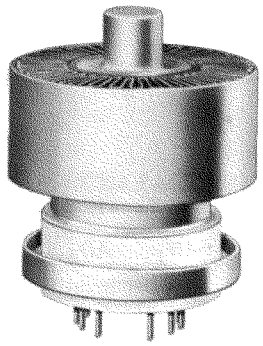


Coaxial-Electrode Structure
Ceramic-Metal Seals
Full Ratings Up to 500 MHz
Forced-Air Cooled
380 Watts PEP Output at 30 MHz AB_1
570 Watts PEP Output at 30 MHz AB_2
300 Watts CW Output at 470 MHz

RCA-8122

BEAM POWER TUBE

RCA-8122 is a very small, low-cost, forced-air-cooled beam power tube designed for use as an rf power amplifier, oscillator, regulator, distributed amplifier, or linear rf power amplifier in mobile or fixed equipment.

The 8122 features a light-weight, cantilever-supported cylindrical electrode structure within a ceramic-metal envelope. This construction provides a very sturdy tube and permits high-temperature operation.

The terminal arrangement of the 8122 facilitates use of the tube with tank circuits of the coaxial or strip-line type. Effective isolation of the output circuit from the input circuit is provided at the higher frequencies by the low-inductance ring terminal for grid-No.2. A base-pin termination for grid-No.2 is also available for operation of the 8122 at the lower frequencies.

The tripod arrangement of both the cathode and the grid-No.1 leads not only simplifies construction, but enhances electrical characteristics. The three cathode leads reduce the inductance path to rf ground and reduce the input admittance at high frequencies.

The three grid-No.1 leads to separate pins accomodate a split-input circuit for distributed amplifier service.

INDEX page

I. DESCRIPTION
- General Data 1
- Ratings 2
- Characteristics Range Values 3
- Footnotes 3
- Dimensional Outline 4
- Basing Diagram 5

II. CHARACTERISTICS
- Cooling 5
- Characteristics Curves 6,7,8

III. GENERAL APPLICATIONS

This bulletin is to be used in conjunction with the publication **Application Guide for RCA Power Tubes, 1CE-300.** For a copy, write RCA, Commercial Engineering, Harrison, N. J.

GENERAL DATA

Electrical:

Heater, for Unipotential:Cathode:		
Voltage (AC or DC)[a]	13.5 ± 10%	volts
Current at 13.5 volts	1.3	A
Minimum heating time	60	s
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 450, Grid-No.2 volts = 325, and plate amperes = 1.2 .	12	
Direct Interelectrode Capacitances:[b]		
Grid No.1 to plate	0.13 max.	pF
Grid No.1 to cathode	16	pF
Plate to cathode	0.011	pF
Grid No.1 to grid No.2	24	pF
Grid No.2 to plate	7.0	pF
Grid No.2 to cathode	2.6	pF
Cathode to heater	3.4	pF

Mechanical:

Operating Position	Any
Maximum Overall Length	2.26"
Seated Length	1.920" ± 0.065"
Greatest Diameter	1.625" ± 0.015"
Base	Large-Wafer Elevenar 11-Pin with Ring (JEDEC No.E11-81)
Socket	Erie▲No. 9802-000 and 9804-000, Johnson■No. 124-311-110, Mycalex* No. CP464-2, or equivalent
Grid No.2 Bypass Capacitor	Erie▲No. 2943-002, Johnson■No. 124-121, or equivalent
Weight (Approx.)	3.5 oz

▲ Erie Technological Products, Inc., 645 West 12th Street, Erie, Pa.
■ E. F. Johnson Co., 1921 10th Ave., S. W., Waseca, Minn.
* Mycalex Corp. of America, 775 Clifton Blvd., Clifton, N. J.

Thermal:

Terminal Temperature (All terminals) . .	250 max.	°C
Radiator Core Temperature (See *Dimensional Outline*)	250 max.	°C
Air Flow: See *Typical Cooling Requirements* on page 5.		

Information furnished by RCA is believed to be accurate and reliable. However, no responsibility is assumed by RCA for its use: nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of RCA.

