7213

Beam Power Tube

CERAMIC-METAL SEALS — **COAXIAL-ELECTRODE STRUCTURE**
UNITIZED-ELECTRODE DESIGN — **INTEGRAL RADIATOR**
FORCED-AIR COOLED — **2500 WATTS CW INPUT**
MATRIX-TYPE, OXIDE-COATED, UNIPOTENTIAL CATHODE

Useful with Full Ratings at Frequencies up to 1215 Mc

GENERAL DATA

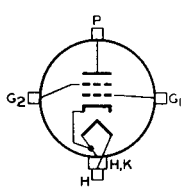
Electrical:

Heater, for Matrix-Type, Oxide-Coated, Unipotential Cathode:		
Voltage (AC or DC)[a]	5.5 typical 6 max.	volts volts
Current at heater volts = 5.5	17.3	amp ←
Minimum heating time at heater volts = 5.5	5	minutes
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 2500, grid-No.2 volts = 600, and plate ma. = 600	17	
Direct Interelectrode Capacitances:		
Grid No.1 to plate[b]	0.17 max.	μμf
Grid No.1 to cathode & heater	42	μμf
Plate to cathode & heater[bc]	0.017 max.	μμf ←
Grid No.1 to grid No.2	55	μμf
Grid No.2 to plate	16	μμf
Grid No.2 to cathode & heater[c]	1.4 max.	μμf

Mechanical:

Operating Position	Any
Overall Length	3.24" ± 0.10"
Greatest Diameter (See *Dimensional Outline*)	3.72" ± 0.03" ←
Weight (Approx.)	2 lbs
Radiator	Integral part of tube
Terminal Connections (See *Dimensional Outline*):	

G_1 – Grid-No.1-Terminal Contact Surface
G_2 – Grid-No.2-Terminal Contact Surface
H – Heater-Terminal Contact Surface



H,K – Heater- & Cathode-Terminal Contact Surface
P – Plate-Terminal Contact Surface

Thermal:

Air Flow:

Through radiator—Adequate air flow to limit the plate-seal temperature to 250° C should be delivered by a blower

← Indicates a change.

through the radiator before and during the application of heater, plate, grid-No.2, and grid-No.1 voltages. Typical values of air flow directed through the radiator versus percentage of maximum rated plate dissipation for each class of service are shown in accompanying *Typical-Cooling-Requirements* curves. Plate power, grid-No.2 power, heater power, and air flow may be removed simultaneously.

To grid-No.2, grid-No.1, cathode, and heater seals—A sufficient quantity of air should be directed at the heater terminal and allowed to flow past each of these seals so that its temperature does not exceed the specified maximum value of 250° C. An air flow of 10 cfm is usually adequate.

Seal Temperature (Plate, grid No.2, grid No.1, cathode, and heater)	250 max.	°C

LINEAR RF POWER AMPLIFIER
Single-Sideband Suppressed-Carrier Service

Maximum CCS[d] Ratings, *Absolute-Maximum Values:*

	Up to 1215 Mc	
DC PLATE VOLTAGE.	2500 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE. . . .	1000 max.	volts
MAX.-SIGNAL DC PLATE CURRENT.	1 max.	amp
MAX.-SIGNAL DC GRID-No.1 (CONTROL-GRID) CURRENT	0.2 max.	amp
MAX.-SIGNAL PLATE INPUT	2500 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT	50 max.	watts
PLATE DISSIPATION	1500 max.	watts

Typical CCS Class AB_1 "Single-Tone" Operation:[e]

	Up to 60 Mc		
DC Plate Voltage.	2250	2500	volts
DC Grid-No.2 Voltage[f]	700	700	volts
DC Grid-No.1 Voltage.	−50	−50	volts
Zero-Signal DC Plate Current.	0.2	0.2	amp
Zero-Signal DC Grid-No.2 Current.	0	0	amp
Effective RF Load Resistance.	1100	1100	ohms
Max.-Signal DC Plate Current.	0.9	1	amp
→ Max.-Signal DC Grid-No.2 Current.	0.045	0.045	amp
Max.-Signal DC Grid-No.1 Current.	0	0	amp
Max.-Signal Peak RF Grid-No.1 Voltage . .	50	50	volts
Max.-Signal Driving Power (Approx.) . . .	0	0	watts
Max.-Signal Power Output (Approx.). . . .	1000	1250	watts

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with maximum modulation factor of 1

Maximum CCS[d] Ratings, *Absolute-Maximum Values:*

	Up to 1215 Mc	
DC PLATE VOLTAGE.	2000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE. . . .	1000 max.	volts

→ Indicates a change.

DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-300 max.	volts
DC PLATE CURRENT	0.85 max.	amp
DC GRID-No.1 CURRENT	0.2 max.	amp
PLATE INPUT	1700 max.	watts
GRID-No.2 INPUT	35 max.	watts
PLATE DISSIPATION	1000 max.	watts

Typical CCS Operation:

In grid-drive circuit at 600 Mc

DC Plate Voltage	1800	2000	volts
DC Grid-No.2 Voltage[g]	500	500	volts
DC Grid-No.1 Voltage[h]	-30	-30	volts
DC Plate Current	0.75	0.83	amp
DC Grid-No.2 Current	0.015	0.015	amp
DC Grid-No.1 Current (Approx.)	0.04	0.04	amp
Driver Power Output (Approx.)[j]	50	55	watts
Useful Power Output (Approx.)	650[k]	800[k]	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition	5000[l] max.	ohms

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy[m] and RF POWER AMPLIFIER — Class C FM Telephony

Maximum CCS[d] Ratings, *Absolute-Maximum Values:*

	Up to 1215 Mc	
DC PLATE VOLTAGE	2500 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	1000 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-300 max.	volts
DC PLATE CURRENT	1 max.	amp
DC GRID-No.1 CURRENT	0.2 max.	amp
PLATE INPUT	2500 max.	watts
GRID-No.2 INPUT	50 max.	watts
PLATE DISSIPATION	1500 max.	watts

Typical CCS Operation:

In grid-drive circuit at 600 Mc

DC Plate Voltage	2250	2500	volts
DC Grid-No.2 Voltage[n]	500	500	volts
DC Grid-No.1 Voltage[p]	-30	-30	volts
DC Plate Current	0.9	1	amp
DC Grid-No.2 Current	0.02	0.02	amp
DC Grid-No.1 Current (Approx.)	0.07	0.07	amp
Driver Power Output (Approx.)[j]	70	75	watts
Useful Power Output (Approx.)	1050[k]	1350[k]	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition	5000[k] max.	ohms

[a] Because the cathode is subjected to considerable back bombardment as the frequency is increased with resultant increase in temperature, the heater voltage should be reduced depending on operating conditions and frequency to prevent overheating the cathode and resultant short life.

[b] With external, flat, metal shield having diameter of 8" and center hole approximately 3" in diameter provided with spring fingers that connect the shield to grid-No.2 terminal. Shield is located in plane of grid-No.2 terminal perpendicular to the tube axis.

[c] With external, flat, metal shield having diameter of 8" and center hole approximately 2-3/8" in diameter provided with spring fingers that connect the shield to grid-No.1 terminal. Shield is located in plane of grid-No.1 terminal perpendicular to the tube axis.

[d] Continuous Commercial Service.

[e] "Single-Tone" operation refers to that class of amplifier service in which the grid-No.1 input consists of a monofrequency rf signal having constant amplitude. This signal is produced in a single-sideband suppressed-carrier system when a single audio frequency of constant amplitude is applied to the input of the system.

[f] Preferably obtained from a fixed supply.

[g] Obtained preferably from a separate source modulated along with the plate supply.

[h] Obtained from grid-No.1 resistor or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor.

[j] The driver stage is required to supply tube losses and rf-circuit losses. It should be designed to provide an excess of power above the indicated value to take care of variations in line voltage, in components, in initial tube characteristics, and in tube characteristics during life.

[k] This value of useful power is measured in load of output circuit.

[l] If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply.

[m] Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

[n] Obtained preferably from a fixed supply, or from the plate-supply voltage with a voltage divider.

[p] Obtained from fixed supply, by grid-No.1 resistor, by cathode resistor, or by combination methods.

SPECIAL TESTS & PERFORMANCE DATA

Design samples of the 7213 have been subjected to the following tests without adverse effects.

