains data on RCA phototubes having a variety of spectral responses, shapes, and sizes. It includes both gas and vacuum single-unit types as well as multiplier types for diversified applications.

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

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PRICES
OF PHOTOTUBE TYPES

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*This price list applies only in the United States of America and is subject to change without notice. All prices are exclusive of all Federal, state and local excise, sales, and similar taxes.

- Schedule A shows user prices for tube types priced for distribution through other than dealer and service channels.
- Schedule B shows list prices for tube types priced for distribution through dealer and service channels.
- Not recommended for new equipment design.

INFORMATION ON PURCHASING ABOVE TYPES

Information as to where RCA Phototube Types can be purchased may be obtained from our regional office nearest you or from Tube Department, Radio Corporation of America, Harrison, N.J.
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.

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- Cartridge type.
- Low-microphonic type.
- Head-on type.
- Non-directional type.
- $ For headlight-control service.
- \$ 9-stage type.
- * 10-stage type.
- ** 14-stage type.
Radiant Sensitivity. The quotient of output current by incident radiant power of a given wavelength, at constant electrode voltages.

Cathode Radiant Sensitivity. The quotient of current leaving the photocathode by incident radiant power of a given wavelength.

Luminous Sensitivity. The quotient of output current by incident luminous flux, at constant electrode voltages.

Cathode Luminous Sensitivity. The quotient of current leaving the photocathode by the incident luminous flux.

Current Amplification. Ratio of the output current to the photocathode current, at constant electrode voltages.

Equivalent Anode-Dark-Current Input. The quotient of the anode dark current by the luminous sensitivity.

Equivalent Noise Input. That value of incident luminous flux which when modulated in a stated manner produces an rms output current equal to the rms noise current within a specified bandwidth.

Electrode Dark Current. The electrode current which flows when there is no radiant flux incident on the photocathode.

Median. That value in a series such that half of the tubes in the series are on one side of it, and half on the other.
PHOTOTUBE SENSITIVITY AND SENSITIVITY MEASUREMENTS

GENERAL CONSIDERATIONS

The range of luminous-sensitivity limits given for a phototube on the data sheets of this Section is that which the tube will display when operated under low-current conditions.

If the tube is to be operated under conditions approaching its maximum-current rating, the equipment design should provide for a wider sensitivity range having a minimum value equal to one-half of that shown for low-current operation. The sensitivity of a phototube under such high-current conditions is dependent upon the tube type; as follows:

1. Single-Unit and Twin Phototubes
   a. Gas Types: For high-current operation, and particularly in applications in which the type is subjected to these higher values continuously, a drop in sensitivity below the values for low-current operation may be expected, the extent of the drop being affected by the severity of the operating conditions. After a period of idleness, a gas phototube usually recovers most of its initial sensitivity.
   b. Vacuum Types: Unlike gas phototubes, this class of phototubes shows negligible drop in sensitivity values for different degrees of illumination and over long periods of use. The output current of a vacuum phototube is a linear function of the exciting illumination under normal operating conditions. The frequency response is flat up to frequencies at which transit-time effects become the limiting factor.

2. Multiplier Phototubes
   Although RCA Multiplier Phototubes are vacuum types, a drop in sensitivity is to be expected from this class of phototubes when operated at high anode-current values. The extent of the drop is affected by the nature and severity of the operating conditions to which the tube is subjected. After a period of idleness, the multiplier phototube usually recovers a substantial percentage of this loss of sensitivity.
   Multiplier-phototube-sensitivity values are dependent on the respective amplification of each dynode stage. Hence, large variations in sensitivity can be expected between individual tubes of a given type. The overall amplification of a multiplier phototube is equal to the average amplification per stage raised to the $n$th power, where $n$ is the number of stages. Thus, very small variations in amplification per stage produce very large changes in overall tube amplification.

Because these overall changes are very large, it is advisable for designers to provide adequate adjustment of the supply voltage per stage so as to be able to adjust the amplification of individual tubes to the desired design value. It is suggested that an overall voltage-adjustment

(continued on next page)
PHOTOTUBE SENSITIVITY AND SENSITIVITY MEASUREMENTS

range of at least 2 to 1 be provided. When the output current can be controlled by change in the illumination of the photocathode of the multiplier phototube, the required range of adjustment in the voltage per stage can be reduced.

SENSITIVITY MEASUREMENTS

The luminous-sensitivity values shown on the data pages of this Section are measured according to the following procedures:

1. Single-Unit and Twin Phototubes
   a. Gas Types: The light source consists of a tungsten lamp operating at a filament color temperature of 2870°K. For the 0-cycle measurements, a light input of 0.1 lumen is used, unless otherwise specified. For the 5000- and 10000 cycle measurements, the light input is varied sinusoidally about a mean value of 0.015 lumen from zero to a maximum of twice the mean. For all measurements, a dc anode-supply voltage of 90 volts and a 1.0-megohm load resistor are employed. Under these conditions, the effect of tube capacitance is negligible.
   b. Vacuum Types: The light source consists of a tungsten lamp operating at a filament color temperature of 2870°K. A steady light input of 0.1 lumen is used, unless otherwise specified, together with a dc anode-supply voltage of 250 volts and a 1-megohm load resistor.

2. Multiplier Phototubes
   The light source consists of a tungsten lamp operating at a filament color temperature of 2870°K. A light flux of 10 microlumens from a rectangular aperture approximately 0.8" long and 0.2" wide is projected normal to the cathode in the direction noted on the basing diagram and outline. The load resistor has a value of 0.01 megohm. The applied voltages are specified on the individual data sheets.
SPECTRAL CHARACTERISTIC OF HUMAN EYE & OF TUNGSTEN LAMP AT COLOR TEMPERATURE OF 2870 °K

EYE CURVE IS ON BASIS OF EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS

RELATIVE ENERGY DISTRIBUTION OF LAMP-ARBITRARY UNITS
RELATIVE SENSITIVITY OF EYE-ARBITRARY UNITS

OCT. 20, 1947
SPECTRAL SENSITIVITY CHARACTERISTIC
OF PHOTOTUBE HAVING
S-1 RESPONSE
FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS
SPECTRAL SENSITIVITY CHARACTERISTIC
OF PHOTOTUBE HAVING
S-3 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS

RELATIVE SENSITIVITY - ARBITRARY UNITS

3000  5000  7000  9000  11000  13000
WAVELENGTH - ANGSTROMS

ULTRA VIOLET  BL  GREEN  YEL  RED  INFRA RED

MAR. 21, 1948

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, MARRISON, NEW JERSEY
SPECTRAL SENSITIVITY CHARACTERISTIC
OF PHOTOTUBE HAVING
S-4 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS
SPECTRAL SENSITIVITY CHARACTERISTIC
OF PHOTOTUBE HAVING
S-4 RESPONSE
RADIANT FLUX FROM TUNGSTEN SOURCE AT 2870°K

MAR. 25, 1947
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
SPECTRAL SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-5 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS

FOR VALUE OF RADIANT SENSITIVITY (µAmps/µWatt) AT 100-UNIT POINT,
SEE DATA SHEET FOR SPECIFIC TYPE
SPECTRAL SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-8 RESPONSE
FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS

FOR VALUE OF RADIANT SENSITIVITY (μAMP/μWATT) AT 100-UNIT POINT, SEE DATA SHEET FOR SPECIFIC TYPE

RANGE OF MAX. VALUE

RELATIVE SENSITIVITY—ARBITRARY UNITS

WAVELENGTH—ANGSTROMS

ULTRA VIOLET
VIOLET
BLUE
GREEN
YELLOW
RED
INFRA RED

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
SPECTRAL SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-8 RESPONSE
FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS

JULY 19, 1945
SPECTRAL SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING 5-9 RESPONSE FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS

For absolute value of sensitivity at 100-unit point, see data sheet for specific tube type.
SPECTRAL SENSITIVITY CHARACTERISTIC
OF PHOTOTUBE HAVING
S-10 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS

FOR ABSOLUTE VALUE OF SENSITIVITY
AT 100-UNIT POINT, SEE DATA SHEET
FOR SPECIFIC TUBE TYPE

NOV. 11, 1952
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-782IRI
SPECTRAL SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-11 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS

FOR VALUE OF RADIANT SENSITIVITY ($\mu$Amp/$\mu$Watt) AT 100-UNIT POINT, SEE DATA SHEET FOR SPECIFIC TYPE.

RELATIVE SENSITIVITY - ARBITRARY UNITS

WAVELENGTH - ANGSTROMS

ULTRA VIOLET VIOLET BLUE GREEN YELLOW RED INFRA RED

JULY 1, 1955 TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
TENTATIVE SPECTRAL SENSITIVITY CHARACTERISTIC OF PHOTOTUBE HAVING S-13 RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS

FOR VALUE OF RADIANT SENSITIVITY (\(\mu\text{Amp/\mu Watt}\)) AT 100-UNIT POINT,
SEE DATA SHEET FOR SPECIFIC TYPE

RANGE OF MAX. VALUE

\begin{figure}
\centering
\includegraphics[width=\textwidth]{chart.png}
\end{figure}
SPECTRAL CHARACTERISTIC OF 2870°K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870°K SOURCE AFTER PASSING THROUGH INDICATED BLUE FILTER

CURVE A: SPECTRAL CHARACTERISTIC OF LIGHT SOURCE AT COLOR TEMPERATURE OF 2870°K
CURVE B: SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870°K SOURCE AFTER PASSING THROUGH BLUE FILTER (CORNING NO.5113 POLISHED TO 1/2 STOCK THICKNESS)

RELATIVE ENERGY DISTRIBUTION—ARBITRARY UNITS

WAVELENGTH—ANGSTROMS

JULY 17, 1952

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7811
SPECTRAL CHARACTERISTIC OF 2870°K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870°K SOURCE AFTER PASSING THROUGH INDICATED RED-INFRARED FILTER

CURVE A: SPECTRAL CHARACTERISTIC OF LIGHT SOURCE AT COLOR TEMPERATURE OF 2870°K

CURVE B: SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870°K SOURCE AFTER PASSING THROUGH RED-INFRARED FILTER (COMBINATION OF CORNING, GLASS CODE NO. 3482 AND NO. 5850 FILTERS)
FREQUENCY-RESPONSE CHARACTERISTICS
OF GAS PHOTOTUBES

ANODE - SUPPLY VOLTS = 90
VOLTAGE DROP IN LOAD - VERY SMALL
CAPACITANCE EFFECTS - MADE NEGLIGIBLE

CURVE A: PHOTOTUBE HAVING S-1 OR S-3 RESPONSE
CURVE B: PHOTOTUBE HAVING S-4 RESPONSE

APRIL 30, 1947
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
MULTIPLIER PHOTOTUBE
9-STAGE TYPE WITH S-4 RESPONSE

For applications involving very low light levels.

DATA

General:
Spectral Response. S-4
Wavelength of Maximum Response. 4000 ± 500 angstroms

Cathode:
  Minimum Projected Length. 15/16"
  Minimum Projected Width. 5/16"

Direct Inter-electrode Capacitances:
  Anode to Dynode No. 9. 4 µf
  Anode to All Other Electrodes. 6.5 µf

Maximum Overall Length. 3-11/16"
Maximum Seated Length. 1-5/16"
Maximum Diameter. Any
Bulb. Mounting Position.
Base. Small-Shell Submagnal 11-Pin, Non-Hygroscopic

Basing Designation for BOTTOM VIEW. 11K

Pin 1 - Dynode No. 1
Pin 2 - Dynode No. 2
Pin 3 - Dynode No. 3
Pin 4 - Dynode No. 4
Pin 5 - Dynode No. 5
Pin 6 - Dynode No. 6
Pin 7 - Dynode No. 7
Pin 8 - Dynode No. 8
Pin 9 - Dynode No. 9
Pin 10 - Anode
Pin 11 - Cathode

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC or Peak AC). 1250 max. volts
SUPPLY VOLTAGE BETWEEN DYNODE No. 9 and ANODE (DC or Peak AC). 250 max. volts
PEAK ANODE CURRENT. 1 max. ma
AVERAGE ANODE CURRENT. 0.1 max. ma
AMBIENT TEMPERATURE. 75 max. °C

Characteristics:
With 100 volts per dynode stage and 100 volts between dynode No. 9 and anode.

<table>
<thead>
<tr>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode Dark Current</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Sensitivity:
  At 4000 Angstroms. 74000 µamp/µwatt
  Luminous. 40 amp/lumen
  Current Amplification. 2000000
  Equivalent Noise Input. 5 x 10^-13 lumen

For the more usual applications, the 931-A is recommended.
* The use of about 50 volts between dynode No. 9 and anode will give improved operating stability without sacrifice in sensitivity as explained in note under Type 931-A.
# on plane perpendicular to indicated direction of incident light.
* indicates a change.

NOV. 15, 1949
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Characteristics:

*With 75 volts per dynode stage
 and 50 volts between dynode No. 9 and anode*

Sensitivity:
- At 4000 Angstroms .................. 11000 μamp/μwatt
- Luminous* .................................. 12 amp/lumen
- Current Amplification* .................. 300000

- Referred to cathode.
- Averaged over any interval of 30 seconds maximum.
- Dark current due to thermionic emission and ion feedback may be reduced by the use of refrigerants.
- For maximum signal-to-noise ratio, operation below 1000 volts is recommended.
- Measured under conditions specified on sheet "PHOTOTUBE SENSITIVITY and MEASUREMENTS" at the front of this Section.
- Ratio of anode sensitivity to cathode sensitivity.
- Defined as the value where the rms output current is equal to the rms noise current determined under the following conditions: 100 volts per stage, 25°C tube temperature, bandwidth of 1 cycle per second, tungsten light source at 2870°K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The "on" period of the pulse is equal to the "off" period. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

OUTLINE DIMENSIONS for Type 1P21 are the same as those for Type 931-A

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-4 Response is shown at the front of this Section

* indicates a change.

NOV. 15, 1949
AVERAGE ANODE CHARACTERISTICS

VOLTS / STAGE = 100

ANODE MILLIAMPERES

VOLTS BETWEEN ANODE & DYNODE N°9

OCT. 26, 1949
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6456R3
100 VOLTS PER STAGE
BANDWIDTH: 1 CPS
LIGHT SOURCE: TUNGSTEN, AT 2870°K;
INTERRUPTED AT 90 CPS TO PRODUCE PULSES
ALTERNATING BETWEEN ZERO AND FLUX VALUE
SHOWED FOR ANY GIVEN TUBE TEMPERATURE;
"ON" PERIOD OF PULSE EQUAL TO "OFF" PERIOD;
RMS SIGNAL CURRENT = RMS NOISE CURRENT.
MUTLIPLER PHOTOTUBE
9-STAGE TYPE WITH S-8 RESPONSE

DATA

General:
Spectral Response ........................................... S-8
Wavelength of Maximum Response ........... 4200 ± 500 angstroms
Cathode:
  Minimum Projected Length* .................. 15/16" 
  Minimum Projected Width* ................. 5/16"
Direct Interelectrode Capacitances:
  Anode to Dynode No. 9 .................. 4 μf
  Anode to All Other Electrodes ....... 6.5 μf
Maximum Overall Length ................... 3-11/16"
Maximum Seated Length ............................. 3-1/8"
Seated Length to Center of Cathode 1-15/16" ± 3/32"
Maximum Diameter .................................. 1-5/16"
Bulb. .................................................. T-9
Mounting Position ..................................... Any
Base. .................................................. Small-Shell Submagnal 11-Pin, Non-Hygrosopic

Basing Designation for BOTTOM VIEW ......... 11K

Pin 1- Dynode No.1 .......... Pin 7- Dynode No.7
Pin 2- Dynode No.2 .......... Pin 8- Dynode No.8
Pin 3- Dynode No.3 .......... Pin 9- Dynode No.9
Pin 4- Dynode No.4 .......... Pin 10- Anode
Pin 5- Dynode No.5 .......... Pin 11- Cathode
Pin 6- Dynode No.6

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
PEAK ANODE CURRENT* .................. 10 max. ma
AVERAGE ANODE CURRENT* .............. 1 max. ma
AMBIENT TEMPERATURE ......................... 50 max. °C

Characteristics:
With 100 volts per dynode stage and
100 volts between dynode No.9 and anode

<table>
<thead>
<tr>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.25</td>
</tr>
</tbody>
</table>

Anode Dark Current*.................. -

Sensitivity:
  At 4200 Angstroms .................. - 370 - μamp/μwatt
  Luminous* .................. 0.115 0.6 50 amp/lumen
  Current Amplification* .......... 200000 -
  Luminous Detectivity* .......... 1 x 10^-10 - lumen

* The use of about 50 volts between dynode No.9 and anode will give improved operating stability without sacrifice in sensitivity as explained in note under Type 931-A.

# on plane perpendicular to indicated direction of incident light.

O, #, *, †, ‡: See next page.

MAR. 15, 1948
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
**Characteristics:**

With 75 volts per dynode stage and 50 volts between dynode No. 9 and anode

<table>
<thead>
<tr>
<th>Sensitivity:</th>
<th>Sensitivity:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Av.</td>
<td></td>
</tr>
<tr>
<td>At 4200 Angstroms.</td>
<td>(55 \mu \text{amp}/\mu \text{watt})</td>
</tr>
<tr>
<td>Luminous</td>
<td>0.09 amp/lumen</td>
</tr>
<tr>
<td>Current Amplification*</td>
<td>30000</td>
</tr>
</tbody>
</table>

- Averaged over any interval of 30 seconds maximum.
- Dark current due to thermionic emission and ion feedback may be reduced by the use of refrigerants.
- For maximum signal-to-noise ratio, operation below 1000 volts is recommended.
- Measured under conditions specified on sheet "PHOTOTUBE SENSITIVITY AND SENSITIVITY MEASUREMENTS" at the front of this Section.
- Ratio of anode sensitivity to cathode sensitivity.
- Defined as the value where the rms output current is equal to the rms noise current determined under the following conditions: 100 volts per stage, 25°C tube temperature, bandwidth of 1 cycle per second, tungsten light source at 2870°K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The "on" period of the pulse is equal to the "off" period. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

**OUTLINE DIMENSIONS** for Type 1P22 are the same as those for Type 931-A

**SPECTRAL-SENSITIVITY CHARACTERISTIC** of Phototube having S-8 Response is shown at the front of this Section.
**RCA**

**IP28**

**MULTIPLIER PHOTOTUBE**

9-STAGE TYPE WITH S-5 RESPONSE

### DATA

#### General:
- Spectral Response: S-5
- Wavelength of Maximum Response: $3400 \pm 500$ angstroms

#### Cathode:
- Minimum projected length*: 15/16"
- Minimum projected width*: 5/16"

#### Direct Interelectrode Capacitances (Approx.):
- Anode to dynode No. 9: 4.4 $\mu$F
- Anode to all other dynodes: 6 $\mu$F

#### Other Dimensions:
- Maximum Overall Length: 3-11/16"
- Maximum Seated Length: 3-1/8"
- Length from Base Seat to Center of Useful Cathode Area: 1-5/16" ± 3/32"
- Maximum Diameter: 1-5/16"
- Mounting Position: Any
- Weight (Approx.): 1.2 oz
- Bulb: T-9
- Base: Small-Shell Subminiature 11-Pin (JETEC No. B11-88)

#### Basing Designation for BOTTOM VIEW:
- Non-hygrosopic

#### 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*: 0.5 max. ma
- Ambient Temperature: 75 max. °C

#### Characteristics Range Values for Equipment Design:
- Under conditions with supply voltage (E) across voltage divider providing 1/10 of E between cathode and dynode No. 1; 1/10 of E for each succeeding dynode stage; and 1/10 of E between dynode No. 9 and anode
- With $E = 1000$ volts (except as noted)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Dynode</th>
<th>I_Sensitivity</th>
<th>3400 Angstroms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No. 1</td>
<td>$\mu$Amp/\mu Watt</td>
<td>61800</td>
</tr>
</tbody>
</table>

* On plane perpendicular to the indicated direction of incident radiation.
- Averaged over any interval of 30 seconds maximum.

**JULY 1, 1955**

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
### Multiplier Phototube

<table>
<thead>
<tr>
<th>Min.</th>
<th>Median</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cathode radiant, at 3400 angstroms</td>
<td>0.050</td>
<td>-</td>
</tr>
<tr>
<td>Luminous at 0 cps</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>At 100 Mc</td>
<td>47.5</td>
<td>-</td>
</tr>
<tr>
<td>Cathode luminous at 0 cps</td>
<td>40</td>
<td>-</td>
</tr>
<tr>
<td>Current Amplification</td>
<td>1,250,000</td>
<td>-</td>
</tr>
<tr>
<td>Equivalent Anode-Dark Current Input</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Equivalent Noise</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Luminous Input</td>
<td>7.5 \times 10^{-12}</td>
<td>-</td>
</tr>
<tr>
<td>Ultraviolet</td>
<td>8 \times 10^{-16}</td>
<td>-</td>
</tr>
</tbody>
</table>

**With E = 750 volts (except as noted)**

<table>
<thead>
<tr>
<th>Min.</th>
<th>Median</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity: Radiant at 3400 angstroms</td>
<td>7900</td>
<td>-</td>
</tr>
<tr>
<td>Cathode radiant, at 3400 angstroms</td>
<td>0.050</td>
<td>-</td>
</tr>
<tr>
<td>Luminous at 0 cps</td>
<td>6.4</td>
<td>-</td>
</tr>
<tr>
<td>Cathode luminous at 0 cps</td>
<td>40</td>
<td>-</td>
</tr>
<tr>
<td>Current Amplification</td>
<td>160000</td>
<td>-</td>
</tr>
</tbody>
</table>

* For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A light input of 10 microlumens is used. The load resistor has a value of 0.01 megohm.
* For conditions the same as shown under (●) except that the value of light flux is 0.01 lumen and 100 volts are applied between cathode and all other electrodes connected together as anode.
* Measured at a tube temperature of 25°C and with the supply voltage (E) adjusted to give a luminous sensitivity of 20 amperes per lumen. Dark current caused by thermionic emission and ion feedback may be reduced by the use of a refrigerant.
* For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1000 volts is recommended.
* Under the following conditions: Supply voltage (E) is 1000 volts, 25°C tube temperature, ac-amplifier band-width of 1 cycle per second, tungsten light source at color temperature of 2870°K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The "on" period of the pulse is equal to the "off" period. The output current is measured through a filter which passes only the fundamental frequency of the pulses.
* Determined under the same conditions as shown under (●) except that use is made of a monochromatic source having radiation at 2537 angstroms.

Curves showing VARIATION IN SENSITIVITY OF PHOTOCATHODE for Type 1P28 are the same as those shown for Type 931-A.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-5 Response is shown at the front of this Section.

JULY 1, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

DATA 1
The operating stability of the IP28 is dependent on the magnitude of the anode current and its duration. When the IP28 is operated at high values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the IP28 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum rated value of 0.5 milliampere is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 10 microamperes, and the tube should be given a warm-up period of about 1/2 hour under load conditions. Electrostatic and/or magnetic shielding of the IP28 may be necessary.
AVERAGE ANODE CHARACTERISTICS

VOLTS/STAGE = 100

LIGHT-FLUX - MICROAMPERES = 30

VOLTS BETWEEN ANODE & DYNODE N29

MAY 6, 1955
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6632R3
AVERAGE CHARACTERISTICS

SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER PROVIDING 1/10 OF E BETWEEN CATHODE AND DYNOE NO. 1; 1/10 OF E FOR EACH SUCCEEDING DYNOE STAGE; AND 1/10 OF E BETWEEN DYNOE NO. 9 AND ANOE.
EQUIVALENT-NOISE-INPUT CHARACTERISTIC

100 VOLTS PER STAGE
BANDWIDTH: 1 CPS
LIGHT SOURCE: TUNGSTEN, AT 2870°K;
INTERRUPTED AT 90 CPS TO PRODUCE PULSES
ALTERNATING BETWEEN ZERO AND FLUX VALUE
SHOWN FOR ANY GIVEN TUBE TEMPERATURE;
“ON” PERIOD OF PULSE EQUAL TO “OFF” PERIOD;
RMS SIGNAL CURRENT = RMS NOISE CURRENT.
EXTERNAL SHIELD VOLTS RELATIVE TO
ANODE VOLTS = -1000

TUBE TEMPERATURE - DEGREES CENTIGRADE
MAY 7, 1955
10^15 10^14 10^13 10^12 10^11 10^10
-150 -100 -50 0 +50
GAS PHOTOTUBE
WITH S-3 RESPONSE

DATA

General:
Spectral Response ........................................... S-3
Wavelength of Maximum Response .................. 4200 ± 1000 Angstroms
Cathode:
Shape .............................................................. Semi-Cylindrical
Minimum Projected Length* .......... 1-1/4"
Minimum Projected Width* ........ 5/8"
Direct Interelectrode Capacitance ................ 3 μf
Maximum Overall Length ................ 4-1/8"
Maximum Seated Length ................ 3-1/2"
Seated Length to Center of Cathode ........ 2-1/8" ± 3/32"
Maximum Diameter ............................................ 1-1/8"
Bulb ................................................................. T-8
Mounting Position .............................................. Any
Base ............................................................... Dwarf-Shell Small 4-Pin
Basing Designation for BOTTOM VIEW ............... 2K

Pin 1 - No Connection
Pin 2 - Anode
Pin 3 - No Connection
Pin 4 - Cathode

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC or Peak AC) ...... 100 max. volts
PEAK CATHODE CURRENT .................................. 20 max. μamp
PEAK CATHODE-CURRENT DENSITY ............ 100 max. μamp/sq.in.
AVERAGE CATHODE CURRENT° ...................... 5 max. μamp
AMBIENT TEMPERATURE .................................... 100 max. °C

Characteristics:

<table>
<thead>
<tr>
<th></th>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark Current at 90 Volts</td>
<td>-</td>
<td>-</td>
<td>0.10</td>
</tr>
<tr>
<td>Sensitivity:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 4200 Angstroms</td>
<td>-</td>
<td>0.01</td>
<td>-</td>
</tr>
<tr>
<td>Luminous:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 0 Cycles</td>
<td>-</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>At 5000 Cycles</td>
<td>-</td>
<td>35</td>
<td>-</td>
</tr>
<tr>
<td>At 10000 Cycles</td>
<td>-</td>
<td>31</td>
<td>-</td>
</tr>
<tr>
<td>Gas Amplification Factor</td>
<td>-</td>
<td>-</td>
<td>9</td>
</tr>
</tbody>
</table>

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

- Indicates a change.