LINEAR RF POWER AMPLIFIER
Single-Sideband Suppressed-Carrier Service[c]

Peak envelope conditions for a signal having a minimum peak-to-average power ratio of 2

Maximum CCS Ratings, *Absolute-Maximum Values:*

DC PLATE VOLTAGE:			
Up to 30 MHz	3000[d]	max.	volts
Up to 500 MHz	2200	max.	volts
	Up to 500 MHz		
DC GRID-No.2 VOLTAGE	400	max.	volts
DC GRID-No.1 VOLTAGE	−100	max.	volts
DC PLATE CURRENT AT PEAK OF ENVELOPE	450[e]	max.	mA
DC GRID-No.1 CURRENT	100	max.	mA
PLATE DISSIPATION	400	max.	watts
GRID-No.2 DISSIPATION	8	max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	150	max.	volts
Heater positive with respect to cathode	150	max.	volts

Maximum Circuit Values:

Grid-No.1 Circuit Resistance			
Under Any Condition:[i]			
With fixed bias	25000	max.	ohms
With fixed bias (In Class AB_1 operation)	100000	max.	ohms
With cathode bias	Not recommended		
Grid-No.2 Circuit Impedance[h]	10000	max.	ohms
Plate Circuit Impedance[d]	See Note[f]		

Typical CCS Operation at 30 MHz with "Two-Tone Modulation":

	AB_1	AB_2	
DC Plate Voltage	2000	2500	volts
DC Grid-No.2 Voltage	400	400	volts
DC Grid-No.1 Voltage	−35	−35	volts
Zero-Signal DC Plate Current	100	115	mA
Effective RF Load Resistance	3050	3500	ohms
DC Plate Current at Peak of Envelope	335	400	mA
Average DC Plate Current	250	275	mA
DC Grid-No.2 Current at Peak of Envelope	10	6	mA
Average DC Grid-No.2 Current	7	4	mA
DC Grid-No.1 Current at Peak of Envelope	0.05[g]	3	mA
Peak-Envelope Driver Power Output (Approx.)	0.3	0.5	watt
Output-Circuit Efficiency (Approx.)	90	90	%
Distortion Products Level:			
Third order	29[k]	28	dB
Fifth order	32	32	dB
Useful Power Output (Approx.):			
Average	190	285	watts
Peak envelope	380	570	watts

RF POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy[c]
and
RF POWER AMPLIFIER – Class C FM Telephony[c]

Maximum CCS Ratings, *Absolute-Maximum Values:*

	Up to 500 MHz		
DC PLATE VOLTAGE	2200	max.	volts
DC GRID-No.2 VOLTAGE	400	max.	volts
DC GRID-No.1 VOLTAGE	−100	max.	volts
DC PLATE CURRENT	300	max.	mA
DC GRID-No.1 CURRENT	100	max.	mA
GRID-No.2 DISSIPATION	8	max.	watts
PLATE DISSIPATION	400	max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	150	max.	volts
Heater positive with respect to cathode	150	max.	volts

Maximum Circuit Values:

Grid-No.1 Circuit Resistance			
Under Any Condition:			
With fixed bias	25000	max.	ohms
Grid-No.2 Circuit Impedance	10000	max.	ohms
Plate Circuit Impedance	See Note[f]		

Typical CCS Operation:

In Grid-Drive Circuit at 50 MHz

DC Plate Voltage	700	1000	1500	2000	volts
DC Grid-No.2 Voltage	175	200	200	200	volts
DC Grid-No.1 Voltage	−10	−30	−30	−30	volts
DC Plate Current	300	300	300	300	mA
DC Grid-No.2 Current	25	20	20	20	mA
DC Grid-No.1 Current	50	40	40	30	mA
Driver Power Output (Approx.)	1.2	2	2	2	watts
Useful Power Output	120	175	275	375	watts

In Grid-Drive Circuit at 470 MHz

DC Plate Voltage	700	1000	1500	2000	volts
DC Grid-No.2 Voltage	200	200	200	200	volts
DC Grid-No.1 Voltage	−30	−30	−30	−30	volts
DC Plate Current	300	300	300	300	mA
DC Grid-No.2 Current	10	10	5	5	mA
DC Grid-No.1 Current	30	30	30	30	mA
Driver Power Output (Approx.)	5	5	5	5	watts
Useful Power Output	100	165	235	300	watts

