RAYTHEON

RK-4D32
RK-4D22

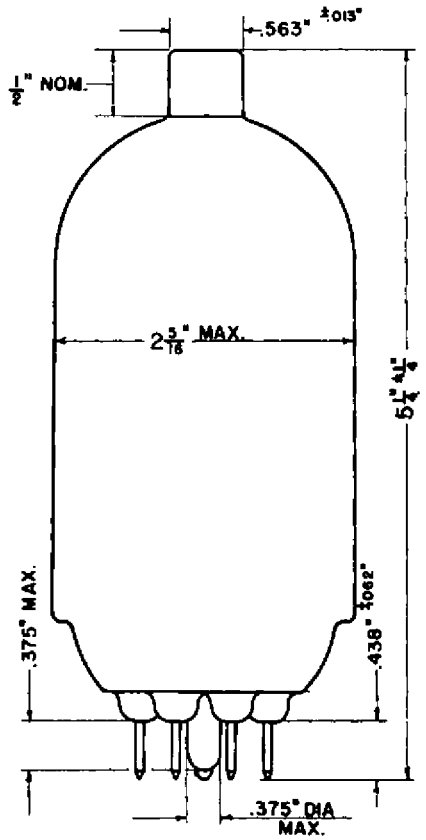
- 100 watts RF Power Output with only 600 volt plate supply.
- 1.25 watts grid drive.
- Low-loss construction; minimum lead inductance with short leads and moulded glass base.
- Full efficiency at 60 Mc.
- Neutralization not required.
- 125 watts audio power for pair in Class AB_2 operation.

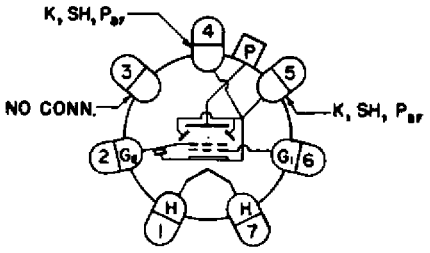
NOTE:
RK-4D32 fil. voltage 6.3 V
RK-4D22 fil. voltage 25.2 V
C.T. @ 12.6 V for mobile or airborne applications.

RAYTHEON
MANUFACTURING COMPANY
WALTHAM, MASS.

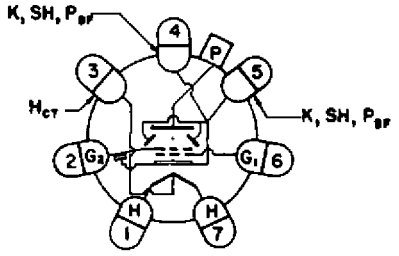
POWER TUBE DIVISION
Excellence in Electronics

from RTMA release #936, Dec. 5, 1950





BOTTOM VIEW OF SOCKET
TYPE RK-4D32



BOTTOM VIEW OF SOCKET
TYPE RK-4D22

BEAM POWER AMPLIFIER OSCILLATOR

The Raytheon RK-4D32 and RK-4D22 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 RK-4D32 has a heater designed to operate from a 6.3 volt supply, while the type RK-4D22 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 ruggedized 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, a 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.

FILAMENT RATINGS

Type 4D32		
Heater Voltage		6.3 volts ac-dc
Heater Current		3.75 amperes
Type 4D22	Series	Parallel
Heater Voltage	25.2	12.6 volts ac-dc
Heater Current	0.8	1.6 amperes

DIRECT INTERELECTRODE CAPACITANCES

Grid to Plate (with external shield)	0.27 μμf (max.)
Input	28.0 μμf (max.)
Output	13.0 μμf (max.)
Screen-Cathode Capacitance (including internal screen by-pass condenser)	40.0 μμf (approx.)

MECHANICAL

Base	7-pin moulded Glass Stem: Will fit the Standard Johnson No. 247 socket or similar type.
Mounting Position	Any
Cooling	Freely circulating air.

