

# Beam Power Tube

FORCED-AIR COOLED

INTEGRAL RADIATOR

CERAMIC-METAL SEALS

380 WATTS PEP OUTPUT AT 30 MHz AB<sub>1</sub>

COAXIAL ELECTRODE STRUCTURE

570 WATTS PEP OUTPUT AT 30 MHz AB<sub>2</sub>

UNIPOTENTIAL CATHODE

300 WATTS CW OUTPUT AT 470 MHz

*For Use as an RF Power Amplifier, Oscillator, Regulator, Distributed Amplifier or Linear RF Power Amplifier in Mobile or Fixed Equipment*

## ELECTRICAL

### Heater, for Unipotential Cathode<sup>P</sup>

|                                           |            |   |
|-------------------------------------------|------------|---|
| Voltage (AC or DC) <sup>a</sup> . . . . . | 13.5 ± 10% | V |
| Current at 13.5 volts. . . . .            | 1.3        | A |
| Minimum heating time . . . . .            | 60         | s |

### Mu-Factor, Grid No.2 to Grid No.1 . . . . . 12

Plate volts = 450, grid-No.2 volts = 325,  
plate amperes = 1.2

### Direct Interelectrode Capacitances<sup>b</sup>

|                                  |          |    |
|----------------------------------|----------|----|
| 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        | pF |
| Grid No.2 to cathode . . . . .   | 2.6      | pF |
| Cathode to heater. . . . .       | 3.4      | pF |

## MECHANICAL

Operating Position . . . . . Any

Maximum Overall Length . . . . . 2.26 in

Seated Length. . . . . 1.920 ± 0.065 in

Diameter . . . . . 1.625 ± 0.015 in

Weight (Approx.) . . . . . 3.5 oz

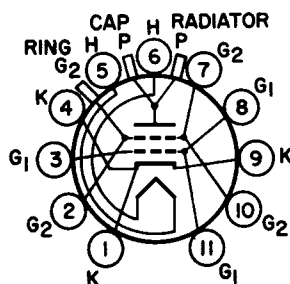
Socket . . . . . Erie<sup>c</sup> No.9802-000 and 9804-000, Johnson<sup>d</sup>  
No.124-311-110, Mycalex<sup>e</sup> No.CP464-2, or equivalent

Grid No.2 Bypass Capacitor . . . . . Erie<sup>c</sup> No.2943-002, Johnson<sup>d</sup>  
No.124-121, or equivalent

Base . . Large-Wafer Elevenar 11-Pin with Ring (JEDEC No.E11-81)

## TERMINAL 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)

## THERMAL

Terminal Temperature (All Terminals) . . . . . 250 max °C

Radiator Core Temperature

See *Dimensional Outline*. . . . . 250 max °C

Air Flow<sup>q</sup> (See accompanying *Typical Cooling Requirements* curve).



RADIO CORPORATION OF AMERICA

Electronic Components and Devices

Harrison, N. J.

DATA 1

10-66

LINEAR RF POWER AMPLIFIER<sup>r</sup>

Single-Sideband Suppressed-Carrier Service  
*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 <sup>f</sup> | V |
| Up to 500 MHz. . . . . | 2200              | V |

Up to 500 MHz

|                                               |                  |    |
|-----------------------------------------------|------------------|----|
| DC Grid-No.2 Voltage . . . . .                | 400              | V  |
| DC Grid-No.1 Voltage . . . . .                | -100             | V  |
| DC Plate Current at Peak of Envelope. . . . . | 450 <sup>g</sup> | mA |
| DC Grid-No.1 Current . . . . .                | 100              | mA |
| Plate Dissipation . . . . .                   | 400              | W  |
| Grid-No.2 Dissipation. . . . .                | 8                | W  |
| Peak Heater-Cathode Voltage. . . . .          | ±150             | V  |

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

|                                                | AB <sub>1</sub>   | AB <sub>2</sub> |    |
|------------------------------------------------|-------------------|-----------------|----|
| DC Plate Voltage . . . . .                     | 2000              | 2500            | V  |
| DC Grid-No.2 Voltage . . . . .                 | 400               | 400             | V  |
| DC Grid-No.1 Voltage . . . . .                 | -35               | -35             | V  |
| Zero-Signal DC Plate Current . . . . .         | 100               | 115             | mA |
| Effective RF Load Resistance . . . . .         | 3050              | 3500            | Ω  |
| DC Plate Current                               |                   |                 |    |
| Peak of envelope . . . . .                     | 335               | 400             | mA |
| Average. . . . .                               | 250               | 275             | mA |
| DC Grid-No.2 Current                           |                   |                 |    |
| Peak of envelope . . . . .                     | 10                | 6               | mA |
| Average. . . . .                               | 7                 | 4               | mA |
| Average DC Grid-No.1 Current . . . . .         | 0.05 <sup>h</sup> | 3               | mA |
| Peak-of-Envelope Driver Power Output (Approx.) | 0.3               | 0.5             | W  |
| Output-Circuit Efficiency (Approx.). . . . .   | 90                | 90              | %  |
| Distortion Products Level                      |                   |                 |    |
| Third order. . . . .                           | 29 <sup>j</sup>   | 28              | dB |
| Fifth order. . . . .                           | 32                | 32              | dB |
| Useful Power Output (Approx.)                  |                   |                 |    |
| Peak of envelope . . . . .                     | 380               | 570             | W  |
| Average. . . . .                               | 190               | 285             | W  |

## Maximum Circuit Values

Grid-No.1 Circuit Resistance Under Any Condition<sup>k</sup>

|                                                                |                 |   |
|----------------------------------------------------------------|-----------------|---|
| With fixed bias. . . . .                                       | 25000           | Ω |
| With fixed bias (In Class-AB <sub>1</sub> operation) . . . . . | 100000          | Ω |
| With cathode bias. . . . .                                     | Not recommended |   |

|                                                    |       |   |
|----------------------------------------------------|-------|---|
| Grid-No.2-Circuit Impedance <sup>m</sup> . . . . . | 10000 | Ω |
| Plate-Circuit Impedance <sup>f</sup> . . . . .     | n     |   |

