# TYPE RK-4D22– RK-4D32

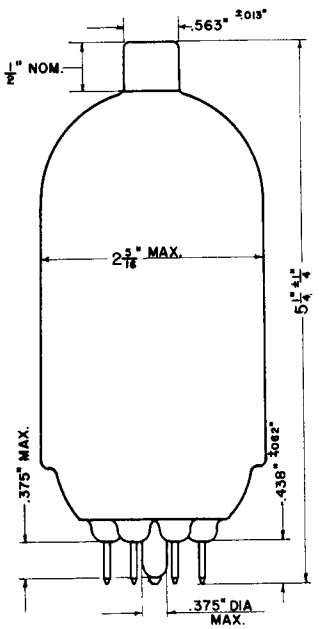
*Excellence in Electronics*

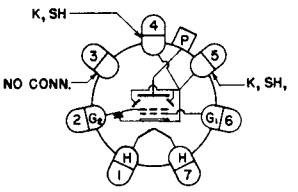
The Raytheon RK4D32 and RK4D22 tubes are beam type aligned grid power amplifiers. Each has a unipotential oxide-coated cathode, a hard glass nonex bulb, and a glass base with short tungsten leads. The type RK4D32 has a heater designed to operate from a 6.3 volt supply, while the type RK4D22 has a center-tapped heater providing for operation from either a 12.6 volt or 25.2 volt supply. The two types are identical with the exception of the heater voltages, and heater base pin connections. Mechanically both types have been ruggadized to withstand the shock and vibration encountered in mobile and aircraft applications.

A single tube may be operated as a "Class C" RF amplifier up to 60 megacycles without neutralization and without reducing the plate input power ratings. With a 600 volt plate supply and 1.25 watts grid driving power, single tube will produce 100 watts power output.

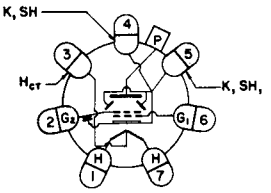
Two tubes may be used in a push-pull audio amplifier circuit under "Class $AB_2$" conditions to produce 125 watts output.

The tube may also be used as an oscillator, frequency multiplier or plate modulated RF amplifier.




BOTTOM VIEW OF SOCKET
TYPE RK-4D32




BOTTOM VIEW OF SOCKET
TYPE RK-4D22

## MECHANICAL DATA

ENVELOPE: Hard Glass

BASE: Medium Molded Flare Septor 7-Pin. Will Fit Standard Johnson #247 Socket or similar type

TERMINAL CONNECTIONS: (Largest Diameter Pin is Pin #4)

| | |
|---|---|
| Pin 1 Heater | Pin 5 Cathode, Internal Shield, Deflector |
| Pin 2 Grid #2 | |
| Pin 3 Heater Center Tap ⊕ | Pin 6 Grid #1 |
| Pin 4 Cathode, Internal Shield, Deflector | Pin 7 Heater |

MOUNTING POSITION: Any

COOLING: Freely Circulating Air

## ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCE: (Without External Shield) ($\mu\mu$fds)

| | |
|---|---|
| Grid #1 to Plate | 0.40 |
| Input | 30 |
| Output | 16 |
| Screen-Cathode Capacitance (including internal screen by-pass condenser) | 40 approx. |

FILAMENT RATINGS:

| | SERIES | PARALLEL | |
|---|---|---|---|
| TYPE RK4D22 | | | |
| Heater Voltage | 25.2 | 12.6 | volts |
| Heater Current | 0.8 | 1.6 | amperes |
| TYPE RK4D32 | | | |
| Heater Voltage | | 6.3 | volts |
| Heater Current | | 3.75 | amperes |

R-F POWER AMPLIFIER OR OSCILLATOR—CLASS C —MAXIMUM C.C.S. RATINGS

| | Telephony ♦ Plate and Screen Modulation | Telegraphy or Frequency Modulation Telephony | |
|---|---|---|---|
| DC Plate Voltage | 600 | 600 | volts |
| DC Grid Voltage | –200 | –200 | volts |
| DC Screen Voltage | 350 | 350 | volts |
| DC Plate Current | 300 | 300 | ma |

Tentative Data

Printed in U.S.A.

