RCA Special Red TUBES

For applications where extreme dependability and uniformity are paramount.

5691
5692
5693

Tube Division
Radio Corporation of America
Harrison, N. J.
The present "Special Red Tubes" include a high-mu twin triode, 5691; a medium-mu twin triode, 5692; and a sharp-cutoff pentode, 5693. They are for industrial applications where 10,000-hour life, rigid construction, uniformity, and stability are paramount. The electrical characteristics of the 5691, 5692, and 5693 are very similar to those of the 6SL7-GT, 6SN7-GT, and 6SJ7, respectively.

**RCA - 5691**

**HIGH-MU TWIN TRIODE**

RCA-5691 is a high-mu twin triode designed and manufactured for critical industrial applications. In such service, it is particularly useful as a voltage amplifier.

In addition to the features illustrated on page 8 of this type has its heaters for the two triode units connected in series so that failure of either heater in bridge circuits makes both units inoperative.

The 5691 is similar to the 6SL7-GT except that it has twice the heater current (0.6 amperes). It is recommended as a replacement for the 6SL7-GT only where provision for the increased heater current can be made, only where the operating conditions are within the ratings of 5691, and only where long life, rigid construction, extreme uniformity, and exceptional stability are needed. If the 5691 is operated at the highest maximum ratings of the 6SL7-GT, the full advantages of the 5691 will not be obtained.

**GENERAL DATA (Cont'd)**

**Mechanical:**
- **Mounting Position**: Any
- **Maximum Overall Length**: 2-7/8”
- **Maximum Seated Length**: 2-5/16”
- **Maximum Diameter**: 1-9/32”
- **Bulb**: T-9
- **Base**: Short Intermediate-Shell Octal 8-Pin, with External Barriers, Non-Hygrosopic

**INDUSTRIAL SERVICE**
- Includes applications such as dc and audio amplifiers
- **Values are for Each Unit**

**Maximum Ratings, Absolute Values:**
- **DC Plate Voltage**: 275 max. Volts
- **DC Plate Supply Voltage**: 330 max. Volts

**Grid Voltage:**
- Negative bias range: –1* min. to –100 max. Volts
- Negative peak value: –200 max. Volts
- **DC Grid Current**: 2 max. Ma
- **DC Cathode Current**: 10 max. Ma
- **Plate Dissipation**: 1 max. Watt
- **Peak Heater-Cathode Voltage:**
  - Heater negative with respect to cathode: 100 max. Volts
  - Heater positive with respect to cathode: 100 max. Volts

**Ambient Temperature Range**: –55 to +90 °C

**Maximum Circuit Value (for any operating condition):**
- **Grid-Circuit Resistance**: 2 max. Meg

**Characteristics and Range Values:**
- **Heater Volts, 6.3; Plate Volts, 250; Grid Volts, –7**

**Heater Current**
- Min. 0.58
- Avg. 0.6
- Max. 0.62

**Heater-Cathode Current with heater-cathode voltage of –100 volts**
- Min. – 5 µA

**Plate Current**
- Avg. 1.7
- Max. 2.3
- 2.9 Ma

**Plate Current for grid voltage of –5.5 volts**
- Min. – 15 µA

**Difference in Plate Current between triode units**
- Min. – 0.6 Ma

**Reverse Grid Current**
- Min. – 0.2 µA

**Amplification Factor**
- Min. 4000
- 80

**Plate Resistance**
- Min. 1300
- Max. 1600
- 1900 µhms

*For resistance-coupled amplifier applications, the negative bias may be as low as –0.6 volt.*

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*Max deviate ±10% from rated value provided such deviation occurs for less than 2% of the operating time.