Variable-Frequency Vibration Performance:

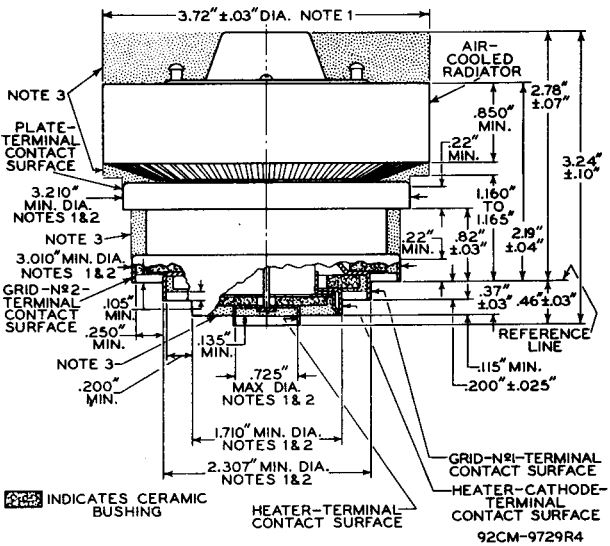
This test was performed (per MIL-E-1C[q], paragraph 4.9.20.3) under the following conditions: heater volts = 5.5, plate-supply volts = 450, grid-No.2 volts = 300, grid-No.1 voltage varied to give a plate current of 10 milliamperes, and plate load resistor (ohms) = 2000. The tubes were vibrated in each of 3 positions through frequency range from 10 to 50 to 10 cycles per second. The vibrating frequency had a fixed amplitude of 0.040 inch (total excursion of 0.080 inch). During the test, the tubes did not show an rms output voltage across the plate load resistor in excess of 500 millivolts. ← At the end of this test, the tubes did not show tap or permanent interelectrode shorts or defects that would cause the tubes to be inoperable. The tubes exhibited no pronounced mechanical resonance during this test.

[q] Military Specification, Electron Tubes and Crystal Rectifiers, 3 October 1955.

← Indicates a change.

Fatigue Performance:

In this test (per MIL-E-IC, paragraph 4.9.20.6), the tubes were rigidly mounted and subjected to 2.5 g vibrational acceleration at 25 cycles per second for 32 hours in each of three positions with heater volts = 5.5. At the end of this test, the tubes did not show permanent or temporary shorts or open circuits, and passed all electrical tests.

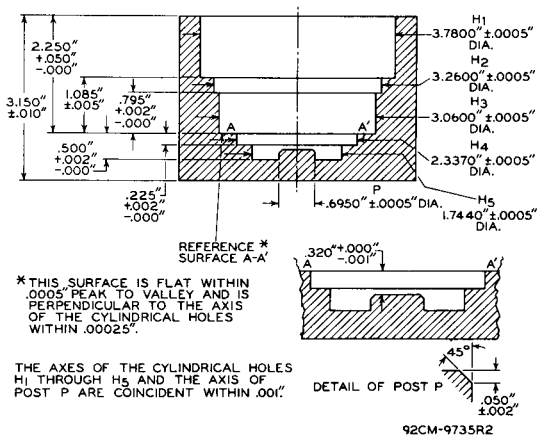


NOTE 1: WITH THE CYLINDRICAL SURFACES OF THE RADIATOR BAND, PLATE TERMINAL, GRID-No.2 TERMINAL, GRID-No.1 TERMINAL, HEATER-CATHODE TERMINAL, AND HEATER TERMINAL CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. PROPER ENTRY OF THE TUBE IS OBTAINED WHEN THE GRID-No.2 TERMINAL IS SEATED ON THE SHOULDER A-A'. THE TUBE IS PROPERLY SEATED ON THE SHOULDER WHEN A 0.010"-THICKNESS GAUGE 1/8" WIDE WILL NOT ENTER MORE THAN 1/16" BETWEEN THE SHOULDER SURFACE AND THE GRID-No.2 TERMINAL. THE GAUGE IS PROVIDED WITH SLOTS TO PERMIT MAKING MEASUREMENT OF SEATING OF GRID-No.2 TERMINAL ON SHOULDER A-A'.

NOTE 2: THE DIAMETER OF EACH TERMINAL IS HELD TO INDICATED VALUES ONLY OVER THE INDICATED MINIMUM LENGTH OF ITS CONTACT SURFACE.

NOTE 3: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES.

GAUGE SKETCH G_1



*THIS SURFACE IS FLAT WITHIN .0005" PEAK TO VALLEY AND IS PERPENDICULAR TO THE AXIS OF THE CYLINDRICAL HOLES WITHIN .00025".