PLATE-MODULATED RF POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum CCS Ratings, *Absolute-Maximum Values up to 500 MHz:*

DC PLATE VOLTAGE	1800	max.	volts
DC GRID-No.2 VOLTAGE	400	max.	volts
DC GRID-No.1 VOLTAGE	−100	max.	volts
DC PLATE CURRENT	250	max.	mA
DC GRID-No.1 CURRENT	100	max.	mA
GRID-No.2 INPUT	5	max.	watts
PLATE DISSIPATION	280	max.	watts

CHARACTERISTICS RANGE VALUES

	Note	Min.	Max.	
1. Heater Current	1	1.15	1.45	A
2. Direct Interelectrode Capacitances:				
Grid No.1 to plate . . .	2	–	0.13	pF
Grid No.1 to cathode .	2	14.3	17.7	pF
Plate to cathode	2	0.0065	0.0155	pF
Grid No.1 to grid No.2	2	20.8	25.2	pF
Grid No.2 to plate . . .	2	6.3	7.7	pF
Grid No.2 to cathode .	2	2.0	3.0	pF
Cathode to heater . . .	2	2.5	4.1	pF
3. Grid-No.1 Voltage	1,3	–8	–19	volts
4. Reverse Grid-No.1 Current	1,3	–	–25	μA
5. Grid-No.2 Current	1,3	–5	+6	mA
6. Peak Emission	1,4	13	–	peak A
7. Interelectrode Leakage Resistance	5	50	–	megohm
8. Zero Bias Plate Current .	1,6	1.0	1.8	A

Note 1: With 13.5 volts ac or dc on heater.

Note 2: Measured with special shield adapter.

Note 3: With dc plate voltage at 700 volts, dc grid-No.2 voltage of 250 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 185 mA.

Note 4: For conditions with grid No.1, grid No.2, and plate tied together; and pulse voltage source connected between plate and cathode. Pulse duration is 2.5 microseconds and pulse repetition frequency is 60 pps. The voltage-pulse amplitude is 200 volts peak. After 1 minute at this value, the current-pulse amplitude will not be less than the value specified.

Note 5: Under conditions with tube at 20° to 30° C for at least 30 minutes without any voltages applied to the tube. The minimum resistance between any two electrodes as measured with a 200-volt Megger-type ohmmeter having an internal impedance of 1.0 megohm, will be no less than the valve specified.

Note 6: With dc plate voltage of 450 volts, dc grid No.2 voltage of 400 volts, dc grid No.1 voltage of –100 volts, grid drive voltage to zero. With pulse duration of 4500 to 5000 μs and pulse repetition frequency is 10 to 12 pps.

FOOTNOTES

[a]Because the cathode is subjected to back bombardment as the frequency is increased with resultant increase in temperature, the heater voltage should, for optimum life, be reduced to a value such that at the heater voltage obtained at minimum supply voltage conditions (all other voltages constant) the tube performance just starts to show some degradation; e.g., at 470 MHz heater volts = 12.5 (approx.).

[b]Measured with special shield adapter.

[c]See Section V.C. of 1CE-300.

[d]For operation above 2200 plate volts, the tube shall see an effective plate-supply impedance of no less than 750 ohms. A fault current limiting resistor of no less than 15 ohms is to be used between the output filter capacitance and the tube plate. The plate-supply-output-filter capacitance is to be no greater than 10 μF.

[e]The maximum rating for a signal having a minimum peak-to-average power ratio less than 2, such as is obtained in "Single-Tone" operation, is 300 mA. During short periods of circuit adjustment under "Single-Tone" conditions, the average plate current may be as high as 450 mA.

[f]The tube should see an effective plate supply impedance which limits the peak current through the tube under surge conditions to 15 amperes.