*With no external shield.
Typical Operation—Resistance-Coupled Amplifier (Each Triode Unit):

<table>
<thead>
<tr>
<th>Plate-Supply Voltage</th>
<th>90</th>
<th>180</th>
<th>300</th>
<th>Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Load Resistor</td>
<td>0.1</td>
<td>0.22</td>
<td>0.47</td>
<td>Megohm</td>
</tr>
<tr>
<td>Grid Resistor (of following stage)</td>
<td>0.22</td>
<td>0.47</td>
<td>1.0</td>
<td>Megohm</td>
</tr>
<tr>
<td>Cathode Resistor</td>
<td>4700</td>
<td>7400</td>
<td>14400</td>
<td>Ohms</td>
</tr>
<tr>
<td>Cathode Bypass Capacitor</td>
<td>2.1</td>
<td>1.3</td>
<td>0.7</td>
<td>(\mu)F</td>
</tr>
<tr>
<td>Blocking Capacitor(\dagger)</td>
<td>0.014</td>
<td>0.0065</td>
<td>0.0035</td>
<td></td>
</tr>
<tr>
<td>Peak Output Voltage(\dagger)</td>
<td>9</td>
<td>13</td>
<td>17</td>
<td>Volts</td>
</tr>
<tr>
<td>Voltage Gain</td>
<td>27(\dagger)</td>
<td>35(\dagger)</td>
<td>40(\dagger)</td>
<td>(\dagger)Volts</td>
</tr>
</tbody>
</table>

\(\dagger\)This peak output voltage is obtained across the grid resistor of the following stage at any frequency within the flat region of the output vs frequency curve, and is for the condition where the signal level is adequate to swing the grid of the resistance-coupled amplifier tube to the point where its grid starts to draw current.
\(\dagger\)At an output voltage of 5 volts rms.

**DIMENSIONAL OUTLINE and SOCKET CONNECTIONS**

for the 5691 are the same as those shown

on page 5 for the 5692.
**RCA - 5692**

**MEDIUM-MU TWIN TRIODE**

RCA-5692 is a medium-mu twin triode designed and manufactured for critical industrial applications. It is particularly useful as a balanced dc amplifier, multivibrator, blocking oscillator, and resistance-coupled amplifier.

In addition to the features illustrated on page 8, this type has its heaters for the two triode units connected in series so that failure of either heater in bridge circuits makes both units inoperative.

The electrical characteristics of the 5692 are similar to those of the 6SN7-GT. The 5692 is recommended as a replacement for the 6SN7-GT only where the operating conditions are within the ratings of the 5692 and only where long life, rigid construction, extreme uniformity, and exceptional stability are needed. If the 5692 is operated at the higher maximum ratings of the 6SN7-GT, the full advantages of the 5692 will not be obtained.

**GENERAL DATA**

**Electrical:**
- **Heater, Pure Tungsten, for Unipotential Cathodes:**
  - Voltage (AC or DC)................................. 6.3 ± 5%* Volts
  - Current ............................................. 0.6 Amp
- **Direct Interelectrode Capacitances:**
  - Triode Unit No. 1—
    - Grid to Plate................................. 3.0 mF
    - Grid to Cathode............................... 2.3 mF
    - Plate to Cathode............................... 2.0 mF
  - Triode Unit No. 2—
    - Grid to Plate................................. 2.8 mF
    - Grid to Cathode............................... 2.1 mF
    - Plate to Cathode............................... 2.2 mF
  - Plate of Triode Unit No. 1 to Plate of Triode Unit No. 2... 0.31 mF

**Mechanical:**
- **Mounting Position:** Any
- **Maximum Overall Length:** 2-7/8" (72.7 mm)
- **Maximum Seated Length:** 2-5/16" (62.2 mm)
- **Maximum Diameter:** 1-9/32" (14.6 mm)
- **Bulb** ............................................. T-9
- **Base** ............................................. Short Intermediate-Shell Octal 8-Pin, with External Contactor, Non-Hygrosopic

**INDUSTRIAL SERVICE**

Includes applications such as dc amplifiers, audio amplifiers and relaxation oscillators.