## ELECTRICAL DATA (Cont'd)

R-F POWER AMPLIFIER OR OSCILLATOR - CLASS C - MAXIMUM C.C.S. RATINGS

| | Telephony ♦ Plate and Screen Modulation | Telegraphy or Frequency Modulation Telephony | |
|---|---|---|---|
| DC Grid Current | 15 | 15 | ma |
| DC Screen Current | 30 | 35 | ma |
| Plate Input Watts | 150 | 200 | watts |
| Plate Dissipation | 35 | 50 | watts |
| Screen Dissipation | 10 | 14 | watts |
| Grid Dissipation | 0.75 | 0.75 | watts |
| Highest Frequency for Maximum Ratings | 60 | 60 | Megacycles |

R-F POWER AMPLIFIER OR OSCILLATOR - CLASS C - TYPICAL OPERATION

| | | Telephony ♦ Plate and Screen Modulation | Telegraphy or Frequency Modulation Telephony | |
|---|---|---|---|---|
| DC Plate Voltage | 550 | 600 | 600 | volts |
| DC Screen Voltage | ---- | ---- | 300 | volts |
| Series Screen Resistor | 15,000 | 10,000 | ---- | ohms |
| DC Grid Voltage | -100 | -100 | -100 | volts |
| DC Plate Current | 175 | 220 | 215 | ma |
| DC Screen Current | 17 | 28 | 30 | ma |
| DC Control Grid Current | 6.0 | 10.0 | 10.0 | ma |
| R-F Grid Driving Power (approx.) | 0.6 | 1.25 | 1.25 | watts |
| Carrier Power Output (approx.) | 70 | 100 | 90 | watts |

A-F POWER AMPLIFIER - CLASS $AB_1$ - CLASS $AB_2$ - TYPICAL OPERATION ●

| | Class $AB_1$ | Class $AB_2$ | |
|---|---|---|---|
| DC Plate Voltage | 600 | 600 | volts |
| DC Grid Voltage | -37.5 | -25 | volts |
| DC Screen Voltage | 350 | 250 | volts |
| Peak A-F Input Voltage (grid to grid) | 74 | 70 | volts |
| DC Plate Current (zero signal) | 100 | 100 | ma |
| DC Plate Current (max. signal) | 350 | 365 | ma |
| DC Screen Current (max. signal) | 46 | 26 | ma |
| Effective Load Resistance (plate to plate) | 3,000 | 3,000 | ohms |
| Maximum Signal Driving Power (approx.) | 0 | 0.45 | watts |
| Maximum Signal Power Output (approx.) | 112 | 125 | watts |
| Maximum Plate Dissipation (per tube - approx.) | 49 | 47 | watts |
| Maximum Screen Dissipation (per tube - approx.) | 8 | 3 | watts |

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

● *Unless other wise specified, values are for two tubes.*

⊕ *Pin #3 for RK4D32 has no connection.*

## OPERATING NOTES

### HEATER

The heater voltage, under all possible conditions of line voltage, should be within 10% of the rated value. A minimum heating time of 2 minutes should be allowed before application of screen or plate voltages. The heater supply should be connected to the cathode where possible, but in no case should the voltage between heater and cathode exceed 100 volts.

### R-F AMPLIFIER

### EXCITATION

The Class C operation curves on the following pages show operating data against D.C. Grid Driving Current for 100 volts of fixed bias. In general, higher efficiencies cannot be achieved by increasing the D.C. bias above this value. Higher screen grid currents are produced by an increase in bias, therefore care should be taken to insure that screen grid dissipation ratings are not exceeded because of too much grid bias or excessive grid excitation current. It should be noted that on some of the Class C operation curves the maximum screen grid current rating is exceeded at the higher values of grid driving current.

### BIAS

In Class C operation the usual forms of fixed bias, cathode resistor bias, or grid leak bias can be used. To prevent damage to the tube by a failure of excitation signal, grid leak bias alone should not be used. Circuit design should be such that at least 40 volts bias is provided in the event of signal failure. For C. W. Operation where the exciter or oscillator stages are keyed, a fixed bias voltage of at least 75 volts should be used.