AUGUST 15, 1947
Minimum Circuit Values:

DC Load Resistance:

With anode-supply voltage of 80 volts or less:

For dc currents

\[
\begin{align*}
\text{above 5 } \mu\text{amp} & : 0.1 \ldots \text{megohm} \\
\text{below 5 } \mu\text{amp} & : \text{No Minimum}
\end{align*}
\]

With anode-supply voltage of 100 volts:

For dc currents

\[
\begin{align*}
\text{above 3 } \mu\text{amp} & : 2.5 \ldots \text{megohms} \\
\text{below 3 } \mu\text{amp} & : 0.1 \ldots \text{megohm}
\end{align*}
\]

OUTLINE DIMENSIONS for Type 1P29 are the same as those for Type 1P37

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-3 Response and

FREQUENCY-RESPONSE CHARACTERISTICS of Gas Phototubes are shown at the beginning of this Section

→ Indicates a change.

AUGUST 15, 1947 TUBE DEPARTMENT RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
GAS PHOTOTUBE
WITH S-4 RESPONSE

DATA

General:
Spectral Response ........................................ S-4
Wavelength of Maximum Response. .......... 4000 ± 500 Angstroms
Cathode:
  Shape ........................................ Semi-Cylindrical
  Minimum Projected Length* .................. 1-1/4"
  Minimum Projected Width* ................. 5/8"
Direct Interelectrode Capacitance ........... 3 μf
Maximum Overall Length ...................... 4-1/8"
Maximum Seated Length ....................... 3-1/2"
Seated Length to Center of Cathode .......... 2-1/8" ± 3/32"
Maximum Diameter .......................... 1-1/8"
Bulb. ........................................ T-8
Mounting Position ......................... Any
Base. ...................... Dwarf-Shell Small 4-Pin
  Basing Designation for BOTTOM VIEW ...... 2K

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC or Peak AC) 100 max. volts
PEAK CATHODE CURRENT ......................... 20 max. μamp
PEAK CATHODE-CURRENT DENSITY ........... 100 max. μamp/sq.in.
AVERAGE CATHODE CURRENT° .................. 5 max. μamp
AMBIENT TEMPERATURE ................... 75 max. °C

Characteristics:
  Min. Av. Max.
Dark Current at 90 Volts . – – 0.05 μamp
Sensitivity:
  At 4000 Angstroms . – 0.125 – μamp/μwatt
Luminous:
  At 0 Cycles ............. 75 135 205 μamp/lumen
  At 5000 Cycles ...... – 124 – μamp/lumen
  At 10000 Cycles ...... – 108 – μamp/lumen
Gas Amplification Factor . – – 5.5

* On plane perpendicular to indicated direction of incident light.
° Averaged over any interval of 30 seconds maximum. Average current may be doubled when anode-supply voltage is limited to 80 volts.

Indicates a change.

AUGUST 15, 1947 TUBE DEPARTMENT RADIO CORPORATION OF AMERICA, MARRISON, NEW JERSEY
Minimum Circuit Values:

DC Load Resistance:

With anode-supply voltage of 80 volts or less:

For dc currents

- above 5 μamp: 0.1 megohm
- below 5 μamp: No Minimum

With anode-supply voltage of 100 volts:

For dc currents

- above 3 μamp: 2.5 megohms
- below 3 μamp: 0.1 megohm

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-4 Response and
FREQUENCY-RESPONSE CHARACTERISTICS
of Gas Phototubes
are shown at the beginning of this Section

AVERAGE ANODE CHARACTERISTICS
of Type 1P37 are the same
as those shown under Type 5581
VACUUM PHOTOTUBE

For applications critical as to leakage under high-humidity conditions

The 1P39 is like the 929, except that the 1P39 has a maximum dark current of 0.005 µA at 250 volts, and has a non-hygrosopic base which insures a value of resistance between anode and cathode pins about 10 times higher than conventional bases under adverse service conditions of high humidity.

- Indicates a change.

GAS PHOTOTUBE

For applications critical as to leakage under high-humidity conditions

The 1P40 is like the 930, except that the 1P40 has a maximum dark current of 0.005 µA at 90 volts, and has a non-hygrosopic base which insures a value of resistance between anode and cathode pins about 10 times higher than conventional bases under adverse service conditions of high humidity.

- Indicates a change.
IP41
GAS PHOTOTUBE
END TYPE WITH S-1 RESPONSE

DATA

General:
Spectral Response ........................................... S-1
Wavelength of Maximum Response .................. 8000 ± 1000 angstroms
Cathode:
Shape ........................................................ Circular
Minimum Diameter ..................................... 9/16"
Direct Interelectrode Capacitance .............. 1.8 μf
Maximum Overall Length ......................... 2-1/16"
Maximum Seated Length ....................... 1-19/32"
Maximum Diameter ................................... 13/16"
Bulb ................................................................. T-6
Mounting Position .......................................... Any
Base .......................................................... Small-Shell Peewee 3-Pin
Basing Designation for BOTTOM VIEW ............. 2F2

Pin 1—No Connection
Pin 2—Anode
Pin 3—Cathode

Maximum Ratings, Absolute Values:
ANODE—SUPPLY VOLTAGE (DC or Peak AC) ....... 90 max. . . . volts
PEAK CATHODE CURRENT ............................. 5 max. . . . μamp
PEAK CATHODE—CURRENT DENSITY ............. 75 max. μamp/sq.in.
AVERAGE CATHODE CURRENT° ................... 1.5 max. . . . μamp
AMBIENT TEMPERATURE ......................... 100 max. . . . °C

Characteristics:

<table>
<thead>
<tr>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Dark Current at 90 Volts:</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sensitivity:</td>
<td>-</td>
<td>0.009</td>
</tr>
<tr>
<td>At 8000 angstroms . .</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Luminous:*</td>
<td>50</td>
<td>90</td>
</tr>
<tr>
<td>At 0 cps.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 5000 cps</td>
<td></td>
<td>77</td>
</tr>
<tr>
<td>At 10000 cps</td>
<td></td>
<td>67</td>
</tr>
<tr>
<td>Gas Amplification Factor</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

° Averaged over any interval of 30 seconds maximum. Average current may be doubled when anode-supply voltage is limited to 70 volts.
* Measured with .06 lumen.

NOV. 1, 1950
**Minimum Circuit Values:**

**DC Load Resistance:**

*With anode-supply voltage of 70 volts or less:*

For dc currents:

- Above 1.5 µamp: 0.1 megohm
- Below 1.5 µamp: No Minimum

*With anode-supply voltage of 90 volts:*

For dc currents:

- Above 1.0 µamp: 2.5 megohms
- Below 1.0 µamp: 0.1 megohm

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-1 Response and FREQUENCY-RESPONSE CHARACTERISTICS of Gas Phototubes are shown at the front of this Section.

---

**Diagram:**

- **Cathode**
- 9/16" MIN. DIA.
- T6 Bulb
- Small-SHELL Peewee
- 3-PIN BASE

Dimensions:

- 13/16" MAX.
- 11/32" MAX.
- 2 1/16" MAX.

---

*Indicates a change.*

NOV. 1, 1950

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
General:
Spectral Response ........................................ S-9
Wavelength of Maximum Response. .......... 4800 ± 500 angstroms
Cathode:
  Shape .................................................. Circular
  Window Area ......................................... 0.030 sq.in.
  Minimum Diameter ................................. 0.19"
Direct Interelectrode Capacitance ................. 1.9 μf
Overall Length ........................................ 1-11/32" ± 1/16"
Maximum Diameter ................................... 1/4"
Bulb. ...................................................... T-2
Mounting Position .................................. Any

TERMINAL CONNECTIONS

Small End: Anode Large End: Cathode

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC or Peak AC) 180 max. . . volts
PEAK CATHODE CURRENT .................. 1.5 max. . . μamp
PEAK CATHODE-CURRENT DENSITY .......... 100 max. μamp/sq.in.
AVERAGE CATHODE CURRENTO ........... 0.4 max. . . μamp
AMBIENT TEMPERATURE ....................... 75 max. . . °C

Characteristics:

<table>
<thead>
<tr>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark Current at 180 Volts . .</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sensitivity:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 4800 Angstroms . . . . . .</td>
<td>-</td>
<td>0.020</td>
</tr>
<tr>
<td>LuminousA . . . . .</td>
<td>20 30 50</td>
<td>μamp/lumen</td>
</tr>
</tbody>
</table>

O Averaged over any interval of 30 seconds maximum.
A Measured under conditions specified on sheet "PHOTOTUBE SENSITIVITY and SENSITIVITY MEASUREMENTS", at the front of this section, except that the anode supply is 180 volts and the light flux is 0.015 lumen.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-9 Response is shown at the front of this Section.

Indicates a change.
NOTE: WHEN TUBE IS ROTATED ABOUT THE LONGITUDINAL AXIS OF ITS CATHODE TERMINAL, NO PART OF THE ANODE TERMINAL WILL FALL OUTSIDE OF A 0.241"-DIAMETER CIRCLE CONCENTRIC WITH THE LONGITUDINAL AXIS OF THE CATHODE TERMINAL.
# 868 GAS PHOTOTUBE WITH S-1 RESPONSE

## General:
- Spectral Response: S-1
- Wavelength of Maximum Response: 8000 ± 1000 Angstroms

## Cathode:
- Shape: Semi-Cylindrical
- Minimum Projected Length: 1-1/4"
- Minimum Projected Width: 5/8"
- Direct Interelectrode Capacitance: 3 μF
- Maximum Overall Length: 4-1/8"
- Maximum Seated Length: 3-1/2"
- Seated Length to Center of Cathode: 2-1/8" ± 3/32"
- Maximum Diameter: "1-1/8"
- Bulb: T-8
- Mounting Position: Any
- Base: Dwarf-Shell Small 4-Pin
- Basing Designation for BOTTOM VIEW: 2K

## Data:

### Pin 1 - No Connection
### Pin 2 - Anode
### Pin 3 - No Connection
### Pin 4 - Cathode

### Maximum Ratings, Absolute Values:
- ANODE-SUPPLY VOLTAGE (DC or Peak AC): 100 max. volts
- PEAK CATHODE CURRENT: 20 max. μamp
- PEAK CATHODE-CURRENT DENSITY: 100 max. μamp/sq.in.
- AVERAGE CATHODE CURRENT: 5 max. μamp
- AMBIENT TEMPERATURE: 100 max. °C

### Characteristics:

<table>
<thead>
<tr>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark Current at 90 Volts</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sensitivity:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 8000 Angstroms</td>
<td>-</td>
<td>0.009</td>
</tr>
<tr>
<td>Luminous:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 0 Cycles</td>
<td>50</td>
<td>90</td>
</tr>
<tr>
<td>At 5000 Cycles</td>
<td>-</td>
<td>77</td>
</tr>
<tr>
<td>At 10000 Cycles</td>
<td>-</td>
<td>67</td>
</tr>
</tbody>
</table>

### Gas Amplification Factor: 8

* On plane perpendicular to indicated direction of incident light.
* Averaged over any interval of 30 seconds maximum. Average current may be doubled when anode-supply voltage is limited to 80 volts.

---

AUGUST 15, 1947 TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Minium Circuit Values:

DC Load Resistance:
- With anode-supply voltage of 80 volts or less:
  - For dc currents:
    - above 5 µamp: 0.1 megohm
    - below 5 µamp: No Minimum
- With anode-supply voltage of 100 volts:
  - For dc currents:
    - above 3 µamp: 2.5 megohms
    - below 3 µamp: 0.1 megohm

OUTLINE DIMENSIONS for Type 868 are the same as those for Type 1P37

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-1 Response and
FREQUENCY-RESPONSE CHARACTERISTICS of Gas Phototubes are shown at the beginning of this Section

AVERAGE ANODE CHARACTERISTICS of Type 868 are the same as those shown under Type 1P41

Indicates a change.

AUGUST 15, 1947
VACUUM PHOTOTUBE
LOW-LEAKAGE TYPE WITH ANODE-TERMINAL CAP AND S-1 RESPONSE
For light-measuring and relay applications

DATA

General:
Spectral Response .................. S-1
Wavelength of Maximum Response ... 8000 ± 1000 angstroms
Cathode:
Shape .................................. Semicylindrical
Minimum projected length* .......... 1-9/16"
Minimum projected width* .......... 5/8"
Direct Interelectrode Capacitance .. 2.2 μf
Maximum Overall Length .......... 4-7/16"
Seated Length ..................... 3-11/16" ± 1/8"
Seated Length to Center of Cathode ... 2-1/8" ± 3/32"
Maximum Diameter .................. 1-1/8"
Mounting Position ................. Any
Weight (Approx.) .................. 1.1 oz
Bulb .................................. T-8
Cap .................................. Small (JETEC No.CL-1)
Base .................................. Dwarf-Shell Small 4-Pin (JETEC No.A4-26)
Basing Designation for BOTTOM VIEW ... 1A

Pin 1 - No Connection
Pin 2 - No Connection
Pin 3 - No Connection
Pin 4 - Cathode
Cap - Anode

Maximum Ratings, Absolute Values:
 ANODE-SUPPLY VOLTAGE (DC or Peak AC) ... 500 max. volts
 AVERAGE CATHODE-CURRENT DENSITY* .... 30 max. μamp/sq.in.
 AVERAGE CATHODE CURRENT* ........ 10 max. μamp
 AMBIENT TEMPERATURE .................. 100 max. °C

Characteristics, At 250 Volts on Anode:

<table>
<thead>
<tr>
<th>Sensitivity:</th>
<th>Min.</th>
<th>Median</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiant, at 8000 angstroms</td>
<td>0.0018</td>
<td></td>
<td>μamp/μwatt</td>
</tr>
<tr>
<td>Luminous*</td>
<td>12</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>Anode Dark Current at 25°C</td>
<td>0.005</td>
<td></td>
<td>μamp</td>
</tr>
</tbody>
</table>

* On plane perpendicular to indicated direction of incident light.
* Averaged over any interval of 30 seconds maximum.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-1 Response
is shown at front of this Section

Indicates a change.

10-56
TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON NEW JERSEY
AVERAGE ANODE CHARACTERISTICS

ANODE VOLTS

ANODE MICROAMPERES

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-4360R2
**GAS PHOTOTUBE WITH S-I RESPONSE**

### DATA

#### General:
- Spectral Response: S-1
- Wavelength of Maximum Response: 8000 ± 1000 Angstroms

#### Cathode:
- Shape: Semi-Cylindrical
- Minimum Projected Length*: 1-1/4"
- Minimum Projected Width*: 5/8"
- Direct Inter-electrode Capacitance: 3 μF
- Maximum Overall Length: 4-1/8"
- Maximum Seated Length: 3-1/2"
- Seated Length to Center of Cathode: 2-1/8" ± 3/32"
- Maximum Diameter: 1-1/8" T-8
- Bulb: Any
- Mounting Position: Dwarf-Shell Small 4-Pin
- Basing Designation for BOTTOM VIEW: 2K

#### Maximum Ratings, Absolute Values:
- ANODE-SUPPLY VOLTAGE (DC or Peak AC): 90 max. volts
- PEAK CATHODE CURRENT: 20 max. μamp
- PEAK CATHODE-CURRENT DENSITY: 100 max. μamp/sq.in.
- AVERAGE CATHODE CURRENT: 5 max. μamp
- AMBIENT TEMPERATURE: 100 max. °C

#### Characteristics:

<table>
<thead>
<tr>
<th></th>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark Current at 90 Volts</td>
<td>-</td>
<td>-</td>
<td>0.1</td>
</tr>
<tr>
<td>Sensitivity:</td>
<td></td>
<td></td>
<td>μamp</td>
</tr>
<tr>
<td>At 8000 Angstroms</td>
<td>-</td>
<td>0.015</td>
<td>μamp/μwatt</td>
</tr>
<tr>
<td>Luminous:</td>
<td></td>
<td></td>
<td>μamp/lumen</td>
</tr>
<tr>
<td>At 0 Cycles</td>
<td>120</td>
<td>150</td>
<td>220</td>
</tr>
<tr>
<td>At 5000 Cycles</td>
<td>-</td>
<td>120</td>
<td>μamp/lumen</td>
</tr>
<tr>
<td>At 10000 Cycles</td>
<td>-</td>
<td>105</td>
<td>μamp/lumen</td>
</tr>
<tr>
<td>Gas Amplification Factor</td>
<td>-</td>
<td>-</td>
<td>7.0</td>
</tr>
</tbody>
</table>

* on plane perpendicular to indicated direction of incident light.

** indications a change.

AUGUST 15, 1947
Minimum Circuit Values:

DC Load Resistance:

*With anode-supply voltage of 70 volts or less:*

- For dc currents above 5 μamp ... 0.1 ... megohm
- For dc currents below 5 μamp ... No Minimum

*With anode-supply voltage of 90 volts:*

- For dc currents above 3 μamp ... 2.5 ... megohms
- For dc currents below 3 μamp ... 0.1 ... megohm

OUTLINE DIMENSIONS for Type 91B are the same as those for Type 1P37.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-1 Response and

FREQUENCY-RESPONSE CHARACTERISTICS of Gas Phototubes are shown at the beginning of this Section.

*Indicates a change.*
VACUUM PHOTOTUBE
LOW-LEAKAGE TYPE WITH CATHODE-TERMINAL CAP AND S-I RESPONSE
For light-measuring and relay applications

The 919 is the same as the 917 except for the following item:

**General:**
Base ............ Dwarf-Shell Small 4-Pin (JETEC No. A4-26)
Basing Designation for BOTTOM VIEW ............... IB

Pin 1 - No Connection
Pin 2 - Anode
Pin 3 - No Connection

Pin 4 - No Connection
Cap - Cathode

DIRECTION OF LIGHT
920
GAS PHOTOTUBE
TWIN TYPE WITH S-1 RESPONSE

General:
Spectral Response........................................ S-1
Wavelength of Maximum Response... 8000 ± 1000 Angstroms
Cathodes (Each):
  Shape........................................ Quarter-Cylindrical
  Minimum Projected Length*.... 1-3/16" 
  Minimum Projected Width*.. 1/4"
Direct Interelectrode Capacitances:
  Cathode to Anode................................ 1.6 μf
  Cathode to Cathode................................ 1.8 μf
  Anode to Anode................................ 0.44 μf
Maximum Overall Length................................ 4"
Maximum Seated Length................................ 3-3/8"
Seated Length to Center of Cathode........ 2-1/8" ± 3/32"
Maximum Diameter................................ 1-3/16"
Bulb.................................................. T-9
Mounting Position...................................... Any
Base.................................................. Small-Shell Small 4-Pin

BOTTOM VIEW
Pin 1—Cathode,  Pin 3—Anode,
Unit No.2          Unit No.1
Pin 2—Anode,      Pin 4—Cathode,
Unit No.2          Unit No.1

MAXIMUM RATINGS, ABSOLUTE VALUES (Each Unit): 
ANODE-SUPPLY VOLTAGE (DC or Peak AC)........ 90 max. . . . volts
PEAK CATHODE CURRENT.......................... 6 max. . . . μamp
PEAK CATHODE-CURRENT DENSITY.................. 50 max. . μamp/sq.in.
AVERAGE CATHODE CURRENT°...................... 2 max. . . . μamp
AMBIENT TEMPERATURE.............................. 100 max. . . . °C

Characteristics:

<table>
<thead>
<tr>
<th></th>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark Current at 90 Volts.</td>
<td>-</td>
<td>-</td>
<td>0.1 . . . μamp</td>
</tr>
<tr>
<td>Sensitivity:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 8000 Angstroms</td>
<td>-</td>
<td>0.010</td>
<td>- μamp/μwatt</td>
</tr>
<tr>
<td>Luminous:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 0 Cycles</td>
<td>50</td>
<td>100</td>
<td>175 μamp/lumen</td>
</tr>
<tr>
<td>At 5000 Cycles</td>
<td>-</td>
<td>85</td>
<td>- μamp/lumen</td>
</tr>
<tr>
<td>At 10000 Cycles</td>
<td>-</td>
<td>74</td>
<td>- μamp/lumen</td>
</tr>
<tr>
<td>Gas Amplification Factor</td>
<td>-</td>
<td>-</td>
<td>9</td>
</tr>
</tbody>
</table>

- On plane perpendicular to indicated direction of incident light.
- Each unit, with other unit grounded.
- Anodes grounded.
- Cathodes grounded.
- Averaged over any interval of 30 seconds maximum. Average current may be doubled when anode-supply voltage is limited to 70 volts.
- Measured with .04 lumen. Indicates a change.

AUGUST 15, 1947
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Minimum Circuit Values:

DC Load Resistance:

With anode-supply voltage of 70 volts or less:

For dc currents { above 2 µamp ... 0.1 ... megohm
below 2 µamp ... No Minimum

With anode-supply voltage of 90 volts:

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

OUTLINE DIMENSIONS for Type 920
are the same as those for Type 5584

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-1 Response and

FREQUENCY-RESPONSE CHARACTERISTICS
of Gas Phototubes
are shown at the beginning of this Section.
GAS PHOTOTUBE
CARTRIDGE TYPE WITH S-I RESPONSE

DATA

General:
Spectral Response: S-1
Wavelength of Maximum Response: 8000 ± 1000 Angstroms

Cathode:
Shape: Semi-Cylindrical
Minimum Projected Length*: 7/8"
Minimum Projected Width*: 1/2"
Direct Interelectrode Capacitance: 1.0 μf
Overall Length: 1-21/32" ± 1/16"
Seated Length: 1-13/32" ± 1/32"
Length, Cathode Center to plane A-A' (see outline): 11/16" ± 1/16"
Maximum Diameter: 0.890"
Mounting Position: Any
Terminal Caps: See Outline

BOTTOM VIEW

Recessed Terminal \} Anode
Protruding Terminal \} Cathode

DIRECTION OF LIGHT: INTO CONCAVE SIDE OF CATHODE

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC or Peak AC): 90 max. . . volts
PEAK CATHODE CURRENT: 10 max. . . μamp
PEAK CATHODE-CURRENT DENSITY: 100 max. μamp/sq.in.
AVERAGE CATHODE CURRENT°C: 3 max. . . μamp
AMBIENT TEMPERATURE: 100 max. . . °C

Characteristics:

<table>
<thead>
<tr>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark Current at 90 Volts. . .</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Sensitivity:
At 8000 Angstroms . . . | - | 0.0135 | μamp/μwatt |
Luminous:Δ
At 0 Cycles . . . | 75 | 135 | 205 μamp/lumen |
At 5000 Cycles . . . | - | 119 | μamp/lumen |
At 10000 Cycles . . . | - | 108 | μamp/lumen |

Gas Amplification Factor . . . | - | - | 10 |

* On plane perpendicular to indicated direction of incident light.
° Averaged over any interval of 30 seconds maximum. Average current may be doubled when anode-supply voltage is limited to 70 volts.
Δ Measured under conditions specified on sheet "PHOTOTUBE SENSITIVITY and SENSITIVITY MEASUREMENTS", at the front of this Section.

Indicates a change.

JUNE 15, 1948
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Minimum Circuit Values:

DC Load Resistance:

With anode-supply voltage of 70 volts or less:

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

With anode-supply voltage of 90 volts:

For dc currents
- above 2 µamp... 2.5 ... megohms
- below 2 µamp... 0.1 ... megohms

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-1 Response
and

FREQUENCY-RESPONSE CHARACTERISTICS
of Gas Phototubes
are shown at the front of this Section

AVERAGE ANODE CHARACTERISTICS
of Type 921 are the same
as those shown under Type 930

JUNE 15, 1948
VACUUM PHOTOTUBE
CARTRIDGE TYPE WITH S-1 RESPONSE
For relay applications

DATA

General:
Spectral Response ........................................ S-1
Wavelength of Maximum Response ...................... 8000 ± 1000 angstroms
Cathode:
Shape .................................................. Semicylindrical
Minimum projected length* .......................... 5/8"
Minimum projected width* .................................. 1/2"
Direct Inter-electrode Capacitance .................. 1 μf
Overall Length ................................ 1-21/32" + 1/32" - 1/16"
Seated Length .................................. 1-13/32" ± 1/32"
Length from Center of Useful Cathode Area to Plane A-A' (See Dimensional Outline) ................ 11/16" ± 1/16"
Maximum Diameter .................................. 0.890"
Mounting Position .................................. Any
Weight (Approx.) ....................................... 0.4 oz
Terminals:
Recessed cap ........................................ JETEC No. J-23
Protruding cap ........................................ JETEC No. J-24
Basing Designation .................................. 2AQ

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC or Peak AC) ........ 500 max. volts
AVERAGE CATHODE-CURRENT DENSITY\(\text{\per sq.in.}\) ......................................... 30 max. \(\mu\text{amp}\)/sq.in.
AVERAGE CATHODE CURRENT\(\text{\per sq.in.}\) ......................................... 5 max. \(\mu\text{amp}\)
AMBIENT TEMPERATURE .................. 100 max. °C

Characteristics, At 250 Volts on Anode:
Min. Median Max.
Sensitivity:
Radiant, at 8000 angstroms ............ 0.0018 μamp/\(\mu\text{watt}\)
Luminous ............................ 10 20 40 \(\mu\text{amp}/\text{lumen}\)
Anode Dark Current
at 25°C .......... - 0.005 \(\mu\text{amp}\)

\* On plane perpendicular to indicated direction of incident light.
\(\Delta\) Averaged over any interval of 30 seconds maximum.
For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K, a dc anode supply of 250 volts, a 1-megohm load resistor, and a light input of 0.1 lumen are used.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-1 Response
is shown at the front of this Section

AVERAGE ANODE CHARACTERISTICS
for Type 922 are the same as those shown for Type 917

A-A' = PLANE PERPENDICULAR
TO AXIS OF TUBE

92CM-4818R5
923
GAS PHOTOTUBE
WITH S-1 RESPONSE

DATA

General:
Spectral Response ............................................ S-1
Wavelength of Maximum Response. 8000 ± 1000 Angstroms
Cathode:
  Shape .................................................. Semi-Cylindrical
  Minimum Projected Length* 13/16"
  Minimum Projected Width* 5/8"
Direct Interelectrode Capacitance 2 μuf
Maximum Overall Length. 3-9/16"
Maximum Seated Length 2-15/16"
Seated Length to Center of Cathode. 1-31/32" ± 3/32"
Maximum Diameter. 1-3/16"
Bulb. T-9
Mounting Position Any
Base. Small-Small Small 4-Pin
Basing Designation for BOTTOM VIEW. 2

Pin 1 - No Connection
Pin 2 - Anode
Pin 3 - No Connection
Pin 4 - Cathode

Maximum Ratings, Characteristics, and Curves for the 923 are the same as those shown for Type 930

* On plane perpendicular to indicated direction of incident light.