**Values for Each Unit**
- **Maximum Ratings, Absolute Values:**
  - DC Plate Voltage................................. 275 max. Volts
  - DC Plate Supply Voltage....................... 330 max. Volts
  - Grid Voltage:
    - Negative bias value........... −1 min. to −100 max. Volts
    - Negative peak value........... −200 max. Volts
    - DC Grid Current......................... 2 max. Ma
  - DC Cathode Current......................... 15 max. Ma
  - Plate Dissipation......................... 1.75 max. Watts
  - Peak Heater-Cathode Voltage:
    - Heater negative with respect to cathode........ 100 max. Volts
    - Heater positive with respect to cathode........ 100 max. Volts
  - Ambient Temperature Range.............. −55 to +90 °C
  - Maximum Circuit Value (for any operating condition):
    - Grid-Circuit Resistance..................... 2 max. Meg

**Characteristics and Range Values:**
- **Heater Volts, 6.3; Plate Volts, 250; Grid Volts, −9**
- **Heater Current**................................. 0.58, 0.6, 0.62 Amp
- **Heater-Cathode Current with heater-cathode voltage of:**
  - ±100 volts........................................ 5 μA
  - Plate Current..................................... 4.8 6.5 8.2 Ma
  - Plate Current for grid voltage of −24 volts........ 15 μA
  - Difference in Plate Current between triode units........ 1.6 Ma
  - Reverse Grid Current.......................... 0.2 μA
  - Amplification Factor........................... 18 20 22
  - Plate Resistance................................. 9100 Ohms
  - Transconductance............................... 1825 2200 2575 μmhos

**Typical Operation—Resistance-Coupled Amplifier (Each Triode Unit):**

<table>
<thead>
<tr>
<th>Plate-Supply Voltage</th>
<th>90</th>
<th>180</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Load Resistor</td>
<td>0.05</td>
<td>0.1</td>
<td>0.25</td>
</tr>
<tr>
<td>Grid Resistor (of following stage)</td>
<td>0.1 0.25 0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cathode Resistor 2070</td>
<td>3940 7960</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cathode Bypass Capacitor</td>
<td>2.66 1.25 0.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blocking Capacitor</td>
<td>0.029 0.013 0.007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Output Voltage</td>
<td>14 17 18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage Gain</td>
<td>12 13 13</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* For resistance-coupled amplifier applications, the negative bias may be as low as −0.5 volt.

† This peak output voltage is obtained across the grid resistor of the following stage at any frequency within the flat region of the output vs frequency curve, and is for the condition where the signal level is adequate to swing the grid of the resistance-coupled amplifier tube to the point where its grid starts to draw current.

‡ May deviate ±10% from rated values provided such deviation occurs for less than 2% of the operating time.

§ With no external shield.

°F at an output voltage of 5 volts rms.

The cathode bypass capacitors and blocking capacitors have been chosen to give output voltages at 100 cps (f1) which are equal to 0.5 of the mid-frequency value. For any other value of (f1), multiply the values of cathode bypass and blocking capacitors by 100/f1.
AVERAGE PLATE CHARACTERISTICS
E_F = 6.3 VOLTS

AVERAGE CHARACTERISTICS
E_L = PLATE VOLTS

PLATE MILLIAMPERES

PLATE MILLIAMPERES

92CM-6257

92CM-6914

SOCKET CONNECTIONS
Bottom View

Pin 1: Grid of Triode Unit No. 2
Pin 2: Plate of Triode Unit No. 2
Pin 3: Cathode of Triode Unit No. 2
Pin 4: Grid of Triode Unit No. 1
Pin 5: Plate of Triode Unit No. 1
Pin 6: Cathode of Triode Unit No. 1
Pin 7: Heater
Pin 8: Heater

DIMENSIONAL OUTLINE

SHORT INTERMEDIATE-SHELL OCTAL 8-PIN BASE
RCA - 5693 -

SHARP-CUTOFF PENTODE

RCA-5693 is a sharp-cutoff pentode designed and manufactured for critical industrial applications. In such service, it is particularly useful as a high-gain resistance-coupled amplifier.

This tube can be operated with a grid-No.1 resistor having a value as high as 40 megohms depending on the operating conditions as given on page 7.