### SHIELDING

The input and output stages must be completely shielded to avoid regeneration or oscillation This may be accomplished by mounting the tube base below the chassis level, with the disc shield (located near the bottom of the elements in the tube ) level with the chassis. The tube may be mounted through a 23/8" diameter hole in the chassis. This arrangement permits isolation of input and output circuits by locating each on opposite sides of the chassis.

### SCREEN VOLTAGE SUPPLY

The screen voltage may be obtained from a fixed voltage supply or through a series resistor from the plate supply. When a fixed voltage is used, care should be taken when making tuning adjustments to prevent excessive screen grid current. The screen should be adequately bypassed to cathode at R-F frequencies in addition to the internal tube condenser. For plate and screen modulation, the series screen resistor should be connected to the plate side of the modulation transformer. The R-F bypass condenser on the screen should not be large enough to produce attenuation or phase shift of the screen modulation voltage through this series screen resistor.

### PLATE CIRCUIT

Because this tube is a relatively low voltage-high power type, the ratio of D.C. plate voltage to D.C. plate current is lower than will be found in most other tube types. This condition requires a lower L/C ratio for optimum Q: i.e., a higher value of tank capacitance than is required by many other transmitting tube types. For typical operating conditions, the tank capacitance (including plate and wiring capacitances) should be approximately 4 $\mu\mu$f per meter

of wavelength. It should be noted that the Class C operation curves on the following pages were taken with the load coupling adjusted to produce maximum output with an average tube operating at the conditions indicated. Closer coupling will not increase the power output, but will increase the plate current and reduce efficiency. In general, looser coupling will produce slightly higher efficiencies than the values shown, with lower plate current and power output values. In adjusting the load in an R-F amplifier, the coupling should be less than the values indicated so that for a given set of operating conditions, the plate current will be slightly less than the values shown on the graphs and the screen current slightly higher. As suggested under the notes on "Screen Voltage Supply", the load coupling and plate current should not be low enough to cause excessive screen current with a fixed screen supply voltage.