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

	Telephony* Plate and Screen Modulation	Telegraphy or Frequency Modulation Telephony	
D.C. Plate Voltage	600	750	Volts
D.C. Grid Voltage	−200	−200	Volts
D.C. Screen Voltage	350	350	Volts
D.C. Plate Current	300	300	MA
D.C. Grid Current	15	15	MA
D.C. 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 Freq. for Max. Ratings	60	60	Megacycles

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

R-F POWER AMPLIFIER OR OSCILLATOR — CLASS C

TYPICAL OPERATION

	Telephony* Plate and Screen Modulation		Telegraphy or Frequency Modulation Telephony		
D.C. Plate Voltage	550	600	600	750	Volts
D.C. Screen Voltage	...	...	300	300	Volts
Series Screen Resistor	15,000	10,000	...	...	Ohms
D.C. Grid Voltage	−100	−100	−100	−100	Volts
D.C. Plate Current	175	220	215	240	MA
D.C. Screen Current	17	28	30	26	MA
D.C.Control Grid Current	6.0	10.0	10.0	12.0	MA
R-F Grid Driving Power (approx.)	0.6	1.25	1.25	1.5	Watts
Carrier Power Output (approx.)	70	100	100	135	Watts

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

A-F POWER AMPLIFIER — CLASS AB_1 — CLASS AB_2

TYPICAL OPERATION*

	Class AB_1	Class AB_2	
D.C. Plate Voltage	600	600	Volts
D.C. Grid Voltage	−37.5	−25	Volts
D.C. Screen Voltage	350	250	Volts
Peak A-F Input Voltage (grid to grid)	74	70	Volts
D.C Plate Current (zero signal)	100	100	MA
D.C. Plate Current (max. signal)	350	365	MA
D.C. 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

* Unless otherwise specified, values are for two tubes.

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.

OPERATING NOTES — Concluded

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 2⅜" 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 by-passed 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 by-pass 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. The curves for a 750-volt plate supply exceed the maximum plate dissipation rating at the higher values of grid driving current, and are included in the data for purposes of information only. 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 plate 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 for 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