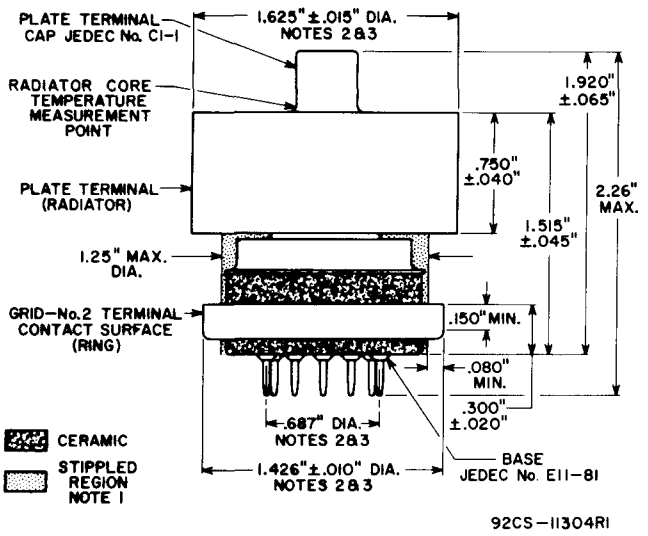
[g]This value represents the approximate grid-No.1 current obtained due to initial electron velocities and contact-potential effects when grid No.1 is driven to zero volts at maximum signal.

[h]A fault current limiting resistor of no less than 320 ohms is to be used between the screen output filter capacitance and the tube screen. The screen supply output filter capacitance is to be no greater than 80 μF.

[i]A fault current limiting resistor of no less than 20 ohms is to be used between the bias supply output filter capacitance and the tube grid-No.1. The bias supply output filter capacitance is to be no greater than 150 μF.

[k]The value of third order distortion product level shown may be improved by approximately 5 dB by utilizing an unbypassed, non-inductive 20-ohm resistor between the cathode and ground; a slight increase in drive power will be required.

DIMENSIONAL OUTLINE



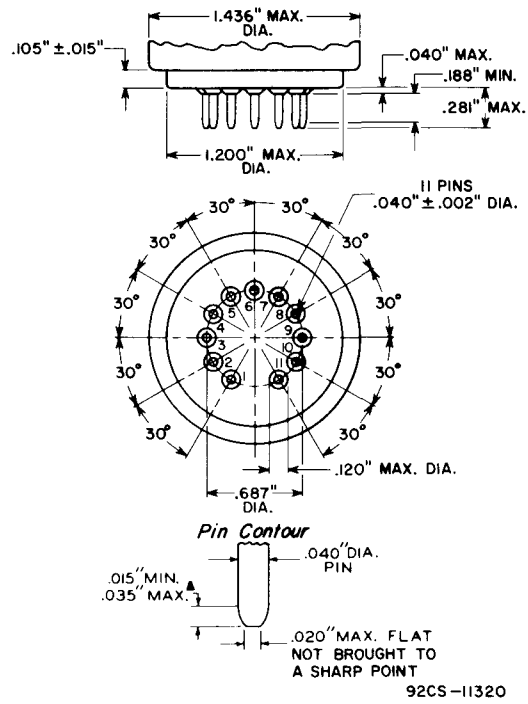
NOTE 1: Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular volumes.

NOTE 2: The diameters of the radiator, grid-No.2 terminal contact surface, and pin circle to be concentric within the following values of maximum full indicator reading:

Radiator to Grid-No.2
Terminal Contact Surface . . . . 0.030" max.
Radiator to Pin Circle . . . . . 0.040" max.
Grid-No.2 Terminal Contact. . . . .
Surface to Pin Circle . . . . . 0.030" max.

NOTE 3: The full indicator reading is the maximum deviation in radial position of a surface when the tube is completely rotated about the center of the reference surface. It is a measure of the total effect of run-out and ellipticity.

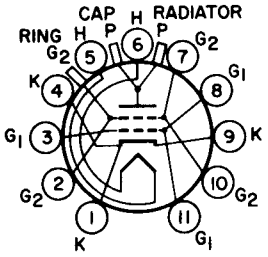
BASE DRAWING LARGE-WAFER ELEVENAR 11-PIN WITH RING JEDEC No.E11-81



* This dimension around the periphery of any individual pin may vary within the limits shown.