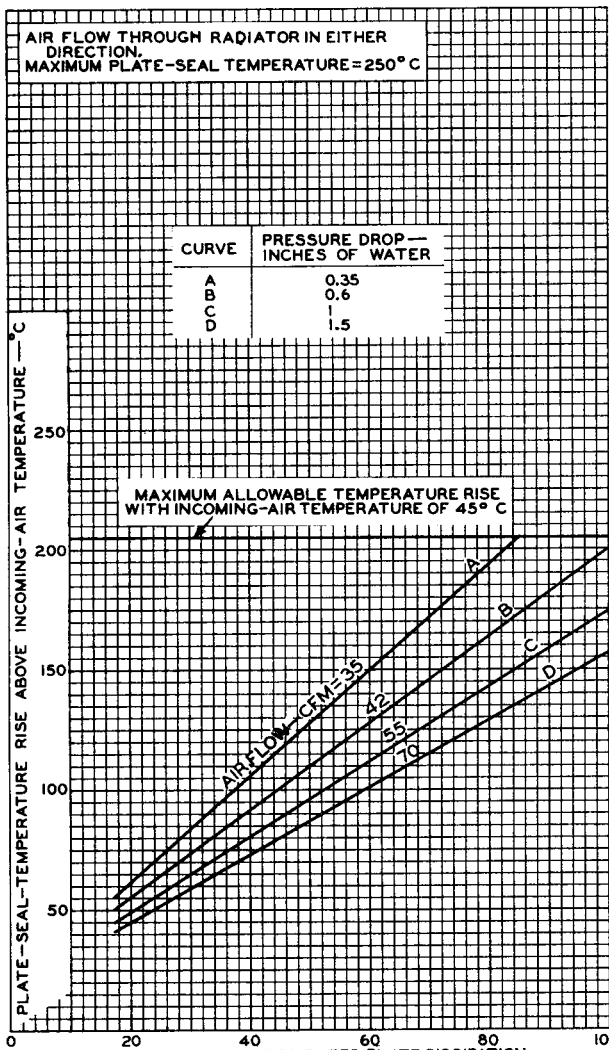
THE AXES OF THE CYLINDRICAL HOLES H_1 THROUGH H_5 AND THE AXIS OF POST P ARE COINCIDENT WITHIN .001".

