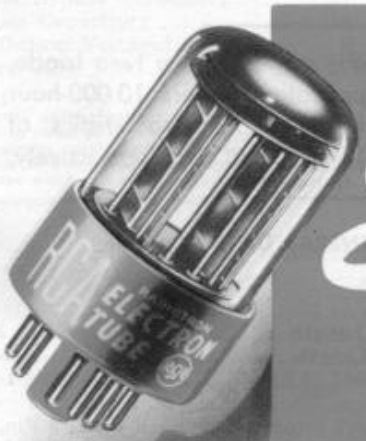
RCA



Special Red TUBES

FOR APPLICATIONS WHERE EXTREME DEPENDABILITY AND UNIFORMITY ARE PARAMOUNT.

5691

5692

5693

TUBE DIVISION

RADIO CORPORATION of AMERICA

HARRISON, N. J.

FORM No. SRB-1002
Photolithographed
In U. S. A.

5691, 5692, 5693

SPECIAL RED TUBES

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 similiar 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 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 ampere). 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 higher maximum ratings of the 6SL7-GT, the full advantages of the 5691 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:°

	Min.	Av.	Max.	
Triode Unit No. 1—				
Grid to Plate	3.1	3.6	4.1	μμf
Grid to Cathode	1.9	2.4	2.9	μμf
Plate to Cathode	1.8	2.3	2.8	μμf
Triode Unit No. 2—				
Grid to Plate	3.1	3.6	4.1	μμf
Grid to Cathode	2.2	2.7	3.2	μμf
Plate to Cathode	2.1	2.6	3.1	μμf
Plate of Triode Unit No. 1 to Plate of Triode Unit No. 2	0.31	0.35	0.39	μμf

*May deviate ±10% from rated value provided such deviation occurs for less than 2% of the operating time.
°With no external shield.

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-Hygroscopic

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, —2

	Min.	Av.	Max.	
Heater Current	0.58	0.6	0.62	Amp
Heater-Cathode Current with heater-cathode voltage of ±100 volts	—	—	5	μa
Plate Current	1.7	2.3	2.9	Ma
Plate Current for grid voltage of —5.5 volts	—	—	15	μa
Difference in Plate Current between triode units	—	—	0.6	Ma
Reverse Grid Current	—	—	0.2	μa
Amplification Factor	60	70	80	
Plate Resistance	—	44000	—	Ohms
Transconductance	1300	1600	1900	μmhos

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

5691

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

Plate-Supply Voltage	90			180			300			Volts
Plate Load Resistor	0.1	0.22	0.47	0.1	0.22	0.47	0.1	0.22	0.47	Megohm
Grid Resistor (of following stage)	0.22	0.47	1.0	0.22	0.47	1.0	0.22	0.47	1.0	Megohm
Cathode Resistor	4700	7400	14400	2600	4600	9000	2180	3970	7550	Ohms
Cathode Bypass Capacitor‡	2.1	1.3	0.7	2.8	1.6	0.9	3.1	1.8	1	μf
Blocking Capacitor‡	0.014	0.0065	0.0035	0.014	0.0065	0.0035	0.014	0.0065	0.0035	μf
Peak Output Voltage†	9	13	17	30	37	44	59	76	88	Volts
Voltage Gain	27‖	35§	40§	33¶	42¶	46¶	36¶	45¶	50¶	

†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.

§At an output voltage of 4 volts rms.