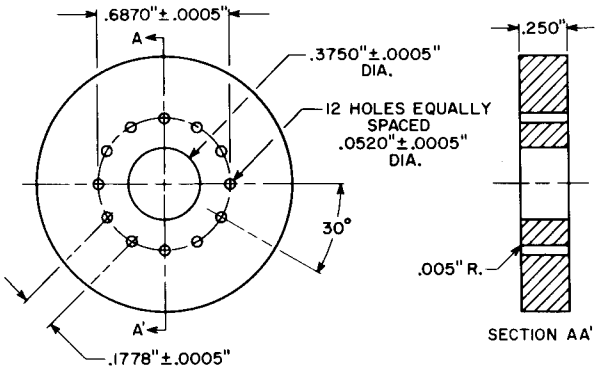
BASING DIAGRAM

Bottom View



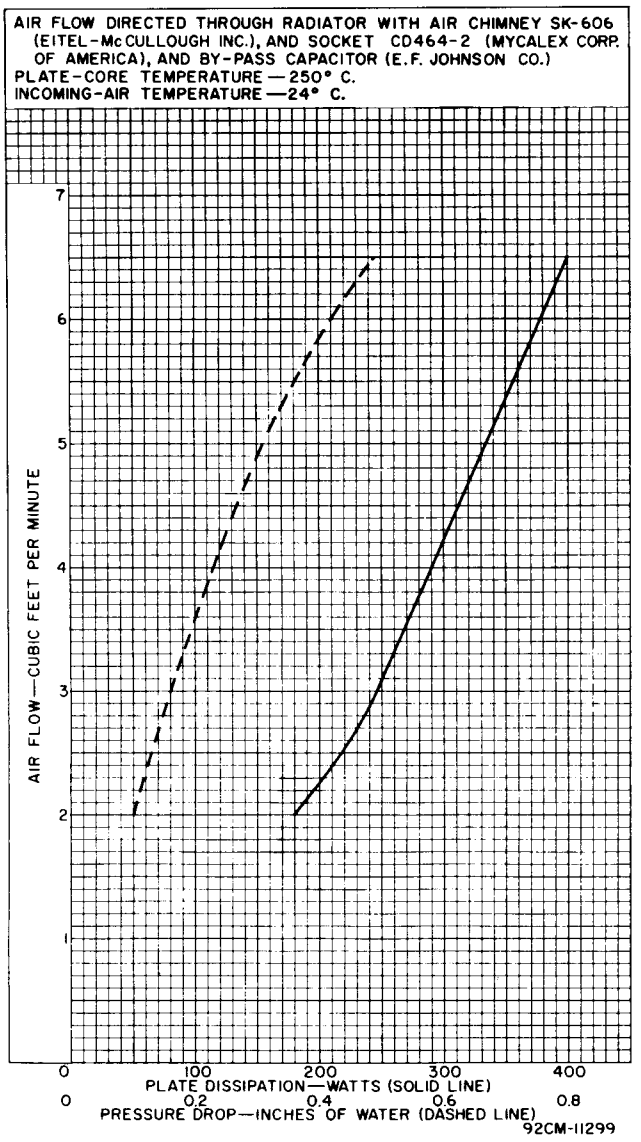
Pin 1: Cathode
Pin 2: Grid No.2
Pin 3: Grid No.1
Pin 4: Cathode
Pin 5: Heater
Pin 6: Heater
Pin 7: Grid No.2
Pin 8: Grid No.1
Pin 9: Cathode
Pin 10: Grid No.2
Pin 11: Grid No.1
Cap: Plate Terminal
Radiator: Plate Terminal
Ring: Grid-No.2 Terminal Contact Surface (For use at higher frequencies)