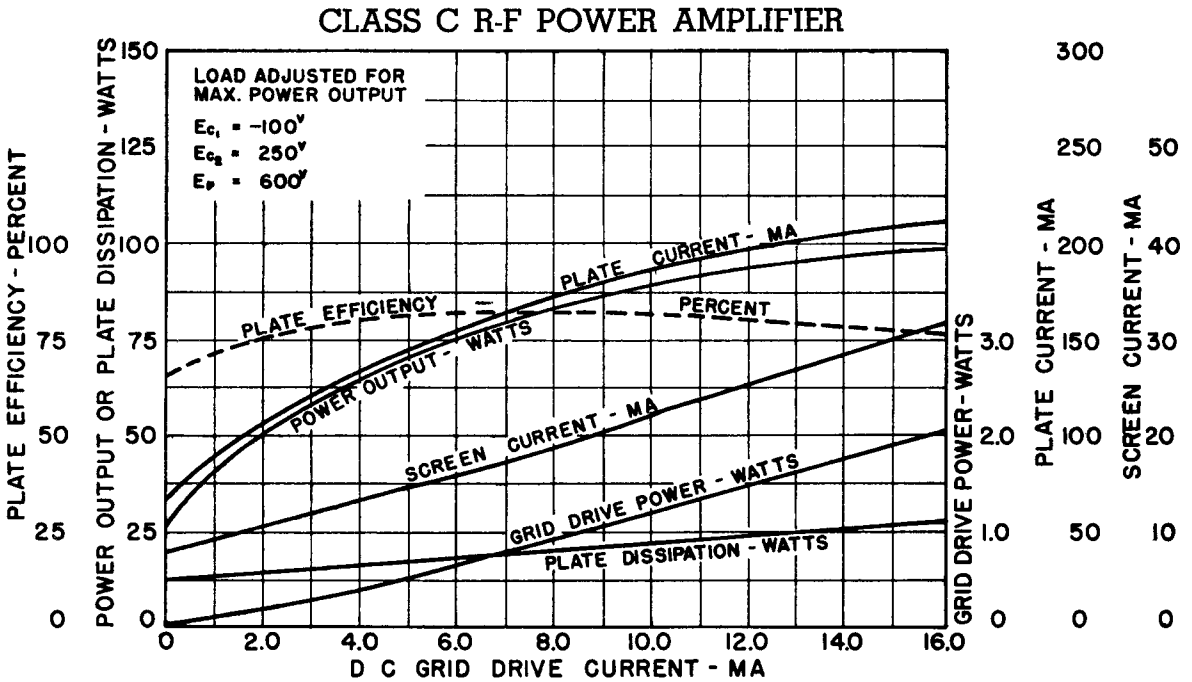
## PLATE TEMPERATURE

At the maximum plate dissipation rating of 50 watts no color is visible on any portion of the plate. For this reason the place dissipation should be determined on the basis of plate input and power output measurements. Under no circumstances is the tube to be operated so that it shows plate color.

## A-F AMPLIFIER

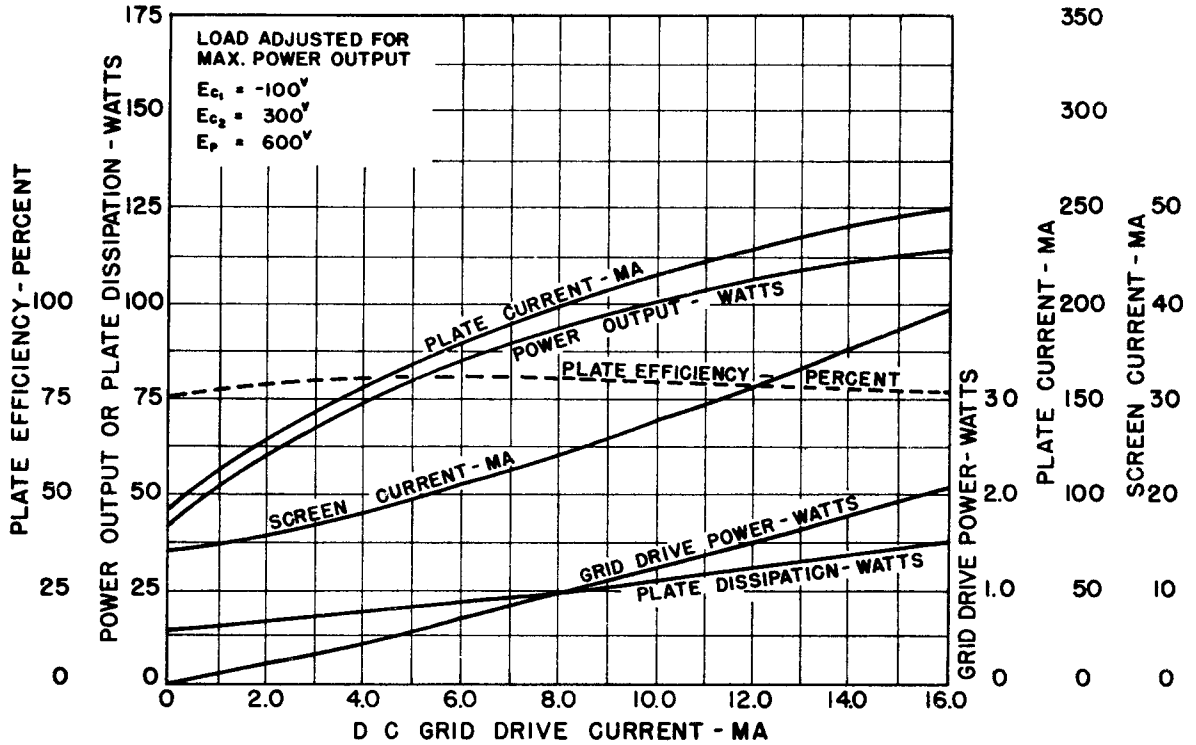
In push-pull audio service, two tubes may be operated in Class $AB_1$ or Class $AB_2$ service. For greatest efficiency, the tubes are best operated with a screen voltage of 250 volts in Class $AB_2$. Grid current flows during the most positive signal swing in this class of operation, and a fixed source of bias voltage with good regulation is necessary. Where driving power is not available, these tubes may be operated in Class $AB_1$. The values given to this type of operation are determined on the basis that no grid current flows at any time. The value of D.C. grid leak resistance should not exceed 25,000 ohms.