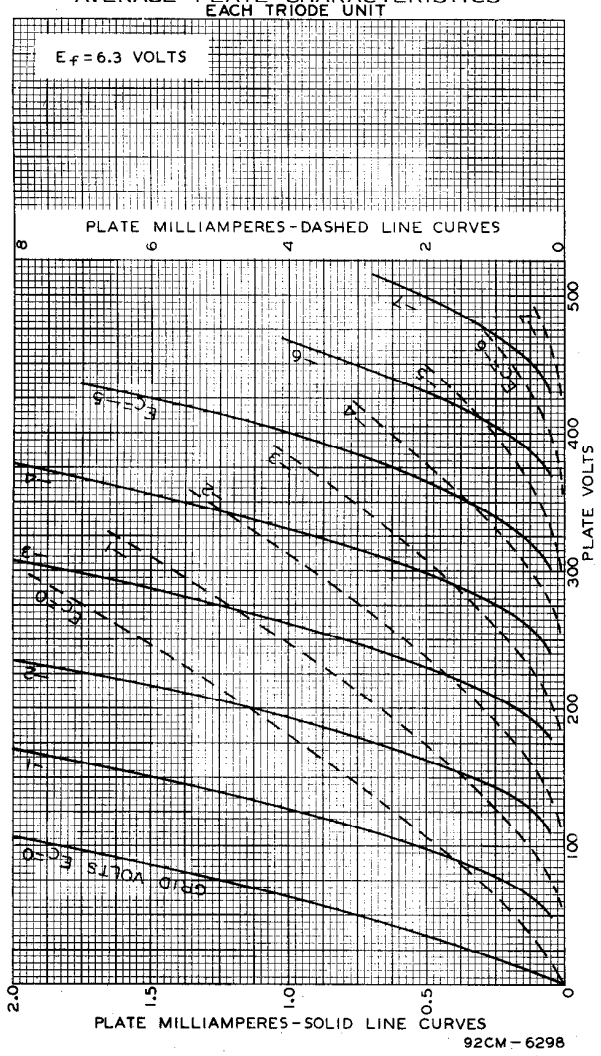
‡The cathode bypass capacitors and blocking capacitors have been chosen to give output voltages at 100 cps (f_1) which are equal to 0.8 of the mid-frequency value. For any other value of (f_1), multiply the values of cathode bypass and blocking capacitors by $100/f_1$.

‖At an output voltage of 3 volts rms.

¶At an output voltage of 5 volts rms.

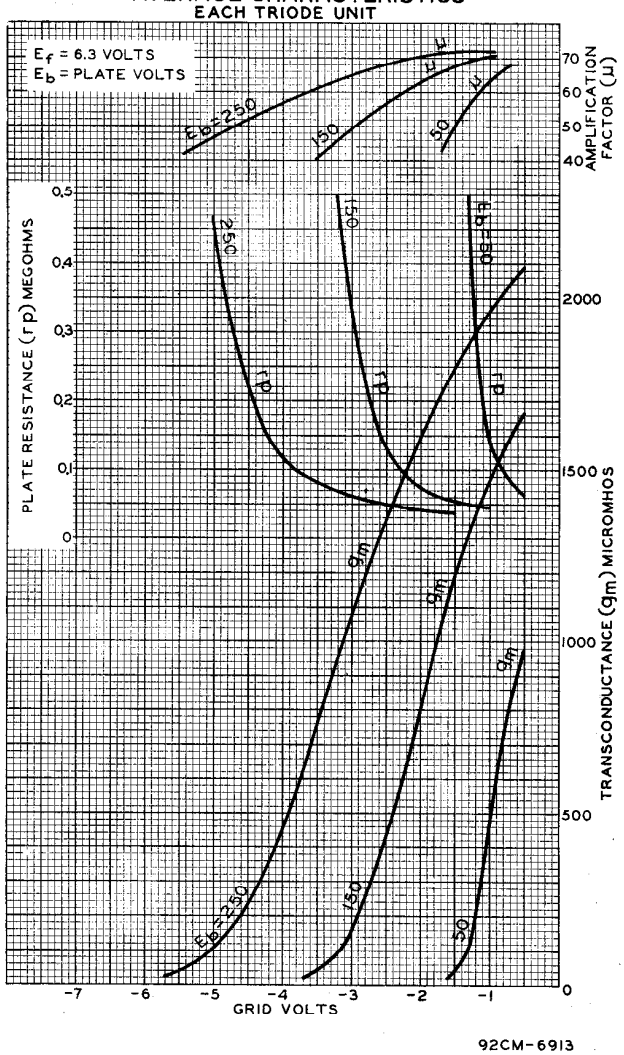
DIMENSIONAL OUTLINE and SOCKET CONNECTIONS
for the 5691 are the same as those shown
on page 5 for the 5692