GAUGE DRAWING
JEDEC No.GE11-1



92CS-11310

TYPICAL COOLING REQUIREMENTS



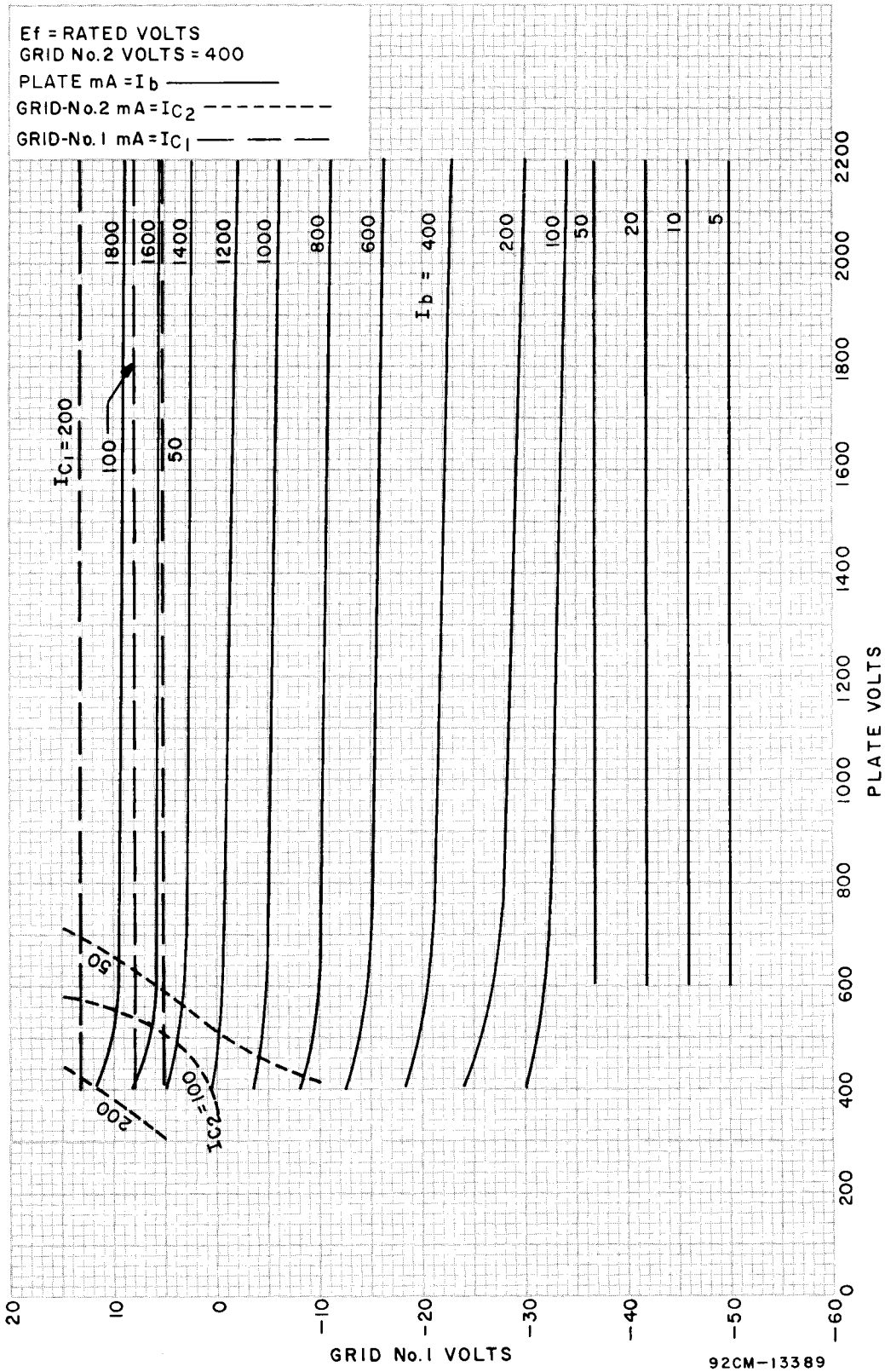
92CM-11299

REFERENCES

1. Application Guide for RCA Power Tubes, 1CE-300.
2. J. F. Gaylord, "The Conduction Cooling of Power Tubes in Vehicular Communication Equipment", IEEE Transactions on Vehicular Communication, September, 1963.