PLATE-MODULATED RF POWER AMPLIFIER - Class C Telephony<sup>r</sup>

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

Maximum CCS Ratings, Absolute-Maximum Values

Up to 500 MHz

|                                |      |   |
|--------------------------------|------|---|
| DC Plate Voltage . . . . .     | 1800 | V |
| DC Grid-No.2 Voltage . . . . . | 400  | V |
| DC Grid-No.1 Voltage . . . . . | -100 | V |



|                                |     |    |
|--------------------------------|-----|----|
| DC Plate Current . . . . .     | 250 | mA |
| DC Grid-No.1 Current . . . . . | 100 | mA |
| Grid-No.2 Input. . . . .       | 5   | W  |
| Plate Dissipation. . . . .     | 280 | W  |

**RF POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy<sup>r</sup>**  
and

**RF POWER AMPLIFIER - Class C FM Telephony<sup>r</sup>**

**Maximum CCS Ratings, Absolute-Maximum Values**

|                                      |                      |    |
|--------------------------------------|----------------------|----|
|                                      | <i>Up to 500 MHz</i> |    |
| DC Plate Voltage . . . . .           | 2200                 | V  |
| DC Grid-No.2 Voltage . . . . .       | 400                  | V  |
| DC Grid-No.1 Voltage . . . . .       | -100                 | V  |
| DC Plate Current . . . . .           | 300                  | mA |
| DC Grid-No.1 Current . . . . .       | 100                  | mA |
| Grid-No.2 Dissipation. . . . .       | 8                    | W  |
| Plate Dissipation. . . . .           | 400                  | W  |
| Peak Heater-Cathode Voltage. . . . . | ±150                 | V  |

**Typical CCS Operation**

*In grid-drive circuit at 50 MHz*

|                                    |     |      |      |      |    |
|------------------------------------|-----|------|------|------|----|
| DC Plate Voltage . . . . .         | 700 | 1000 | 1500 | 2000 | V  |
| DC Grid-No.2 Voltage . . . . .     | 175 | 200  | 200  | 200  | V  |
| DC Grid-No.1 Voltage . . . . .     | -10 | -30  | -30  | -30  | V  |
| 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    | W  |
| Useful Power Output. . . . .       | 120 | 175  | 275  | 375  | W  |

*In grid-drive circuit at 470 MHz*

|                                    |     |      |      |      |    |
|------------------------------------|-----|------|------|------|----|
| DC Plate Voltage . . . . .         | 700 | 1000 | 1500 | 2000 | V  |
| DC Grid-No.2 Voltage . . . . .     | 200 | 200  | 200  | 200  | V  |
| DC Grid-No.1 Voltage . . . . .     | -30 | -30  | -30  | -30  | V  |
| 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    | W  |
| Useful Power Output. . . . .       | 100 | 165  | 235  | 300  | W  |

**Maximum Circuit Values**

**Grid-No.1 Circuit Resistance Under Any Condition**

With fixed bias. . . . . 25000  $\Omega$ .

**Grid-No.2-Circuit Impedance. . . . .** 10000  $\Omega$

**Plate-Circuit Impedance. . . . .** n

<sup>a</sup> 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.).

<sup>b</sup> Measured with special shield adapter.

<sup>c</sup> Erie Technological Products, Inc., 645 West 12th Street, Erie, Pa.

<sup>d</sup> E. F. Johnson Co., 1921 10th Ave. S.W. Waseca, Minn.

<sup>e</sup> Mycalex Corporation of America, 775 Clifton Boulevard, Clifton.

<sup>f</sup> 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  $\mu\text{F}$ .

g 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.

h 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.

j 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.

k 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  $\mu\text{F}$ .

m 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  $\mu\text{F}$ .

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

The following footnotes apply to the *RCA Transmitting Tube Operating Considerations* given at front of this section.

p See *Electrical Considerations* - Filament or Heater.

q See *Cooling Considerations* - Forced-Air Cooling.

r See *Classes of Service*.

### CHARACTERISTICS RANGE VALUES

| Test No.                               | 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    | 5.7    | 7.1    | 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    | V             |
| 4. Reverse Grid-No.1 Current . . . . . | 1,3  | -      | -25    | $\mu\text{A}$ |
| → 5. Grid-No.2 Current . . . . .       | 1,3  | -7     | +6     | mA            |
| 6. Peak Emission . . . . .             | 1,4  | 13     | -      | peak A        |
| → 7. Interelectrode Leakage Resistance | 5    | 50     | -      | M $\Omega$    |
| → 8. Zero Bias Plate Current . . . . . | 1,6  | 1      | 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.

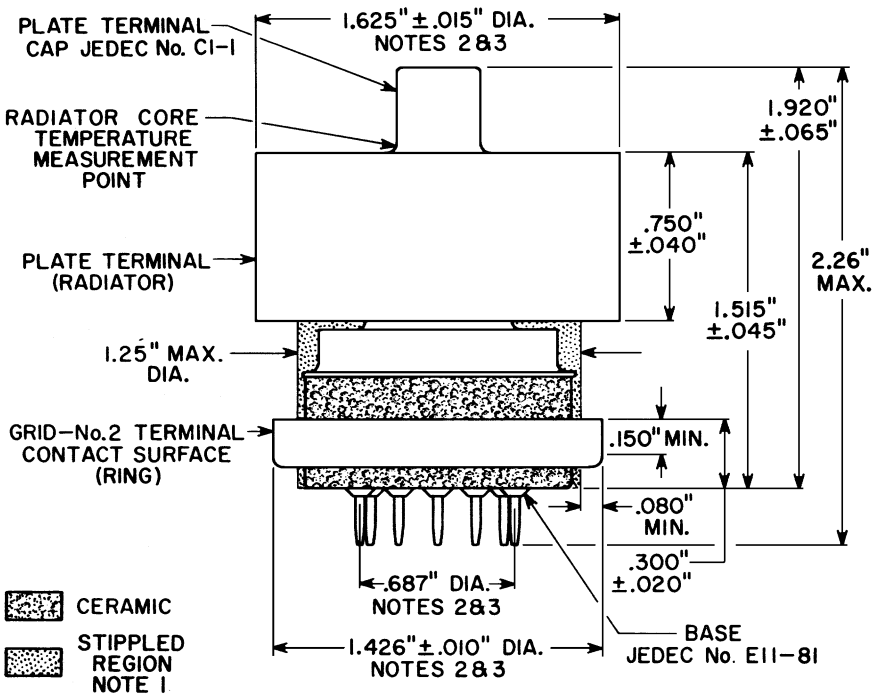
Note 4: For conditions with grid No.1, grid No.2, and plate tied together; and pulse voltage source connected between plate and cathode. Pulse duration is 2.5 microseconds and pulse repetition frequency is 60 p/s. The voltage-pulse amplitude is 200 volts peak. After 1 minute at this value, the current-pulse 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 megohm, will be no less than the value 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  $\mu\text{s}$  and pulse repetition frequency is 10 to 12 p/s.