AVERAGE PLATE CHARACTERISTICS
EACH TRIODE UNIT



92CM-6298

AVERAGE CHARACTERISTICS
EACH TRIODE UNIT

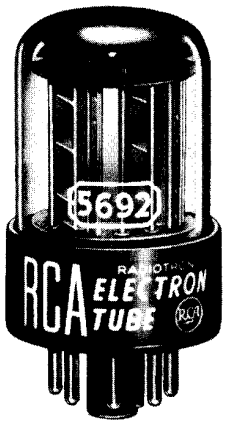


92CM-6913

• 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:°

	Min.	Av.	Max.	
Triode Unit No. 1—				
Grid to Plate	3.0	3.5	4.0	μμf
Grid to Cathode	1.8	2.3	2.8	μμf
Plate to Cathode	2.0	2.5	3.0	μμf
Triode Unit No. 2—				
Grid to Plate	2.8	3.3	3.8	μμf
Grid to Cathode	2.1	2.6	3.1	μμf
Plate to Cathode	2.2	2.7	3.2	μμf
Plate of Triode Unit No. 1 to Plate of Triode Unit No. 2	0.31	0.35	0.39	μμf

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-Hygroscopic

INDUSTRIAL SERVICE

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

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 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

	Min.	Av.	Max.	
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):

Plate-Supply Voltage	90			180			300			Volts
Plate Load Resistor	0.05	0.1	0.25	0.05	0.1	0.25	0.05	0.1	0.25	Megohm
Grid Resistor (of following stage)	0.1	0.25	0.5	0.1	0.25	0.5	0.1	0.25	0.5	Megohm
Cathode Resistor	2070	3940	9760	1490	2830	7000	1270	2440	5770	Ohms
Cathode Bypass Capacitor‡	2.66	1.29	0.55	2.86	1.35	0.62	2.96	1.42	0.64	μf
Blocking Capacitor‡	0.029	0.012	0.007	0.032	0.012	0.007	0.034	0.0125	0.0075	μf
Peak Output Voltage†	14	17	18	30	34	36	51	56	57	Volts
Voltage Gain¶	12	13	13	13	14	14	14	14	14	

• 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.

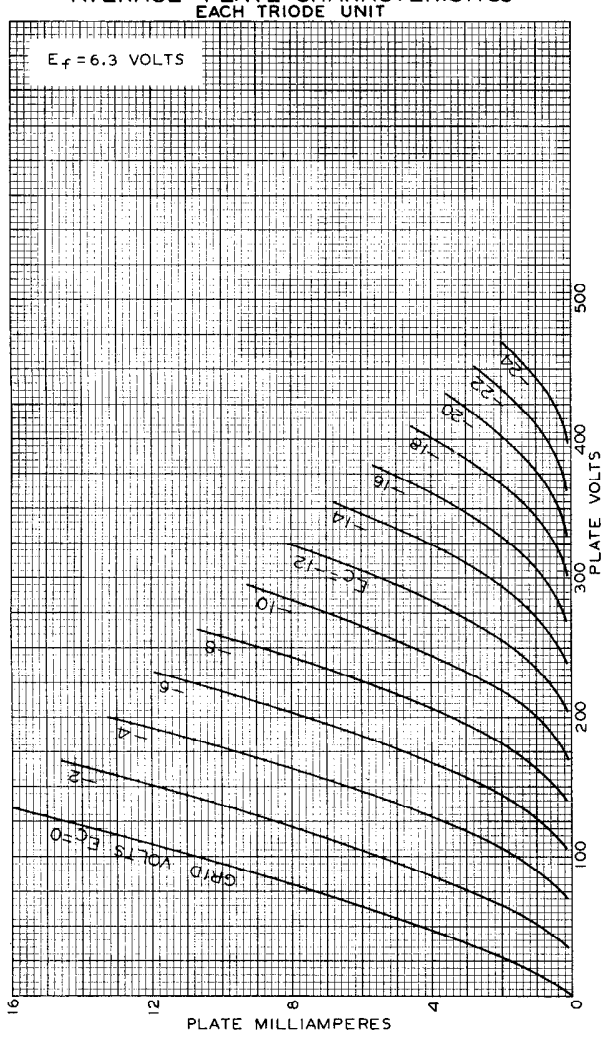
*May deviate ±10% from rated value provided such deviation occurs for less than 2% of the operating time.

°With no external shield. ¶At an output voltage of 5 volts rms.