CLASS C R-F POWER AMPLIFIER

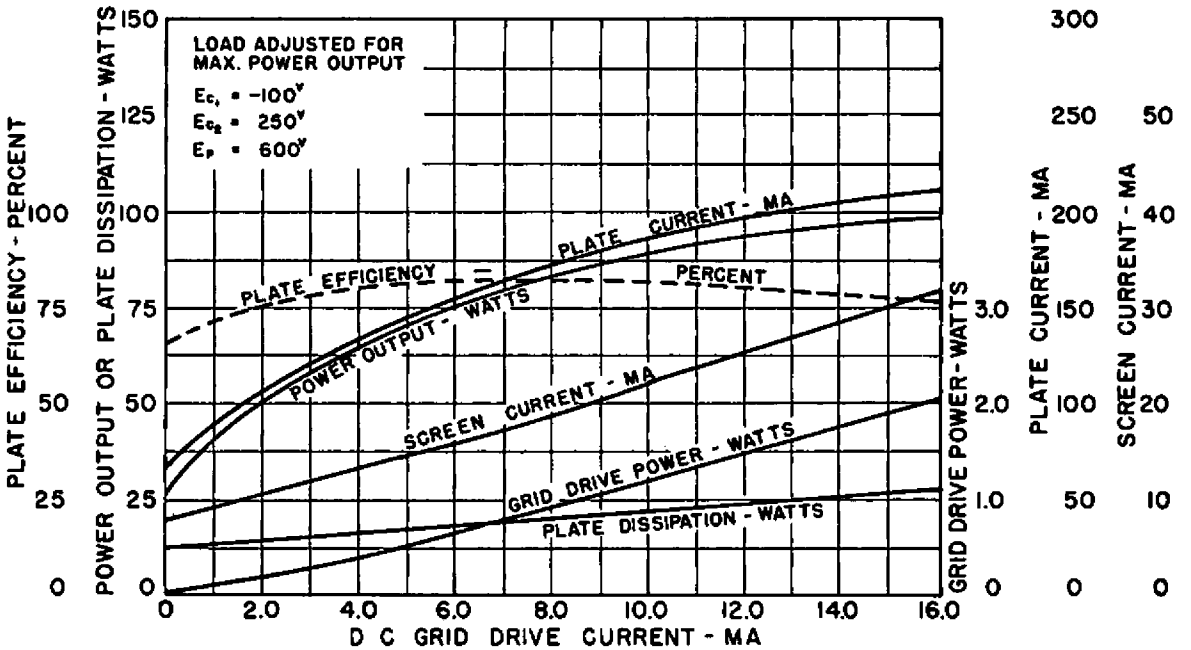


FIGURE 1

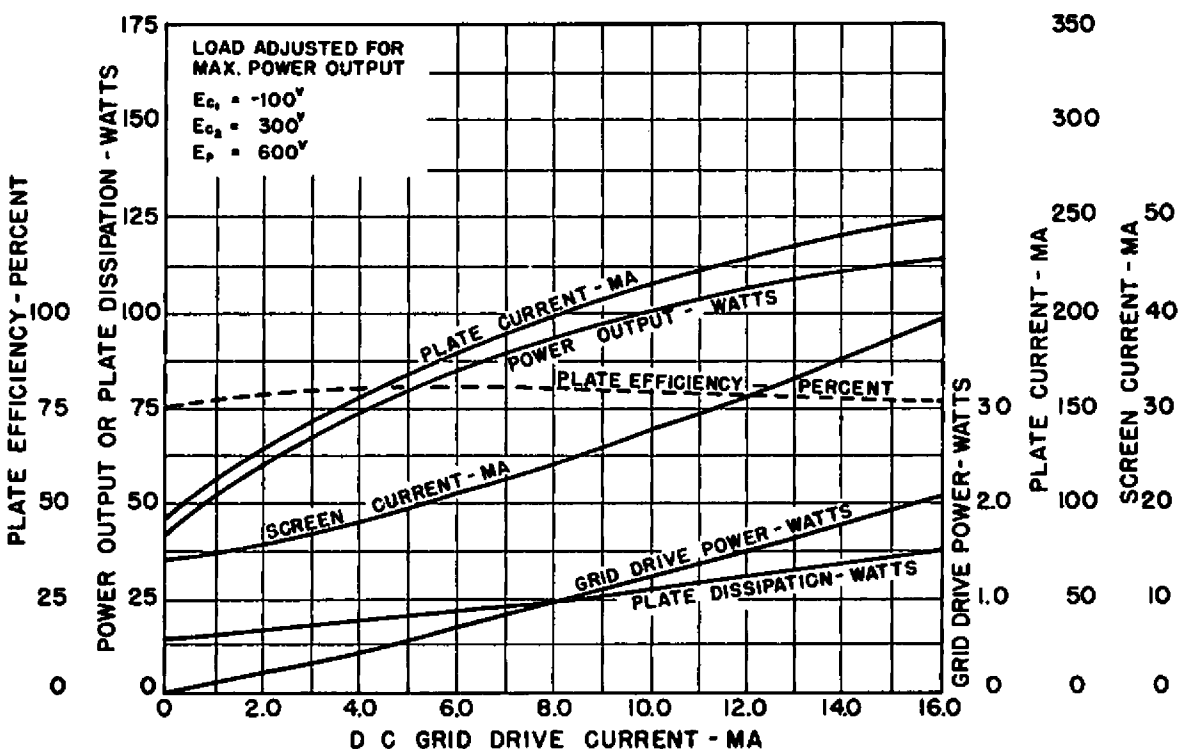