→ Indicates a change.





92CS-11304RI

**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

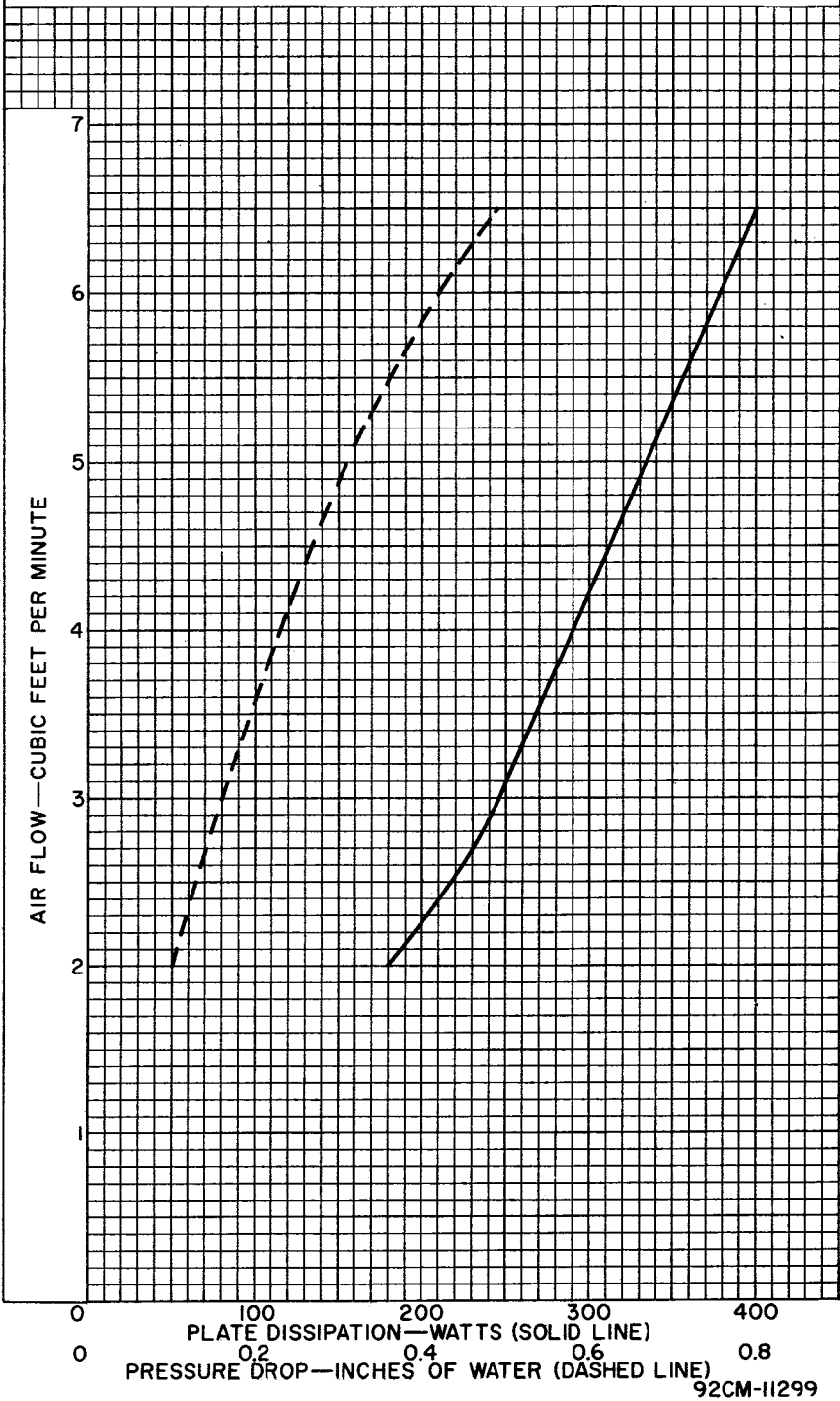
Surface to Pin Circle . . . . . 0.030" max.