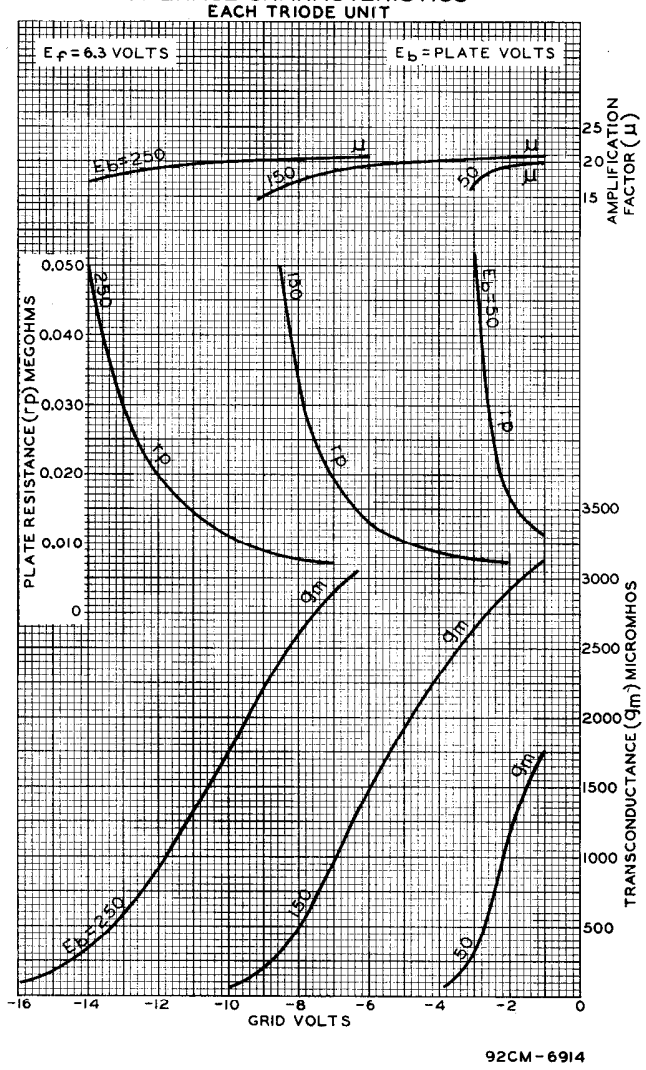
‡The cathode bypass capacitors and blocking capacitors have been chosen to give output voltages at 100 cps (f_1) which are equal to 0.8 of the mid-frequency value. For any other value of (f_1), multiply the values of cathode bypass and blocking capacitors by $100/f_1$.

5692

AVERAGE PLATE CHARACTERISTICS
EACH TRIODE UNIT

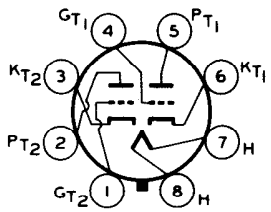


AVERAGE CHARACTERISTICS
EACH TRIODE UNIT



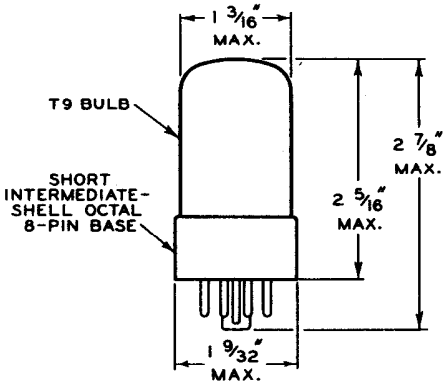
SOCKET CONNECTIONS

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



• 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 Unipotential Cathodes:				
Voltage (AC or DC)			6.3 ± 5%*	Volts
Current			0.3	Amp
Direct Interelectrode Capacitances:°	*Min.*	*Av.*	*Max.*	
Grid to Plate	—	—	0.005	μμf
Input	4.8	5.3	5.8	μμf
Output	5.6	6.2	6.8	μμf

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 Octal 8-Pin, with External Barriers, Non-Hygroscopic

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:		
Negative bias value	0 min.	Volts
	—100 max.	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:		
Negative bias range	—1■ min. to —50 max.	Volts
Negative peak value	—50 max.	Volts
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	—55 to +90	°C

Maximum Circuit Value:

See curve on page 7 for max. 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

	Min.	*Av.*	*Max.*	
Heater Current	0.290	0.3	0.310	Amp
Heater-Cathode Current with heater-cathode voltage ±100 volts	—	—	5	μa
Plate Current	2.3	3.0	3.7	Ma
Plate Cur. for grid-No.1 voltage of —7.5 volts	2	30	80	μa
Plate Cur. for grid-No.3 voltage of —70 volts	50	275	500	μa
Grid-No. 2 Current	0.60	0.85	1.10	Ma
Reverse Grid No.1 Cur.	—	—	0.1	μa
Plate Resistance	1.0	—	—	Meg
Transconductance	1400	1650	1900	μmhos