AUGUST 15, 1947 TUBE DEPARTMENT RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
The 924 is the same electrically as the 1P41 with the exception of its interelectrode capacitance. Mechanically, the 924 and 1P41 differ as to base, base connections, and overall length.

Direct Interelectrode Capacitance: 2.6 µf
Overall Length: 2-1/16" ± 1/8"
Base: Intermediate Screw
# General:

- **Spectral Response**: S-1
- **Wavelength of Maximum Response**: 8000 ± 1000 Angstroms

## Cathode:
- **Shape**: Semi-Cylindrical
- **Minimum Projected Length**: 13/16"
- **Minimum Projected Width**: 5/8"
- **Direct Interelectrode Capacitance**: 1.6 μf
- **Maximum Overall Length**: 2-5/8"
- **Maximum Seated Length**: 2-1/16"
- **Seated Length to Center of Cathode**: 1-9/32" ± 3/32"
- **Maximum Diameter**: 1-9/32"
- **Bulb**: T-9
- **Mounting Position**: Intermediate-Shell Octal 5-Pin
- **Base**: Any Intermediate-Shell Octal 5-Pin

## Basing Designation for BOTTOM VIEW:
- 3J

## Pin Connections:
- Pin 1-No Connection
- Pin 2-No Connection
- Pin 4-Anode Connection
- Pin 6-No Connection
- Pin 8-Cathode

## Maximum Ratings, Absolute Values:
- **Anode-Supply Voltage (DC or Peak AC)**: 250 max. volts
- **Peak Cathode Current**: 15 max. μamp
- **Peak Cathode-CURRENT DENSITY**: 100 max. μamp/sq.in.
- **Average Cathode Current**: 5 max. μamp
- **Ambient Temperature**: 100 max. °C

## Characteristics:
- **Dark Current at 250 Volts**: Min. - Av. - Max. 0.0125 μamp
- **Sensitivity**:
  - At 8000 Angstroms: 0.0015 μamp/μwatt
  - Luminous: 10 20 40 μamp/lumen

*S on plane perpendicular to indicated direction of incident light.

O Averaged over any interval of 30 seconds maximum.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-1 Response is shown at the beginning of this Section.

*Indicates a change.
AVERAGE ANODE CHARACTERISTICS

JULY 31, 1947
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
General:
Spectral Response ........................................ S-3
Wavelength of Maximum Response .... 4200 ± 1000 Angstroms
Cathode:
  Shape .......................................................... Semi-Cylindrical
  Minimum Projected Length*........................... 7/8"
  Minimum Projected Width*............................. 1/2"
Direct Interelectrode Capacitance ........ 1 µuf
Overall Length .................................................. 1-21/32" ± 1/16"
Seated Length .................................................. 1-13/32" ± 1/32"
Length, Cathode Center to plane A-A' (See outline) .... 11/16" ± 1/16"
Maximum Diameter .............................................. 0.890"
Mounting Position ............................................. Any
Terminal Caps ................................................... See Outline

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC or Peak AC) ........ 500 max. .... volts
PEAK CATHODE CURRENT ........................................... 15 max. ...... µamp
PEAK CATHODE-CURRENT DENSITY .................. 100 max. ...... µamp/sq. in.
AVERAGE CATHODE CURRENT° .................... 5 max. ...... µamp
AMBIENT TEMPERATURE .................. 100 max. .... °C

Characteristics:

<table>
<thead>
<tr>
<th></th>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark Current at 250 Volts</td>
<td></td>
<td></td>
<td>0.005</td>
</tr>
</tbody>
</table>

Sensitivity:

At 4200 Angstroms .................................. 0.0016 µamp/µwatt
Luminous* ........................................ 4 6.5 15 µamp/lumen

* On plane perpendicular to indicated direction of incident light.
° Averaged over any interval of 30 seconds maximum.

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

OUTLINE DIMENSIONS for Type 926
are the same as those for Type 921

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-3 Response
is shown at the front of this Section

Indicates a change.
General:
Spectral Response .......................................................... S-1
Wavelength of Maximum Response .................. 8000 ± 1000 angstroms
Cathode:
Shape ............................................................... Semi-Cylindrical
Minimum Projected Length* ......................... 11/16"
Minimum Projected Width* ........................... 7/16"
Direct Interelectrode Capacitance ................. 2 μf
Maximum Overall Length ................................ 2-13/32"
Maximum Seated Length ................................ 1-15/16"
Seated Length to Center of Cathode ............. 1-1/4" ± 3/32"
Maximum Diameter ........................................ 0.669"
Bulb ................................................................. T-5-1/4
Mounting Position ................................. Any
Base ................................................................. Small-Shell Peewee 3-Pin
Basing Designation for BOTTOM VIEW .......... 2F

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC or Peak AC) .......................... 90 max. volts
PEAK CATHODE CURRENT ............................................. 6 max. μamp
PEAK CATHODE-CURRENT DENSITY .................. 100 max. μamp/sq.in.
AVERAGE CATHODE CURRENT° .................. 2 max. μamp
AMBIENT TEMPERATURE ........................................... 100 max. °C

Characteristics:

<table>
<thead>
<tr>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Dark Current*</td>
<td>-</td>
<td>0.1</td>
</tr>
<tr>
<td>Sensitivity:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 8000 angstroms</td>
<td>-</td>
<td>0.0125</td>
</tr>
<tr>
<td>Luminous:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 0 cps.</td>
<td>75</td>
<td>125</td>
</tr>
<tr>
<td>At 5000 cps.</td>
<td>-</td>
<td>110</td>
</tr>
<tr>
<td>At 10000 cps.</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Gas Amplification Factor</td>
<td>-</td>
<td>10</td>
</tr>
</tbody>
</table>

* On plane perpendicular to indicated direction of incident light.
° Averaged over any interval of 30 seconds maximum. Average current may be doubled when anode-supply voltage is limited to 70 volts.
■ At 25°C and 90 volts.

- Indicates a change.
Minimum Circuit Values:

DC Load Resistance:

*With anode-supply voltage of 70 volts or less:*

For dc currents:

- above 2 µamp ... 0.1 ... megohm
- below 2 µamp ... No Minimum

*With anode-supply voltage of 90 volts:*

For dc currents:

- above 1.0 µamp ... 2.5 ... megohms
- below 1.0 µamp ... 0.1 ... megohm

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-1 Response and FREQUENCY-RESPONSE CHARACTERISTICS of Gas Phototubes are shown at the front of this Section.

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SEPT. 1, 1950  
TUBE DEPARTMENT  
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
GAS PHOTOTUBE
NON-DIRECTIONAL TYPE WITH S-1 RESPONSE

DATA

General:
Spectral Response ........................................ S-1
Wavelength of Maximum Response. 8000 ± 1000 Angstroms

Cathode:
Shape .............................................................. Cylindrical Mesh
Minimum Length .............................................. 13/16"
Minimum Diameter .......................................... 5/8"
Direct Interelectrode Capacitance ...................... 3 μuf
Maximum Overall Length ................................... 3-9/16"
Maximum Seated Length ................................... 2-15/16"
Seated Length to Center of Cathode .................. 1-31/32" ± 3/32"
Maximum Diameter .......................................... 1-3/16"
Bulb ................................................................. T-9
Mounting Position ........................................... Any
Base ................................................................. Small-Shell Small 4-Pin
Basing Designation for BOTTOM VIEW ............ 2K^1

Pin 1 - No Connection
Pin 2 – Anode
Pin 3 - No Connection
Pin 4 – Cathode

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC or Peak AC) 90 max. ... volts
PEAK CATHODE CURRENT ................................ 10 max. ... μamp
PEAK CATHODE-CURRENT DENSITY ................. 100 max. μamp/sq.in.
AVERAGE CATHODE CURRENT^0 ...................... 3 max. ... μamp
AMBIENT TEMPERATURE .................................. 100 max. ... °C

Characteristics:

<table>
<thead>
<tr>
<th></th>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark Current at 90 Volts</td>
<td>-</td>
<td>-</td>
<td>0.1</td>
</tr>
<tr>
<td>Sensitivity:</td>
<td></td>
<td></td>
<td>μamp</td>
</tr>
<tr>
<td>At 8000 Angstroms</td>
<td>-</td>
<td>0.0065</td>
<td>- μamp/μwatt</td>
</tr>
<tr>
<td>Luminous:</td>
<td></td>
<td></td>
<td>μamp/lumen</td>
</tr>
<tr>
<td>At 0 Cycles</td>
<td>40</td>
<td>65</td>
<td>100</td>
</tr>
<tr>
<td>At 5000 Cycles</td>
<td>-</td>
<td>56</td>
<td>μamp/lumen</td>
</tr>
<tr>
<td>At 10000 Cycles</td>
<td>-</td>
<td>50</td>
<td>μamp/lumen</td>
</tr>
</tbody>
</table>

Gas Amplification Factor ................................ - 10

^0 Averaged over any interval of 30 seconds maximum. Average current may be doubled when anode-supply voltage is limited to 70 volts.

Indicates a change.

AUGUST 15, 1947  TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
GAS PHOTOTUBE

Minimum Circuit Values:

DC Load Resistance:

With anode-supply voltage of 70 volts or less:

For dc currents above 3 \( \mu \text{amp} \) ... 0.1 ... megohm

For dc currents below 3 \( \mu \text{amp} \) ... No Minimum

With anode-supply voltage of 90 volts:

For dc currents above 2 \( \mu \text{amp} \) ... 2.5 ... megohms

For dc currents below 2 \( \mu \text{amp} \) ... 0.1 ... megohms

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-1 Response

and

FREQUENCY-RESPONSE CHARACTERISTICS
of Gas Phototubes

are shown at the beginning of this Section

---

`indicating a change.`

AUGUST 15, 1947  TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE ANODE CHARACTERISTICS

ANODE VOLTS

ANODE MICROAMPERES

JAN. 16, 1940
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6117
929

VACUUM PHOTOTUBE
WITH S-4 RESPONSE

DATA

General:
Spectral Response .......................................................... S-4
Wavelength of Maximum Response................................ 4000 ± 500 Angstroms

Cathode:
Shape .................................................................................. Semi-Cylindrical
Minimum Projected Length* .............................................. 13/16"
Minimum Projected Width* ................................................. 5/8"

Direct Interelectrode Capacitance ...................................... 2.6 μf

Maximum Overall Length .......................................................... 3-1/16"
Maximum Seated Length ......................................................... 2-1/2"
Seated Length to Center of Cathode ........................................ 1-5/8" ± 3/32"

Maximum Diameter .................................................................. 1-9/32"

Bulb. ......................................................................................... T-9

Mounting Position ............................................................... Any

Base. ......................................................................................... Intermediate-Shell Octal 5-Pin

Basing Designation for BOTTOM VIEW................................. 3J

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC or Peak AC) ....... 250 max. ... volts
PEAK CATHODE CURRENT .................................................. 20 max. ... μamp
PEAK CATHODE-CURRENT DENSITY ................................... 100 max. μamp/sq.in.
AVERAGE CATHODE CURRENT°C ...................................... 5 max. ... μamp
AMBIENT TEMPERATURE ...................................................... 75 max. ... °C

Characteristics:

<table>
<thead>
<tr>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark Current at 250 Volts</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sensitivity:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 4000 Angstroms</td>
<td>-</td>
<td>0.042</td>
</tr>
<tr>
<td>Luminous</td>
<td>25</td>
<td>45</td>
</tr>
</tbody>
</table>

* on plane perpendicular to indicated direction of incident light.
O Averaged over any interval of 30 seconds maximum.

OUTLINE DIMENSIONS for Type 929
are the same as those for Type 5581

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-4 Response
is shown at the beginning of this Section

♦-Indicates a change.

AUGUST 15, 1947
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE ANODE CHARACTERISTICS

ANODE, MICROAMPERES

AUG. 4, 1947
General:

Spectral Response ........................................ S-1
Wavelength of Maximum Response. ...................... 8000 ± 1000 Angstroms
Cathode:

Shape .................................................. Semi-Cylindrical
Minimum Projected Length* .......................... 13/16"
Minimum Projected Width* ......................... 5/8"
Direct Inter-electrode Capacitance .................. 2.4 µf
Maximum Overall Length .................................. 3-1/16"
Maximum Seated Length ................................. 2-1/2"
Seated Length to Center of Cathode .................. 1-5/8" ± 3/32"
Maximum Diameter ....................................... 1-9/32"
Bulb .......................................................... T-9
Mounting Position ........................................ Any
Base ........................................................ Intermediate-Shell Octal 5-Pin
Basing Designation for BOTTOM VIEW ................. 3J1

Pin 1-No Connection Pin 4-Anode Connection
Pin 2-No Connection Pin 6-No Connection
Pin 4- Anode Connection Pin 8-Cathode Connection

Maximum Ratings, Absolute Values:

ANODE-SUPPLY VOLTAGE (DC or Peak AC) ............... 90 max. ... volts
PEAK CATHODE CURRENT .................................. 10 max. ... µamp
PEAK CATHODE-CURRENT DENSITY ...................... 100 max. µamp/sq.in.
AVERAGE CATHODE CURRENT°C .......................... 3 max. ... µamp
AMBIENT TEMPERATURE ................................. 100 max. ... °C

Characteristics:

Dark Current at 90 Volts ................................

Sensitivity:

At 8000 Angstroms ................................
Luminous:

At 0 Cycles .................................. 75 135 205 µamp/lumen
At 5000 Cycles ................................ 111
At 10000 Cycles ................................ 101
Gas Amplification Factor .............................. 10

* On plane perpendicular to indicated direction of incident light.
° Averaged over any interval of 30 seconds maximum. Average current may be doubled when anode-supply voltage is limited to 70 volts.

Indicates a change.

AUGUST 15, 1947
Minimum Circuit Values:

DC Load Resistance:

*With anode-supply voltage of 70 volts or less:*

For dc currents

- above 3 μamp ... 0.1 ... megohm
- below 3 μamp ... No Minimum

*With anode-supply voltage of 90 volts:*

For dc currents

- above 2 μamp ... 2.5 ... megohms
- below 2 μamp ... 1 ... megohm

OUTLINE DIMENSIONS for Type 930 are the same as those for Type 5581

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-1 Response and

FREQUENCY-RESPONSE CHARACTERISTICS of Gas Phototubes are shown at the beginning of this Section.

---

Indicates a change.

AUGUST 15, 1947

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
General:
Spectral Response.............................................................. S-4
Wavelength of Maximum Response................................. 4000 ± 500 angstroms
Cathode:
  Minimum projected length*.......................................... 15/16"
  Minimum projected width*............................................ 5/16"
Direct Interelectrode Capacitances (Approx.):
  Anode to dynode No.9.............................................. 4.4 μuf
  Anode to all other electrodes.................................... 6 μuf
Maximum Overall Length................................................ 3-11/16"
Maximum Seated Length................................................ 3-1/8"
Length from Base Seat to Center of Useful Cathode Area...... 1-15/16" ± 3/32"
Maximum Diameter......................................................... 1-5/16"
Mounting Position.......................................................... Any
Weight (Approx.)............................................................ 1.6 oz
Bulb................................ .............................................. T-9
Base.................................................................................. Small-Shell Submagnal 11-Pin (JETEC No.B11-88),
Basing Designation for BOTTOM VIEW............................... 11K

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC or Peak AC)...................... 1250 max. volts
SUPPLY VOLTAGE BETWEEN DYNODE No.9 AND ANODE (DC or Peak AC). ...................... 250 max. volts
AVERAGE ANODE CURRENT*........................................... 1 max. ma
AMBIENT TEMPERATURE.................................................... 75 max. °C

Characteristic Range Values for Equipment Design:
Under conditions with supply voltage (E) across voltage divider providing 1/10 of E between cathode and dynode No.1; 1/10 of E for each succeeding dynode stage; and 1/10 of E between dynode No.9 and anode
With E = 1000 volts (except as noted)

Min. Median Max.
Sensitivity:
Radiant, at 4000 angstroms........................................... 24000 μamp/μwatt

* On plane perpendicular to the indicated direction of incident light.
• Averaged over any interval of 30 seconds maximum.
MULTIPLIER PHOTOTUBE

<table>
<thead>
<tr>
<th>Min.</th>
<th>Median</th>
<th>Max.</th>
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</thead>
<tbody>
<tr>
<td>Cathode radiant, at 4000 angstroms. . . .</td>
<td>0.03</td>
<td>-</td>
</tr>
<tr>
<td>Luminous:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 0 cps. . . . . . 4.5</td>
<td>24</td>
<td>300</td>
</tr>
<tr>
<td>At 100 Mc . . . . .</td>
<td>23</td>
<td>-</td>
</tr>
<tr>
<td>Cathode luminous:</td>
<td>-</td>
<td>30</td>
</tr>
<tr>
<td>Current Amplification</td>
<td>-</td>
<td>800,000</td>
</tr>
<tr>
<td>Equivalent Anode-Dark—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Input:</td>
<td>-</td>
<td>2.5 x 10^-9</td>
</tr>
<tr>
<td>Equivalent Noise Input:</td>
<td>9.5 x 10^-13</td>
<td>-</td>
</tr>
<tr>
<td>With E = 750 volts (except as noted)</td>
<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Min.</th>
<th>Median</th>
<th>Max.</th>
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<tbody>
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<td>Sensitivity:</td>
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<td></td>
</tr>
<tr>
<td>Radiant, at 4000 angstroms . . . .</td>
<td>3300</td>
<td>-</td>
</tr>
<tr>
<td>Cathode radiant, at 4000 angstroms. . . .</td>
<td>0.03</td>
<td>-</td>
</tr>
<tr>
<td>Luminous:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 0 cps. . . . . .</td>
<td>3.3</td>
<td>-</td>
</tr>
<tr>
<td>Cathode luminous:</td>
<td>-</td>
<td>30</td>
</tr>
<tr>
<td>Current Amplification</td>
<td>-</td>
<td>110,000</td>
</tr>
</tbody>
</table>

For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A light input of 10 microlumens is used. The load resistor has a value of 0.01 megohm.

For conditions the same as shown under (1) except that the value of light flux is 0.01 lumen and 100 volts are applied between cathode and all other electrodes connected together as anode.

Measured at a tube temperature of 25°C and with the supply voltage (E) adjusted to give a luminous sensitivity of 20 amperes per lumen. Dark current caused by thermionic emission and ion feedback may be reduced by the use of a refrigerant.

For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1000 volts is recommended.

For the following conditions: Supply voltage (E) is 1000 volts, external shield operated at -1000 volts with respect to anode, 25°C tube temperature, ac-amplifier bandwidth of 1 cycle per second, tungsten light source at color temperature of 2870°K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The *on* period of the pulse is equal to the *off* period. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

OPERATING CONSIDERATIONS

The operating stability of the 931-A is dependent on the magnitude of the anode current and its duration. When the 931-A is operated at high values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 931-A usually recovers a substantial percentage of such loss in sensitivity.

SEPT. 1, 1955
The use of an average anode current well below the maximum rated value of 1.0 milliampere is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 10 microamperes, and the tube should be given a warm-up period of about 1/2 hour under load conditions.

_Electrostatic and/or magnetic shielding_ of the 931-A may be necessary.

**SPECTRAL-SENSITIVITY CHARACTERISTIC**

_of Phototube having S-4 Response_

_is shown at the front of this Section_

---

**DIRECTION OF LIGHT**

---

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

---

**SEPT. 1, 1955**

**DATA 2**
931-A

AVERAGE ANODE CHARACTERISTICS

VOLT/STAGE = 100
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870°K.

JULY 8, 1955
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6268R5
AVERAGE CHARACTERISTICS

SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER PROVIDING \( \frac{1}{10} \) OF E BETWEEN CATHODE AND DYNODE NO. 1; \( \frac{1}{10} \) OF E FOR EACH SUCCEEDING DYNODE STAGE; AND \( \frac{1}{10} \) OF E BETWEEN DYNODE NO. 9 AND ANODE.
CHARACTERISTIC CURVES

EQUIVALENT-NOISE-INPUT CHARACTERISTIC

100 VOLTS PER STAGE
BANDWIDTH: 1 CPS
LIGHT SOURCE: TUNGSTEN, AT 2870°K INTERRUPTED AT 90 CPS
TO PRODUCE PULSES ALTERNATING BETWEEN ZERO AND FLUX VALUE SHOWN FOR ANY GIVEN TUBE TEMPERATURE, ON-PERIOD OF PULSE EQUAL TO OFF-PERIOD. RMS SIGNAL CURRENT + RMS NOISE CURRENT.
EXTERNAL SHIELD VOLTS RELATIVE TO ANODE VOLTS = \(-1000\)

EFFECT OF MAGNETIC FIELD ON ANODE CURRENT

MAGNETIC FIELD IS ALONG TUBE AXIS
POSITIVE VALUES ARE FOR LINES OF FORCE TOWARD BASE

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

SEPT. 1, 1955

TUBE DIVISION

CE-7505T1

-7664T1
VARIATION IN SENSITIVITY OF PHOTOCATHODE ALONG ITS LENGTH

SPOT SIZE: 1 MM APPROX.
VARIATIONS CAUSED BY INTERCEPTION OF LIGHT BY GRILL AS WELL AS SURFACE IRREGULARITIES HAVE BEEN IGNORED

RELATIVE ANODE CURRENT

DISTANCE ALONG CATHODE FROM END OF CATHODE NEARER BASE—MILLIMETERS

MAR. 18, 1954
TUBE DIVISION
RADIO CORPORATION OF AMERICA, MARRIISON, NEW JERSEY
VARIATION IN SENSITIVITY OF PHOTOCATHODE ACROSS ITS PROJECTED WIDTH IN PLANE OF GRILL

SPOT SIZE: 1 MM APPROX.
GRILL TOWARD OBSERVER, BASE DOWN
CATHODE WIDTH PROJECTED NORMAL TO PLANE OF GRILL
VARIATIONS CAUSED BY INTERCEPTION OF LIGHT BY GRILL AS WELL AS SURFACE IRREGULARITIES HAVE BEEN IGNORED

RELATIVE ANODE CURRENT

DISTANCE ALONG PLANE OF GRILL FROM LEFT TO RIGHT—MILLIMETERS

MAR. 18, 1954 92CM-7667RI
TUBE DIVISION RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
VACUUM PHOTOTUBE
WITH S-4 RESPONSE

DATA

General:
Spectral Response ................................ S-4
Wavelength of Maximum Response ................. 4000 ± 500 angstroms

Cathode:
Shape ............................................. Semi-Cylindrical
Minimum Projected Length* ...................... 11/16"
Minimum Projected Width* ........................ 7/16"
Direct Interelectrode Capacitance .................. 1.5 µf

Maximum Overall Length ......................... 2-13/32"
Maximum Seated Length ......................... 1-15/16"

Seated Length to Center of Cathode .......... 1-1/4" ± 3/32"

Maximum Diameter ................................ 0.669"

Bulb .............................................. T-5-1/4"

Mounting Position ................................ Any

Base ............................................... Small-Shell Peewee 3-Pin

Basing Designation for BOTTOM VIEW ....... 2F

Maximun Ratings, Absolute Values:

ANODE-SUPPLY VOLTAGE (DC or Peak AC) .... 250 max. . . . volts
PEAK CATHODE CURRENT ....................... 12 max. . . . µamp
PEAK CATHODE-CURRENT DENSITY ............. 100 max. µamp/sq.in.
AVERAGE CATHODE CURRENT* ................. 4 max. . . . µamp
AMBIENT TEMPERATURE* .......................... 75 max. . . . °C

Characteristics:

DC Dark Current* ................................ - - 0.005 . . . µamp

Sensitivity:
At 4000 angstroms ......................... - 0.028 - µamp/µwatt
Luminous ..................................... 15 30 70 µamp/lumen

* On plane perpendicular to indicated direction of incident light.
• Averaged over any interval of 30 seconds maximum.
□ At 25°C and 250 volts.