**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.

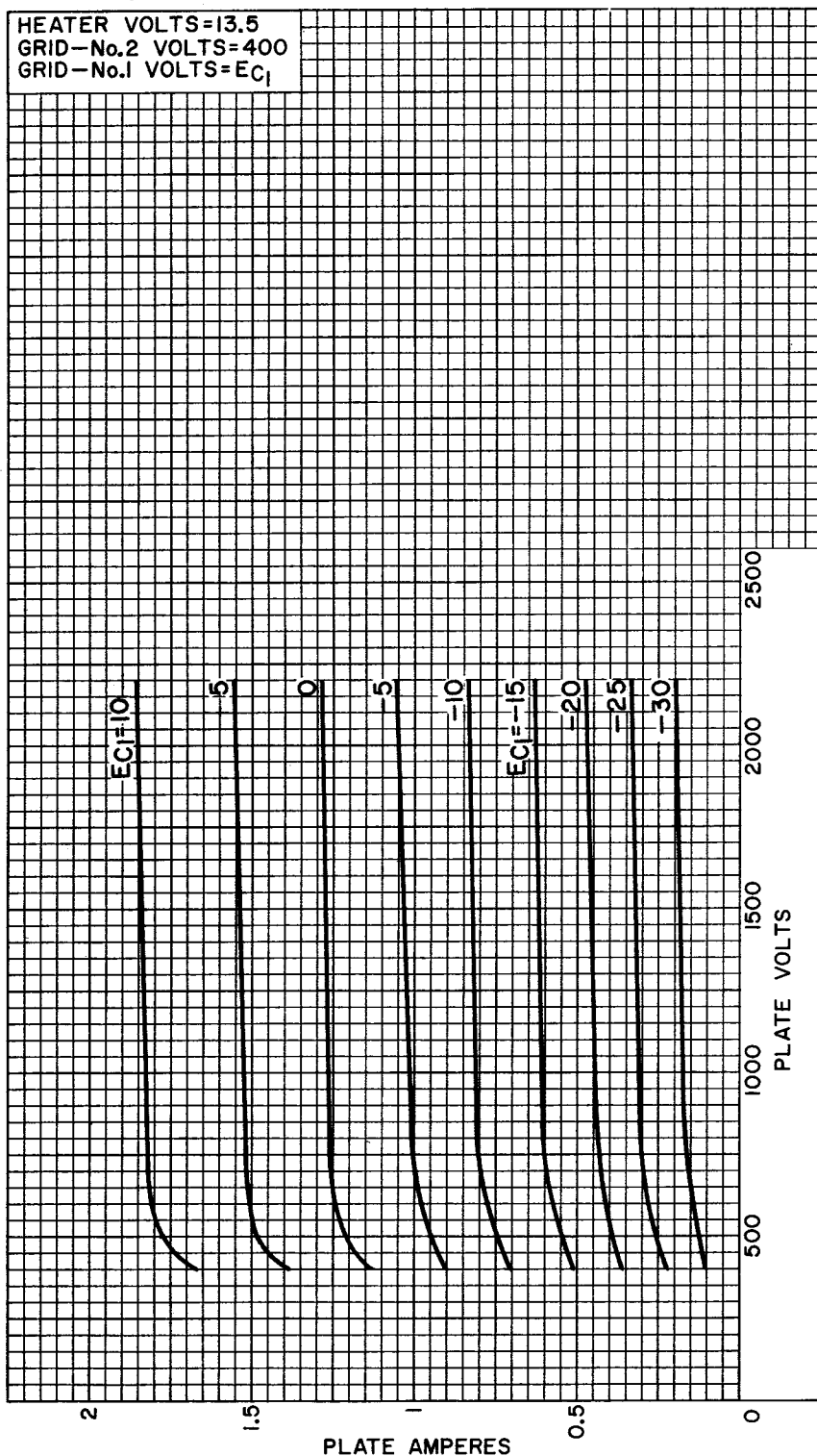


TYPICAL COOLING REQUIREMENTS

AIR FLOW DIRECTED THROUGH RADIATOR WITH AIR CHIMNEY SK-606 (EITEL-McCULLOUGH INC.), AND SOCKET CD464-2 (MYCALEX CORP. OF AMERICA), AND BY-PASS CAPACITOR (E.F. JOHNSON CO.)  
PLATE-CORE TEMPERATURE — 250° C.  
INCOMING-AIR TEMPERATURE — 24° C.