The electrical characteristics of the 5693 are similar to those of the 6SJ7. The 5693 is recommended as a replacement for the 6SJ7 only where the operating conditions are within the ratings of the 5693, and only where long life, rigid construction, extreme uniformity and exceptional stability are needed. If the 5693 is operated at the higher maximum ratings of the 6SJ7, the full advantages of the 5693 will not be obtained.

GENERAL DATA

Electrical:
Heater, Pure Tungsten, for Unpotential Cathodes:
Voltage (AC or DC) 6.3 ± 5%* Volts
Current 0.3 Amp
Direct Interelectrode Capacitance Min. 0.005 μf
Input 4.8 5.3 5.8 μf
Output 5.9 0.2 0.6 μf

Mechanical:
Mounting Position Any
Maximum Overall Length 2-5/8"
Seated Length 1-31/32" ± 3/32"
Maximum Diameter 1-5/16"
Bulb Metal Shell MT-8
Base Small-Wafer Ortal 8-Pin, with External Barriers, Non-Hygrosopic

Typical Operation—Resistance-Coupled Amplifier:
Plate & Grid-No. 2 Supply Voltage 90 Volts
Plate Load Resistor 0.1 0.25 0.5
Grid-No. 1 Resistor 0.25 0.5 1
Grid-No. 2 Resistor 0.29 0.92 1.7
Cathode Resistor 880 1700 3800
Grid-No. 2 Bypass Capacitor* 0.085 0.045 0.03
Cathode Bypass Capacitor* 7.4 4.5 2.4
Blocking Capacitor* 0.016 0.005 0.002
Peak Output Voltage 23 18 92
Voltage Gain 68 99 119

*At an output voltage of 5 volts rms.
*May deviate ±10% from rated value provided such deviation occurs for less than 2% of the operating time.
*With shunt connected to cathode.
**The 5693 may be operated at a grid-No.2 voltage as high as the maximum rated grid-No.2 supply voltage (530 volts) when the grid-No.2 dissipation is not exceeded for any signal conditions and when a resistor is used to couple with the grid-no.2 supply voltage. For resistance-coupled amplifier applications, the negative grid-No.1 bias may be as low as -0.5 volt.

Industrial Service

Includes applications such as dc and resistance-coupled amplifiers

Maximum Ratings, Absolute Values:
DC Plate Voltage 300 max. Volts
DC Plate Supply Voltage 330 max. Volts
DC Grid-No. 3 (Suppressor) Voltage 0 min. Volts
DC Grid-No. 2 (Screen) Voltage 125 max. Volts
DC Grid-No. 2 Supply Voltage 330 max. Volts
Grid-No. 1 (Control-Grid) Voltage 1 max. to 50 max. Volts
Negative bias range
DC Cathode Current 10 max. Ma
Plate Dissipation 2 max. Watts
Grid-No. 2 Dissipation 0.3 max. Watt
Peak Heater-Cathode Voltage
Heater negative with respect to cathode 100 max. Volts
Heater positive with respect to cathode 100 max. Volts
Ambient Temperature Range -65 to +90 °C

Maximum Circuit Value:
See curve on page 7 for maximum values of grid No.1 resistor.

Characteristics and Range Values:
Heater Volts, 6.3; Plate Volts, 250; Grid-No. 3 Volts, 0;
Grid-No. 2 Volts, 100; Grid-No. 1 Volts, -3

<table>
<thead>
<tr>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater Current</td>
<td>0.290</td>
</tr>
<tr>
<td>Heater-Cathode Current</td>
<td>2.3</td>
</tr>
<tr>
<td>Plate Cur. for grid-No.1 voltage of 7.5 volts</td>
<td>5</td>
</tr>
<tr>
<td>Plate Cur. for grid-No.3 voltage of -70 volts</td>
<td>50</td>
</tr>
<tr>
<td>Grid-No. 2 Current</td>
<td>0.80</td>
</tr>
<tr>
<td>Reverse Grid-No. 1 Cur.</td>
<td>0.1</td>
</tr>
<tr>
<td>Plate Resistance</td>
<td>1.0</td>
</tr>
<tr>
<td>Transconductance</td>
<td>1400</td>
</tr>
</tbody>
</table>