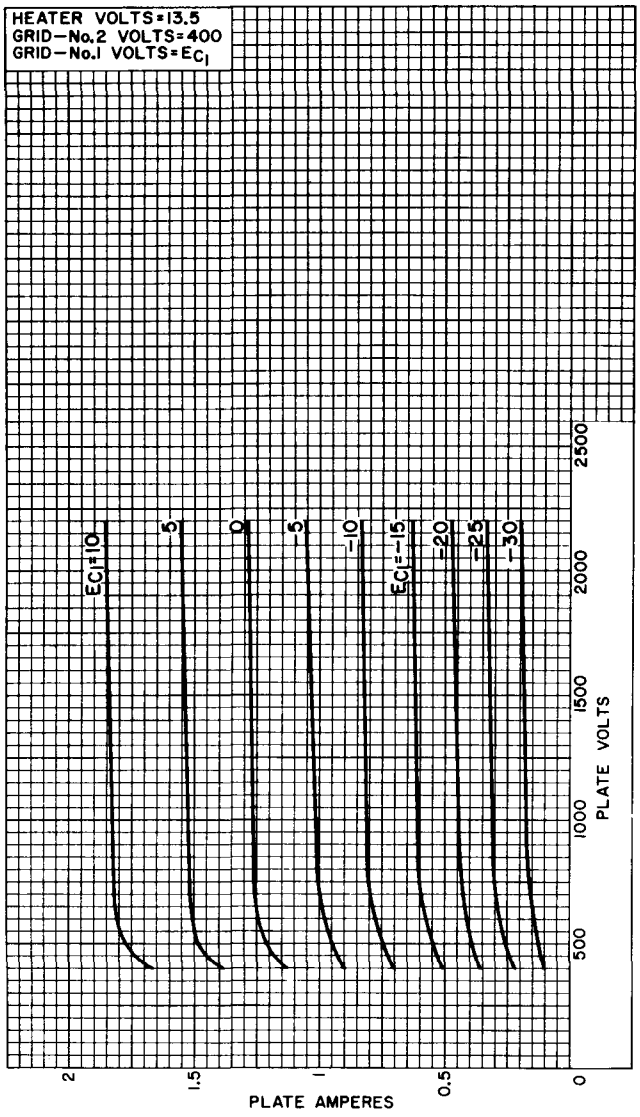
TYPICAL CONSTANT-CURRENT CHARACTERISTICS

For Grid-No.2 Voltage = 400 Volts



TYPICAL PLATE CHARACTERISTICS

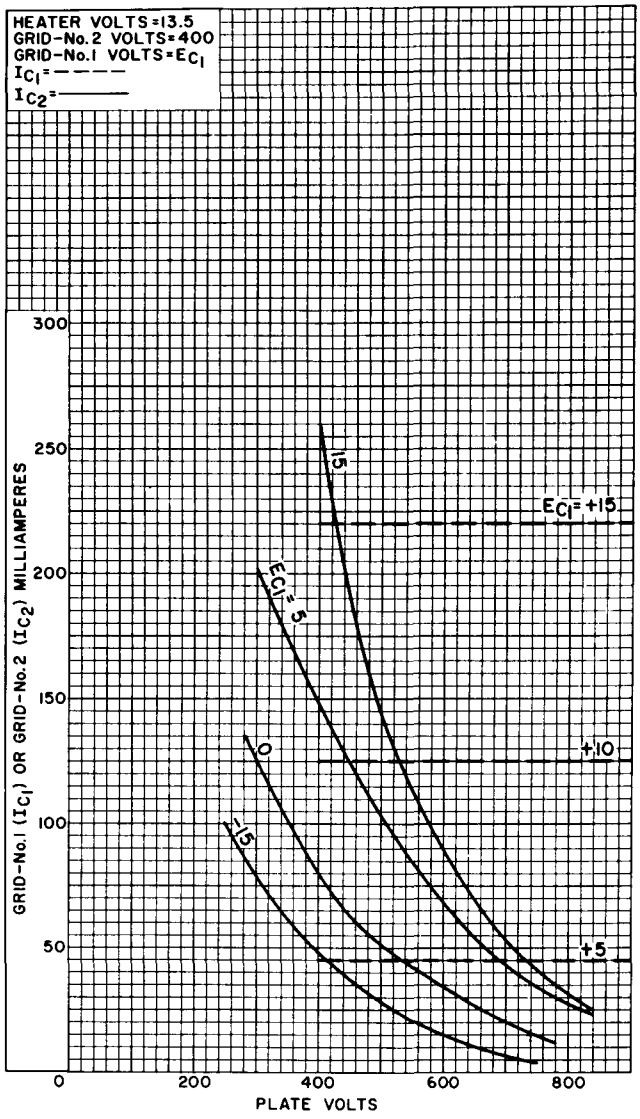
For Grid-No.2 Voltage = 400 Volts