OUTLINE DIMENSIONS for Type 934
are the same as those for Type 927

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-4 Response
is shown at the front of this Section

INDEX INDICATES A CHANGE.
AVERAGE ANODE CHARACTERISTICS

ANODE VOLTS

ANODE MICROAMPERES

OCT. 16, 1944
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-6479
**VACUUM PHOTOTUBE**

**WITH S-5 RESPONSE**

### General:
- **Spectral Response:** S-5
- **Wavelength of Maximum Response:** 3400 ± 500 Angstroms

### Cathode:
- **Shape:** Semi-Cylindrical
- **Minimum Projected Length:** 1-5/16" ± 1/8"
- **Minimum Projected Width:** 0.6 µf
- **Overall Length:** 4-1/8" ± 1/8"
- **Seated Length:** 3-9/16" ± 1/8"
- **Seated Length to Center of Cathode:** 2" ± 1/16"
- **Maximum Diameter:** 1-9/32" ± 1/16" ± 1/8"
- **Bulb:** Semi-Cylindrical
- **Mounting Position:** Any
- **Cap:** Skirted Miniature
- **Base:** Intermediate-Shell Octal 5-Pin

### Bottom View

- **Pin 1 - No Connection**
- **Pin 2 - No Connection**
- **Pin 4 - No Connection**
- **Pin 6 - No Connection**
- **Pin 8 - Cathode**
- **Cap - Anode**

### Maximum Ratings, Absolute Values:
- **Anode-Supply Voltage (DC or Peak AC):** 250 max. volts
- **Peak Cathode Current:** 30 max. µamp
- **Peak Cathode-CURRENT DENSITY:** 100 max. µamp/sq.in.
- **Average Cathode CURRENT:** 10 max. µamp
- **Ambient Temperature:** 75 max. °C

### Characteristics:

<table>
<thead>
<tr>
<th></th>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark Current at 250 Volts</td>
<td></td>
<td></td>
<td>0.0005</td>
</tr>
<tr>
<td>Sensitivity:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 3400 Angstroms</td>
<td></td>
<td></td>
<td>0.032</td>
</tr>
<tr>
<td>Luminous</td>
<td>18</td>
<td>35</td>
<td>70</td>
</tr>
</tbody>
</table>

*On plane perpendicular to indicated direction of incident radiation.

○ Averaged over any interval of 30 seconds maximum.

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

**SPECTRAL-SENSITIVITY CHARACTERISTIC**

of Phototube having S-5 Response is shown at the beginning of this Section

*indicates a change.

**JULY 3, 1950**

**TUBE DEPARTMENT**

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
# Multiplier Phototube

**General:**

- **Spectral Response:** S-11
- **Wavelength of Maximum Response:** 4400 ± 500 angstroms
- **Cathode, Semitransparent, Low-Resistivity:**
  - Shape: Circular with conductive grating
  - Window: Area including grating
  - Minimum diameter: 1.8 sq. in.
  - Index of refraction: 1.51
- **Direct Interelectrode Capacitances (Approx.):**
  - Anode to dynode No.10: 4.4 μf
  - Anode to all other electrodes: 7 μf
- **Maximum Overall Length:** 5-13/16"
- **Seated Length:** 4-7/8" ± 3/16"
- **Maximum Diameter:** 2-5/16"
- **Operating Position:** Any
- **Weight (Approx.):** 5 oz
- **Bulb:** Medium-Shell Diheptal 14-Pin (JEDEC Group 5, No. B14-38), Non-hydroscopic

**Basing Designation for BOTTOM VIEW:** 14AA

**Maximum Ratings, Absolute Values:**

- **Supply Voltage Between Anode and Cathode (DC or Peak AC):** 1500 max. volts
- **Supply Voltage Between Dynode No.10 and Anode (DC or Peak AC):** 250 max. volts
- **Dynode No.1 Supply Voltage (DC or Peak AC):** 400 max. volts
- **Focusing-Electrode Voltage (DC or Peak AC):** 400 max. volts
- **Average Anode Current:** 2 max. mA
- **Cathode Illumination:** 0.1 max. $^*$ lumen
- **Ambient Temperature:** 75 max. °C

*$^*$: See next page.
### Characteristics Range Values for Equipment Design:

Under conditions with supply voltage (E) across voltage divider providing 1/6 of E between cathode and dynode No.1; 1/12 of E for each succeeding dynode stage; and 1/12 of E between dynode No. 10 and anode

With E = 1250 volts (Except as noted) and focusing electrode* connected to dynode No. 1 at socket

<table>
<thead>
<tr>
<th>Min.</th>
<th>Median</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>22400</td>
<td>24000</td>
<td>315</td>
</tr>
</tbody>
</table>

#### Sensitivity:

- **Radiant,** at 4400 angstroms...
- **Cathode radiant,** at 4400 angstroms...
- **Luminous:**
  - At 0 cps...
  - With dynode No.10 as output electrode:
  - Cathode luminous:
    - With tungsten light source:
    - With blue light source:

#### Current Amplification:

<table>
<thead>
<tr>
<th>Input</th>
<th>2.5 x 10^-10</th>
<th>2.25 x 10^-9</th>
</tr>
</thead>
</table>

#### Equivalent Noise Input: 7 x 10^-12 lumen

### Equivalent Anode—Dark-Current

<table>
<thead>
<tr>
<th>Input</th>
<th>2.5 x 10^-10</th>
<th>2.25 x 10^-9</th>
</tr>
</thead>
</table>

### Equivalent Noise Input

- **Radiant,** at 4400 angstroms...
- **Cathode radiant,** at 4400 angstroms...
- **Luminous:**
  - At 0 cps...
  - With dynode No.10 as output electrode:
  - Cathode luminous:
    - With tungsten light source:
    - With blue light source:

<table>
<thead>
<tr>
<th>Current Amplification</th>
<th>560000</th>
</tr>
</thead>
</table>

*See next page.*
Averaged over any interval of 30 seconds maximum.

Above this value of cathode illumination, serious loss in linearity between light input and anode current will be caused by the resistivity of the cathode. For continuous light input of 0.1 lumen from tungsten light source at 2870°K incident on cathode area having diameter of 1.4 in. a potentiometer connected between dynode-No.1 and cathode. When the dynode-No.1 voltage of 200 volts, the loss in linearity will not exceed 30 per cent depending on the magnitude of the cathode current. At 0.1 lumen, the corresponding continuous cathode current is approximately 5 microamperes, regardless of the spectral distribution of the exciting illumination.

In general, the focusing electrode is connected to dynode No.1 at the socket and operated at the same fixed potential as dynode No.1. However, in applications critical as to magnitude, uniformity, or speed of the response, the focusing electrode may be connected to the adjustable and a potentiometer between cathode and dynode No.1 in the voltage divider, and operated at an optimum potential within a range of 10 to 60 per cent of the dynode-No.1 potential.

For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A light input of 10 microlumens is used. The load resistor has a value of 0.01 megohm.

An output current of reversed polarity to that obtained at the anode may be provided by using dynode No.10 as the output electrode. With this arrangement, the load is connected in the dynode-No.10 circuit and the anode serves only as a collector. The value of sensitivity at dynode No.10 is approximately 60 per cent of that when the anode is the output electrode. Specifically, the sensitivity measured at dynode No.10 is equal to (1 - g/10) times the sensitivity measured at the anode, where "g" is the gain of the dynode-No.10 stage.

For conditions the same as shown under (b) except that the value of light flux is 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected together as anode.

Under the following conditions: Light incident on the cathode is transmitted through s blue filter (Corning, Glass Code No.513) polished to 1/2 stock thickness) from a tungsten-filament lamp operated at a color temperature of 2870°K. The value of light flux on the filament is 0.01 lumen. The load resistor has a value of 0.01 megohm, and 200 volts are applied between cathode and all other electrodes connected together as anode.

For spectral characteristic of this source, see sheet SPECTRAL CHARACTERISTIC OF 2870° K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870°K SOURCE AFTER PASSING THROUGH INDICATED BLUE FILTER at front of this section.

Measured at a tube temperature of 25°C and with the supply voltage (E) adjusted to give a luminous sensitivity of 20 amperes per lumen. Dark current caused by thermionic emission may be reduced by the use of a refrigerant.

For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1250 volts is recommended.

Under the following conditions: Supply voltage (E) is 1250 volts, 25°C tube temperature, ac-amplifier bandwidth of 1 cycle per second, tungsten light source of 2870°K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The time period of the pulse is equal to the "off" period. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

OPERATING CONSIDERATIONS

The operating stability of the 2020 depends on the magnitude and duration of the anode current. When the 2020 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 2020 usually recovers a substantial percentage of such loss in sensitivity.
Operation at an average anode current well below the maximum rated value of 2 milliamperes is recommended when stability is important. When maximum stability is required, the anode current should not exceed 250 microamperes.

*Electrostatic and/or magnetic shielding of the 2020 may be necessary.*

**SPECTRAL-SENSITIVITY CHARACTERISTIC**

of Phototube having S-II Response is shown at front of this Section

---

**CONDUCTIVE GRATING**

**PHOTOCATHODE DIA.**

1 1/2" MIN.

(SEE NOTE)

**T16 BULB**

**MEDIUM-SHELL DIHEPTAL 14-PIN BASE JEDEC GROUP 5, N#BI4-38**

---

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

**NOTE:** WITHIN 1-1/2" DIAMETER, DEVIATION FROM FLATNESS OF EXTERNAL SURFACE OF FACEPLATE WILL NOT EXCEED 0.010" FROM PEAK TO VALLEY.
AVERAGE ANODE CHARACTERISTICS

DYNODE-N & TO-CATHODE VOLTS = 200  
EACH-SUCCEEDING DYNODE-STAGE VOLTS = 100
FOCUSING ELECTRODE CONNECTED TO DYNODE N&1,  
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP  
OPERATED AT A COLOR TEMPERATURE OF 2670°K.
SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER PROVIDING $\frac{1}{6}$ OF E BETWEEN CATHODE AND DYNOE NO.1, $\frac{1}{12}$ OF E FOR EACH SUCCEEDING DYNOE STAGE, AND $\frac{1}{12}$ OF E BETWEEN DYNOE NO.10 AND ANODE.

FOCUSING ELECTRODE IS CONNECTED TO DYNOE NO.1.
TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES $\frac{1}{6}$ OF E BETWEEN CATHODE AND DYNODE NO. 1; $\frac{1}{12}$ OF E FOR EACH SUCCEEDING STAGE; AND $\frac{1}{12}$ OF E BETWEEN DYNODE NO. 10 AND ANODE.

FOCUSING ELECTRODE IS CONNECTED TO DYNODE NO. 1.

LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.

DASHED PORTION INDICATES INSTABILITY.

TUBE TEMPERATURE = 25° C
EFFECT OF MAGNETIC FIELD ON ANODE CURRENT

MAGNETIC FIELD IS PARALLEL TO DYNODE—CAGE AXIS.
POSITIVE VALUES ARE FOR LINES OF FORCE FROM LEFT TO RIGHT WITH BASE DOWN AND BASE KEY TOWARD OBSERVER.
DYNODE—NO. 1—TO—CATHODE VOLTS = 150
EACH SUCCEEDING STAGE VOLTS = 100
FOCUSING ELECTRODE IS CONNECTED TO DYNODE NO. 1.
GAS PHOTOTUBE
BLUE-SENSITIVE

DATA

General:
Spectral Response. ........................................ S-4
Wavelength of Maximum Response. ................. 4000 ± 500 Angstroms
Cathode:
Shape. ........................................ Semi-Cylindrical
Minimum Projected Length*. .................. 13/16"
Minimum Projected Width*. .................. 5/8"
Direct Interelectrode Capacitance. .............. 2.6 μf
Maximum Overall Length. ......................... 3-1/16"
Maximum Seated Length. ......................... 2-1/2"
Seated Length to Center of Cathode .......... 1-5/8" ± 3/32"
Maximum Diameter. ................................. 1-5/16"
Bulb ........................................ T-9
Mounting Position ................................ Any
Base ........................................ Intermediate-Shell Octal 5-Pin

Bottom View
Direction of Light

Pin 1—No Connection
Pin 2—No Connection
Pin 4—Anode
Pin 6—No Connection
Pin 8—Cathode

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC or Peak AC) 100 max. ... volts
PEAK CATHODE CURRENT .............. 10 max. ... μamp
PEAK CATHODE-CURRENT DENSITY ........ 100 max. μamp/sq.in.
AVERAGE CATHODE CURRENT° ................. 3 max. ... μamp
AMBIENT TEMPERATURE.............. 75 max. ... °C

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

Minimum Circuit Values:
DC Load Resistance:
With anode-supply voltage of 80 volts or less
For dc currents { above 3 μamp ... 0.1 ... megohms
{ below 3 μamp ... No Minimum
With anode-supply voltage of 100 volts
For dc currents { above 1 μamp ... 2.5 ... megohms
{ below 1 μamp ... 0.1 ... megohms
°: See next page.

APRIL 15, 1947
TUBE DEPARTMENT
TENTATIVE DATA
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
On plane perpendicular to indicated direction of incident light.
O Averaged over any interval of 30 seconds maximum. Average current may be doubled when anode-supply-voltage is limited to 80 volts.

SPECTRAL-SENSITIVITY CHARACTERISTIC
and
FREQUENCY-RESPONSE CHARACTERISTIC
of Gas Phototube having S-4 Response are shown at beginning of this Section
GAS PHOTOTUBE
CARTRIDGE TYPE WITH S-4 RESPONSE

DATA

General:
Spectral Response .............................................. S-4
Wavelength of Maximum Response ........ 4000 ± 500 Angstroms
Cathode:
Shape .......................................................... Semi-Cylindrical
Minimum Projected Length* .................. 5/8"
Minimum Projected Width* .................. 1/2"
Direct Interelectrode Capacitance ........ 1.0 μf
Overall Length .......................... 1-21/32" ± 1/16"
Length, Cathode Center to plane A–A' (see outline) 11/16" ± 1/16"
Maximum Diameter ......................... 0.890"
Mounting Position ........................................... Any
Terminal Caps .............................................. See Outline

Recessed Terminal } Anode

Protruding Terminal } Cathode

Maximum Ratings, Absolute Values:
ANODE–SUPPLY VOLTAGE (DC or Peak AC) 100 max. .. volts
PEAK CATHODE CURRENT .................. 10 max. .. μamp
PEAK CATHODE–CURRENT DENSITY .......... 100 max. μamp/sq.in.
AVERAGE CATHODE CURRENT° .......... 2 max. .. μamp
AMBIENT TEMPERATURE .................. 75 max. .. °C

Characteristics:

<table>
<thead>
<tr>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark Current at 90 Volts .......... - - 0.050 .. μamp</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sensitivity:
At 4000 Angstroms .......... - 0.11 - μamp/μwatt
Luminous: A
At 0 Cycles .................. 80 120 175 μamp/lumen
At 5000 Cycles ................ - 110 - μamp/lumen
At 10000 Cycles .............. - 96 - μamp/lumen

Gas Amplification Factor .......... - - 5.5

Minimum Circuit Values:
DC Load Resistance:
With anode-supply voltage of 80 volts or less
For dc currents { above 3 μamp ... 0.1 .... megohm
Below 3 μamp ... No Minimum
With anode-supply voltage of 100 volts
For dc currents { above 1 μamp ... 2.5 .... megohms
Below 1 μamp ... 0.1 .... megohms
°, A: See next page.

JUNE 15, 1948
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
GAS PHOTOTUBE

* On plane perpendicular to indicated direction of incident light.

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

△ Measured under conditions specified on sheet "PHOTOTUBE SENSITIVITY and SENSITIVITY MEASUREMENTS" at the front of this Section.

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

92CM-4818R2

JUNE 15, 1948
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-4818R2
GAS PHOTOTUBE
WITH S-4 RESPONSE

DATA

General:
Spectral Response.
Wavelength of Maximum Response.
Cathode:
Shape.
Minimum Projected Length.
Minimum Projected Width.
Direct Interelectrode Capacitance.
Maximum Overall Length.
Maximum Seated Length.
Bulb.
Mounting Position.
Base.

S-4
4000 ± 500 angstroms
Semi-Cylindrical
11/16"
7/16"
2.0 μf
2-13/32"
1-15/16"
1-1/4" ± 3/32"
0.669"
Any
Small-Shell Peewee 3-Pin
2F

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

Characteristics:

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

Minimum Circuit Values:
DC Load Resistance:
With anode-supply voltage of 80 volts or less
For dc currents above 3 μamp ... 0.1 ... megohm
below 3 μamp ... No Minimum
With anode-supply voltage of 100 volts
For dc currents above 1 μamp ... 2.5 ... megohms
below 1 μamp ... 0.1 ... megohms

* o, a: See next page.

MAY 1, 1951
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Gas Phototube

* On plane perpendicular to indicated direction of incident light.
0 Averaged over any interval of 30 seconds maximum. Average current may be doubled when anode-supply voltage is limited to 80 volts.
* Measured under conditions specified on sheet "PHOTOTUBE SENSITIVITY AND SENSITIVITY MEASUREMENTS" at front of this Section.

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

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

MAY 1, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
CE-6053R4
**5584 GAS PHOTOTUBE**

**BLUE SENSITIVE, TWIN TYPE**

---

**General:**
Spectral Response: S-4
Wavelength of Maximum Response: 4000 ± 500 Angstroms
Cathode (Each):
  - Shape: Quarter-Cylindrical
  - Minimum Projected Length*: 1-3/16"
  - Minimum Projected Width*: 1/4"
Direct Interelectrode Capacitances:
  - Cathode to Anode: 1.6 μf
  - Cathode to Cathode: 1.8 μf
  - Anode to Anode: 0.44 μf
Maximum Overall Length: 4"
Maximum Seated Length: 3-3/8"
Seated Length to Center of Cathode: 2-1/8" ± 3/32"
Maximum Diameter: 1-3/16"
Bulb: T-9
Mounting Position: Any
Base: Small-Shell Small 4-Pin

**Basing Designation for BOTTOM VIEW:** 4BG

---

**Pin 1 - Cathode, Unit No.2**
**Pin 2 - Anode, Unit No.2**
**Pin 3 - Anode, Unit No.1**
**Pin 4 - Cathode, Unit No.1**

---

**Maximum Ratings, Absolute Values (Each Unit):**
ANODE-SUPPLY VOLTAGE (DC or Peak AC): 100 max. volts
PEAK CATHODE CURRENT: 10 max. μamp
PEAK CATHODE-CURRENT DENSITY: 50 max. μamp/sq.in.
AVERAGE CATHODE CURRENT°: 2 max. μamp
AMBIENT TEMPERATURE: 75 max. °C

---

**Characteristics (Each Unit):**

<table>
<thead>
<tr>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark Current at 90 Volts</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Sensitivity:
- At 4000 Angstroms: - | 0.11 | - | μamp/μwatt |

Luminous:
- At 0 Cycles: | 80 | 120 | 175 | μamp/lumen |
- At 5000 Cycles: | - | 110 | - | μamp/lumen |
- At 10000 Cycles: | - | 96 | - | μamp/lumen |

Gas Amplification Factor: | - | - | 5.5 |

---

**Minimum Circuit Values (Each Unit):**
DC Load Resistance:
- With anode-supply voltage of 80 volts or less:
  - For dc currents above 3 μamp: | 0.1 | - | megohm |
  - For dc currents below 3 μamp: | No Minimum |

°, †, ‡, §, ‡, ‡: See next page.

---

APRIL 15, 1947
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE DATA
With anode-supply voltage of 100 volts
For dc currents:

\[ \begin{align*}
\text{above } 1 \mu\text{amp} & \quad .\quad 2.5 \quad \ldots \quad \text{megohms} \\
\text{below } 1 \mu\text{amp} & \quad .\quad 0.1 \quad \ldots \quad \text{megohms}
\end{align*} \]

- On plane perpendicular to indicated direction of incident light.
- Each unit, with other unit grounded.
- Anodes grounded.
- Cathodes grounded.
- Averaged over any interval of 30 seconds maximum. Average current may be doubled when anode-supply voltage is limited to 80 volts.

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

AVERAGE ANODE CHARACTERISTICS
of Type 5584 are the same
as those shown under Type 5582

---

**Diagram:**

- **Cathodes**
- **T9 Bulb**
- **Small-shell Small 4-pin Base**

---

**Dimensions:**

- 1 3/16 MAX.
- 1/4 MIN.
- 1/8 MAX.
- 3 3/8 MAX.
- 2 1/8
- ± 3/32
- 4 MAX.
- 1 3/16 MAX.

**Bottom View:**

- **Cathodes**

---

**Notes:**

- April 15, 1947
- Tube Department
- Radio Corporation of America, Harrison, New Jersey
- CE-4561R3
VACUUM PHOTOTUBE
COMPOSITE ANODE-CATHODE TYPE WITH S-4 RESPONSE

DATA

General:
Spectral Response......................................................... S-4
Wavelength of Maximum Response.................. 4000 ± 500 Angstroms

Cathode:
Shape................................................................. Flat
Minimum Projected Length*............................. 1/4"
Minimum Projected Width*............................... 19/32"
Direct Inter electrode Capacitance (C1)\^............. 1 \(\mu\)f
Balancing Capacitance (C2)\^............................... 1 \(\mu\)f
Capacitance Difference Between
\(C_1 \text{ and } C_2\).............................................. Not more than 0.3 \(\mu\)f
Maximum Overall Length.............................. 2-7/8"
Maximum Seated Length................................. 2-5/16"
Seated Length to Center of Cathode............. 1-5/8" ± 3/32"
Maximum Diameter........................................... 1-9/32"
Bulb................................................................. T-9
Mounting Position............................................... Any
Base................................................................. Intermediate-Shell Octal
Basing Designation for BOTTOM VIEW............ 5-Pin, Non-hygrosopic
Pin 1: No Connection.............................................. Pin 6: No Connection
Pin 2: Balancing Capacitance......................... Pin 8: Anode or Cathode
Pin 4: Cathode or Anode

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC or Peak AC).... 250 max. . . . volts
PEAK CATHODE CURRENT (For either electrode).... 12 max. . . . \(\mu\)amp
PEAK CATHODE-CURRENT DENSITY ............ 100 max. \(\mu\)amp/sq.in.
AVERAGE CATHODE CURRENT (For either electrode)\(^o\)........ 4 max. . . . \(\mu\)amp
AMBIENT TEMPERATURE................................. 75 max. . . . °C

Characteristics:

\[
\begin{array}{ccc}
\text{Min.} & \text{Av.} & \text{Max.} \\
\hline
\text{Dark Current at 250 Volts.} & - & - & 0.01 . . \mu\text{amp} \\
\text{Sensitivity:} & & & \\
\text{At 4000 Angstroms.} & - & 0.042 & \mu\text{amp/\muwatt} \\
\text{Luminous} & 30 & 45 & 70 \mu\text{amp/lumen} \\
\end{array}
\]

\^ On plane perpendicular to indicated direction of incident light.
\^ Measured between base pins 2 and 4.
\(^o\) Measured between base pins 4 and 8.
\(\mu\) Measured over any interval of 30 seconds maximum.

OCTOBER 1, 1947
TUBE DEPARTMENT
TENTATIVE DATA
SPECTRAL SENSITIVITY CHARACTERISTIC
of Phototube having S-4 Response
is shown at the beginning of this Section.

The curve shown under Type 929
is also applicable to the 5652.

TYPICAL CIRCUIT

AC INPUT

LOAD

TO AMPLIFIER

T9 BULB

INTERMEDIATE-SHELL OCTAL 5-PIN BASE

ANODE OR CATHODE

CATHODE OR ANODE

BOTTOM VIEW
AVERAGE OPERATION CHARACTERISTICS
WITH AC VOLTAGE APPLIED BETWEEN THE TWO ELECTRODES

ILLUMINATION: 2870°K TUNGSTEN
LOAD RESISTANCE: ZERO

DASHED CURVE A STATIC CHARACTERISTIC FOR ONE ELECTRODE WITH 0.1 LUMEN
DASHED CURVE B STATIC CHARACTERISTIC FOR OTHER ELECTRODE WITH 0.1 LUMEN
CURVE C OPERATION CURVE OBTAINED FROM STATIC CURVES A & B; OTHER OPERATION CURVES OBTAINED SIMILARLY

SEP. 4, 1947
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
General:
Spectral Response ........................................... S-4
Wavelength of Maximum Response .................. 4000 ± 500 Angstroms

Cathode:
- Shape ...................................................... Semi-Cylindrical
- Minimum Projected Length* .................. 13/16"
- Minimum Projected Width* .................. 5/8"
- Direct Interelectrode Capacitance ............. 2.6 µf
- Maximum Overall Length ....................... 3-1/16"
- Maximum Seated Length ......................... 2-1/2"
- Seated Length to Center of Cathode .......... 1-5/8" ± 3/32"
- Maximum Diameter .................................. 1-9/32"
- Bulb ......................................................... T-9
- Mounting Position ..................................... Any
- Base .................................................. Intermediate-Shell Octal 5-Pin

Basing Designation for BOTTOM VIEW .......... 3J

Maximum Ratings, Absolute Values:
- ANODE-SUPPLY VOLTAGE (DC or Peak AC) ....... 250 max. volts
- PEAK CATHODE CURRENT .............................. 20 max. µamp
- PEAK CATHODE-CURRENT DENSITY ............. 100 max. µamp/sq.in.
- AVERAGE CATHODE CURRENT° .................. 5 max. µamp
- AMBIENT TEMPERATURE .............................. 75 max. °C

Characteristics:

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
<th>unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark Current at 250 Volts</td>
<td>-</td>
<td>-</td>
<td>0.25</td>
<td>µamp</td>
</tr>
<tr>
<td>Sensitivity:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 4000 Angstroms.</td>
<td>-</td>
<td>0.042</td>
<td>0.042</td>
<td>µamp/µwatt</td>
</tr>
<tr>
<td>Luminous</td>
<td>20</td>
<td>45</td>
<td>100</td>
<td>µamp/lumen</td>
</tr>
</tbody>
</table>

* on plane perpendicular to indicated direction of incident light.
° Averaged over any interval of 30 seconds maximum.