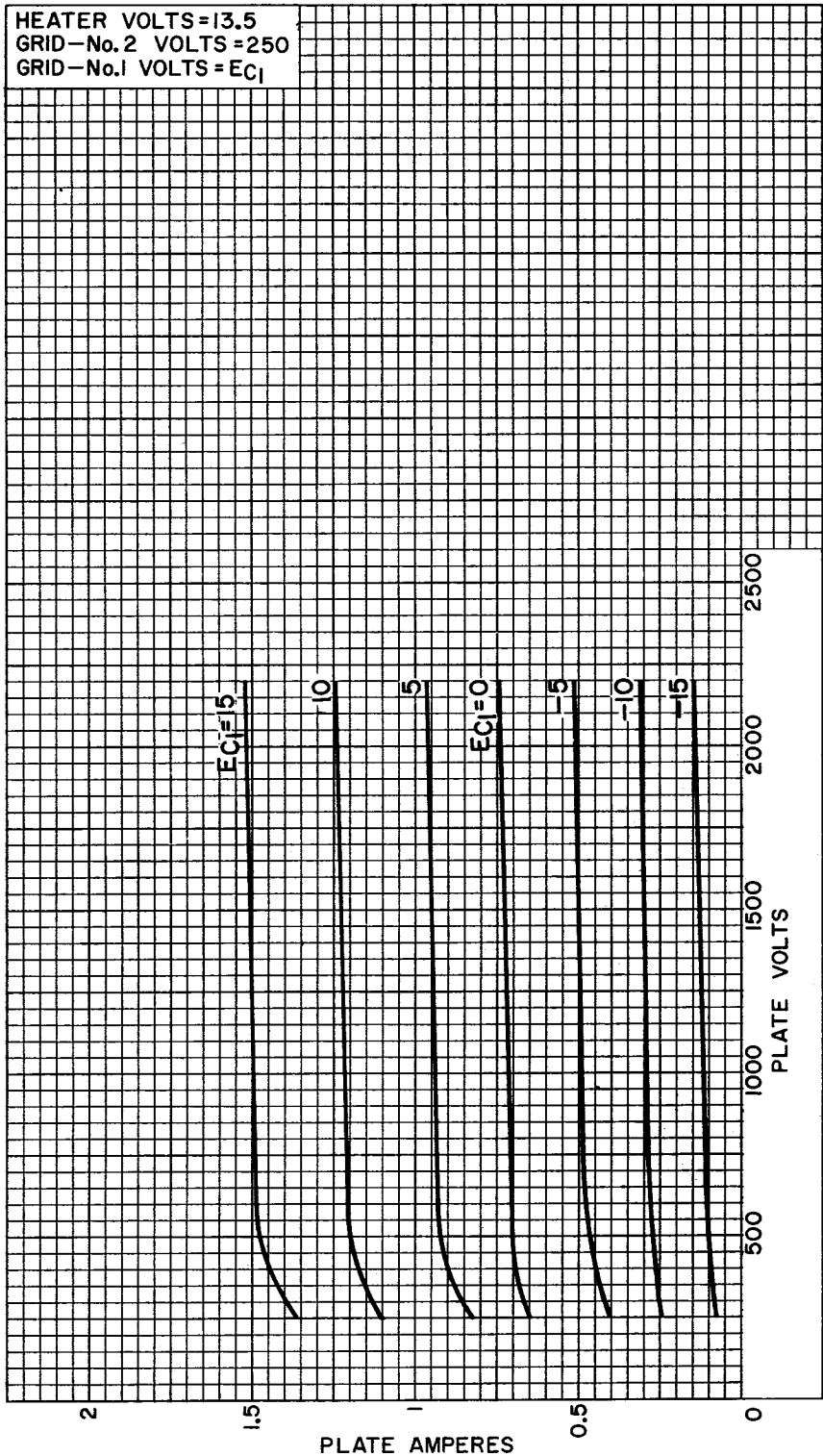
## TYPICAL PLATE CHARACTERISTICS



92CM-11290



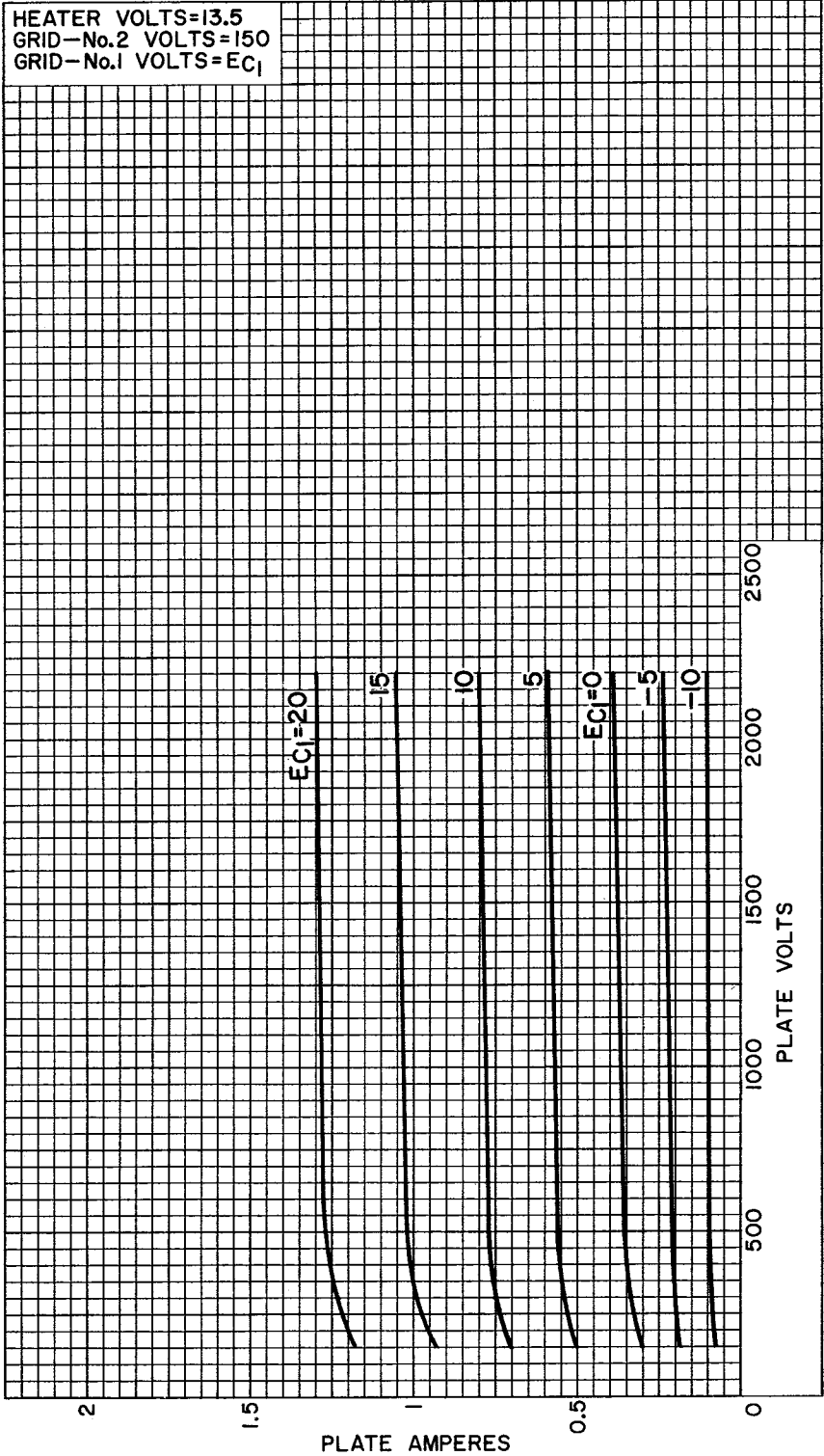
## TYPICAL PLATE CHARACTERISTICS



92CM-11288