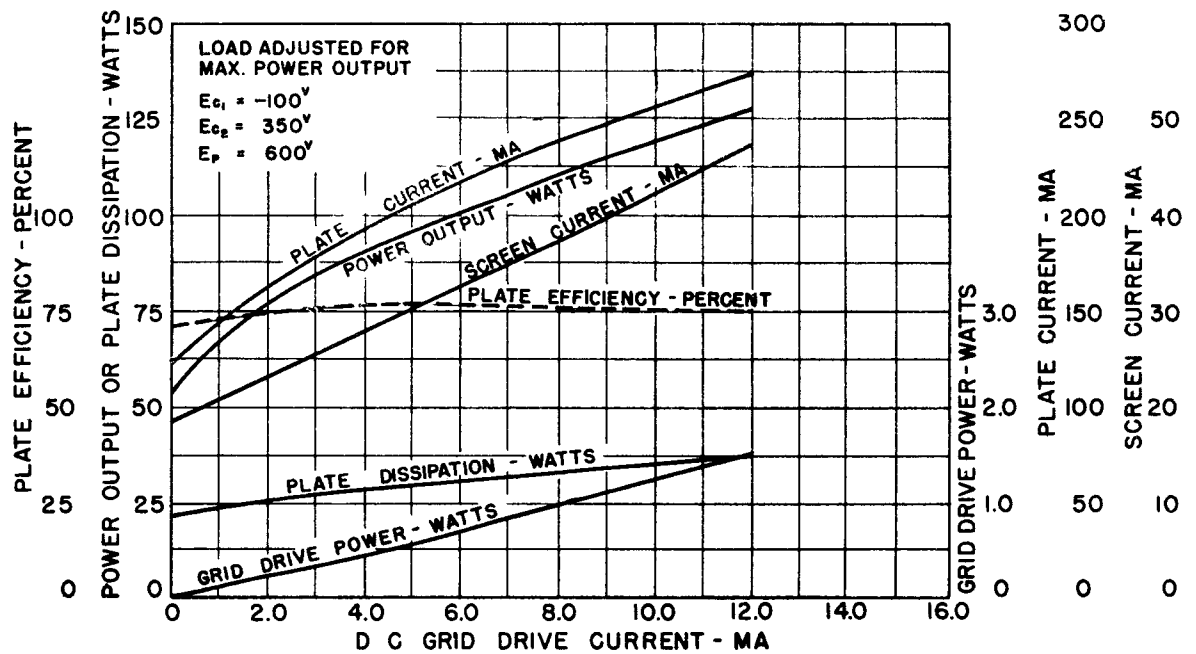
## AVERAGE CHARACTERISTICS



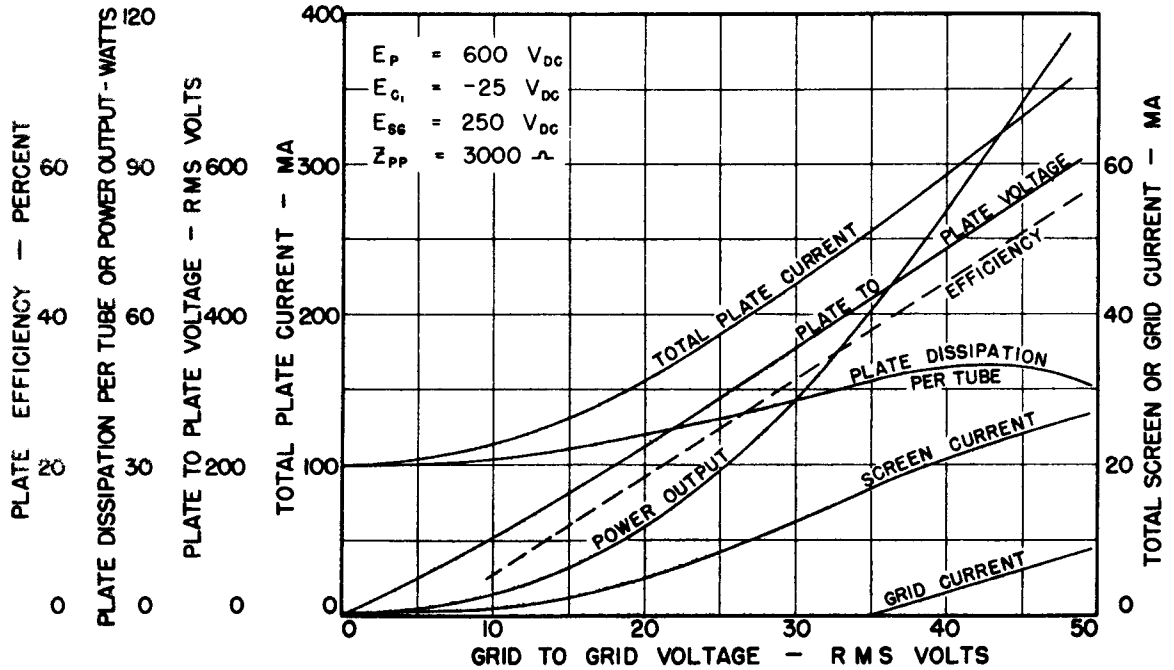