OUTLINE DIMENSIONS for Type 5653
are the same as those for Type 5581

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-4 Response
is shown at beginning of this Section

AVERAGE ANODE CHARACTERISTICS
of Type 5653 are the same
as those shown under Type 929
MULTIPLIER PHOTOTUBE
10-STAGE, HEAD-ON TYPE WITH
1-1/2" SEMI-TRANSPARENT CATHODE AND S-4 RESPONSE

DATA

General:
Spectral Response ........................................ S-4
Wavelength of Maximum Response .................. 4000 ± 500 angstroms
Cathode, Semi-Transparent:
Shape ........................................................ Circular
Window:
Area .................................................. 1.8 sq. in.
Minimum diameter ........................................ 1.5 in.
Index of refraction ....................................... 1.51
Direct Interelectrode Capacitances (Approx):
Anode to dynode No.10 ......................... 4.2 μf
Anode to all other electrodes .......... 6.5 μf
Overall Length ........................................ 5-5/8" ± 3/16"
Seated Length ........................................ 4-7/8" ± 3/16"
Maximum Diameter .................................... 2-1/4"
Mounting Position ..................................... Any
Bulb ..................................................... T-16
Base ................................................ Medium-Shell Diheptal 14-Pin, Non-hygroscopic
(JETEC No.B14-38)

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC or Peak AC) .... 1250 max. volts
SUPPLY VOLTAGE BETWEEN DYNODE No.10
AND ANODE (DC or Peak AC) ........ 150 max. volts
SUPPLY VOLTAGE BETWEEN CATHODE
AND DYNODE No.1 (DC or Peak AC) .... 300 max. volts

ANODE CURRENT:
Peak ....................................................... 7.5 max. ma
Average .................................................. 0.75 max. ma
AMBIENT TEMPERATURE .................................. 75 max. °C

○ Referred to cathode.
○ Averaged over any interval of 30 seconds maximum.

MAY 3, 1954
MULTIPLIER PHOTOTUBE

Characteristics Range Values for Equipment Design:

Under conditions with supply voltage (E) across voltage divider providing 1/6 of E between cathode and dynode No. 1; 1/12 of E for each succeeding dynode stage; and 1/12 of E between dynode No. 10 and anode.

Min.  Median  Max.

With \( E = 1000 \) volts (except as noted)

Sensitivity:
- Radiant, at 4000 angstroms - 23200 - \( \mu \)amp/\( \mu \)watt
- Luminous:
  - At 0 cps . . . . . 10 25 - \( \)amp/lumen
  - At 100 Mc . . . . . - 22 - \( \)amp/lumen
- Cathode radiant, at 4000 angstroms - 0.0464 - \( \mu \)amp/\( \mu \)watt
- Cathode luminous:
  - With tungsten light source 40 50 - \( \mu \)amp/lumen
  - With blue light source 0.04 - - \( \mu \)amp

Current Amplification . . . - 500000 -

Equivalent: Anode-Dark-
- Current Input\* - \( 8.5 \times 10^{-10} \) \( 2 \times 10^{-9} \) lumen
- Equivalent Noise Input* - \( 2 \times 10^{-11} \) - lumen

With \( E = 750 \) volts (except as noted)

Sensitivity:
- Radiant, at 4000 angstroms - 2320 - \( \mu \)amp/\( \mu \)watt
- Luminous:
  - At 0 cps . . . . . - 2.5 - \( \)amp/lumen
- Cathode radiant at 4000 angstroms - 0.0464 - \( \mu \)amp/\( \mu \)watt
- Cathode luminous:
  - With tungsten light source 40 50 - \( \mu \)amp/lumen
  - With blue light source 0.04 - - \( \mu \)amp

For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 28700K. A light Input of 10 microlumens is used. The load resistor has a value of 0.01 megohm.

* For conditions the same as shown under (*) except that the value of light flux is 0.01 lumen and that 150 volts are applied between cathode and all other electrodes connected together as anode.

* under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning, Glass Code No. 5113 polished to 1/2 stock thickness) from a tungsten-filament lamp operated at a color temperature of 28700K. The value of light flux on the filter is 0.01 lumen. The load resistor has a value of 0.01 megohm, and 150 volts are applied between cathode and all other electrodes connected together as anode.

\( \bullet \) \( \bullet \) \( \bullet \): See next page  → indicates a change
MULTIPLIER PHOTOTUBE

For Spectral Characteristic of this source, see sheet SPECTRAL CHARACTERISTIC OF 2870°K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870°K SOURCE AFTER PASSING THROUGH INDICATED BLUE FILTER at front of this section.

- Measured at a tube temperature of 25°C and with the supply voltage (E) adjusted to give luminous sensitivity of 20 amperes per lumen. Dark current caused by thermionic emission and ion feedback may be reduced by the use of a refrigerant.

- For maximum signal-to-noise ratio, operation below 1000 volts is recommended.

- under the following conditions: Supply voltage (E) is 1000 volts, 25°C tube temperature, ac-amplifier bandwidth of 1 cycle per second, tungsten light source of 2870°C interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The "on" period of the pulse is equal to the "off" period. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

OPERATING CONSIDERATIONS

The operating stability of the 5819 is dependent on the magnitude of the anode current and its duration. When the 5819 is operated at high values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 5819 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum rated value of 0.75 milliampere is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 100 microamperes.

Electrostatic and/or magnetic shielding of the 5819 may be necessary.

AVERAGE ANODE CHARACTERISTICS are the same as those shown for Type 6199

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-4 Response is shown at the front of this Section.
MULTIPLIER PHOTOTUBE

PHOTOCATHODE DIAMETER
1 1/2" MIN.

MEDIUM-SHELL DIHEPTAL
14-PIN BASE
JETEC NO B14-38

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

MAY 3, 1954

CE-7232R3

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

92CM-7232R3
SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER PROVIDING \( \frac{1}{6} \) OF E BETWEEN CATHODE AND DYNODE NO. 1, \( \frac{1}{12} \) OF E FOR EACH SUCCEEDING DYNODE STAGE, AND \( \frac{1}{12} \) OF E BETWEEN DYNODE NO. 10 AND ANODE.

JUNE 30, 1953
TYPICAL ANODE DARK-CURRENT CHARACTERISTIC

Anode luminous sensitivity is varied by adjusting the supply voltage \( E \) across voltage divider which provides \( \frac{1}{6} \) of \( E \) between cathode and dynode \#1; \( \frac{1}{12} \) of \( E \) for each succeeding stage; and \( \frac{1}{12} \) of \( E \) between dynode \#10 and anode.

Tube temperature = 25°C

Dashed portion indicates instability

Light source is a tungsten-filament lamp operated at a color temperature of 2870°K.

Tube temperature = 25°C

---

ANODE LUMINOUS SENSITIVITY—AMPERES/LUMEN

EQUIVALENT ANODE-DARK-CURRENT INPUT-LUMENS

ANODE LUMINOUS SENSITIVITY—AMPERES/LUMEN

FEB. 6, 1953 TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7920RI
MULTIPLIER PHOTOTUBE
10-STAGE, HEAD-ON TYPE WITH
1-1/4" SEMI-TRANSPARENT CATHODE AND S-4 RESPONSE

DATA

General:
Spectral Response ................. S-4
Wavelength of Maximum Response .... 4000 ± 500 angstroms
Cathode, Semi-transparent:
  Shape .................................. Circular
  Window:
    Area .................................. 1.2 sq. in.
    Minimum Diameter .................... 1.24 in.
    Minimum Diameter of Flat Surface ... 1 in.
    Index of Refraction ................. 1.51
Direct Interelectrode Capacitances:
  (Approx.):
    Anode to Dynode No. 10 ............. 4 μμf
    Anode to All Other Electrodes ...... 7 μμf
  Overall Length ....................... 4-3/8" ± 3/16"
  Seated Length ......................... 3-7/8" ± 3/16"
  Maximum Diameter ..................... 1-9/16"
  Bulb .................................. T-12
  Mounting Position ..................... Any
  Base .................................. Small-Shell Duodecal 12-Pin, Non-hygroscopic
                                      (JETEC No.B12-43)

BOTT. VIEW

Pin 1 - Dynode No. 1
Pin 2 - Dynode No. 3
Pin 3 - Dynode No. 5
Pin 4 - Dynode No. 7
Pin 5 - Dynode No. 9
Pin 6 - Anode
Pin 7 - Dynode No. 10
Pin 8 - Dynode No. 8
Pin 9 - Dynode No. 6
Pin 10 - Dynode No. 4
Pin 11 - Dynode No. 2
Pin 12 - Cathode

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC or Peak AC) D .......... 1250 max. volts
SUPPLY VOLTAGE BETWEEN DYNODE No. 10
AND ANODE (DC or Peak AC) .......... 150 max. volts
ANODE CURRENT:
  Peak .................................. 7.5 max. ma
  Average D ............................ 0.75 max. ma
  Average for Minimum Fatigue D .......... 0.1 max. ma
AMBIENT TEMPERATURE .................. 75 max. °C

D Referred to cathode.
D Averaged over any interval of 30 seconds maximum.

NOV. 1, 1952
TUBE DEPARTMENT
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 1/6 of E between cathode and dynode No.1; 1/12 of E for each succeeding dynode stage; and 1/12 of E between dynode No.10 and anode

With $E = 1000$ volts (except as noted)

<table>
<thead>
<tr>
<th></th>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity:</td>
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<td></td>
</tr>
<tr>
<td>Anode, at 4000</td>
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<td></td>
</tr>
<tr>
<td>angstroms</td>
<td>10</td>
<td>24</td>
<td>22</td>
</tr>
<tr>
<td>Luminous:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anode:†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 0 cps</td>
<td>10</td>
<td>24</td>
<td>22</td>
</tr>
<tr>
<td>At 100 Mc</td>
<td>10</td>
<td>24</td>
<td>22</td>
</tr>
<tr>
<td>Cathode:</td>
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</tr>
<tr>
<td>With Tungsten</td>
<td>20</td>
<td>40</td>
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<tr>
<td>Light Source</td>
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<tr>
<td>With Blue</td>
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<td></td>
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</tr>
<tr>
<td>Current Amplification*</td>
<td>60000</td>
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<td></td>
</tr>
<tr>
<td>Equivalent Anode-Dark-Current Input*</td>
<td>$8 \times 10^{-10}$</td>
<td>$2.5 \times 10^{-9}$</td>
<td>lumen</td>
</tr>
<tr>
<td>Equivalent Noise Input*</td>
<td>$4 \times 10^{-12}$</td>
<td></td>
<td>lumen</td>
</tr>
</tbody>
</table>

With $E = 750$ volts (except as noted)

<table>
<thead>
<tr>
<th></th>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity:</td>
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<tr>
<td>Anode, at 4000</td>
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<tr>
<td>angstroms</td>
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<td>24</td>
<td>22</td>
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<tr>
<td>Luminous:</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Anode:†</td>
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<tr>
<td>At 0 cps</td>
<td>10</td>
<td>24</td>
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<tr>
<td>At 100 Mc</td>
<td>10</td>
<td>24</td>
<td>22</td>
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<td>Cathode:</td>
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<td>With Tungsten</td>
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<td>Light Source</td>
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<tr>
<td>With Blue</td>
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<tr>
<td>Current Amplification*</td>
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</tr>
</tbody>
</table>

† For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A light input of 10 microlumens is used. The load resistor has a value of 0.01 megohm.

‡ For conditions the same as shown under (†) except that the value of light flux is 0.01 lumen and that 150 volts are applied between cathode and all other electrodes connected together as anode.

¶ Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning, Glass code No. 5113 polished to 1/2 stock thickness) from a tungsten-filament lamp operated at a color temperature of 2870°K. The value of light flux on the filter is 0.01 lumen. The load resistor has a value of 0.01 megohm, and 150 volts are applied between cathode and all other electrodes connected together as anode.

†, ‡, ¶: See next page.

NOV. 1, 1952

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
For Spectral Characteristic of this source, see Sheet SPECTRAL CHARACTERISTIC OF 2870°K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870°K SOURCE AFTER PASSING THROUGH INDICATED BLUE FILTER at front of this section.

Ratio of anode sensitivity to cathode sensitivity under conditions of 2870°K tungsten light input.
- Defined as the quotient of the dc anode dark current by the anode luminous sensitivity. It is measured at a tube temperature of 25°C and with the supply voltage (E) adjusted to give an anode luminous sensitivity of 20 amperes per lumen. Dark current caused by thermionic emission and ion feedback may be reduced by the use of a refrigerant.
- For maximum signal-to-noise ratio, operation below 1000 volts is recommended.

Defined as the value where the rms output current is equal to the rms noise current determined under the following conditions: Supply voltage (E) is 1000 volts, 25°C tube temperature, ac-amplifier bandwidth of 1 cycle per second, tungsten light source of 2870°K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The "on" period of the pulse is equal to the "off" period. The output current is measured through a filter which passes only the fundamental frequency of the pulse.

OPERATING NOTES

Performance of the 6199 is affected by magnetic fields. It will be observed with certain orientations of the 6199 that the earth's magnetic field is sufficient to cause a noticeable decrease in the response of the tube. Therefore, it may be desirable to provide magnetic shielding for the 6199 particularly when it is to be used in a strong magnetic field.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-4 Response is shown at the front of this Section
NOTE: DEVIATION FROM FLATNESS WILL NOT EXCEED 0.015" FROM PEAK TO VALLEY.

1/2 OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.
AVERAGE ANODE CHARACTERISTICS

DYNOODE-N°1-TO-CATHODE VOLTS = 167
EACH-SUCCEEDING-DYNOODE-STAGE VOLTS = 83

JUNE 10, 1952
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7255R3
AVERAGE CHARACTERISTICS

SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER PROVIDING \( \frac{1}{6} \) OF E BETWEEN CATHODE AND DYNODE NO.1; \( \frac{1}{12} \) OF E FOR EACH SUCCEEDING DYNODE STAGE; AND \( \frac{1}{12} \) OF E BETWEEN DYNODE NO.10 AND ANODE.
TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

Anode luminous sensitivity is varied by adjusting the supply voltage (E) across voltage divider which provides \( \frac{1}{6} \) of E between cathode and dynode No. 1; \( \frac{1}{12} \) of E for each succeeding stage; and \( \frac{1}{12} \) of E between dynode No. 10 and anode.

Tube temperature = 25°C

Dashed portion indicates instability.
## DATA

### General:
- Spectral Response: S-10
- Wavelength Range of Highest-Response Region: 3700 to 5600 angstroms

### Cathode, Semi-transparent:
- Shape: Circular
- Window:
  - Area: 1.8 sq. in.
  - Minimum Diameter: 1.5 in.
  - Index of Refraction: 1.51

### Direct Interelectrode Capacitances:
- Anode to Dynode No. 10: 4.2 μF
- Anode to All Other Electrodes: 6.5 μF
- Overall Length: 5-5/8" ± 3/16"
- Seated Length: 4-7/8" ± 3/16"
- Maximum Diameter: 2-1/4"
- Mounting Position: Any
- Base: Medium-Shell Diheptal 14-Pin, Non-hygroscopic (JETEC No.B14-38)

### Basing Designation for BOTTOM VIEW:
- 14M1

### Maximum Ratings, Absolute Values:
- ANODE-SUPPLY VOLTAGE (DC or Peak AC)\(^0\): 1250 max. volts
- SUPPLY VOLTAGE BETWEEN DYNODE No. 10 AND ANODE (DC or Peak AC): 150 max. volts

### Anode Current:
- Peak: 7.5 max. ma
- Average\(^0\): 0.75 max. ma
- Average for Minimum Fatigue\(^0\): 0.1 max. ma

### Ambient Temperature: 75 max. °C

---

\(^0\) Referred to cathode.
\(^0\) Averaged over any interval of 30 seconds maximum.

---

**Bulb**

**Pin 1** - Dynode No. 1
**Pin 2** - Dynode No. 2
**Pin 3** - Dynode No. 3
**Pin 4** - Dynode No. 4
**Pin 5** - Dynode No. 5
**Pin 6** - Dynode No. 6
**Pin 7** - Dynode No. 7
**Pin 8** - Dynode No. 8
**Pin 9** - Dynode No. 9
**Pin 10** - Dynode No. 10
**Pin 11** - Anode
**Pin 12** - No Connection
**Pin 13** - Internal Con. Do Not Use
**Pin 14** - Cathode

---

**Instruction:**
- **DIRECTION OF LIGHT:** INTO END OF BULB

---

**NOV. 1, 1952**

**TENTATIVE DATA**

**TUBE DEPARTMENT**

**RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY**
CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Under conditions with supply voltage (E) across voltage divider providing 1/6 of E between cathode and dynode No.1; 1/12 of E for each succeeding dynode stage; and 1/12 of E between dynode No.10 and anode

With E = 1000 volts (except as noted)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity:</td>
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<td></td>
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<tr>
<td>Anode, at 5400</td>
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<td></td>
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</tr>
<tr>
<td>angstroms</td>
<td>-</td>
<td>8500</td>
<td>- μamp/μwatt</td>
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<td>Luminous:</td>
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<tr>
<td>Anode:*</td>
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<td></td>
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</tr>
<tr>
<td>At 0 cps</td>
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<td>At 100 Mc</td>
<td>-</td>
<td>21</td>
<td>- amp/lumen</td>
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<tr>
<td>With Tungsten</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Light Source*</td>
<td>20</td>
<td>40</td>
<td>- μamp/lumen</td>
</tr>
<tr>
<td>With Red-Infrared</td>
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<td></td>
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</tr>
<tr>
<td>Light Source#</td>
<td>0.05</td>
<td>-</td>
<td>- μamp</td>
</tr>
<tr>
<td>Current Amplification*</td>
<td>-</td>
<td>600000</td>
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<tr>
<td>Equivalent Anode-Dark-Current Input**</td>
<td>-</td>
<td>1 x 10^-8</td>
<td>2.5 x 10^-8</td>
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<tr>
<td>Equivalent Noise Input##</td>
<td>-</td>
<td>4 x 10^-11</td>
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With E = 750 volts (except as noted)

<table>
<thead>
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<th>Characteristic</th>
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<th>Max.</th>
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</thead>
<tbody>
<tr>
<td>Sensitivity:</td>
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</tr>
<tr>
<td>Anode, at 5400</td>
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</tr>
<tr>
<td>angstroms</td>
<td>-</td>
<td>8500</td>
<td>- μamp/μwatt</td>
</tr>
<tr>
<td>Luminous:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anode:*</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>At 0 cps</td>
<td>-</td>
<td>2.4</td>
<td>- amp/lumen</td>
</tr>
<tr>
<td>Cathode:</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>With Tungsten</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light Source*</td>
<td>20</td>
<td>40</td>
<td>- μamp/lumen</td>
</tr>
<tr>
<td>With Red-Infrared</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Light Source#</td>
<td>0.05</td>
<td>-</td>
<td>- μamp</td>
</tr>
<tr>
<td>Current Amplification*</td>
<td>-</td>
<td>60000</td>
<td>-</td>
</tr>
</tbody>
</table>

* For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A light input of 10 microlumens is used. The load resistor has a value of 0.01 megohm.

* For conditions the same as shown under (*) except that the value of light flux is 0.01 lumen and that 150 volts are applied between cathode and all other electrodes connected together as anode.

Under the following conditions: Light incident on the cathode is transmitted through a red-infrared filter (combination of Corning Glass Code nos. 3462 and 5650 filters) from a tungsten-filament lamp operated at a color temperature of 2870°K. The value of light flux on the filter is 0.1 lumen. The load resistor has a value of 0.01 megohm, and 150 volts are applied between cathode and all other electrodes connected together as anode. This test evaluates the magnitude of the infrared response in the tail of the response characteristic and provides a critical criterion for the response in the red band.

#,#,##: see next page.
MULTIPLIER PHOTOTUBE

For Spectral Characteristic of this source, see sheet SPECTRAL CHARACTERISTIC OF 2870°K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870°K SOURCE AFTER PASSING THROUGH INDICATED RED-INFRARED FILTER at front of this section.

Ratio of anode sensitivity to cathode sensitivity under conditions of 2870°K tungsten light input.

Defined as the quotient of the dc anode dark current by the anode luminous sensitivity. After tube has been in the dark for 30 minutes, the equivalent dark-current input is measured at a tube temperature of 25°C and with the supply voltage (E) adjusted to give an anode luminous sensitivity of 20 amperes per lumen. Dark current caused by thermionic emission and ion feedback may be reduced by the use of a refrigerant.

Defined as the value where the rms output current is equal to the rms noise current determined under the following conditions: Supply voltage (E) is 1000 volts, 25°C tube temperature, ac-amplifier bandwidth of 1 cycle per second, tungsten light source of 2870°K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The "on" period of the pulse is equal to the "off" period. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

OPERATING NOTES

Performance of the 6217 is affected by magnetic fields. It will be observed with certain orientations of the 6217 that the earth's magnetic field is sufficient to cause a noticeable decrease in the response of the tube. Therefore, it may be desirable to provide magnetic shielding for the 6217 particularly when it is to be used in a strong magnetic field.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-10 Response is shown at the front of this Section

AVERAGE ANODE CHARACTERISTICS, SENSITIVITY CHARACTERISTIC, and CURRENT AMPLIFICATION CHARACTERISTIC are the same as those shown for Type 6199
MEDIUM-SHELL DIHEPTAL
14-PIN BASE
JETEC #BI4-38

PHOTOCATHODE DIAMETER
1 1/2" MIN.

92CM-7232R3

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

NOV. 1, 1952

6217
MULTIPLIER PHOTOTUBE

1/4 OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.
The 6323 is the same as the 6328 except for the following items:

**General:**

Direct Interelectrode Capacitances (Approx.):
- Anode to dynode No. 9: 4.4 μf
- Anode to all other electrodes: 6 μf
- Maximum Overall Length: 3-11/16" 
- Maximum Seated Length: 3-1/8" 
- Length from Base Seat to Center of Useful Cathode Area: 1-15/16" ± 3/32" 
- Weight (Approx.): 1.6 oz 
- Base: Small-Shell Submagnal 11-Pin (JETEC No. B11-88), Non-hygroscopic

**DIMENSIONS:**

- T9 BULB 
- CATHODE 
- SMALL-SHELL SUBMAGNAL 11-PIN BASE JETEC No. B11-88
- 92CM-6264R3 
- DIRECTION OF LIGHT

**NOTE:**

- The maximum angular variation between the plane through pins No. 1 and No. 11 and the plane of the grill will not exceed 6°.

SEP. 1, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

MAX. — 5/16" MIN.

MAX. — 3 11/16" MIN.

MAX. — 3 1/4" MIN.

± 3/32"
MULTIPLIER PHOTOTUBE
9-STAGE TYPE WITH S-4 RESPONSE
FOR HEADLIGHT-CONTROL SERVICE

DATA

General:
Spectral Response ................. S-4
Wavelength of Maximum Response .... 4000 ± 500 angstroms
Cathode:
  Minimum Projected Length* .......... 15/16"
  Minimum Projected Width* ........... 5/16"
Direct Interelectrode Capacitances:
  Anode to Dynode No.9 .............. 4.2 μμf
  Anode to All Other Electrodes ...... 5.5 μμf
Maximum Overall Length .............. 3-1/8"
Maximum Seated Length .............. 2-11/16"
Length from Base Seat to Center of Useful Cathode Area ............. 1-9/16" ± 3/32"
Bulb ..................................... 1-5/16"
Mounting Position .................... T-9
Base ..................................... Any
Base ... Small-Shell Neosubmagnal 11-Pin, Non-hygroscopic (JETEC No.811-104)

Basing Designation for BOTTOM VIEW .......... 11K

Pin 1: Dynode No.1
Pin 2: Dynode No.2
Pin 3: Dynode No.3
Pin 4: Dynode No.4
Pin 5: Dynode No.5
Pin 6: Dynode No.6
Pin 7: Dynode No.7
Pin 8: Dynode No.8
Pin 9: Dynode No.9
Pin 10: Anode
Pin 11: Cathode

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC or Peak AC) ........ 1250 max. volts
SUPPLY VOLTAGE BETWEEN DYNODE No.9
  AND ANODE (DC or Peak AC) ........... 250 max. volts
AVERAGE ANODE CURRENT* .............. 0.1 max. ma
AMBIENT TEMPERATURE ................. 75 max. °C

* On plane perpendicular to the indicated direction of light (see Dimensional Outline).
* Averaged over any interval of 30 seconds maximum.
**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. 0 and anode

With \(E = 1000\) volts

<table>
<thead>
<tr>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity: Radiant, at 4000 angstroms</td>
<td>-</td>
<td>32500</td>
</tr>
<tr>
<td>Luminous:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 0 cps</td>
<td>5</td>
<td>35</td>
</tr>
<tr>
<td>At 100 Mc</td>
<td>-</td>
<td>33</td>
</tr>
</tbody>
</table>

Electrode Dark Current

(At 25°C):

| Anode | - | - | 0.1 | \(\mu\)amp |
| Any other electrode | - | - | 0.75 | \(\mu\)amp |

*For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A light input of 10 microlumens is used. The load resistor has a value of 0.01 megohm.*

**OPERATING CONSIDERATIONS**

The operating stability of the 6328 is dependent on the magnitude of the anode current and its duration. When the 6328 is operated at high values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 6328 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum rated value of 0.1 milliampere is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 10 microamperes.