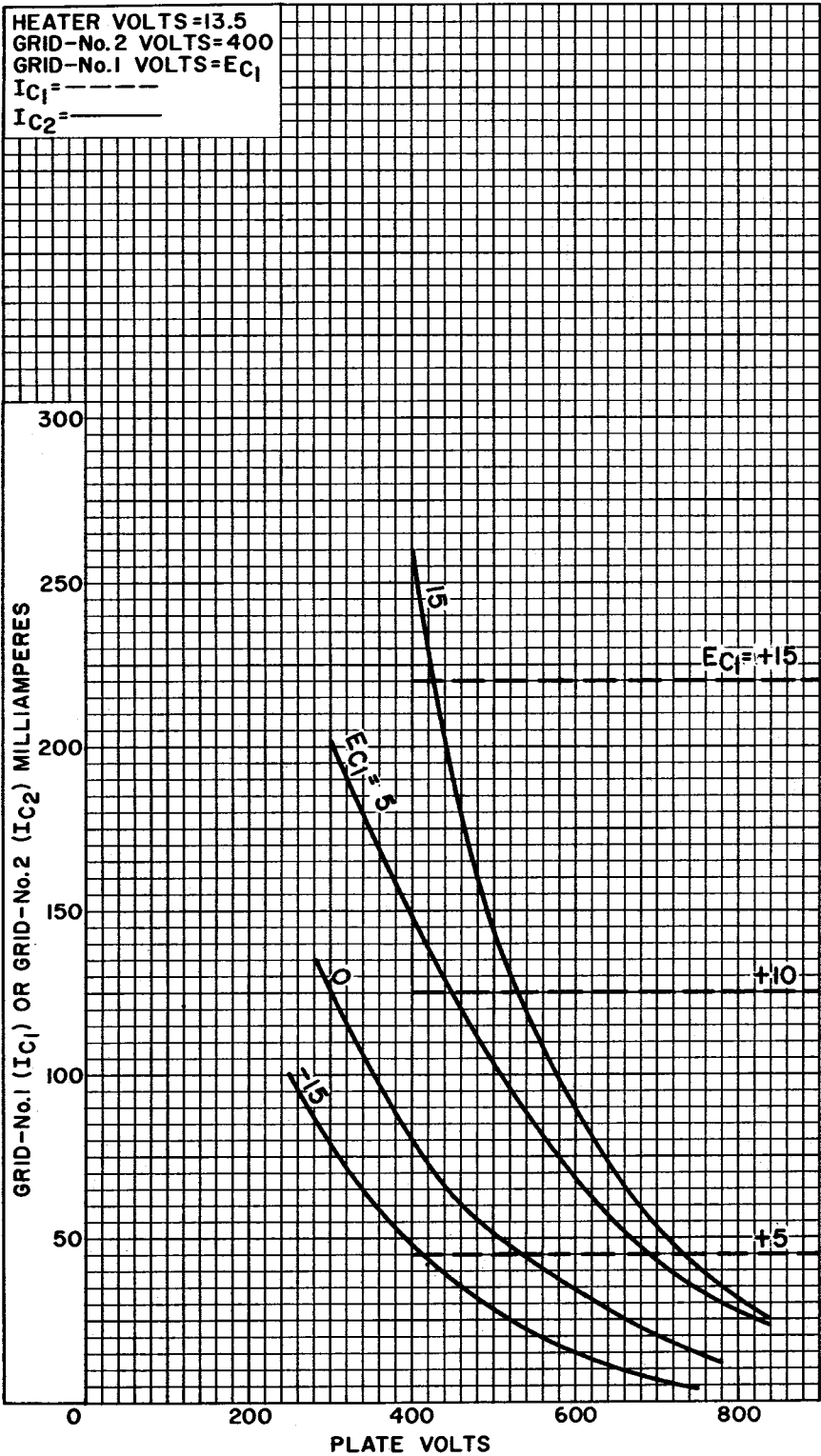
## TYPICAL PLATE CHARACTERISTICS



92CM-11289



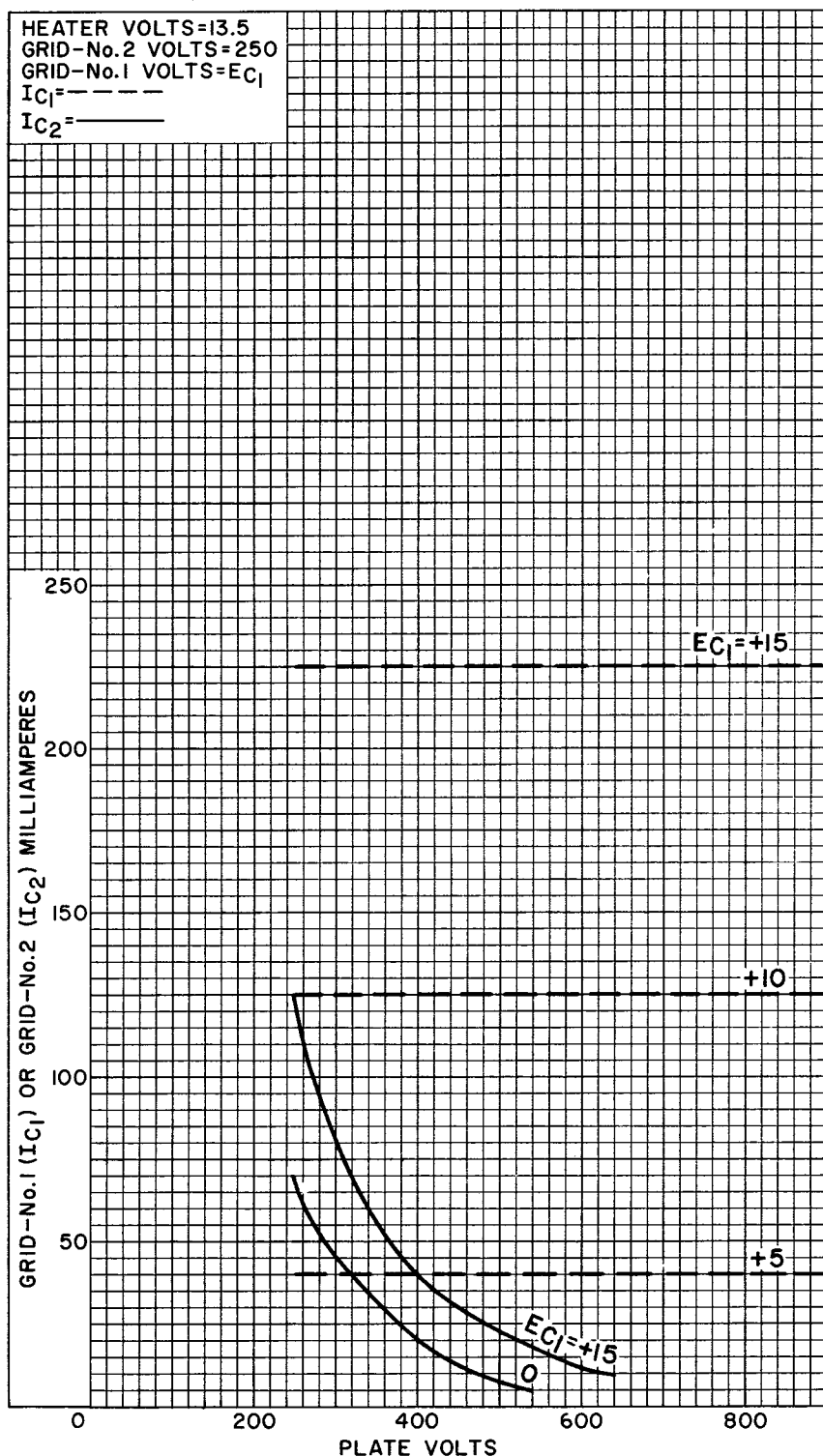
TYPICAL CHARACTERISTICS



92CM-11293RI