FIGURE 2

AVERAGE CHARACTERISTICS

CLASS C R-F POWER AMPLIFIER

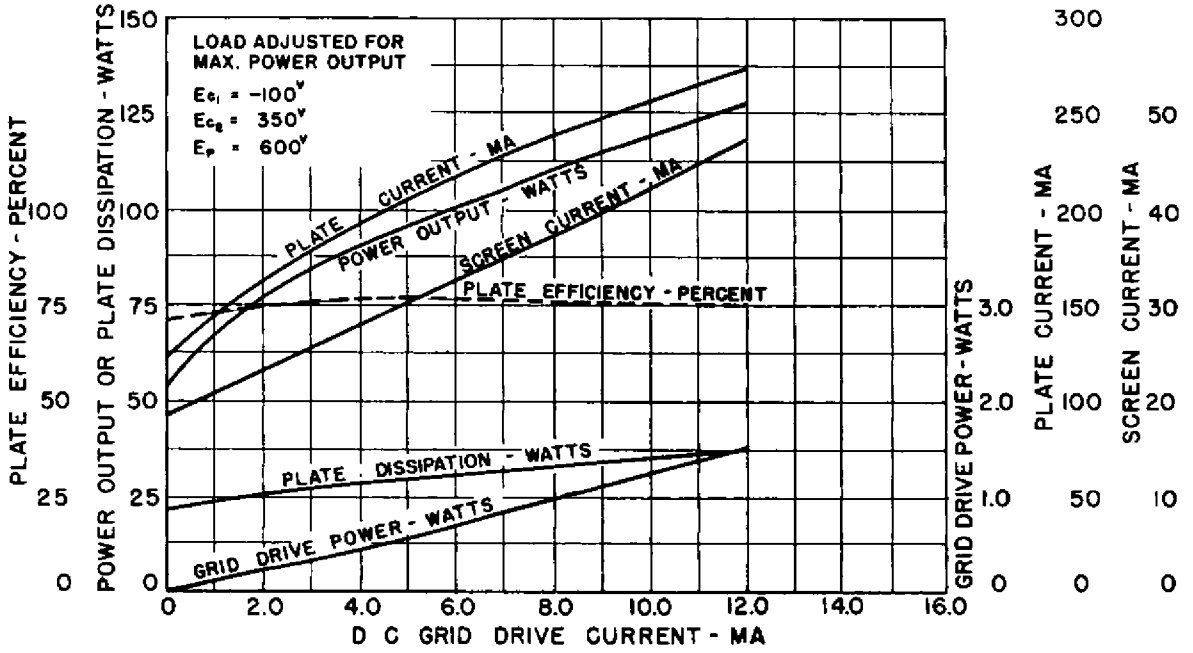


FIGURE 3