A recommended design of voltage-divider network for use with the 6328 to provide stable operation and long tube life is shown in the accompanying circuit. This design provides linear operation within the range normally required for 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.
RECOMMENDED VOLTAGE-DIVIDER NETWORK FOR USE
WITH TYPE 6328 IN HEADLIGHT DIMMING SERVICE

AC OR DC
POWER SUPPLY

R10
R11
DYNODE N° 9

R9
R12
N° 8

R8
R13
N° 7

R7
R14
N° 6

R6
R15
N° 5

R5
R16
N° 4

R4
R17
N° 3

R3
R18
N° 2

R2
R19
N° 1

R1
R20
CATHODE

-1000 V

R21
OUTPUT

ANODE

TYPE 6328

92CS-8127

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

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

T9 BULB
CATHODE

SMALL-SHELL NEOSUBMAGNAL 11-PIN BASE JETEC No. B11-104

DIRECTION OF LIGHT

BOTTOM VIEW

AVERAGE ANODE CHARACTERISTICS

VOLTS/STAGE = 100

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

92CM-8029
VARIATION IN SENSITIVITY OF PHOTOCATHODE ALONG ITS LENGTH

SPOT SIZE: 1MM APPROX.
VARIATIONS CAUSED BY INTERCEPTION OF LIGHT BY GRILL AS WELL AS SURFACE IRREGULARITIES HAVE BEEN IGNORED

DISTANCE ALONG CATHODE FROM END OF CATHODE NEARER BASE—MILLIMETERS

MAR. 18, 1954 TUBE DEPARTMENT 92CM-7663RI
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, BASE DOWN
CATHODE WIDTH PROJECTED NORMAL TO PLANE OF GRILL
VARIATIONS CAUSED BY INTERCEPTION OF LIGHT BY GRILL AS WELL AS SURFACE IRREGULARITIES HAVE BEEN IGNORED
RANGE OF LUMINOUS SENSITIVITY

SENSITIVITY-AMPERES/LUMEN (COLOR TEMP. 2870°K)

DC VOLTS PER STAGE

JUNE 29, 1953

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CL-8027
MULTIPLIER PHOTOTUBE
10-STAGE, HEAD-ON TYPE WITH
1-11/16" SEMITRANSPARENT CATHODE AND S-11 RESPONSE
SHORT TIME-RESOLUTION CAPABILITY

DATA

General:
Spectral Response. ............................................ S-11
Wavelength of Maximum Response ....... 4400 ± 500 angstroms
Cathode, Semitransparent:
Shape. ......................................................... Circular
Window:
Area .......................................................... 2.2 sq. in.
Minimum diameter .................................. 1-11/16 in.
Index of refraction .................................. 1.51
Direct Interelectrode Capacitances (Approx.):
   Anode to dynode No.10. ......................... 4.4 μf
   Anode to all other electrodes. ............... 7 μf
Maximum Overall Length .............. S-13/16" ± 7/8
Seated Length ........................................ 4-7/8" ± 3/16"
Maximum Diameter .......................... 2-1/4"
Mounting Position ................................ Any
Weight (Approx.) .................................. 5.2 oz
Bulb ..................................................... T-16

Base .................................. Medium-Shelf Diheptal 14-Pin (JETEC No.B14-38),
                              Non-hygroscopic

BOTTOM VIEW

Pin 1 - Dynode No.1
Pin 2 - Dynode No.2
Pin 3 - Dynode No.3
Pin 4 - Dynode No.4
Pin 5 - Dynode No.5
Pin 6 - Dynode No.6
Pin 7 - Dynode No.7
Pin 8 - Dynode No.8
Pin 9 - Dynode No.9
Pin 10 - Dynode No.10
Pin 11 - Anode
Pin 12 - Internal Connection-
Pin 13 - Focusing Electrode
Pin 14 - Cathode

DIRECTION OF LIGHT: INTO END OF BULB

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC or Peak AC) .... 1500 max. volts
SUPPLY VOLTAGE BETWEEN DYNODE No.10
   AND ANODE (DC or Peak AC). ............... 250 max. volts
DYNODE-No.1 SUPPLY VOLTAGE
   (DC or Peak AC). ............................... 400 max. volts
FOCUSBNG-ELECTRODE VOLTAGE (DC or Peak AC) . 400 max. volts
AVERAGE ANODE CURRENT* .......................... 2 max. ma
AMBIENT TEMPERATURE .......................... 75 max. °C

* Averaged over any interval of 30 seconds maximum.

Indicates a change.

SEPT. 1, 1955
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
### Characteristics Range Values for Equipment Design:

Under conditions with supply voltage (E) across voltage divider providing 1/6 of E between cathode and dynode No.1; 1/12 of E for each succeeding dynode stage; and 1/12 of E between dynode No.10 and anode

*With E = 1250 volts (except as noted) and Focusing Electrode* connected to Dynode No.1 at socket

<table>
<thead>
<tr>
<th>Sensitivity:</th>
<th>Min.</th>
<th>Median</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiant, at</td>
<td>4400 angstroms</td>
<td>-</td>
<td>6000</td>
</tr>
<tr>
<td>Cathode radiant, at 4400 angstroms</td>
<td>-</td>
<td>0.048</td>
<td>μamp/μwatt</td>
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<tr>
<td>Luminous: At 0 cps</td>
<td>3</td>
<td>7.5</td>
<td>100</td>
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<tr>
<td>Cathode luminous: With tungsten light source</td>
<td>40</td>
<td>60</td>
<td>-</td>
</tr>
<tr>
<td>With blue light source</td>
<td>0.04</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Current Amplification</td>
<td>-</td>
<td>125000</td>
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</table>

*Equivalent Anode-Dark-

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<th>Median</th>
<th>Max.</th>
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<td>28000</td>
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<tr>
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<td>0.048</td>
<td>μamp/μwatt</td>
</tr>
<tr>
<td>Luminous: At 0 cps</td>
<td>-</td>
<td>35</td>
<td>-</td>
</tr>
<tr>
<td>Cathode luminous: With tungsten light source</td>
<td>40</td>
<td>60</td>
<td>-</td>
</tr>
<tr>
<td>With blue light source</td>
<td>0.04</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Current Amplification</td>
<td>-</td>
<td>600000</td>
<td>-</td>
</tr>
</tbody>
</table>

*In general, the focusing electrode is connected to dynode No.1 at the socket and operated at the same fixed potential as dynode No.1. However, in applications critical as to magnitude, uniformity, or speed of the response, the focusing electrode may be connected to the adjustable arm of a potentiometer between cathode and dynode No.1 in the voltage divider, and operated at an optimum potential within a range of 10 to 60 per cent of the dynode-No.1 potential.

*For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A light input of 10 microlumens is used. The load resistor has a value of 0.01 megohm.

---

*See next page.*

---

SEPT. 1, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
For conditions the same as shown under (6) except that the value of light flux is 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected together as anode.

Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning Glass Code No. 5113 polished to 1/2 stock thickness) from a tungsten filament lamp operated at a color temperature of 2870°K. The value of light flux on the filter is 0.01 lumen. The load resistor has a value of 0.01 megohm, and 200 volts are applied between cathode and all other electrodes connected together as anode.

For spectral characteristic of this source, see sheet SPECTRAL CHARACTERISTIC OF 2870°K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870°K SOURCE AFTER PASSING THROUGH INDICATED BLUE FILTER at front of this section.

Measured at a tube temperature of 25°C and with the supply voltage (E) adjusted to give a luminous sensitivity of 20 amperes per lumen. Dark current caused by thermionic emission and ion feedback may be reduced by the use of a refrigerant.

For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1250 volts is recommended.

Under the following conditions: Supply voltage (E) is 1250 volts, 25°C tube temperature, ac-amplifier bandwidth of 1 cycle per second, tungsten light source of 2870°K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The "on" period of the pulse is equal to the "off" period. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

OPERATING CONSIDERATIONS

The operating stability of the 6342 is dependent on the magnitude of the anode current and its duration. When the 6342 is operated at high values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 6342 usually recovers a substantial percentage of such loss in sensitivity. The use of an average anode current well below the maximum rated value of 2 milliamperes is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 250 microamperes.

Electrostatic and/or magnetic shielding of the 6342 may be necessary.

The material of which the dynodes of the 6342 are made has stable, high-current carrying capabilities and permits the use of a tube manufacturing process which minimizes regenerative effects such as afterpulses. The relative freedom of the 6342 from afterpulses and its small spread in electron transit time make it particularly useful for fast coincidence scintillation counting.

Because the 6342 offers the advantage of small spread in electron transit time, it has a fast pulse rise time. For an input pulse having a rise time of 1 millimicrosecond or less, the rise time of the pulse at the anode is about...
5 millimicroseconds as measured between its 10- and 90-percent magnitude points when the supply voltage is 1500 volts and the focusing electrode is connected to dynode No.1.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-11 Response is shown at the front of this Section

NOTE: WITHIN MINIMUM DIAMETER, DEVIATION FROM FLATNESS WILL NOT EXCEED 0.010" FROM PEAK TO VALLEY.
AVERAGE ANODE CHARACTERISTICS

DYNODE-N°1-TO-CATHODE VOLTS = 208
EACH-SUCCEEDING-DYNODE STAGE VOLTS = 104
FOCUSING ELECTRODE CONNECTED TO DYNODE N°1
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP
OPERATED AT A COLOR TEMPERATURE OF 2870°K.
LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE ($E$) ACROSS VOLTAGE DIVIDER WHICH PROVIDES $\frac{1}{6}$ OF $E$ BETWEEN CATHODE AND DYNODE NO.1; $\frac{1}{12}$ OF $E$ FOR EACH SUCCEEDING STAGE; AND $\frac{1}{12}$ OF $E$ BETWEEN DYNODE NO.10 AND ANODE.

FOCUSBING ELECTRODE IS CONNECTED TO DYNODE NO.1. DASHED PORTION INDICATES INSTABILITY.

LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.

TUBE TEMPERATURE = 25°C

OCT. 15, 1953 TUBE DIVISION 92CM-8124
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE CHARACTERISTICS

SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER PROVIDING \( \frac{1}{6} \) OF \( E \) BETWEEN CATHODE AND DYNODE \( N\) \( 1 \), \( \frac{1}{12} \) OF \( E \) FOR EACH SUCCEEDING DYNODE STAGE; AND \( \frac{1}{12} \) OF \( E \) BETWEEN DYNODE \( N\) \( 10 \) AND ANODE

FOCUSING ELECTRODE IS CONNECTED TO DYNODE \( N\) \( 1 \)

Sensitivity-Ampere/Lumen (Color Temp. 2870°K)

Current Amplification

SUPPLY VOLTS (E)

OCT. 15, 1953

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CL-8123
### General:

- Spectral Response: S-11
- Wavelength of Maximum Response: 4400 ± 500 angstroms

#### Shape, Semitransparent:

- Window:
  - Minimum length: 4-1/8 in.
  - Minimum width (Along circumference of bulb): 3 in.
  - Minimum area: 12-3/8 sq. in.

- Index of refraction: 1.48

#### Direct Interelectrode Capacitances (Approx.):

- Anode to dynode No. 10: 5 μf
- Anode to all other electrodes: 6.5 μf

#### Lengths and Dimensions:

- Maximum Overall Length: 7-3/4" ± 1/8"
- Maximum Seated Length: 7-1/4"
- Length from Base Seat to Center of Useful Cathode Area: 3-5/8" ± 1/8"
- Maximum Diameter: 2-9/16"
- Mounting Position: Any
- Weight (Approx.): 9 oz
- Bulb: T-20

#### Pin Numbers and Functions:

<table>
<thead>
<tr>
<th>Pin 1</th>
<th>Anode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin 2</td>
<td>Dynode No. 10</td>
</tr>
<tr>
<td>Pin 3</td>
<td>Dynode No. 9</td>
</tr>
<tr>
<td>Pin 4</td>
<td>Dynode No. 8</td>
</tr>
<tr>
<td>Pin 5</td>
<td>Dynode No. 7</td>
</tr>
<tr>
<td>Pin 6</td>
<td>Dynode No. 6</td>
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<td>Pin 7</td>
<td>Dynode No. 5</td>
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<td>Pin 8</td>
<td>Dynode No. 4</td>
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<td>Pin 9</td>
<td>Dynode No. 3</td>
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<td>Pin 10</td>
<td>Dynode No. 2</td>
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<tr>
<td>Pin 11</td>
<td>Dynode No. 1</td>
</tr>
<tr>
<td>Pin 12</td>
<td>Internal Connection—Do Not Use</td>
</tr>
<tr>
<td>Pin 13</td>
<td>Focusing Electrode</td>
</tr>
<tr>
<td>Pin 14</td>
<td>Same as Pin 12</td>
</tr>
<tr>
<td>Pin 15</td>
<td>Same as Pin 12</td>
</tr>
<tr>
<td>Pin 16</td>
<td>Cathode</td>
</tr>
<tr>
<td>Pin 17</td>
<td>Same as Pin 12</td>
</tr>
<tr>
<td>Pin 18</td>
<td>Same as Pin 12</td>
</tr>
<tr>
<td>Pin 19</td>
<td>Same as Pin 12</td>
</tr>
<tr>
<td>Pin 20</td>
<td>Same as Pin 12</td>
</tr>
<tr>
<td>Pin 21</td>
<td>Same as Pin 12</td>
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<tr>
<td>Pin 22</td>
<td>Same as Pin 12</td>
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<tr>
<td>Pin 23</td>
<td>Same as Pin 12</td>
</tr>
<tr>
<td>Pin 24</td>
<td>Same as Pin 12</td>
</tr>
<tr>
<td>Pin 25</td>
<td>Same as Pin 12</td>
</tr>
<tr>
<td>Pin 26</td>
<td>Same as Pin 12</td>
</tr>
<tr>
<td>Pin 27</td>
<td>Same as Pin 12</td>
</tr>
<tr>
<td>Pin 28</td>
<td>Same as Pin 12</td>
</tr>
</tbody>
</table>

---

**BOTTOM VIEW**

- Indicate a change.

**SEPT. 1, 1955**

---

**TUBE DIVISION**

**RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY**
### Maximum Ratings, Absolute Values:

- **Anode-Supply Voltage (DC or Peak AC)**: 1200 max. volts
- **Supply Voltage Between Dynode No. 10 and Anode (DC or Peak AC)**: 180 max. volts
- **Dynode-No. 1 Supply Voltage (DC or Peak AC)**: 300 max. volts
- **Focusing-Electrode Voltage (DC or Peak AC)**: 300 max. volts
- **Average Anode Current**: 0.75 max. mA
- **Ambient Temperature**: 75 max. °C

### Characteristics Range Values for Equipment Design:

Under conditions with supply voltage \( E \) across a voltage divider providing \( 1/12 \) of \( E \) between cathode and focusing electrode; \( 1/12 \) of \( E \) between focusing electrode and dynode No. 1; \( 1/12 \) of \( E \) for each succeeding dynode stage; and \( 1/12 \) of \( E \) between dynode No. 10 and anode.

With \( E = 1000 \) volts (except as noted)

#### Sensitivity:

- Radiant, at 4400 angstroms: 16000 µamp/µwatt
- Cathode radiant, at 4400 angstroms: 0.026 µamp/µwatt
- Luminous:
  - At 0 cps: 5 amp/lumen
  - At 100 Mc: 19 amp/lumen
- Cathode luminous:
  - With tungsten light source: 20 µamp/lumen
  - With blue light source: 0.026 µamp/lumen

#### Current Amplification

- Equivalent Anode-Dark-Current Input: \( 5 \times 10^{-9} \) lumen
- Equivalent Noise Input: \( 1 \times 10^{-10} \) lumen

---

* For conditions when the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A light input of 10 microlumens is used. The load resistor has a value of 0.01 megohm.

- For conditions the same as shown under (*) except that the value of light flux is 0.01 lumen and 150 volts are applied between cathode and all other electrodes connected together as anode.

† Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning, Glass Code No. 5113 polished to 1/2 stock thickness) from a tungsten-filament lamp operated at a color temperature of 2870°K. The value of light flux on the filter is 0.01 lumen. The load resistor has a value of 0.01 megohm, and 150 volts are applied between cathode and all other electrodes connected together as anode.

- Averaged over any interval of 30 seconds maximum.

- Indicates a change.

---

SEPT. 1, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
MULTIPLIER PHOTOTUBE

For Spectral Characteristic of this source, see sheet SPECTRAL CHARACTERISTIC OF 2870°K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870°K SOURCE AFTER PASSING THROUGH INDICATED BLUE FILTER at front of this section.

- Measured at a tube temperature of 25°C and with the supply voltage (E) adjusted to give a luminous sensitivity of 20 amperes per lumen. Dark current caused by thermionic emission and ion feedback may be reduced by the use of a refrigerant.

- Under the following conditions: Supply voltage (E) is 1000 volts, 25°C tube temperature, ac-amplifier bandwidth of 1 cycle per second, tungsten light source of 2870°K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The "on" period of the pulse is equal to the "off" period. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

- For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1000 volts is recommended.

OPERATING CONSIDERATIONS

The operating stability of the 6372 is dependent on the magnitude of the anode current and its duration. When the 6372 is operated at high values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 6372 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum rated value of 0.75 milliampere is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 100 microamperes.

Electrostatic and/or magnetic shielding of the 6372 may be necessary.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-11 Response is shown at the front of this Section

SEPT. 1, 1955

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE ANODE CHARACTERISTICS

CATHODE-TO-FOCUSING-ELECTRODE VOLTS = 83
FOCUSING-ELECTRODE-TO-DYNODE-N° 1 VOLTS = 83
EACH-SUCCEEDING-DYNODE-STAGE VOLTS = 83

VOLTS BETWEEN ANODE & DYNODE N° 1
200
0

LIGHT FLUX - MICROAMULENS = 20

VOLTS BETWEEN ANODE & DYNODE N° 10
200
0

ANODE MILLIAMPERES

FEB. 26, 1954
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-8258
AVERAGE CHARACTERISTICS

SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER PROVIDING
1/12 OF E BETWEEN CATHODE AND FOCUSING ELECTRODE;
1/12 OF E BETWEEN FOCUSING ELECTRODE AND DYNODE NO. 1;
1/12 OF E FOR EACH SUCCEEDING
DYNODE STAGE; AND 1/12 OF E
BETWEEN DYNODE NO. 10 & ANODE

SENSITIVITY - AMPERES/LUMEN (COLOR TEMPERATURE 2870°K.)

CURRENT AMPLIFICATION

FEB. 26, 1954
TUBE DIVISION
RADIO CORPORATION OF AMERICA, KARLSTEIN, NEW JERSEY

92CL-8257
VARIATION IN SENSITIVITY

LIGHT SPOT: 1/2 INCH DIA. APPROX. POSITIONED MIDWAY ALONG LENGTH OF PHOTOCATHODE.
VARIATIONS CAUSED BY INTERCEPTION OF LIGHT BY GRILL HAVE BEEN IGNORED.
VARIATION IN SENSITIVITY

LIGHT SPOT: ½ INCH DIA. APPROX.
VARIATIONS CAUSED BY INTERCEPTION OF LIGHT BY GRILL HAVE BEEN IGNORED

VARIATION IN SENSITIVITY FROM BASE END TO TIP END—INCHES

RELATIVE SENSITIVITY

DISTANCE ALONG MIDDLE OF CATHODE FROM BASE END TO TIP END—INCHES

APRIL 9, 1954
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
GAS PHOTOTUBE
LOW-MICROPHONIC TYPE WITH S-1 RESPONSE

DATA

General:
Spectral Response ........................................ S-1
Wavelength of Maximum Response ........ 8000 ± 1000 angstroms

Cathode:
- Shape .................................................. Semicylindrical
- Minimum projected length* .................. 1-1/4"
- Minimum projected width* ................. 5/8"

Direct Interelectrode Capacitance ................. 3 μf

Overall Length ........................................ 4-5/16" ± 1/8"
Seated Length ......................................... 3-11/16" ± 1/8"
Seated Length to Center of Cathode ................. 2-1/8" ± 3/32"
Maximum Diameter .................................. 1-1/8"
Mounting Position .................................... Any
Weight (Approx.) ...................................... 1.3 oz

Bulb .................................................. T-8
Base .................................................. Dwarf-Shell Small 4-Pin (JETEC No.A4-26),
Non-hygroscopic

Maximum Ratings, Absolute Values:

<table>
<thead>
<tr>
<th>ANODE-SUPPLY VOLTAGE</th>
<th>Rating I</th>
<th>Rating II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(DC or Peak AC) ......</td>
<td>70 max.</td>
<td>90 max.</td>
</tr>
<tr>
<td>AVERAGE CATHODE-</td>
<td>50 max.</td>
<td>25 max.</td>
</tr>
<tr>
<td>CURRENT DENSITY</td>
<td>μamp/sq.in.</td>
<td></td>
</tr>
<tr>
<td>AVERAGE CATHODE-</td>
<td>10 max.</td>
<td>5 max.</td>
</tr>
<tr>
<td>CURRENT°. ..........</td>
<td>μamp</td>
<td></td>
</tr>
<tr>
<td>AMBIENT TEMPERATURE</td>
<td>100 max.</td>
<td>100 max.</td>
</tr>
<tr>
<td>°C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Characteristics at 90 Volts on Anode:

Min. Av. Max.

Sensitivity:
Radiant at
8000 angstroms ........ 0.0135 µamp/µwatt

* On plane perpendicular to indicated direction of incident light.
° Averaged over any interval of 30 seconds maximum.
<table>
<thead>
<tr>
<th>Sensitivity:</th>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luminous:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 0 cos</td>
<td>80</td>
<td>135</td>
<td>200</td>
</tr>
<tr>
<td>At 5000 cps</td>
<td>–</td>
<td>116</td>
<td>–</td>
</tr>
<tr>
<td>At 10000 cps</td>
<td>–</td>
<td>100</td>
<td>–</td>
</tr>
</tbody>
</table>

Sensitivity Difference
Between Highest Value and Lowest Value Along Cathode Length
Gas Amplification Factor
Anode Dark Current:
At 25°C

Minimum Circuit Values:
With anode-supply voltage of 70 or less 90 volts
DC Load Resistance:
For dc currents above 5 µamp 0.1 min. – megohm
For dc currents below 5 µamp 0 min. – megohm
For dc currents above 3 µamp – 2.5 min. megohms
For dc currents below 3 µamp – 0.1 min. megohm

* For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A dc anode supply of 90 volts and a 1-megohm load resistor are used. For the 0-cycle measurements, a light input of 0.1 lumen is used. For the 5000 and 10000-cycle measurements, the light input is varied sinusoidally about a mean value of 0.015 lumen from zero to a maximum of twice the mean.

† Measured under the same conditions as indicated under (*) with light input of 0.1 lumen and a light spot 1/2 inch in diameter.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-1 Response
and FREQUENCY-RESPONSE CHARACTERISTICS of Gas Phototubes are shown at the front of this Section.
AA' IS PLANE PASSING THROUGH CENTER OF BOTTOM OF BASE PARALLEL TO PLANE THROUGH PINS 1 & 4

PLANE PASSING THROUGH SIDE RODS OF CATHODE WILL NOT DEVIATE FROM PLANE AA' BY MORE THAN 12°
**General:**
- Spectral Response: S-4
- Wavelength of Maximum Response: 4000 ± 500 angstroms

**Cathode:**
- Minimum projected length: 15/16" (5-16")
- Minimum projected width: 15/16" (15/16")

**Direct Interelectrode Capacitances:**
- Anode to dynode No. 9: 4.2 \(\mu\)F
- Anode to all other electrodes: 5.5 \(\mu\)F

**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"

**Bulb Diameter:** 1-3/16"
**Mounting Position:** Any

**Weight (Approx.):** 2 oz

**Terminals, Flexible Lead:** See Dimensional Outline

**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).*

*Average over any interval of 30 seconds maximum.*
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>Min.</th>
<th>Median</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiant, at 4000 angstroms</td>
<td>32500</td>
<td>µamp/µwatt</td>
</tr>
<tr>
<td>Luminous:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 0 cps</td>
<td>5</td>
<td>35</td>
</tr>
<tr>
<td>At 100 Mc.</td>
<td>-</td>
<td>33</td>
</tr>
<tr>
<td>Electrode Dark Current (At 25°C):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anode</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Any other electrode</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A light input of 10 microlumens is used. The load resistor has a value of 0.01 megohm.

With sine-wave, 60-cycle supply voltage adjusted to give sensitivity of 7.5 amperes per lumen.

OPERATING CONSIDERATIONS

The operating stability of the 6472 is dependent on the magnitude of the anode current and its duration. When the 6472 is operated at high values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 6472 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum rated value of 0.1 milliampere is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 10 microamperes.

A recommended design of voltage-divider network for use with the 6472 to provide stable operation and long tube life is shown in the accompanying circuit. This design provides linear operation within the range normally required for dimming. At higher light levels, the network design limits the tube output to a safe value. The indicated design values provide dimming operation for an anode current in the range between 5 and 10 microamperes on basis of dc operation. When operation at other current values is desired, the values of the resistors can be changed proportionately.