DETAIL OF POST P

92CM-9735R2

7213

TYPICAL COOLING REQUIREMENTS



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

92CM-9737

7213

RCA

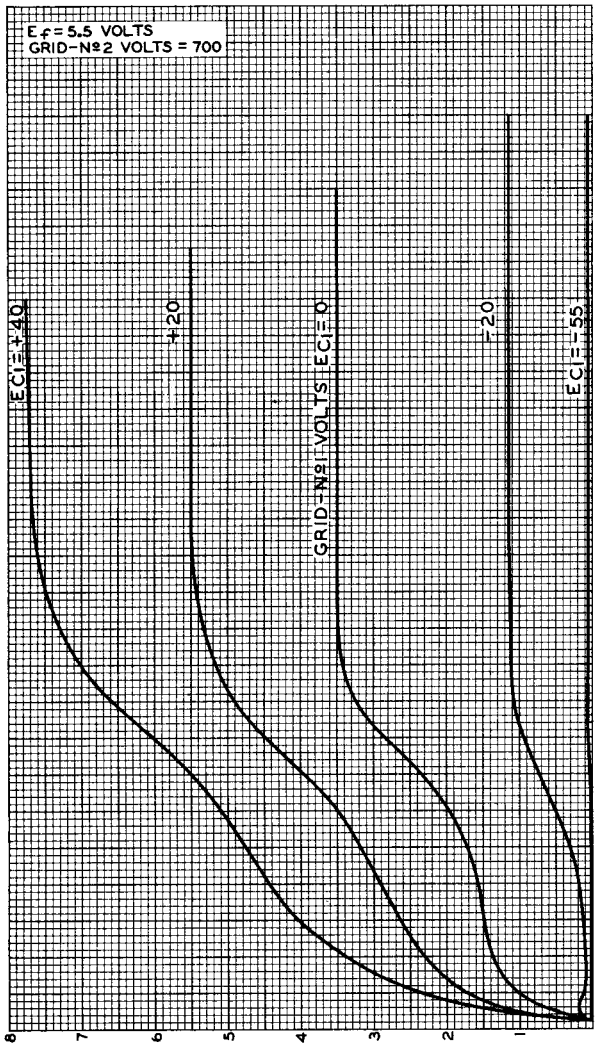
7213

TYPICAL PLATE CHARACTERISTICS

RCA

7213

TYPICAL PLATE CHARACTERISTICS



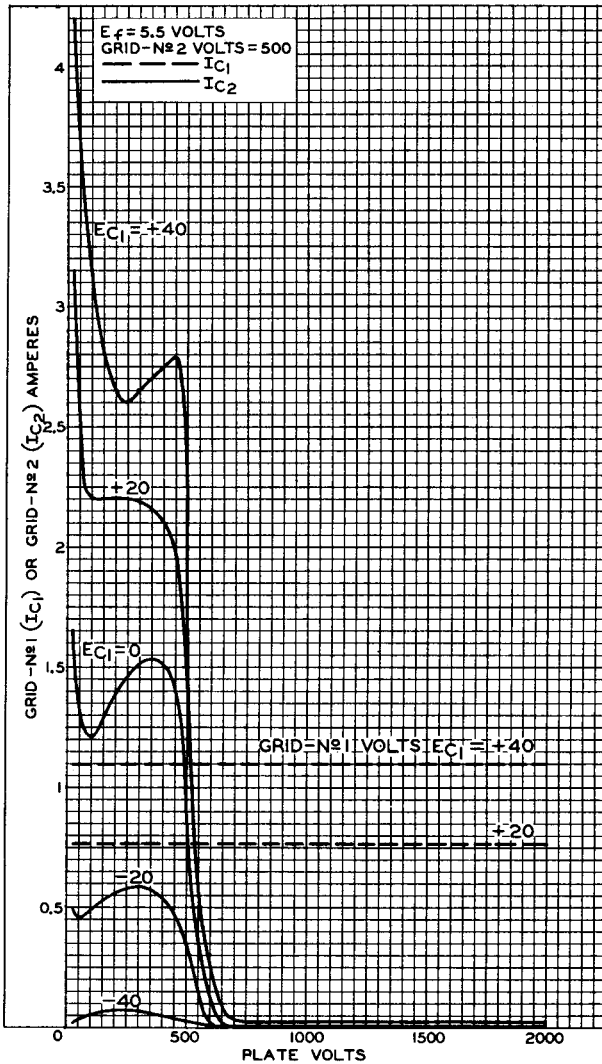
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9753