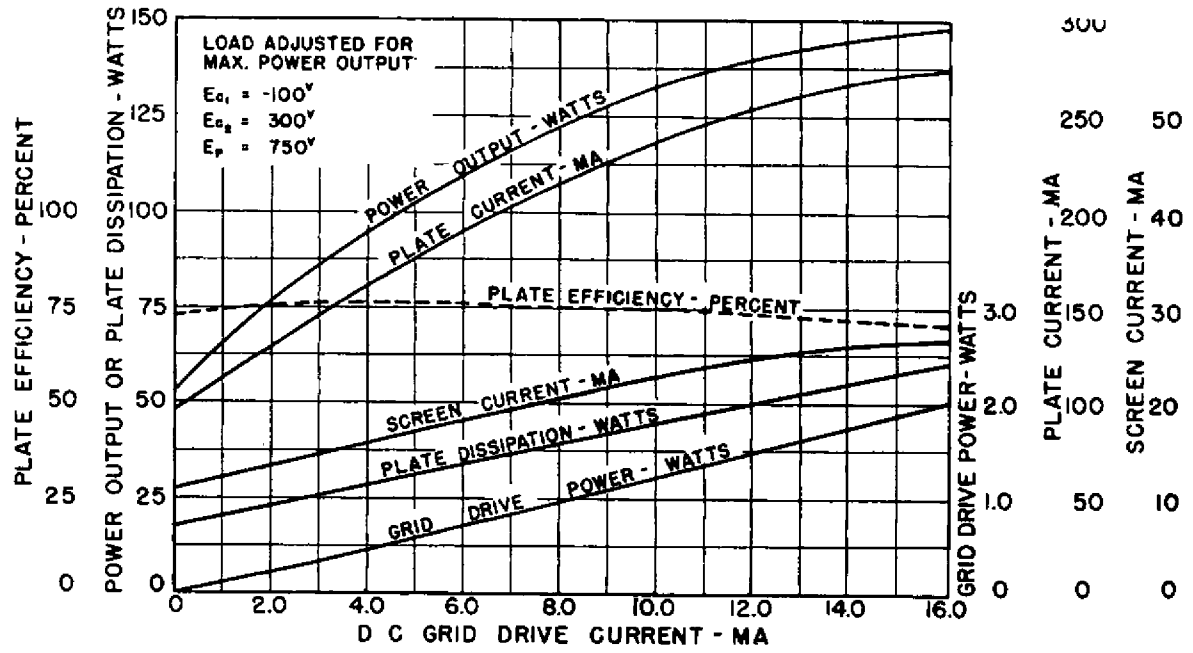


FIGURE 4

AVERAGE CHARACTERISTICS

CLASS AB$_2$ PUSH PULL AUDIO AMPLIFIER