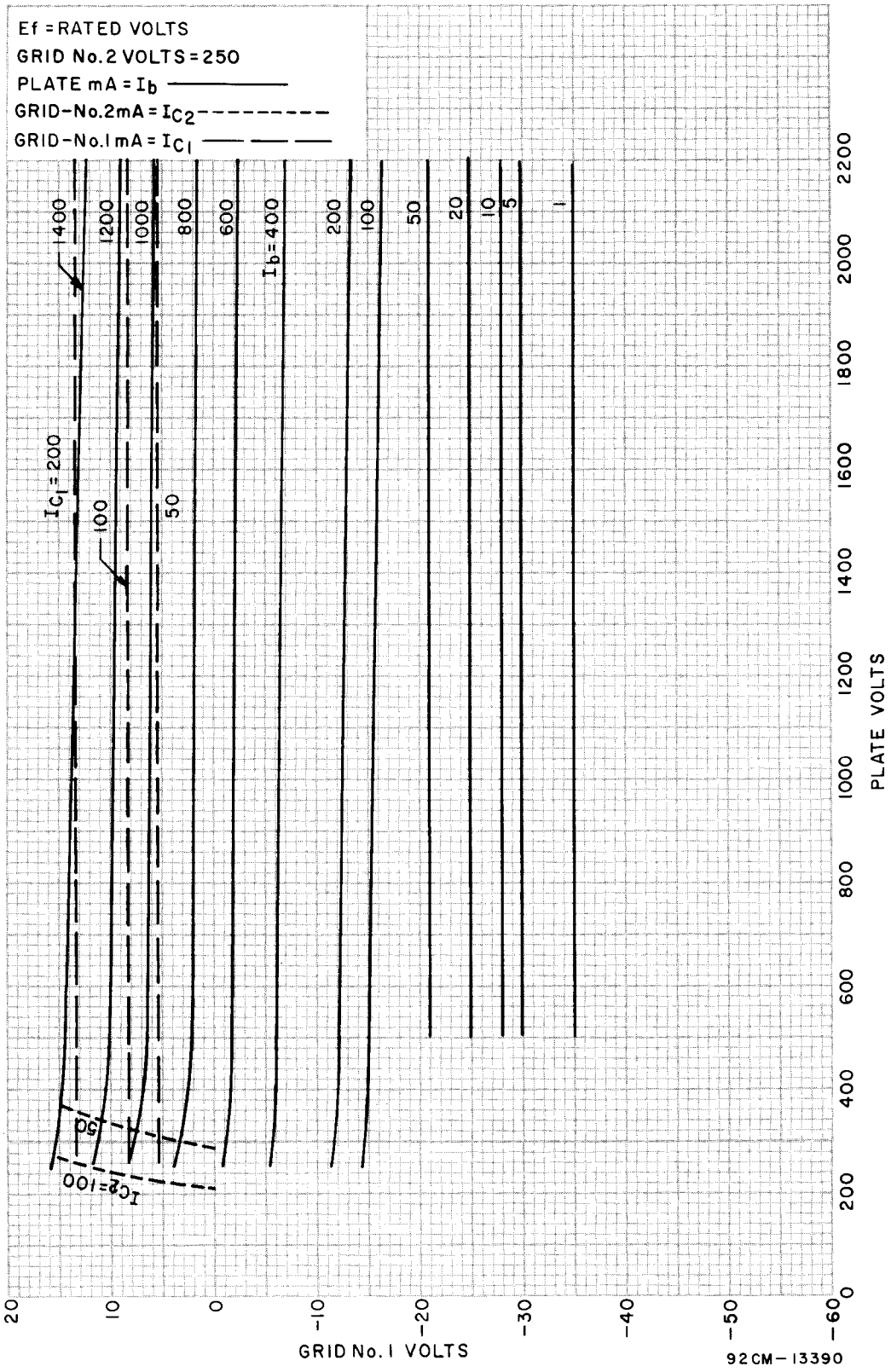
92CM-11290

TYPICAL CHARACTERISTICS

For Grid-No.2 Voltage = 400 Volts



92CM-11293R1

TYPICAL CONSTANT-CURRENT CHARACTERISTICS

For Grid-No.2 Voltage = 250 Volts