## AVERAGE CHARACTERISTICS

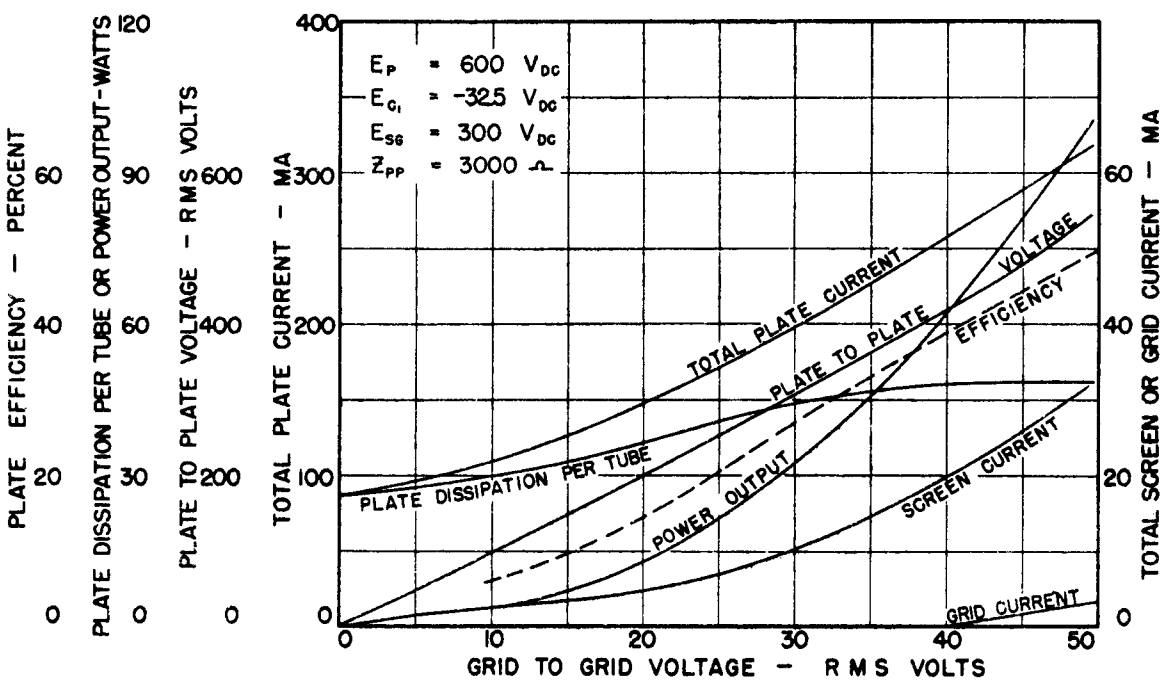
CLASS C R-F POWER AMPLIFIER



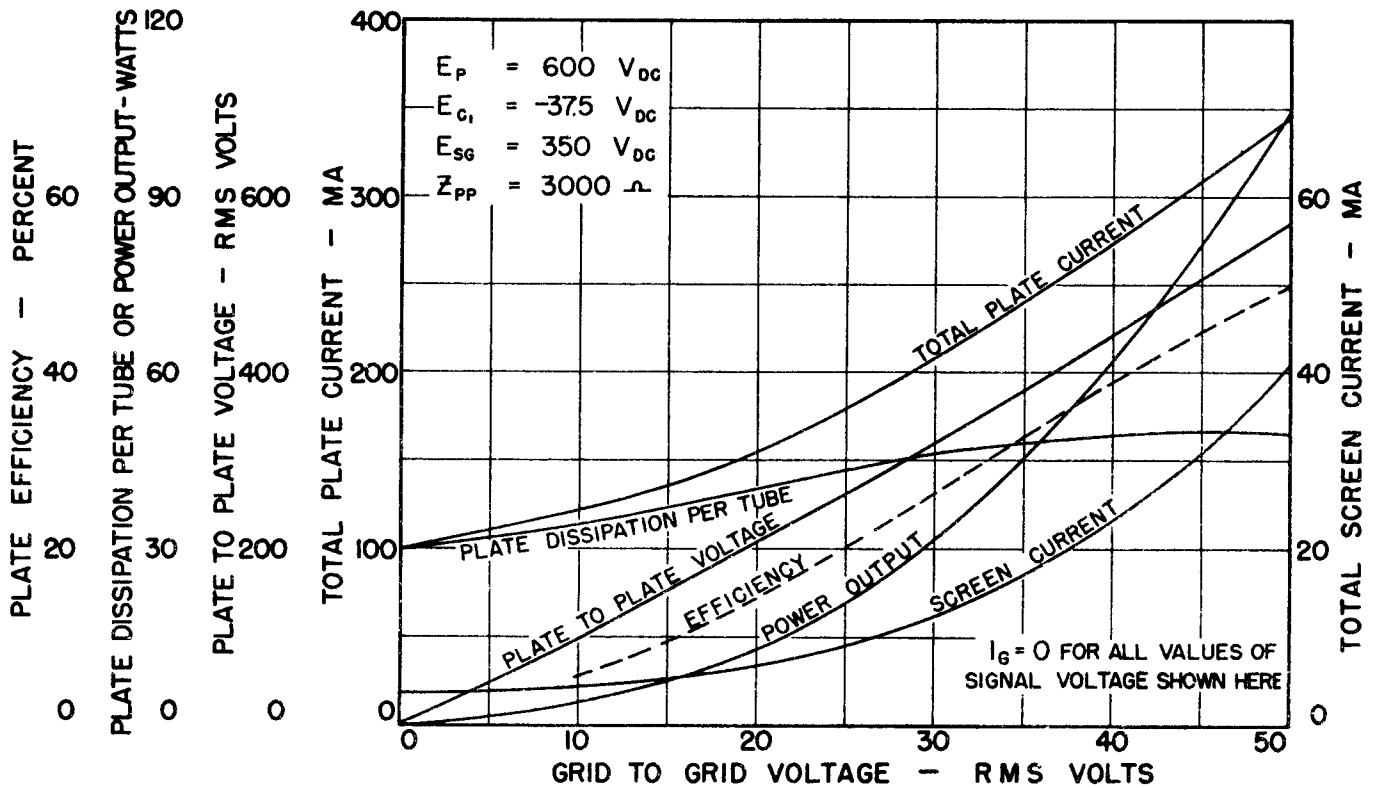