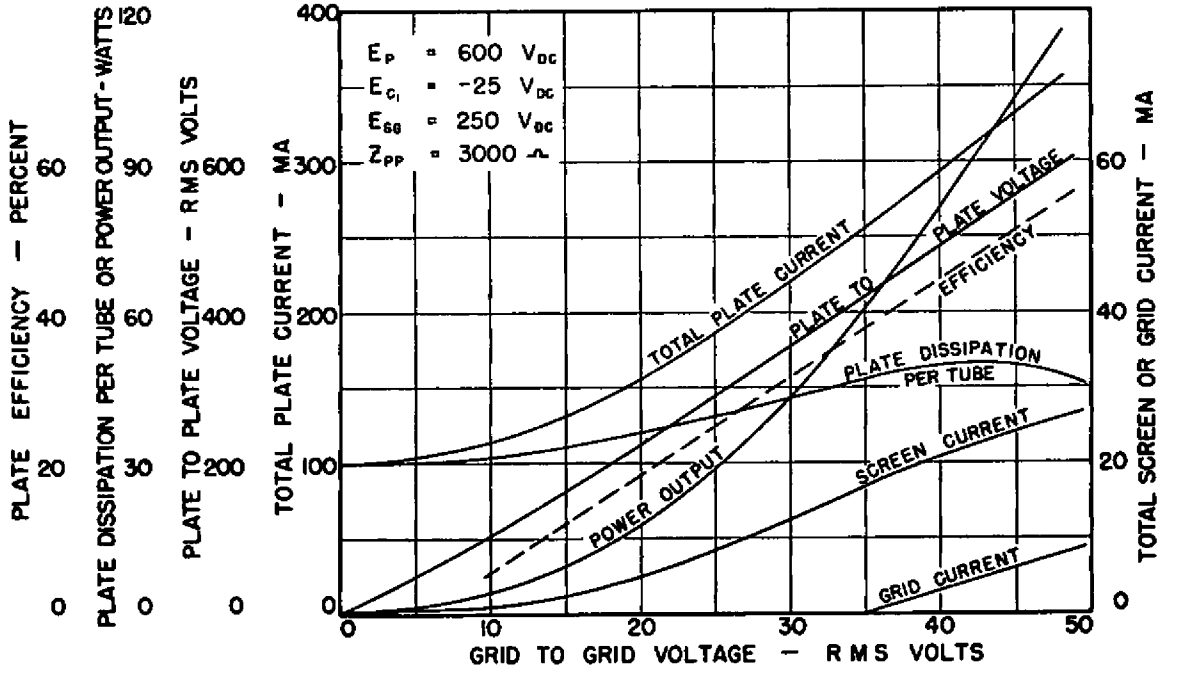


FIGURE 5

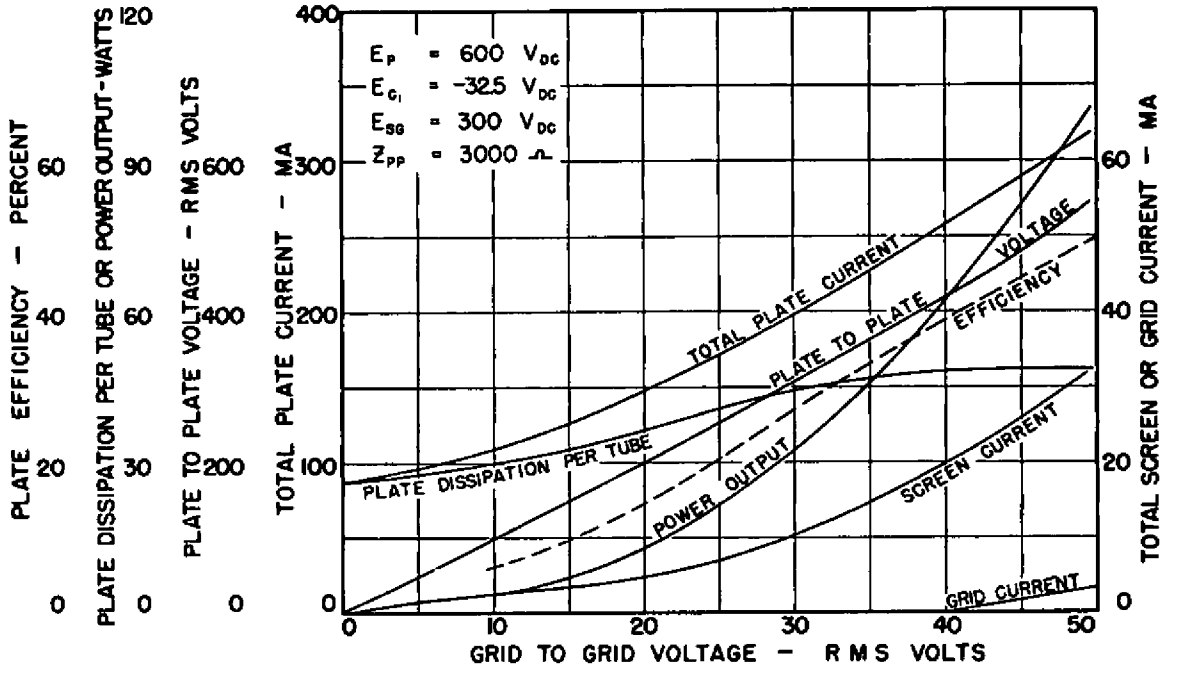


FIGURE 6

AVERAGE CHARACTERISTICS