RCA

7213

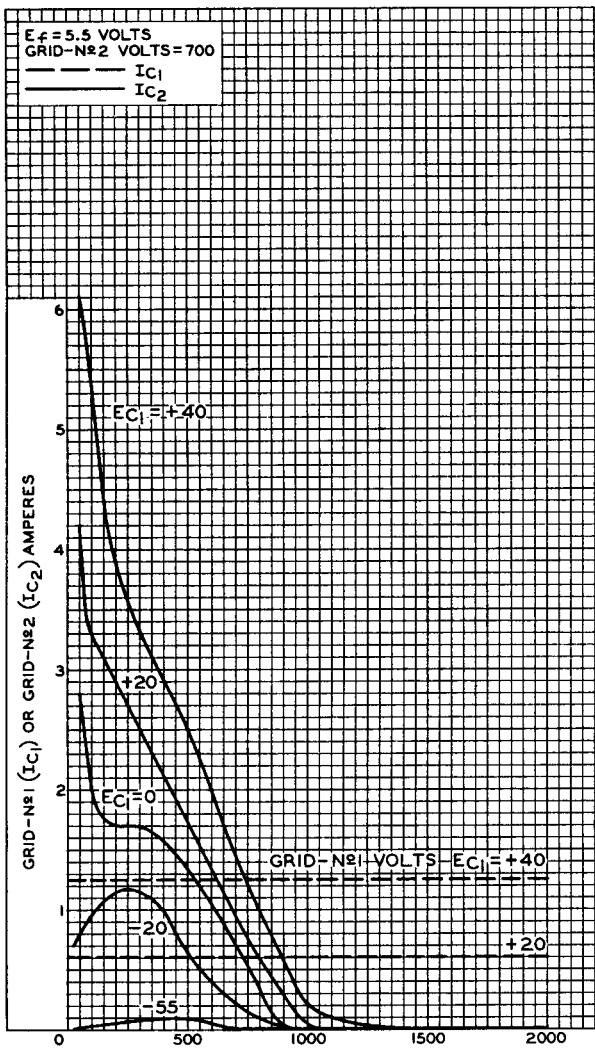
TYPICAL CHARACTERISTICS



RCA

7213

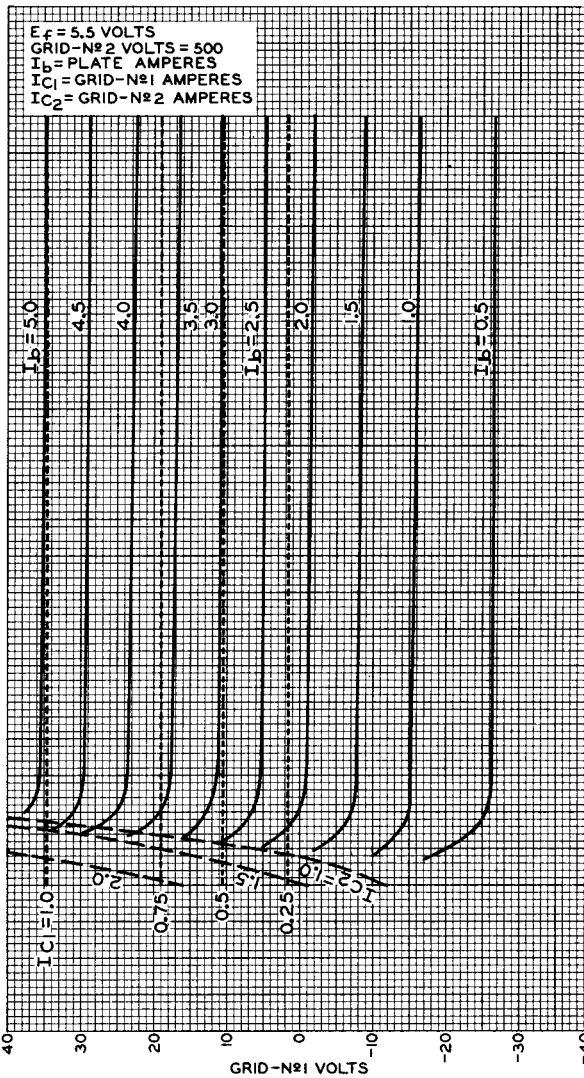
TYPICAL CHARACTERISTICS



RCA

7213

TYPICAL CONSTANT-CURRENT CHARACTERISTICS

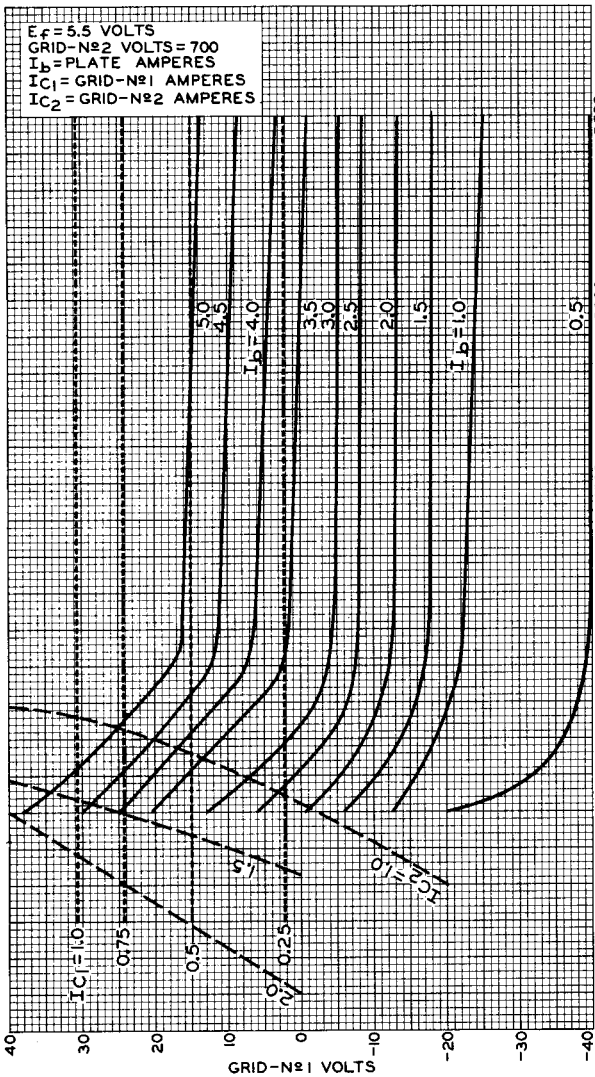


ELECTRON TUBE DIVISION 92CM-9744

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7213

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



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

92CM-9752