## AVERAGE CHARACTERISTICS
### CLASS $AB_2$ PUSH PULL AUDIO AMPLIFIER

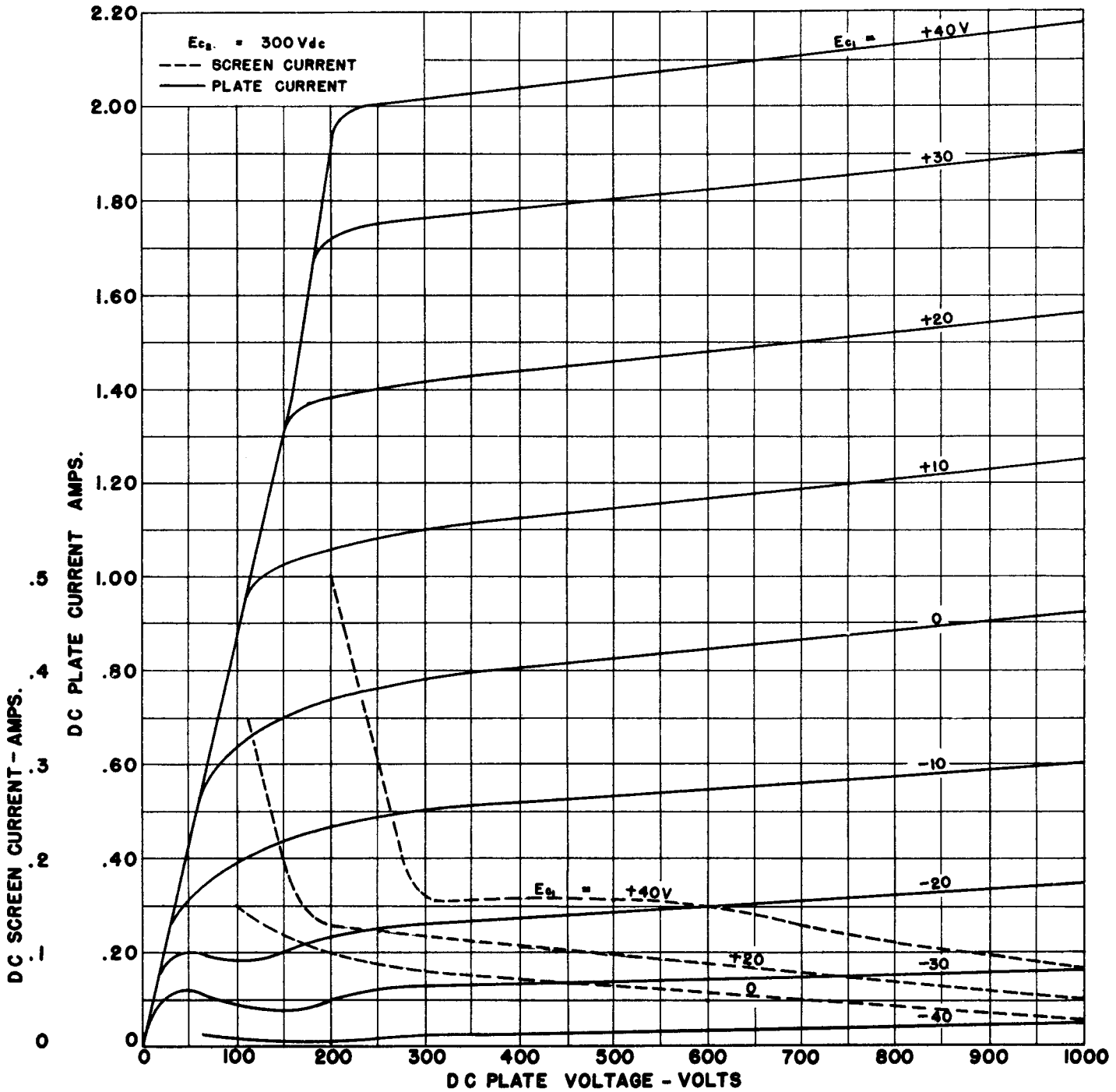


## AVERAGE CHARACTERISTICS



## AVERAGE PLATE CHARACTERISTICS



## CONSTANT CURRENT CHARACTERISTICS