CLASS AB$_1$ PUSH PULL AUDIO AMPLIFIER

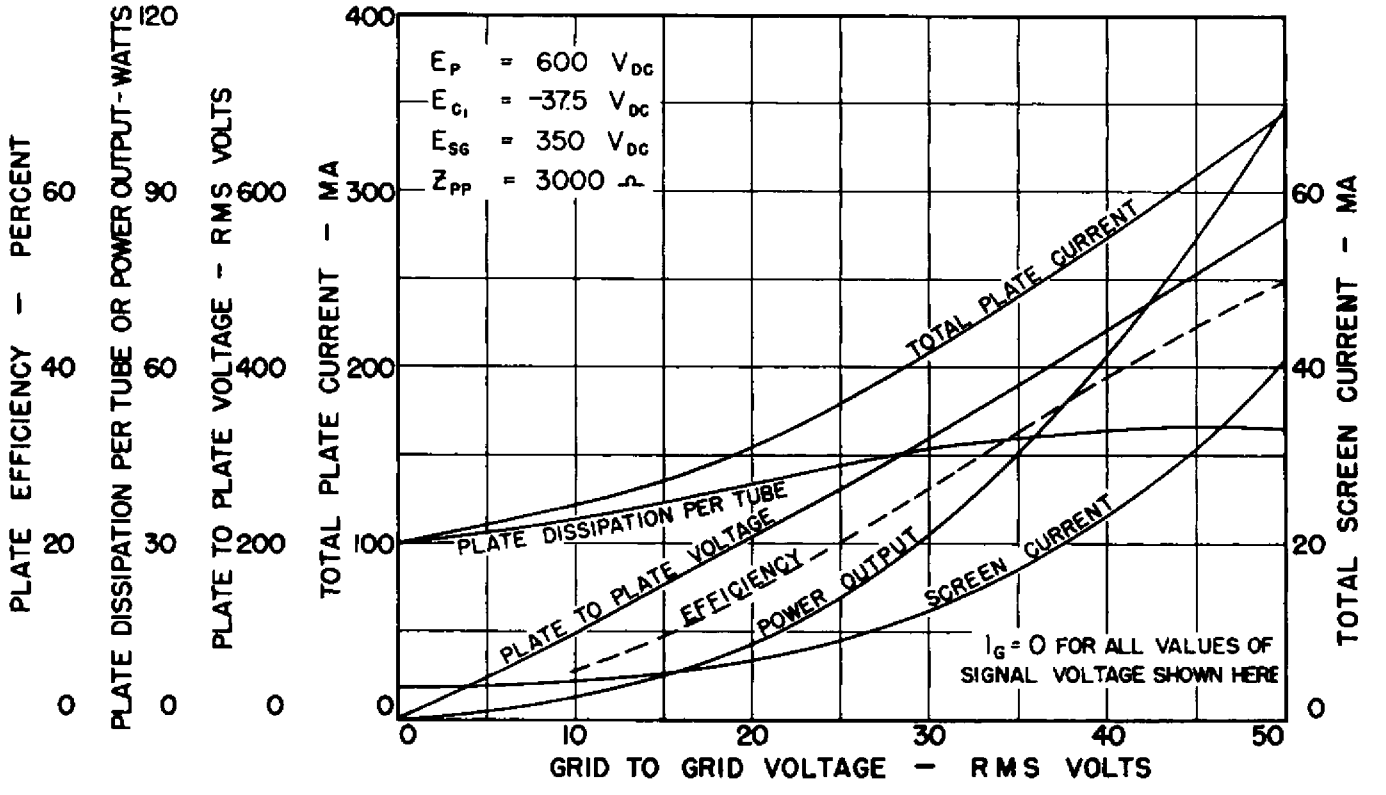


FIGURE 7

AVERAGE PLATE CHARACTERISTICS