MAY 1, 1955

TENTATIVE DATA
MULTIPLIER PHOTOTUBE

RECOMMENDED VOLTAGE-DIVIDER NETWORK FOR USE WITH TYPE 6472 IN HEADLIGHT-DIMMING SERVICE

RI 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.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-4 Response is shown at front of this Section.
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
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 IRRегULARITIES HAVE BEEN IGNORED
RANGE OF LUMINOUS SENSITIVITY

Sensitivity = Amperes / Lumen (Color Temp. 2870°K)

DC or Peak Sine-Wave AC Volts Per Stage

Jan. 29, 1955
Tube Division
Radio Corporation of America, Harrison, New Jersey
General:
Spectral Response ........................................... 8000 ± 1000 angstroms
Wavelength of Maximum Response ...................... 8000 ± 1000 angstroms
Cathode:
Shape .......................................................... Semicylindrical
Minimum projected length* ................................ 1-1/4"
Minimum projected width* .................................. 5/8"
Direct Interelectrode Capacitance ................. 3 µf
Overall Length ............................................ 4-5/16" ± 1/8"
Seated Length .............................................. 3-11/16" ± 1/8"
Seated Length to Center of Cathode .............. 2-1/8" ± 3/32"
Maximum Diameter ........................................ 1-1/8"
Mounting Position ......................................... Any
Weight (Approx.) ........................................ 1.3 oz
Bulb .......................................................... T-8
Base ......................................................... Dwarf-Shell Small 4-Pin (JETEC No. A4-26),
Non-hygroscopic

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE
( DC or Peak AC) ........................................ 500 max. volts
AVERAGE CATHODE-CURRENT DENSITY° ........ 25 max. µamp/sq.in.
AVERAGE CATHODE CURRENT° ..................... 5 max. µamp
AMBIENT TEMPERATURE ................................. 100 max. °C

Characteristics at 250 Volts on Anode:

<table>
<thead>
<tr>
<th>Min.</th>
<th>Av.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiant at 8000 angstroms</td>
<td>0.0027</td>
<td>µamp/µwatt</td>
</tr>
<tr>
<td>Luminous#</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>Sensitivity Difference Between Highest Value and Lowest Value Along Cathode Length^</td>
<td>-</td>
<td>4.5</td>
</tr>
<tr>
<td>Anode Dark Current at 250°C</td>
<td>-</td>
<td>0.013 µamp</td>
</tr>
</tbody>
</table>

* On plane perpendicular to indicated direction of incident light.
° Averaged over any interval of 30 seconds maximum.
# For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A dc anode supply of 250 volts, a 1-megohm load resistor, and a light input of 0.1 lumen are used.
\^ Measured under the same conditions as indicated under (#) with light input of 0.1 lumen and a light spot 1/2 inch in diameter.
SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-1 Response
is shown at the front of this Section

1 3/16 MAX.
1 5/8 MIN.
1 1/4 MIN.
3 7/16 ± 1/8
4 5/16 ± 1/8
2 1/8 ± 3/32
1 1/8 MAX.

AA' IS PLANE PASSING
THROUGH CENTER OF
BOTTOM OF BASE
PARALLEL TO PLANE
THROUGH PINS 1 & 4

PLANE PASSING THROUGH
SIDE RODS OF CATHODE
WILL NOT DEVIATE
FROM PLANE AA'
BY MORE THAN 12°
MULTIPLIER PHOTOTUBE
10-STAGE, HEAD-ON TYPE WITH
1-11/16" SEMITRANSPARENT CATHODE AND S-11 RESPONSE

**DATA**

**General:**

- Spectral Response: S-11
- Wavelength of Maximum Response: 4400 ± 500 angstroms

**Cathode, Semitransparent:**

- Shape: Circular
- Window:
  - Area: 2.2 sq. in.
  - Index of refraction: 1.51

**Direct Interelectrode Capacitances (Approx.):**

- Anode to dynode No.40: 4.4 μμf
- Anode to all other electrodes: 7 μμf

**Maximum Overall Length:** 5-13/16"

**Seated Length:** 4-7/8" ± 3/16"

**Maximum Diameter:** 2-5/16"

**Mounting Position:** Any

**Weight (Approx.):** 5.2 oz

**Base:** Medium-Shell Diheptal 14-Pin (JETEC No.B14-38), Non-hygroscopic T-16

**Basing Designation for BOTTOM VIEW:** 14AA

**Pin 1 – Dynode No.1**
**Pin 2 – Dynode No.2**
**Pin 3 – Dynode No.3**
**Pin 4 – Dynode No.4**
**Pin 5 – Dynode No.5**
**Pin 6 – Dynode No.6**
**Pin 7 – Dynode No.7**
**Pin 8 – Dynode No.8**
**Pin 9 – Dynode No.9**
**Pin 10 – Dynode No.10**
**Pin 11 – Anode**
**Pin 12 – Internal Connection**
**Pin 13 – Focusing Electrode**
**Pin 14 – Cathode**

**DIRECTION OF LIGHT INTO END OF BULB**

**Maximum Ratings, Absolute Values:**

- ANODE-SUPPLY VOLTAGE (DC or Peak AC): 1250 max. volts
- SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE (DC or Peak AC): 250 max. volts
- DYNODE-No.1 SUPPLY VOLTAGE (DC or Peak AC): 300 max. volts
- FOCUSING-ELECTRODE VOLTAGE (DC or Peak AC): 300 max. volts
- AVERAGE ANODE CURRENT: 0.75 max. ma
- AMBIENT TEMPERATURE: 75 max. °C

* Averaged over any interval of 30 seconds maximum.

---

**Indicates a change.**
MULTIPLIER PHOTOTUBE

Characteristics Range Values for Equipment Design:

Under conditions with supply voltage (E) across voltage divider providing 1/6 of E between cathode and dynode No.1; 1/12 of E for each succeeding dynode stage; and 1/12 of E between dynode No.10 and anode

With E = 1000 volts (except as noted) and
Focusing Electrode* connected to Dynode No.1 at socket

<table>
<thead>
<tr>
<th>Min.</th>
<th>Median</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity: Radiation, at 4400 angstroms . .</td>
<td>20000</td>
<td>-μamp/μwatt</td>
</tr>
<tr>
<td>4400 angstroms . .</td>
<td>0.040</td>
<td>-μamp/μwatt</td>
</tr>
<tr>
<td>Luminous: At 0 cps . . . . . .</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>With dynode No.10 as output electrode . . . . . .</td>
<td>15</td>
<td>-amp/lumen</td>
</tr>
<tr>
<td>Cathode Luminous: With tungsten light source . . . . 40</td>
<td>50</td>
<td>-μamp/lumen</td>
</tr>
<tr>
<td>With blue light source . . . . 0.04</td>
<td>-</td>
<td>-μamp</td>
</tr>
<tr>
<td>Current Amplification.</td>
<td>500000</td>
<td>-</td>
</tr>
<tr>
<td>Equivalent Anode-Dark Current Input . . .</td>
<td>8.5 x 10^-10</td>
<td>2 x 10^-9</td>
</tr>
<tr>
<td>Equivalent Noise Input . .</td>
<td>7 x 10^-12</td>
<td>-</td>
</tr>
<tr>
<td>Dark Current to Any Electrode Except Anode (At 25°C) . . . .</td>
<td>-</td>
<td>-0.75</td>
</tr>
</tbody>
</table>

With E = 750 volts (except as noted) and
Focusing Electrode* connected to Dynode No.1 at socket

<table>
<thead>
<tr>
<th>Min.</th>
<th>Median</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity: Radiation, at 4400 angstroms . .</td>
<td>2000</td>
<td>-μamp/μwatt</td>
</tr>
<tr>
<td>4400 angstroms . .</td>
<td>0.040</td>
<td>-μamp/μwatt</td>
</tr>
<tr>
<td>Luminous: At 0 cps . . . . . .</td>
<td>2.5</td>
<td>-amp/lumen</td>
</tr>
<tr>
<td>Cathode Luminous: With tungsten light source . . . . 40</td>
<td>50</td>
<td>-μamp/lumen</td>
</tr>
<tr>
<td>With blue light source . . . . 0.04</td>
<td>-</td>
<td>-μamp</td>
</tr>
<tr>
<td>Current Amplification.</td>
<td>50000</td>
<td>-</td>
</tr>
</tbody>
</table>

* For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A light input of 10 microlumens is used. The load resistor has a value of 0.01 megohm.

See next page. Indicates a change.
in general, the focusing electrode is connected to dynode No.1 at the socket and operated at the same fixed potential as dynode No.1. However, in applications critical as to magnitude, uniformity, or speed of the response, the focusing electrode may be connected to the adjustable arm of a potentiometer between cathode and dynode No.1 in the voltage divider, and operated at an optimum potential within a range of 10 to 60 per cent of the dynode-No.1 potential.

An output current of opposite polarity to that obtained at the anode may be provided by using dynode No.10 as the output electrode. With this arrangement, the load is connected in the dynode-No.10 circuit and the anode serves only as collector.

For conditions the same as shown under (a) except that the value of light flux is 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected together as anode.

Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning, Glass Code No.5113 polished to 1/2 stock thickness) from a tungsten-filament lamp operated at a color temperature of 2870°K. The value of light flux on the filter is 0.01 lumen. The load resistor has a value of 0.01 megohm, and 200 volts are applied between cathode and all other electrodes connected together as anode.

For spectral characteristic of this source, see sheet SPECTRAL CHARACTERISTIC OF 2870°K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870°K SOURCE AFTER PASSING THROUGH INDICATED BLUE FILTER at front of this section.

Measured at a tube temperature of 25°C and with the supply voltage (E) adjusted to give a luminous sensitivity of 20 amperes per lumen. Dark current caused by thermionic emission and ion feedback may be reduced by the use of a refrigerant.

For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1000 volts is recommended.

Under the following conditions: Supply voltage (E) is 1000 volts, 25°C tube temperature, ac-amplifier bandwidth of 1 cycle per second, tungsten light source of 2870°K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The "on" period of the pulse is equal to the "off" period. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

OPERATING CONSIDERATIONS

The operating stability of the 6655 is dependent on the magnitude of the anode current and its duration. When the 6655 is operated at high values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 6655 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum rated value of 0.75 milliamperes is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 100 microamperes.

Electrostatic and/or magnetic shielding of the 6655 may be necessary.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-11 Response is shown at the front of this Section

Indicates a change.
MULTIPLIER PHOTOTUBE

PHOTOCATHODE DIAMETER
1 11/16'' MIN.
(SEE NOTE)

MEDIUM-SHELL DIHEPTAL 14-PIN BASE
JETEC NB14-38

T 16 BULB

2 1/16'' MAX.

4 7/8'' ± 3/16'' 5 13/16'' MAX.

NOTE: WITHIN MINIMUM DIAMETER, DEVIATION FROM FLATNESS WILL NOT EXCEED 0.010'' FROM PEAK TO VALLEY.
6655

AVERAGE CHARACTERISTICS

SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER PROVIDING 1/6 OF E BETWEEN CATHODE AND DYNOE N°1; 1/12 OF E FOR EACH SUCCEEDING DYNOE STAGE; AND 1/12 OF E BETWEEN DYNOE N°10 AND ANODE

FOCUSING ELECTRODE IS CONNECTED TO DYNOE N°1

SENSITIVITY-AMPERES/LUMEN (COLOR TEMP. 2870°K)

CURRENT AMPLIFICATION

MAY 27, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CL-8636
TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE \( E \) ACROSS VOLTAGE DIVIDER WHICH PROVIDES \( \frac{1}{6} \) OF \( E \) BETWEEN CATHODE AND DYNODE \( \text{No. 1} \); \( \frac{1}{12} \) OF \( E \) FOR EACH SUCCEEDING STAGE; AND \( \frac{1}{12} \) OF \( E \) BETWEEN DYNODE \( \text{No. 10} \) AND ANODE.

FOCUSING ELECTRODE IS CONNECTED TO DYNODE \( \text{No. 1} \).

DASHED PORTION INDICATES INSTABILITY.

LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870°K.

TUBE TEMPERATURE = 25°C
EFFECT OF MAGNETIC FIELD ON ANODE CURRENT

MAGNETIC FIELD IS PARALLEL TO DYNODE-CAGE AXIS.
POSITIVE VALUES ARE FOR LINES OF FORCE FROM LEFT
TO RIGHT WITH BASE DOWN AND BASE KEY TOWARD
OBSERVER.

DYNODE-N\#1-TO-CATHODE VOLTS=150
EACH-SUCCEEDING-STAGE VOLTS=100
FOCUSING ELECTRODE IS CONNECTED TO DYNODE N\#1

MAY 7, 1955
TUBE DIVISION
92CM-8136R1
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
MULTIPLIER PHOTOTUBE

14-STAGE, HEAD-ON TYPE WITH
1-11/16" SEMITRANSPARENT CATHODE AND S-11 RESPONSE
SHORT TIME-RESOLUTION CAPABILITY

DATA

General:
Spectral Response .......... S-11
Wavelength of Maximum Response ... 4400 ± 500 angstroms

Cathode, Semitransparent:
Shape: Circular

Window:
Area: 2.2 sq. in.
Minimum diameter: 1-11/16 in.
Index of refraction: 1.51

Direct Interelectrode Capacitances (Approx.):
Anode to dynode No. 14: 2.4 μf
Anode to all other electrodes: 5.5 μf
Dynode No. 14 to all other electrodes: 7.5 μf

Maximum Overall Length: 7-1/2"
Seated Length: 6-11/16" ± 3/16"
Maximum Diameter: 2-3/8"
Mounting Position: Any
Weight (Approx.): 8 oz
Base: Small-Shell Bidecal 20-Pin (JETEC No. B20-102), Non-hygrosopic

Basing Designation for BOTTOM VIEW: 20B
Pin 1—No Connection Pin 11—Dynode No. 14
Pin 2—Dynode No. 1 Pin 12—Dynode No. 12
Pin 3—Dynode No. 3 Pin 13—Dynode No. 10
Pin 4—Dynode No. 5 Pin 14—Dynode No. 8
Pin 5—Dynode No. 7 Pin 15—Dynode No. 6
Pin 6—Dynode No. 9 Pin 16—Dynode No. 4
Pin 7—Dynode No. 11 Pin 17—Dynode No. 2
Pin 8—Dynode No. 13 Pin 18—No Connection
Pin 9—Grid No. 2 Pin 19—Grid No. 1
(Accelerating Electrode) (Focusing Electrode)
Pin 10—Anode Pin 20—Photocathode

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC) .............. 2300 max. volts
SUPPLY VOLTAGE BETWEEN DYNODE No. 14
AND ANODE (DC) .................. 400 max. volts
SUPPLY VOLTAGE BETWEEN ACCELERATING-
ELECTRODE AND DYNODE No. 13 (DC) .......... ±500 max. volts
DYNODE-No. 1 SUPPLY VOLTAGE (DC) .......... 400 max. volts
FOCUSING-ELECTRODE SUPPLY VOLTAGE (DC) .......... 400 max. volts
AVERAGE ANODE CURRENT* .......... 2 max. ma
AMBIENT TEMPERATURE ............... 75 max. °C

*averaged over any interval of 30 seconds maximum.
### MULTIPLIER PHOTOTUBE

**Characteristics Range Values for Equipment Design:**

Under conditions with supply voltage (E) across a voltage divider providing electrode voltages shown in Table 1

With $E = 2000$ volts (except as noted) and Accelerating-Electrode Voltage adjusted to give maximum gain

<table>
<thead>
<tr>
<th>Min.</th>
<th>Median</th>
<th>Max.</th>
</tr>
</thead>
</table>

**Sensitivity:**

- Radiant, at 4400 angstroms... - 0.6 - amperes/μwatt
- Cathode radiant; at 4400 angstroms... - 0.048 - amperes/μwatt

**Luminous:**

- At 0 cps... 120 750 4500 amperes/lumen
- With dynode No.14 as output electrode... - 525 - amperes/lumen
- Cathode luminous:
  - With tungsten light source... 40 60 - amperes/lumen
  - With blue light source... 0.04 - - amperes

**Current Amplification:**

- 12.5 x 10^6

**Equivalent Anode-Dark Current Input:**

- $5 \times 10^{-10}$ $2 \times 10^{-9}$ lumen

**Equivalent Noise Input:**

- $6 \times 10^{-12}$ lumen

**Dark Current to Any Electrode Except Anode (At 25°C):**

- 0.75 amperes

With $E = 2300$ volts (except as noted) and Accelerating-Electrode Voltage adjusted to give maximum gain

<table>
<thead>
<tr>
<th>Min.</th>
<th>Median</th>
<th>Max.</th>
</tr>
</thead>
</table>

**Sensitivity:**

- Radiant, at 4400 angstroms... - 3.2 - amperes/μwatt
- Cathode radiant, at 4400 angstroms... - 0.048 - amperes/μwatt

**Luminous:**

- At 0 cps... 660 4000 28000 amperes/lumen
- With dynode No.14 as output electrode... - 2800 - amperes/lumen
- Cathode luminous:
  - With tungsten light source... 40 60 - amperes/lumen
  - With blue light source... 0.04 - - amperes

**Current Amplification:**

- 66 x 10^6

---

See next page.
## MULTIPLIER PHOTOTUBE

### TABLE 1

<table>
<thead>
<tr>
<th>Between</th>
<th>5.4% of Supply Voltage (E) multiplied by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cathode and Focusing Electrode</td>
<td>1</td>
</tr>
<tr>
<td>Focusing Electrode and Dynode No.1</td>
<td>1</td>
</tr>
<tr>
<td>Dynode No.1 and Dynode No.2</td>
<td>1</td>
</tr>
<tr>
<td>Dynode No.2 and Dynode No.3</td>
<td>1</td>
</tr>
<tr>
<td>Dynode No.3 and Dynode No.4</td>
<td>1</td>
</tr>
<tr>
<td>Dynode No.4 and Dynode No.5</td>
<td>1</td>
</tr>
<tr>
<td>Dynode No.5 and Dynode No.6</td>
<td>1</td>
</tr>
<tr>
<td>Dynode No.6 and Dynode No.7</td>
<td>1</td>
</tr>
<tr>
<td>Dynode No.7 and Dynode No.8</td>
<td>1</td>
</tr>
<tr>
<td>Dynode No.8 and Dynode No.9</td>
<td>1</td>
</tr>
<tr>
<td>Dynode No.9 and Dynode No.10</td>
<td>1</td>
</tr>
<tr>
<td>Dynode No.10 and Dynode No.11</td>
<td>1</td>
</tr>
<tr>
<td>Dynode No.11 and Dynode No.12</td>
<td>1.25</td>
</tr>
<tr>
<td>Dynode No.12 and Dynode No.13</td>
<td>1.5</td>
</tr>
<tr>
<td>Dynode No.13 and Dynode No.14</td>
<td>1.75</td>
</tr>
<tr>
<td>Dynode No.14 and Anode</td>
<td>2</td>
</tr>
<tr>
<td>Anode and Cathode</td>
<td>18.5</td>
</tr>
</tbody>
</table>

For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A light input of 0.1 microlumen is used. The load resistor has a value of 0.01 megohm.

An output current of opposite polarity to that obtained at the anode may be provided by using dynode No.14 as the output electrode. With this arrangement, the load is connected in the dynode-No.14 circuit and the anode serves only as collector. The value of sensitivity at dynode No.14 is approximately 70% of that when the anode is the output electrode. Specifically, the sensitivity measured at dynode No.14 is equal to (1/14) times the sensitivity measured at the anode, where "g" is the gain of the dynode-No.14 stage.

For conditions the same as shown above except that the value of light flux is 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected together as anode.

Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning, Glass Code No.5115 polished to 1/2 stock thickness) from a tungsten-filament lamp operated at a color temperature of 2870°K. The value of light flux on the filter is 0.01 lumen. The load resistor has a value of 0.01 megohm, and 200 volts are applied between cathode and all other electrodes connected together as anode.

For spectral characteristic of this source, see sheet SPECTRAL CHARACTERISTIC OF 2870K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870K SOURCE AFTER PASSING THROUGH INDICATED BLUE FILTER at front of this section.

Measured at a tube temperature of 25°C and with the supply voltage (E) adjusted to give a luminous sensitivity of 2000 amperes per lumen. Dark current caused by thermionic emission and ion feedback may be reduced by the use of a refrigerant.

For maximum signal-to-noise ratio, operation with a supply voltage (E) below 2000 volts is recommended.

Under the following conditions: Supply voltage (E) is 2000 volts, 25°C tube temperature, external shield potential of -2000 volts, ac-amplifier bandwidth of 1 cycle per second, tungsten light source of 2870°K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The "on" period of the pulse is equal to the "off" period. The output current is measured through a filter which passes only the fundamental frequency of the pulses.
MULTIPLIER PHOTOTUBE

OPERATING CONSIDERATIONS

The operating stability of the 6810 is dependent on the magnitude of the anode current and its duration. When the 6810 is operated at high values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 6810 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum rated value of 2 milliamperes is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 250 microamperes.

Electrostatic and/or magnetic shielding of the 6810 may be necessary.

The material of which the dynodes of the 6810 are made has stable, high-current carrying capabilities and permits the use of a tube manufacturing process which minimizes regenerative effects such as afterpulses. The relative freedom of the 6810 from afterpulses and its small spread in electron transit time make it particularly useful for fast coincidence scintillation counting.

Because the 6810 offers the advantage of small spread in electron transit time, it has a fast pulse rise time. As a result, the 6810 has very short time-resolution capability, i.e., in the order of 1 or 2 millimicroseconds. For an input pulse having a duration of 1 millisecond or less, the time spread of the pulse at the anode is about 9 millimicroseconds measured at 50 per cent of the maximum pulse height, when the supply voltage is 2000 volts and the focusing electrode is connected to dynode No.1.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-11 Response is shown at the front of this Section.
OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

NOTE: WITHIN MINIMUM DIAMETER, DEVIATION FROM FLATNESS WILL NOT EXCEED 0.010" FROM PEAK TO VALLEY.
AVERAGE ANODE CHARACTERISTICS

CATHODE-TO-GRID-N\#1 VOLTS = 108
GRID-N\#1-TO-DYNODE N\#1 (DY1) VOLTS = 108
DY1 - TO - DY2
DY2 - TO - DY3
ETC. TO
DY10 - TO - DY11
VOLTS = 108
DY11 - TO - DY12 VOLTS = 135
DY12 - TO - DY13 VOLTS = 160
DY13 - TO - DY14 VOLTS = 189
GRID-N\#2 VOLTS ADJUSTED TO GIVE MAX. GAIN

LIGHT SOURCE IS TUNGSTEN FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870°K.
TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF
THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER
WHICH PROVIDES VOLTAGES AS FOLLOWS:

<table>
<thead>
<tr>
<th>BETWEEN</th>
<th>5.4% OF E MULTIPLIED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>CATHODE &amp; GRID NO. 1</td>
<td>1</td>
</tr>
<tr>
<td>GRID NO. 1 &amp; DYNODE NO. 1 (DY1)</td>
<td>1</td>
</tr>
<tr>
<td>DY1 &amp; DY2</td>
<td>1</td>
</tr>
<tr>
<td>DY2 &amp; DY3</td>
<td>1</td>
</tr>
<tr>
<td>DY3 &amp; DY4</td>
<td>1</td>
</tr>
<tr>
<td>DY4 &amp; DY5</td>
<td>1</td>
</tr>
<tr>
<td>DY5 &amp; DY6</td>
<td>1</td>
</tr>
<tr>
<td>DY6 &amp; DY7</td>
<td>1</td>
</tr>
<tr>
<td>DY7 &amp; DY8</td>
<td>1</td>
</tr>
<tr>
<td>DY8 &amp; DY9</td>
<td>1</td>
</tr>
<tr>
<td>DY9 &amp; DY10</td>
<td>1</td>
</tr>
<tr>
<td>DY10 &amp; DY11</td>
<td>1</td>
</tr>
<tr>
<td>DY11 &amp; DY12</td>
<td>1.25</td>
</tr>
<tr>
<td>DY12 &amp; DY13</td>
<td>1.50</td>
</tr>
<tr>
<td>DY13 &amp; DY14</td>
<td>1.75</td>
</tr>
<tr>
<td>DY14 &amp; ANODE</td>
<td>2</td>
</tr>
<tr>
<td>ANODE &amp; CATHODE</td>
<td>18.5</td>
</tr>
</tbody>
</table>

GRID NO. 2 VOLTS ADJUSTED TO GIVE MAX. GAIN.
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPER-
ATED AT A COLOR TEMPERATURE OF 2870°K.
TUBE TEMPERATURE=25°C
DASHED PORTION INDICATES INSTABILITY.
6810 CHARACTERISTICS

CATHODE-TO-GRID-N1 VOLTS = 108
GRID-N1 TO DYNODE-N1 (DY1) VOLTS = 108
DY1 TO DY2 VOLTS = 135
DY2 TO DY3 VOLTS = 160
ETC. TO
DY10 TO DY11 VOLTS = 108
DY11 TO DY12 VOLTS = 189
DY12 TO DY13 VOLTS = 216
DY13 TO ANODE VOLTS = 216
GRID-N2 VOLTS ADJUSTED TO GIVE MAX. GAIN

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
MULTIPLIER PHOTOTUBE
10-STAGE, HEAD-ON TYPE WITH
1-5/8" SEMITRANSPARENT CATHODE AND S-13 RESPONSE

DATA

General:
Spectral Response....................... S-13
Wavelength of Maximum Response....... 4400 ± 500 angstroms
Cathode, Semitransparent:
Shape................................. Circular
Window:
Area.................................. 2.0 sq. in.
Minimum diameter...................... 1-5/8 in.
Index of refraction at 2000 angstroms 1.51
Direct Interelectrode Capacitances (Approx.):
Anode to dynode No.10.............. 4.4 μf
Anode to all other electrodes....... 7 μf
Maximum Overall Length............... 6-9/16"
Seated Length........................ 5-5/8" ± 3/16"
Maximum Diameter..................... 2-5/16"
Mounting Position..................... Any
Weight (Approx.)...................... 7 oz
Bulb.................................. T-16
Faceplate.............................. Fused Silica
Maximum thickness.................... 0.150"
Base................................. Medium-Shell Diheptal 14-Pin (JETEC No.314-38)
Basing Designation for BOTTOM VIEW 14AA
Pin 1 - Dynode No.1
Pin 2 - Dynode No.2
Pin 3 - Dynode No.3
Pin 4 - Dynode No.4
Pin 5 - Dynode No.5
Pin 6 - Dynode No.6
Pin 7 - Dynode No.7
Pin 8 - Dynode No.8
Pin 9 - Dynode No.9
Pin 10 - Dynode No.10
Pin 11 - Anode
Pin 12 - Internal
Connection-
Do Not Use
Pin 13 - Focusing
Electrode
DIRECTION OF LIGHT: Pin 14 - Cathode
AMOUNTED INTO END OF BULB