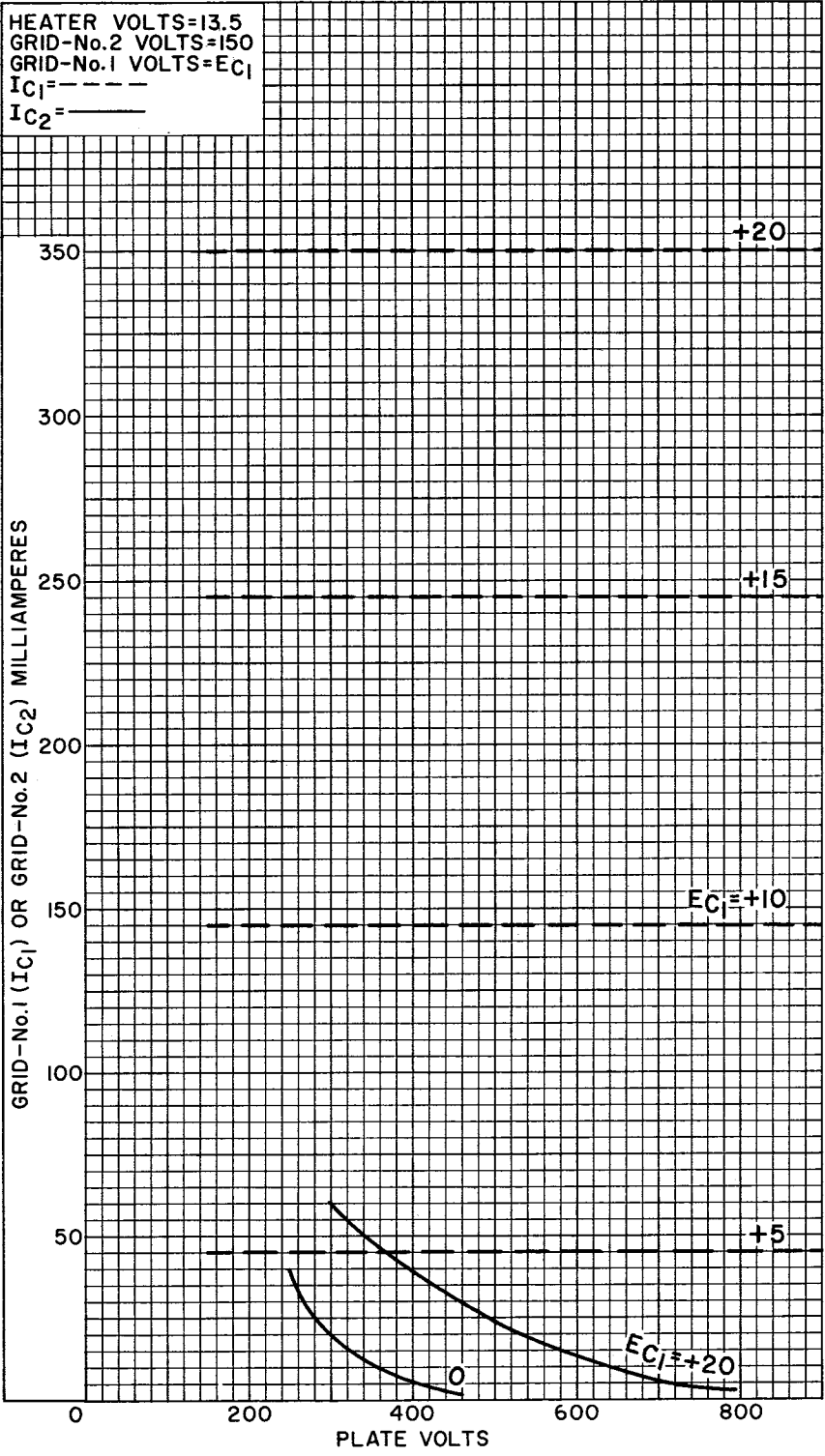
## TYPICAL CHARACTERISTICS



92CM-11291



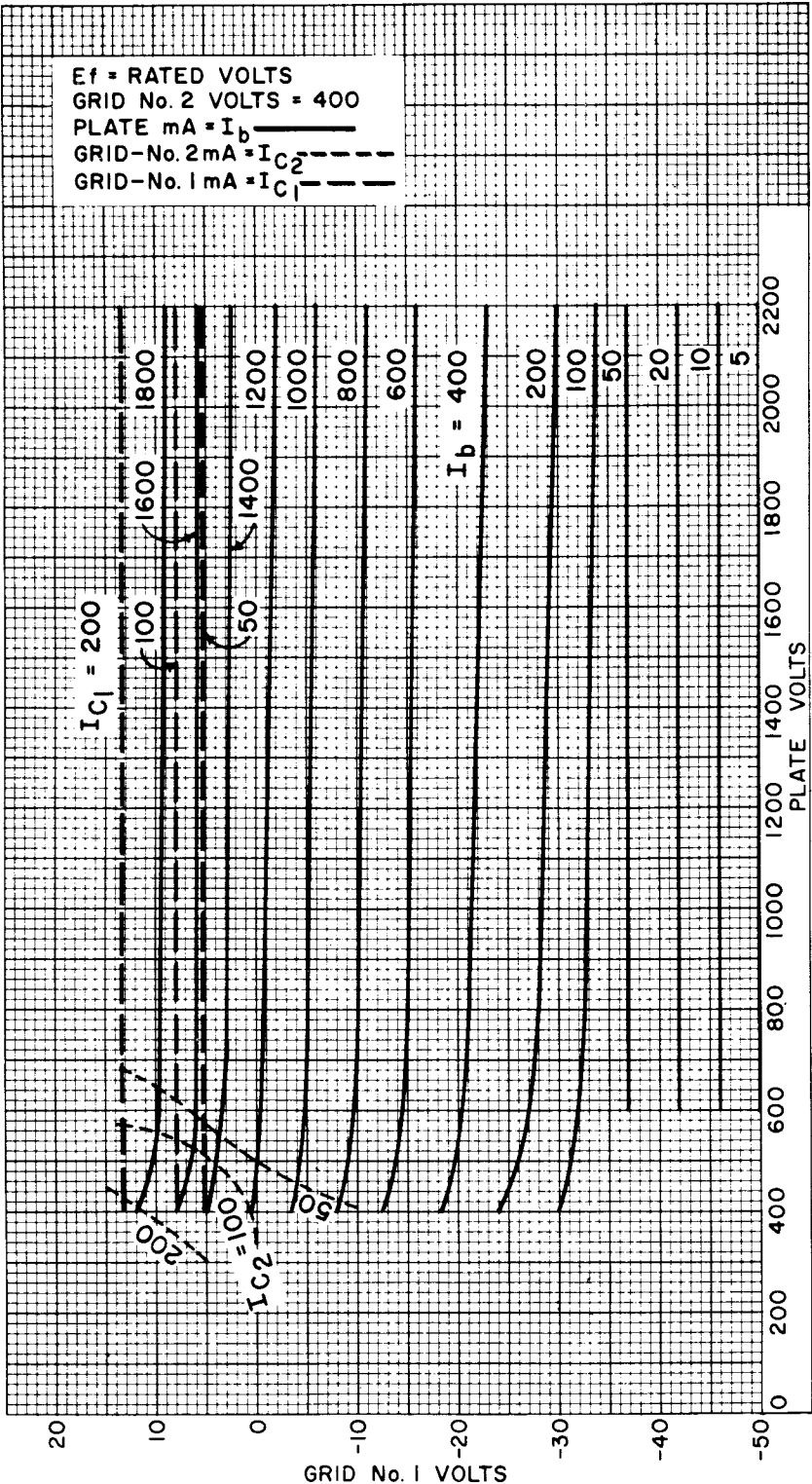
TYPICAL CHARACTERISTICS



92CM-11292

## TYPICAL CONSTANT-CURRENT CHARACTERISTICS