Typical Operation—Resistance-Coupled Amplifier:

Plate & Grid-No. 2 Supply Voltage	90			180			300			Volts
Plate Load Resistor	0.1	0.25	0.5	0.1	0.25	0.5	0.1	0.25	0.5	Megohm
Grid-No. 1 Resistor	0.25	0.5	1	0.25	0.5	1	0.25	0.5	1	Megohm
Grid-No. 2 Resistor	0.29	0.92	1.7	0.31	0.94	2.2	0.37	1.10	2.2	Megohms
Cathode Resistor	880	1700	3800	800	1060	2180	530	860	1410	Ohms
Grid-No. 2 Bypass Capacitor•	0.085	0.045	0.03	0.09	0.06	0.04	0.09	0.06	0.05	μf
Cathode Bypass Capacitor•	7.4	4.5	2.4	8	6.6	3.8	10.9	7.4	5.8	μf
Blocking Capacitor•	0.016	0.005	0.002	0.015	0.004	0.002	0.016	0.004	0.002	μf
Peak Output Voltage†	23	18	22	60	47	44	96	88	79	Volts
Voltage Gain¶	68	93	119	82	131	192	98	167	238	

¶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 shell 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 (330 volts) when the grid-No.2 dissipation is not exceeded for any signal conditions and when a resistor is used in series with the grid No.2 and its supply voltage.

■For resistance-coupled amplifier applications, the negative grid-No.1 bias may be as low as —0.5 volt.

• The cathode and grid-No.2 bypass capacitors and blocking capacitors have been chosen to give output voltages at 100 cps (f_1) which are equal to 0.7 of the mid-frequency value. For any other value of (f_1), multiply the values of cathode bypass, grid-No.2 bypass, and blocking capacitors by $100/f_1$.

†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.

5693

OPERATION CHARACTERISTICS

E_f = 6.3 VOLTS PLATE VOLTS = 300 GRID-№3 VOLTS = 0

CURVE	GRID-№2 RESISTOR	GRID-№2 SUPPLY VOLTS
1	0 MEG.	100
2	0.25 MEG.	300
3	0.5 MEG.	300
4	0.75 MEG.	300

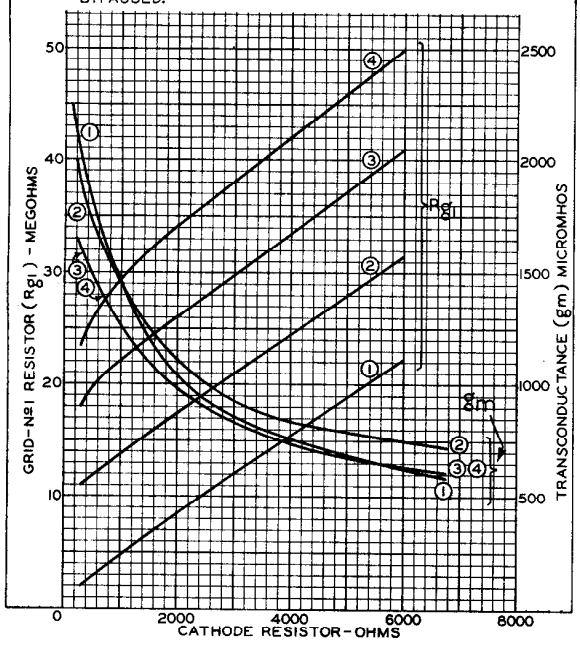
THESE CURVES ARE BASED ON THE FOLLOWING VALUES: ΔI_K=300μAMP, ΔI_{g_1}=0.1μAMP

EXPRESSING THESE VALUES AS A RATIO, WE HAVE:

$$\frac{\Delta I_K}{\Delta I_{g_1}} = \frac{300}{0.1} \text{ OR } 3000$$

FOR THOSE APPLICATIONS PERMITTING OTHER VALUES OF ΔI_K, A NEW RATIO OF $\Delta I_K/\Delta I_{g_1}$ CAN BE CALCULATED. THE VALUES OF R_{g_1} 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_{g_1} AS READ FROM THE CURVE ARE THEREFORE MULTIPLIED BY 2.