Maximum Ratings, Absolute Values:
ANODE-SUPPLY VOLTAGE (DC or Peak AC)...... 1250 max. volts
SUPPLY VOLTAGE BETWEEN DYNODE No.10
AND ANODE (DC or Peak AC)............... 250 max. volts
DYNOE-NO.1 SUPPLY VOLTAGE
( DC or Peak AC).......................... 300 max. volts
FOCUSING-ELECTRODE VOLTAGE
( DC or Peak AC)......................... 300 max. volts
AVERAGE ANODE CURRENT*.............. 0.75 max. ma
AMBIENT TEMPERATURE.................... 75 max. °C

* Averaged over any interval of 30 seconds maximum.
### Characteristics Range Values for Equipment Design:

Under conditions with supply voltage \( E \) across voltage divider providing \( \frac{1}{6} \) of \( E \) between cathode and dynode No. 1; \( \frac{1}{12} \) of \( E \) for each succeeding dynode stage; and \( \frac{1}{12} \) of \( E \) between dynode No. 10 and anode

**With \( E = 1000 \) volts (except as noted) and Focusing Electrode* connected to Dynode No. 1 at socket**

<table>
<thead>
<tr>
<th>Min.</th>
<th>Median</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiant, at 4400 angstroms</td>
<td>19000</td>
<td>( \mu \text{amp}/\mu\text{watt} )</td>
</tr>
<tr>
<td>Cathode radiant, at 4400 angstroms</td>
<td>0.047</td>
<td>( \mu \text{amp}/\mu\text{watt} )</td>
</tr>
<tr>
<td>Luminous:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 0 cps</td>
<td>8</td>
<td>24</td>
</tr>
<tr>
<td>With dynode No. 10 as output electrode**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cathode luminous:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With tungsten light source^*</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>With blue light source^*</td>
<td>0.04</td>
<td>( \mu \text{amp} )</td>
</tr>
<tr>
<td>Current Amplification</td>
<td>400000</td>
<td></td>
</tr>
<tr>
<td>Equivalent Anode–Dark–Current Input*</td>
<td>( 1 \times 10^{-9} )</td>
<td>( 3 \times 10^{-9} )</td>
</tr>
<tr>
<td>Equivalent Noise Input:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Luminous</td>
<td>( 6.7 \times 10^{-12} )</td>
<td></td>
</tr>
<tr>
<td>Ultraviolet</td>
<td>( 1.6 \times 10^{-14} )</td>
<td></td>
</tr>
<tr>
<td>Dark Current to Any Electrode Except Anode (At 25°C)</td>
<td></td>
<td>( 0.75 \mu \text{amp} )</td>
</tr>
</tbody>
</table>

**With \( E = 750 \) volts (except as noted) and Focusing Electrode* connected to Dynode No. 1 at socket**

<table>
<thead>
<tr>
<th>Min.</th>
<th>Median</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiant, at 4400 angstroms</td>
<td>1650</td>
<td>( \mu \text{amp}/\mu\text{watt} )</td>
</tr>
<tr>
<td>Cathode radiant, at 4400 angstroms</td>
<td>0.047</td>
<td>( \mu \text{amp}/\mu\text{watt} )</td>
</tr>
<tr>
<td>Luminous:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 0 cps</td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td>With dynode No. 10 as output electrode**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A light input of 10 microlumens is used. The load resistor has a value of 0.01 megohm.

*...^* See next page.
MULTIPLIERSHOT TUBE

**Cathode luminous:**

With tungsten light source . . . 40 60 - \( \mu \text{amp/lumen} \)

With blue light source . . . 0.04 - - \( \mu \text{amp} \)

**Current Amplification:** - 35000 -

In general, the focusing electrode is connected to dynode No.1 at the socket and operated at the same fixed potential as dynode No.1. However, in applications critical as to magnitude, uniformity, or speed of the response, the focusing electrode may be connected to the adjustable arm of a potentiometer between cathode and dynode No.1 in the voltage divider, and operated at an optimum potential within a range of 10 to 60 per cent of the dynode-No.1 potential.

*An output current of opposite polarity to that obtained at the anode may be provided by using dynode No.10 as the output electrode. With this arrangement, the load is connected in the dynode-No.10 circuit and the anode serves only as collector.*

For conditions the same as shown under (b) except that the value of light flux is 0.01 lumen and 150 volts are applied between cathode and all other electrodes connected together as anode.

Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning, Glass Code No.5113 polished to 1/2 stock thickness) from a tungsten-filament lamp operated at a color temperature of 2870°K. The value of light flux on the filter is 0.01 lumen. The load resistor has a value of 0.01 megohm, and 150 volts are applied between cathode and all other electrodes connected together as anode.

For spectral characteristic of this source, see sheet SPECTRAL CHARACTERISTIC OF 2870°K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870°K SOURCE AFTER PASSING THROUGH INDIATED BLUE FILTER at front of this section.

Measured at a tube temperature of 25°C and with the supply voltage (E) adjusted to give a luminous sensitivity of 20 amperes per lumen. Dark current caused by thermionic emission and ion feedback may be reduced by the use of a refrigerant.

For maximum signal-to-noise ratio operation with a supply voltage (E) below 1000 volts is recommended.

Under the following conditions: Supply voltage (E) is 1000 volts, 25°C tube temperature, ac-amplifier bandwidth of 1 cycle per second, tungsten light source of 2870°K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The "on" period of the pulse is equal to the "off" period. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

Determined under the same conditions as shown under (b) except that use is made of monochromatic source having radiation of 5537 angstroms.

**OPERATING CONSIDERATIONS**

The operating stability of the 6903 is dependent on the magnitude of the anode current and its duration. When the 6903 is operated at high values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 6903 usually recovers a substantial percentage of such loss in sensitivity.
The use of an average anode current well below the maximum rated value of 0.75 milliampere is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 100 microamperes.

Electrostatic and/or magnetic shielding of the 6903 may be necessary.

**SPECTRAL-SENSITIVITY CHARACTERISTIC**

of Phototube having S-13 Response

is shown at the front of this Section

---

**Diagram**

- Photocathode Diameter: 1 5/8" MIN.
- Medium-SHELL DIHEPTAL 14-PIN BASE JETEC N8B14-38
- T16 BULB
- 2 5/32" DIA.
- 5 5/8" ± 3/16" 6 9/16" MAX.

---

*NOTE:* Within minimum diameter, deviation from flatness will not exceed 0.010" from peak to valley.
AVERAGE ANODE CHARACTERISTICS

DYNODE-Nº 1-TO-CATHODE VOLTS = 167
EACH-SUCCEEDING-DYNOE-STAGE VOLTS = 83
LIGHT SOURCE IS A TUNGSTEN-FILAMENT
LAMP OPERATED AT COLOR TEMPERATURE
OF 2870° K

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9039
LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES $\frac{1}{6}$ OF $E$ BETWEEN CATHODE AND DYNODE NO.1; $\frac{1}{12}$ OF $E$ FOR EACH SUCCEEDING STAGE; AND $\frac{1}{12}$ OF $E$ BETWEEN DYNODE NO.10 AND ANODE. FOCUSING ELECTRODE IS CONNECTED TO DYNODE NO.1. DASHED PORTION INDICATES INSTABILITY. LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870°K. TUBE TEMPERATURE = 25°C

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

LUMINOUS SENSITIVITY—AMPERES/LUMEN

EQUIVALENT ANODE-DARK-CURRENT INPUT—LUMENS

92CM-9032
CHARACTERISTICS

Supply voltage $(E)$ across voltage divider providing $1/6$ of $E$ between cathode and dynode $N_0 1$; $1/12$ of $E$ for each succeeding dynode stage; and $1/12$ of $E$ between dynode $N_0 10$ and anode.

Focusing electrode is connected to dynode $N_0 1$.

![Characteristics graph](image)

Supply voltage $(E)$ on the x-axis.

Sensitivity—amperes/lumen (color temp. 2870° K) on the y-axis.

Current amplification on the y-axis.

RCA TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CL-9033
EFFECT OF MAGNETIC FIELD ON ANODE CURRENT

MAGNETIC FIELD IS PARALLEL TO DYNODE-CAGE AXIS. POSITIVE VALUES ARE FOR LINES OF FORCE FROM LEFT TO RIGHT WITH BASE DOWN AND BASE KEY TOWARD OBSERVER.

DYNODE-N°1-TO-CATHODE VOLTS = 150
EACH-SUCCEEDING-STAGE VOLTS = 100
FOCUSING ELECTRODE IS CONNECTED TO DYNODE N°1.
7038
VIDICON
600-LINE RESOLUTION
For film and live pickup
with color or black-and-white TV cameras

DATA

General:
Heater, for Unipotential Cathode:
Voltage. ........................................ 6.3 ± 10% ac or dc volts
Current. ........................................ 0.6 amperes
Direct Interelectrode Capacitance:
Target to all other electrodes. .......... 4.6 µf
Spectral Response. ......................... See Curves

Photoconductive Layer:
Maximum useful diagonal of rectangular image (4 x 3 aspect ratio) .......... 0.62"
Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the straight sides of the masked portions of the faceplate. The straight sides are parallel to the plane passing through the tube axis and short index pin. The masking is for orientation only and does not define the proper scanned area of the photoconductive layer.

Focusing Method. ......................... Magnetic
Deflection Method. ......................... Magnetic
Overall Length. .......................... 6.25" ± 0.25"
Greatest Diameter. ....................... 1.125" ± 0.010"
Weight (Approx.) ......................... 2 oz
Operating Position ....................... Any
Bulb ........................................ T8
Base Connector ......................... Cinch No.54A18088, or equivalent
Base ........................................ Small-Button Ditetrar 8-Pin (JEDEC No.E8-11)
Basing Designation for BOTTOM VIEW .................................. 8HN

Pin 1—Heater
Pin 2—Grid No.1
Pin 3—Internal Connection—Do Not Use
Pin 4—Same as Pin 3
Pin 5—Grid No.2
Pin 6—Grid No.4,
Pin 7—Cathode
Pin 8—Heater
Flange—Target
Same as Pin 3

Maximum Ratings, Absolute Values:
For scanned area of 1/2" x 3/8"
GRID-No.3 & GRID-No.4 VOLTAGE .......................... 350 max. volts
GRID-No.2 VOLTAGE ........................................ 350 max. volts
GRID-No.1 VOLTAGE:
Negative-bias value. ......................... 125 max. volts
Positive-bias value. ......................... 0 max. volts

†: see next page.  ⇑ indicates a change.
VIDICON

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

DARK CURRENT: 0.25 max. μA

PEAK TARGET CURRENT: 0.55 max. μA

FACEPLATE:
- Illumination: 1000 max. ft-c
- Temperature: 60 max. °C

Typical Operation:
For scanned area of 1/2" x 3/8" and faceplate temperature of 300°C to 35°C

Grid-No. 4 (Decelerator) & Grid-No. 3 (Beam-Focus Electrode*) Voltage: 250 to 300 volts
Grid-No. 2 (Accelerator) Voltage: 300 volts
Grid-No. 1 Voltage for picture cutoff*: -45 to -100 volts
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μA and 0.2 μA: 0.65

Visual Equivalent Signal-to-Noise Ratio (Approx.): 300:1

Minimum Peak-to-Peak Blanking Voltage:
- When applied to grid No. 1: 75 volts
- When applied to cathode: 20 volts

Field Strength at Center of Focusing Coil (Approx.): 40 gausses
Field Strength of Adjustable Alignment Coil*: 0 to 4 gausses

Maximum-Sensitivity Operation for Live-Scene Pickup
Faceplate Illumination (Highlight): 2 ft-c
Maximum Target Voltage required to produce dark current of 0.2 μA in any tube**: 110 volts
Target Voltage: 60 to 100 volts
Dark Current: 0.2 μA
Target Current (Highlight)*: 0.4 to 0.5 μA
Signal-Output Current:
- Peak: 0.2 to 0.3 μA
- Average: 0.08 to 0.1 μA

Average-Sensitivity Operation for Live-Scene Pickup
Faceplate Illumination (Highlight): 15 ft-c
Maximum Target Voltage required to produce dark current of 0.02 μA in any tube**: 60 volts
Target Voltage: 30 to 50 volts
Dark Current: 0.02 μA
Target Current (Highlight)*: 0.3 to 0.4 μA

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* Grid-No. 3 (Beam-Focus Electrode) above Photocathode Plane
** This specification applies to data listed for any tube

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DATA 1

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
Signal-Output Current:
Peak....................................................... 0.3 to 0.4 μA
Average..................................................... 0.1 to 0.2 μA

Minimum-Lag Operation for Film Pickup
Faceplate Illumination (Highlight). 100 ft-c
Maximum Target Voltage required to produce dark current of 0.004 μA in any tube*.......................... 30 volts
Target Voltage†............................. 15 to 25 volts
Dark Current.................................. 0.004 μA
Target Current (Highlight).......................... 0.3 to 0.4 μA
Signal-Output Current:
Peak....................................................... 0.3 to 0.4 μA
Average..................................................... 0.1 to 0.2 μA

This capacitance, which effectively is the output impedance of the 7038, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms.

Beam focus is obtained by combined effect of grid-No. 3 voltage which should be adjustable over indicated range, and a focusing coil having an average field strength of 40 gausses.

Definition, focus uniformity, and picture quality decrease with decreasing grid-No. 4 and grid-No. 3 voltage. In general, grid-No. 4 and grid No. 3 should be operated above 250 volts.

with no blanking voltage on grid No. 1.

Measured with high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of highlight video-signal current to rms noise current, multiplied by a factor of 3.

The alignment coil should be located on the tube so that its center is at a distance of 3 to 11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

The target voltage for each 7038 must be adjusted to that value which gives the desired operating dark current.

Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

Defined as the component of the target current after the dark-current component has been subtracted.
NOTE: STRAIGHT SIDES OF MASKED PORTIONS ARE PARALLEL TO THE PLANE PASSING THROUGH TUBE AXIS AND SHORT INDEX PIN.
For use under severe shock and vibration, high humidity, and altitudes up to 50,000 feet in small, compact, transistorized TV cameras

### DATA General:

**Heater, for Unipotential Cathode:**
- Voltage: $6.3 \pm 10\%$ ac or dc volts
- Current: 0.095 amp

**Direct Interelectrode Capacitance:**
- Target to all other electrodes: 4.6 $\mu$F

**Spectral Response:**
- See Curves

**Photoconductive Layer:**
- Maximum useful diagonal of rectangular image (4 x 3 aspect ratio): 0.62".
- Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the plane passing through the tube axis and short index pin.

**Focusing Method:**
- Magnetic

**Deflection Method:**
- Magnetic

**Overall Length:**
- 5.12" $\pm$ 0.06"

**Greatest Diameter:**
- 1.125" $\pm$ 0.010"

**Weight (Approx.):**
- 2 oz

**Operating Position:**
- Any

**Bulb:**
- T8

**Base Connector:**
- Cinch No.54A18088, or equivalent

**Base:**
- Small-Button Ditetrar 8-Pin (JEDEC No.E8-11)

**Basing Designation for BOTTOM VIEW:**
- 8HM

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

For altitudes up to 50,000 feet and scanned area of $1/2" \times 3/8"

- **GRID-No.3 & GRID-No.4 VOLTAGE:**
  - 350 max. volts
- **GRID-No.2 VOLTAGE:**
  - 350 max. volts
- **GRID-No.1 VOLTAGE:**
  - Negative-bias value: 125 max. volts
  - Positive-bias value: 0 max. volts
- **PEAK HEATER-CATHODE VOLTAGE:**
  - Heater negative with respect to cathode: 125 max. volts
  - Heater positive with respect to cathode: 10 max. volts

$: See next page.
DARK CURRENT: .............. 0.25 max. \( \mu \text{A} \)
PEAK TARGET CURRENT ........... 0.55 max. \( \mu \text{A} \)

FACEPLATE:
- Illumination: .......... 1000 max. \( \text{ft-c} \)
- Temperature (Operating or storage): 60 max. °C

**Typical Operation:**

For scanned area of 1/2" x 3/8" and faceplate temperature of 30° to 35°C

Grid-No.4 (Decelerator) &
Grid-No.3 (Beam-Focus-Electrode*) Voltage .......... 250° to 300 volts
Grid-No.2 (Accelerator) Voltage ............ 300 volts
Grid-No.1 Voltage for picture cutoff* .......... -45 to -100 volts

Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 \( \mu \text{A} \) and 0.2 \( \mu \text{A} \) .......... 0.65

Visual Equivalent Signal-to-Noise Ratio (Approx.)° .......... 300:1

Minimum Peak-to-Peak Blanking Voltage:
- When applied to grid No.1 .......... 75 volts
- When applied to cathode .......... 20 volts

Field Strength at Center of Focusing Coil (Approx.) .......... 40 gausses
Field Strength of Adjustable Alignment Coil* .......... 0 to 4 gausses

Maximum-Sensitivity Operation for Live-Scene Pickup

Faceplate Illumination (Highlight) .......... 2 \( \text{ft-c} \)

Maximum Target Voltage required to produce dark current of 0.2 \( \mu \text{A} \) in any tube** .......... 110 volts
Target Voltage† .......... 60 to 100 volts
Dark Current‡ .......... 0.2 \( \mu \text{A} \)
Target Current (Highlight)§ .......... 0.4 to 0.5 \( \mu \text{A} \)

Signal-Output Current:
- Peak .......... 0.2 to 0.3 \( \mu \text{A} \)
- Average .......... 0.08 to 0.1 \( \mu \text{A} \)

Average-Sensitivity Operation for Live-Scene Pickup

Faceplate Illumination (Highlight) .......... 15 \( \text{ft-c} \)

Maximum Target Voltage required to produce dark current of 0.02 \( \mu \text{A} \) in any tube** .......... 60 volts
Target Voltage† .......... 30 to 50 volts
Dark Current .......... 0.02 \( \mu \text{A} \)
Target Current (Highlight)§ .......... 0.3 to 0.4 \( \mu \text{A} \)

* - ** - See next page.
**Signal-Output Current:**
- Peak: 0.3 to 0.4 μA
- Average: 0.1 to 0.2 μA

**Minimum-Lag Operation for Film Pickup**

<table>
<thead>
<tr>
<th>Faceplate Illumination (Highlight)</th>
<th>100 ft-c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Target Voltage required to produce dark current of 0.004 μA</td>
<td>30 volts</td>
</tr>
<tr>
<td>Target Voltage</td>
<td>15 to 25 volts</td>
</tr>
<tr>
<td>Dark Current</td>
<td>0.004 μA</td>
</tr>
<tr>
<td>Target Current (Highlight)</td>
<td>0.3 to 0.4 μA</td>
</tr>
<tr>
<td>Signal-Output Current:</td>
<td>0.3 to 0.4 μA</td>
</tr>
<tr>
<td>Peak:</td>
<td>0.1 to 0.2 μA</td>
</tr>
</tbody>
</table>

This capacitance, which effectively is the output impedance of the 7263, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms.

* Beam focus is obtained by combined effect of grid-No.3 voltage which should be adjustable over indicated range, and a focusing coil having an average field strength of 40 gauss.

** Definition, focus uniformity, and picture quality decrease with decreasing grid-No.4 and grid-No.3 voltage. In general, grid No.4 and grid No.3 should be operated above 250 volts.

- With no blanking voltage on grid No.1.
- Measured with high-gain, low-noise, cascade-input-type amplifier having bandwidth of 5 Mc. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of highlight video-signal current to rms noise current, multiplied by a factor of 3.
- The alignment coil should be located on the tube so that its center is a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.
- The target voltage for each 7263 must be adjusted to that value which gives the desired operating dark current.
- Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.
- The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.
- Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

**SPECIAL PERFORMANCE DATA**

In connection with the following tests, sample 7263's will maintain resolution as determined with a RETMA Resolution Chart, or equivalent, and will faithfully reproduce all resolution wedges and grey scales of the chart.

**Vibration Tests:**
These tests are performed under conditions for Average-Sensitivity Operation for Live-Scene Pickup on a sample lot.
of tubes from each production run. Tubes and their associated components§ are vibrated on apparatus providing dynamic conditions similar to those described in MIL-E-5272B, paragraph 4.7.1.

Resonance. Tubes and associated components§ are vibrated (per the method of MIL-E-5272B, paragraph 4.7.1.1) for 1 hour at +25°C, for 15 minutes at 0°C, and for 15 minutes at +55°C.

Cycling. Tubes and associated components§ are vibrated (per the method of MIL-E-5272B, paragraph 4.7.1.2 pertaining to specimen without vibration isolators) for 1 hour at +25°C, for 15 minutes at 0°C, and for 15 minutes at +55°C.

Temperature-Pressure (Altitude) Tests:
Tubes and associated components§ are subjected (per the method of MIL-E-5400*, paragraph 3.2.20, 3.2.20.1, and 3.2.20.1.1) to the separate and combined effects of varying temperature 0°C to +55°C and varying barometric pressure 30 to 3.4 inches of mercury. The pressures correspond to sea level and to an altitude of 50,000 feet, respectively.

Shock Tests:
These tests are performed with no voltages applied and on a sample lot of tubes from each production run. Tubes and their associated components§ are subjected in these tests (per MIL-E-5400*, paragraph 3.2.21.2.1) to 18 impact shocks of 15 g consisting of 3 shocks in opposite directions along each of three mutually perpendicular axes of the tube. Each shock impulse has a duration of 11 ± 1 milliseconds with a maximum impact acceleration occurring at approximately 5.5 milliseconds.

Temperature-Humidity Tests:
These tests are performed with no voltages applied to the 7263. The 7263 and associated components§ are subjected (per the method of MIL-E-5400*, paragraph 3.2.20.28) to relative humidities up to and including 100 per cent at temperatures up to and including +50°C.

§ Tube socket such as Cinch No.54418088 and RCA Assembly No.200SDUS01, or equivalent, which consists of the deflecting coils, focusing coil, alignment coil, shield, and target connector.
† 1 January 1956.

OPERATING CONSIDERATIONS

The target connection is made by a suitable spring contact bearing against the edge of the target flange. This spring contact may conveniently be provided as part of the focusing-coil design.

Support for the 7263 should be provided such that, under vibration and shock, the tube will not be displaced with respect
to the focusing, deflecting, and alignment fields. Suitable support is provided for the tube and its socket in the RCA Deflection Assembly 200SDU501, or equivalent. Orientation of the 7263 in its support should be such that the horizontal scan is essentially parallel to the plane passing through the tube axis and short index pin.
TYPICAL LIGHT-TRANSFER CHARACTERISTICS

ILLUMINATION: UNIFORM OVER PHOTOCONDUCTIVE LAYER,
SCANNED AREA OF PHOTOCONDUCTIVE LAYER = 1/2" x 3/8"
FACEPLATE TEMPERATURE = 30°C APPROX.

TYPICAL PERSISTENCE CHARACTERISTIC

INITIAL HIGHLIGHT SIGNAL-OUTPUT MICROAMPERES = 0.3
SCANNED AREA OF PHOTOCONDUCTIVE LAYER = 1/2" x 3/8"
FACEPLATE TEMPERATURE = 30°C APPROX.
TYPICAL PERSISTENCE CHARACTERISTICS

INITIAL HIGHLIGHT SIGNAL-OUTPUT MICROAMPERES = 0.3
SCANNED AREA OF PHOTOCONDUCTIVE LAYER = $\frac{1}{2}'' \times \frac{3}{8}''$
FACEPLATE TEMPERATURE = 30°C APPROX.
Spectral-Sensitivity Characteristics


Output current with radiant flux from tungsten source. Curve B: Spectral characteristic of average human eye. Dark current (microwatts) = 0.02 at 2870° K. Signal = output current at all wavelengths. Signal: for equal values of signal.

4°C

Range of maximum values.
TYPICAL CHARACTERISTICS

HIGHLIGHT SIGNAL - OUTPUT MICROAMPERES = 0.2
DARK CURRENT (MICROAMPERES) = 0.2
SCANNED AREA OF PHOTOCO nductive LAYER = $1/2'' \times 3/8''$
CURVE A: RELATIVE TARGET VOLTAGE REQUIRED TO MAINTAIN DARK CURRENT OF 0.2 μA.
CURVE B: 2870°K INCANDESCENT ILLUMINATION REQUIRED TO PRODUCE SIGNAL-OUTPUT CURRENT OF 0.2 μA.
CURVE C: PERSISTENCE (LAG) CHARACTERISTIC FOR AN INITIAL SIGNAL-OUTPUT CURRENT OF 0.2 μA.
DARK-CURRENT RANGE

SCANNED AREA OF PHOTOCONDUCTIVE LAYER = 1/2" x 3/8"
FACEPLATE TEMPERATURE = 30° C APPROX.
ILLUMINATION: 2870° K INCANDESCENT.
HIGHLIGHT SIGNAL-OUTPUT MICRO-
AMPERES = 0.3
SCANNED AREA OF PHOTOCONDUCTIVE
LAYER = 1/2" x 3/8"
FACEPLATE TEMPERATURE = 30°C APPROX.