For Grid-No.2 Voltage = 400 Volts

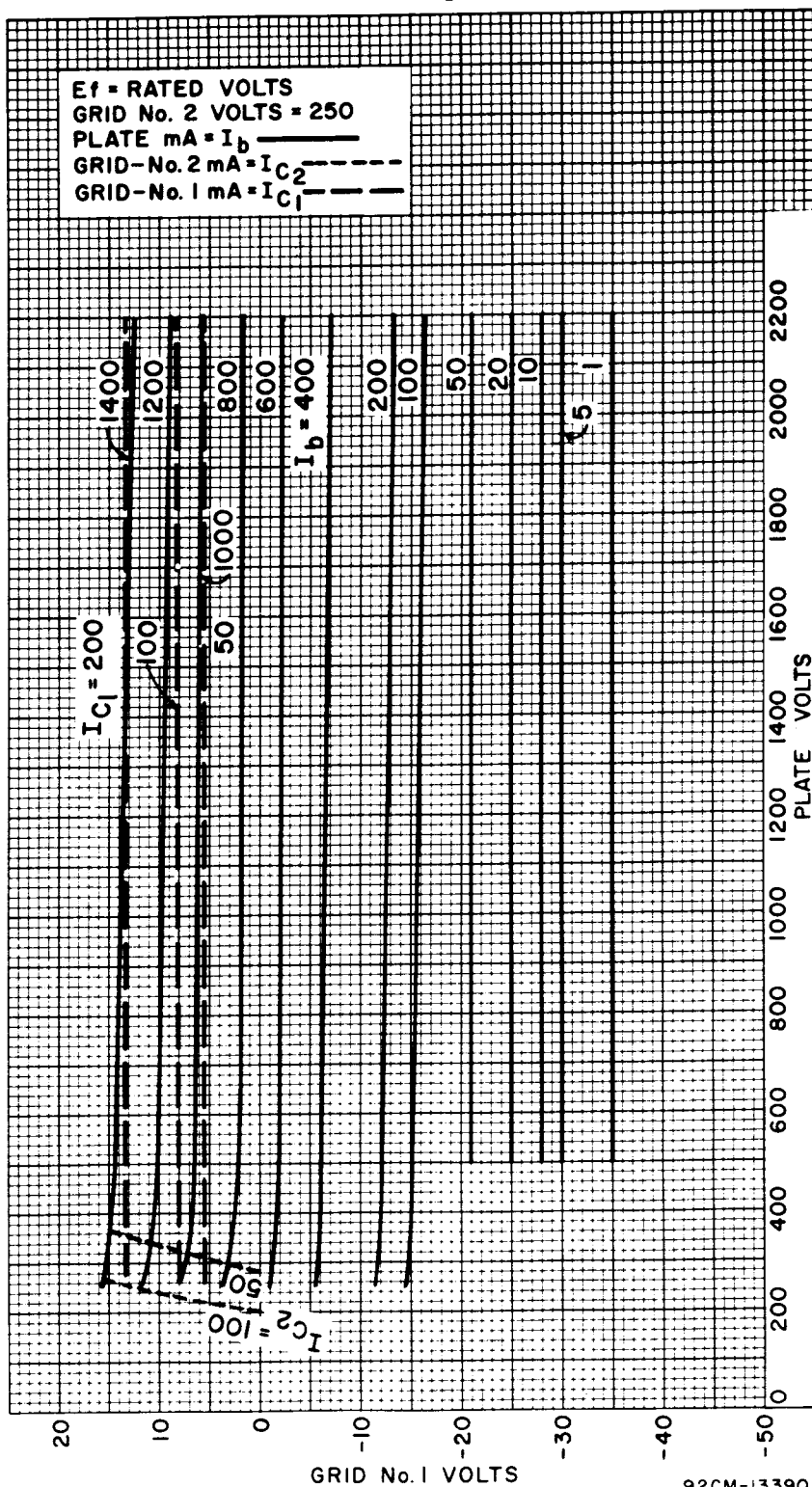


92CM-13389



## TYPICAL CONSTANT-CURRENT CHARACTERISTICS

For Grid-No.2 Voltage = 250 Volts



92CM-13390