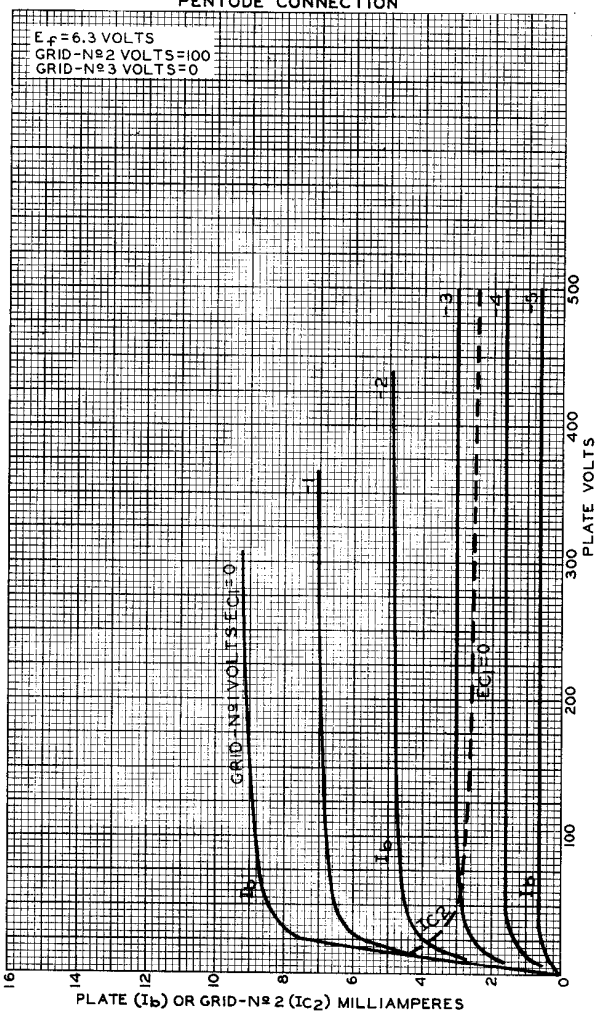
NOTE: TRANSCONDUCTANCE CURVES WERE OBTAINED WITH GRID-№2 RESISTOR AND CATHODE RESISTOR SUITABLY BYPASSED.



92CM-6920RI

AVERAGE PLATE CHARACTERISTICS

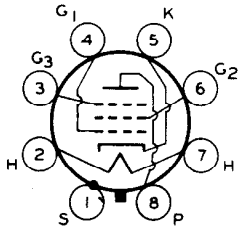
PENTODE CONNECTION



92CM-4939RI

SOCKET CONNECTIONS

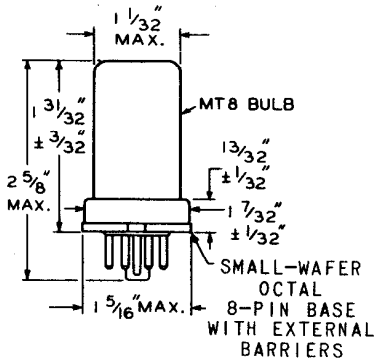
Bottom View



8N

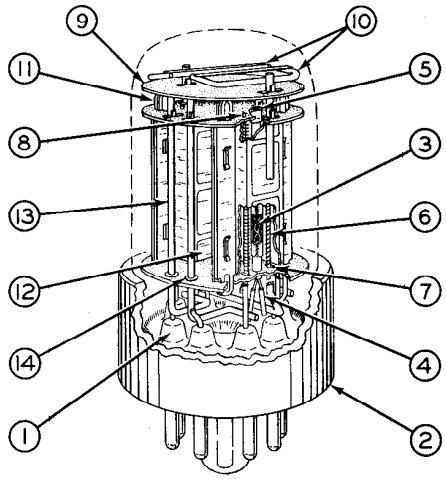
Pin 1: Shell
Pin 2: Heater
Pin 3: Grid No. 3
Pin 4: Grid No. 1
Pin 5: Cathode
Pin 6: Grid No. 2
Pin 7: Heater
Pin 8: Plate

DIMENSIONAL OUTLINE



RCA *Special Red* TUBES

for 10,000 Hours of Dependable Service



1—Low-leakage button stem.
2—Non-hygroscopic 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.

Structure of RCA-5691 and RCA-5692

- **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, exactingly processed, and rigorously tested, and will withstand impact shocks of 500g for short periods, and 2.5g of continuous vibration for hundreds of hours.