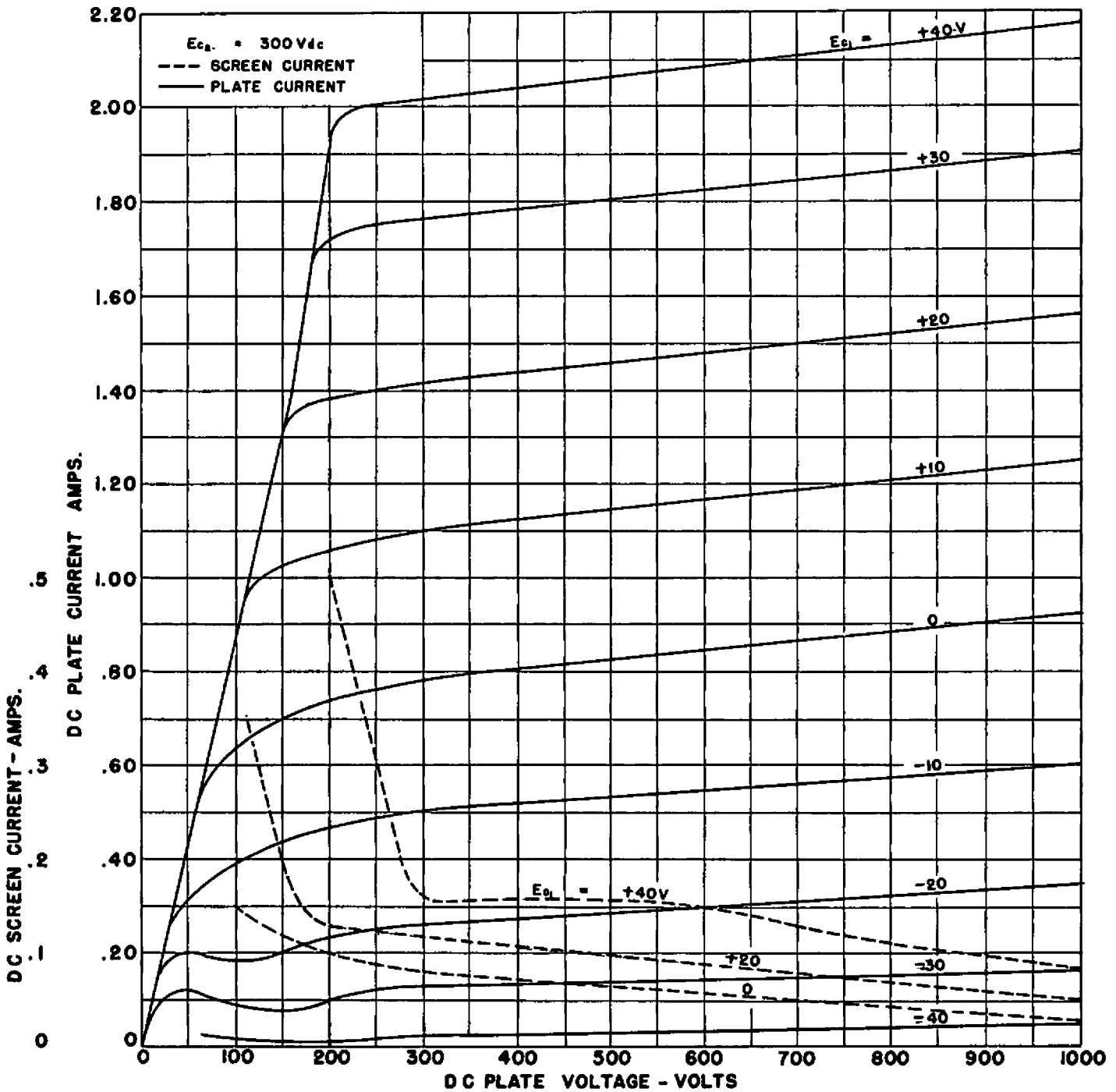


FIGURE 8

CONSTANT CURRENT CHARACTERISTICS

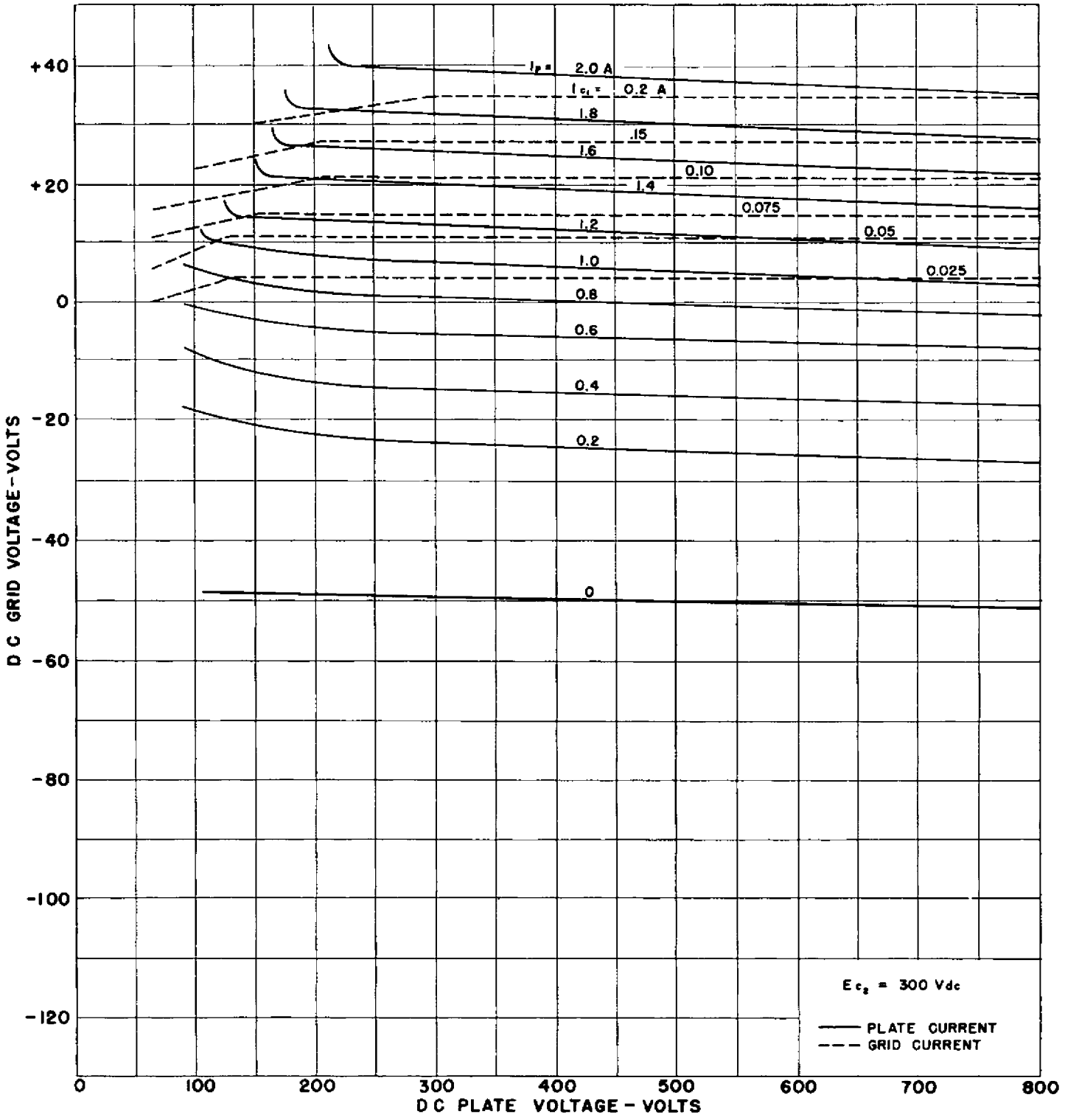


FIGURE 9