*The cathode and grid-No.2 bypass capacitors and blocking capacitors have been chosen to give output voltages at 100 cps (f1) which are equal to 0.7 of the mid-frequency value. For any other value of (f1), multiply the values of cathode bypass, grid-No.2 bypass, and blocking capacitors by 100/(f1).†This peak output voltage is obtained across the grid resistor of the following stage at any frequency within the flat region of the output vs Frequency curve, and it is for the condition where the signal level is adequate to swing the grid of the resistance-coupled amplifier tube to the point where its grid starts to draw current.

* Meghohm
OPERATION CHARACTERISTICS

<table>
<thead>
<tr>
<th>CURVE</th>
<th>GRID-NO. 2 RESISTOR (MGS)</th>
<th>GRID-NO. 2 SUPPLY VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.00</td>
<td>300</td>
</tr>
<tr>
<td>2</td>
<td>0.05</td>
<td>300</td>
</tr>
<tr>
<td>3</td>
<td>0.15</td>
<td>300</td>
</tr>
<tr>
<td>4</td>
<td>0.75</td>
<td>300</td>
</tr>
</tbody>
</table>

These curves are based on the following values:
\( \Delta I_A = 100 \mu\text{Amps, } \Delta I_G = 0 \mu\text{Amps} \)

Expressing these values as a ratio, we have:
\( \frac{\Delta I_A}{\Delta I_G} = 100 \) or 3000
\( \frac{I_A}{I_G} = \frac{1}{3} \) or 3000

For those applications permitting other values of \( \Delta I_A \), a new ratio of \( \Delta I_A/\Delta I_G \) can be calculated. The values of \( R_2 \) as read from the curve must be multiplied by a factor which is the quotient of the new ratio divided by the old ratio. For example, if the new ratio is 6000, the multiplying factor is 6000/3000 or 2. And values of \( R_2 \) as read from the curve are therefore multiplied by 2.

Note: Transconductance curves were obtained with grid-no. 2 resistor and cathode resistor suitably bypassed.

AVERAGE PLATE CHARACTERISTICS

PEOPLE'S CONNECTION

GRID-NO. 2 VOLTS = 100
GRID-NO. 3 VOLTS = 10

SOCKET CONNECTIONS

Bottom View

DIMENSIONAL OUTLINE

MT8 BULB

1.25 MAX.

1.25 MAX.

2.25 MAX.

3.5 MAX.

4.5 MAX.

5.5 MAX.

8-PIN BASE WITH EXTERNAL BARRIERS
RCA Special Red TUBES for 10,000 Hours of Dependable Service

- when the proper operation of vital manufacturing, communications, laboratory, and other industrial equipment depends on tube uniformity and stability.
- when tube failure means factory shutdown or hazardous operation.
- when initial tube cost is secondary to cost of maintenance.

- WHENEVER the accent is on quality—and quality alone—

USE RCA “Special Red” Tubes: RCA-5691, RCA-5692, or RCA-5693. They are skillfully engineered, ruggedly designed, precisely manufactured, exactlying processed, and rigorously tested, and will withstand impact shocks of 500g for short periods, and 2.5g of continuous vibration for hundreds of hours.

Structure of RCA-5691 and RCA-5692

1—Low-leakage button stem.
2—Non-hygrosopic base.
3—Pure-tungsten heater for high mechanical strength.
4—Sleeves on heater legs insure good mechanical and electrical bond between heater and heater leads.
5—Cathode sleeves locked to mica insulator.
6—Grid plated to minimize variation in contact potential.
7—“Stops” prevent vertical movement of grid rods.
8—Grid rods fit tightly into mica insulators.
9—Extra mica insulator provides getter shield.
10—Two getters for long life.
11—Plates held rigid by plate ears wedged into mica insulators.
12—Plates are designed to minimize electron coupling between units.
13—Mount secured by five supporting rods.
14—Twelve reinforcing eyelets provide a firm bond between mica insulators and five supporting rods.