Western Electric

305A Vacuum Tube

Classification—Filamentary air-cooled tetrode

May be used as a radio-frequency power amplifier, oscillator or harmonic generator at intermediate power levels at the ultra-high frequencies.

Dimensions—Dimensions and outline diagrams are shown in Figures 1 and 2. The overall dimensions are:

Maximum overall length	7 3/16″
Maximum diameter	2 7/16″

Mounting—Medium four-pin bayonet base for use in a W.E. 143B or similar socket, for vertical mounting only with the base end down. Filament center tap, grid and plate terminals at top of bulb must have large cooling lugs if operated above 50 megacycles. A typical cooling lug is shown in Figure 3.

Filament—Thoriated tungsten.

Filament voltage	10 volts, a.c. or d.c.
Nominal filament current	3.1 amperes
Average thermionic emission	1.0 ampere

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Average Direct Interelectrode Capacitances

Plate to grid	.14 μμf
Grid to filament and screen grid	10.5 μμf
Plate to filament and screen grid	5.4 μμf

Characteristics—Performance data given below are based upon a typical set of conditions. Variations can be expected with different circuits and tubes.

Figures 4 and 5 give the static characteristics of a typical tube plotted against grid and plate voltages.

Average Characteristics at 1000 volts direct plate potential and 60 watts plate dissipation (I_b = 60 milliamperes).

Amplification factor	56
Plate resistance	40000 ohms
Grid to plate transconductance	1400 micromhos

Operation

Maximum Ratings

Max. direct plate voltage	1000 volts
Max. direct plate current	125 milliamperes
Max. plate dissipation	60 watts
Max. screen-grid voltage	200 volts
Max. screen-grid dissipation	6 watts
Max. direct grid current	40 milliamperes
Max. r-f grid current	5 amperes
Max. frequency for the above ratings	50 megacycles
Max. plate voltage for upper frequency limit of 100 Mc	500 volts
Max. plate voltage for frequencies between 50 and 100 Mc in proportion.	

Class B Radio-Frequency Amplifier

Direct plate voltage	1000	750 volts
Control-grid bias	−135	−100 volts
Direct screen-grid voltage	200	150 volts
Direct plate current	90	120 milliamperes
Plate dissipation	60	60 watts
Approx. carrier watts for use with 100% modulation	30	30 watts

Class C Radio-Frequency Oscillator or Power Amplifier—Unmodulated

Direct plate voltage	1000	750 volts
Control-grid bias	−200 to −270	−150 to −200 volts
Screen-grid voltage	200	200 volts
Direct plate current	125	125 milliamperes
Nominal power output	85	65 watts

Class C Radio-Frequency Amplifier—Plate Modulated

Direct plate voltage	800	500 volts
Control-grid bias	−270	−200 volts
Screen-grid voltage	200	200 volts
Direct plate current	125	125 milliamperes
Max. r-f grid current	5	5 amperes
Nominal carrier power output for use with 100% modulation	70	42 watts

Operating Precautions

Mechanical—Figures 1 and 2 show the overall dimensions and basing arrangement for the tube.

The tubes should not be subjected to mechanical shock or excessive vibration. Mechanical vibration may cause breakage of the thoriated tungsten filaments.

A free circulation of air must be provided to insure adequate cooling of the glass during operation.

Electrical—Overload protection should always be provided for the plate circuit. A suitable fuse or circuit breaker should remove the plate voltage if the plate current exceeds 175 milliamperes. Although the tube is sufficiently rugged to witshtand momentary overloads, a prolonged overload caused by inefficient adjustment of the circuit, may damage the tube. When adjusting a new circuit, reduced plate voltage or a series resistance of 1,000 to 5,000 ohms in the plate circuit should be used until it is operating properly.

The filament should always be operated at the rated voltage, measured at the tube terminals. A 5% decrease in filament voltage reduces the thermionic emission approximately 25%. Either direct or alternating current may be used for heating the filament. If direct current is used, the plate and grid circuit returns should be connected to the negative filament terminal. If alternating current is used, the circuit returns should be connected to the center tap of the filament.

In cases where severe and prolonged overload has temporarily impaired the electronic emission of the filament, the activity may be restored by operating the filament, with the plate and grid voltages off, 30% above normal voltage for 10 minutes followed by a longer period at normal voltage.

The voltage for the screen grid may be obtained from a separate source or from a potentiometer or series resistor in the plate supply. A series resistor of approximately 25,000 ohms is recommended. The screen-grid voltage should not be applied without the plate voltage. In order to obtain maximum output at the upper frequency limit of operation, special circuit precautions in connecting the screen-grid supply should be taken.

Radio Frequency Oscillator or Power Amplifier

Class B—Radio-Frequency Amplifier

The Class B radio-frequency amplifier is used to amplify a modulated radio-frequency carrier wave without appreciable distortion. It operates similarly to the Class B audio amplifier except that a single tube may be used, the tuned output circuit serving to preserve the wave shape. The push-pull circuit, however, eliminates the even order harmonics and thus increases the efficiency slightly.

Class C—Radio Frequency Oscillator or Power Amplifier -Grid bias below cut-off.

Unmodulated

This type of operation is suitable for telegraphy, or the production of a continuous flow of radio-frequency power for purposes other than communication.

Plate Modulated

This type of operation is for use when the modulating voltage is superimposed on the plate supply voltage and to obtain good quality the output power should vary as the square of the plate voltage. For complete or 100% modulation, the plate voltage varies from zero to twice the applied direct value during a cycle of the audio frequency. With no modulation applied, the plate voltage is, of course, the direct value and the carrier power output is one-fourth of the peak power output under 100% modulation. In this case, since the plate voltage varies with modulation, the direct value must be rated lower than for other types of operation.

High Frequency Ratings

The frequency limits specified under maximum ratings are based on the tube being used as an oscillator. The tube may be used at full rating up to 50 megacycles. Cooling lugs are required for the terminals at the top of the bulb when the tube is operated above 50 megacycles. When operating at higher frequencies, the dielectric losses, charging currents and lead-in heating are increased greatly. The plate voltage and hence plate dissipation must be reduced to values specified for the upper frequency limit and for frequencies between these two limits the plate voltage should be proportionately reduced.

The plate, screen grid and filament center tap terminals are brought out through the top of the glass envelope. This construction provides low inductance and low resistance connections to the electrodes which are essential to efficient operation at the ultra-high frequencies. The screen grid by-pass condenser should be located between the screen and filament center tap terminals and connected with the shortest possible leads.

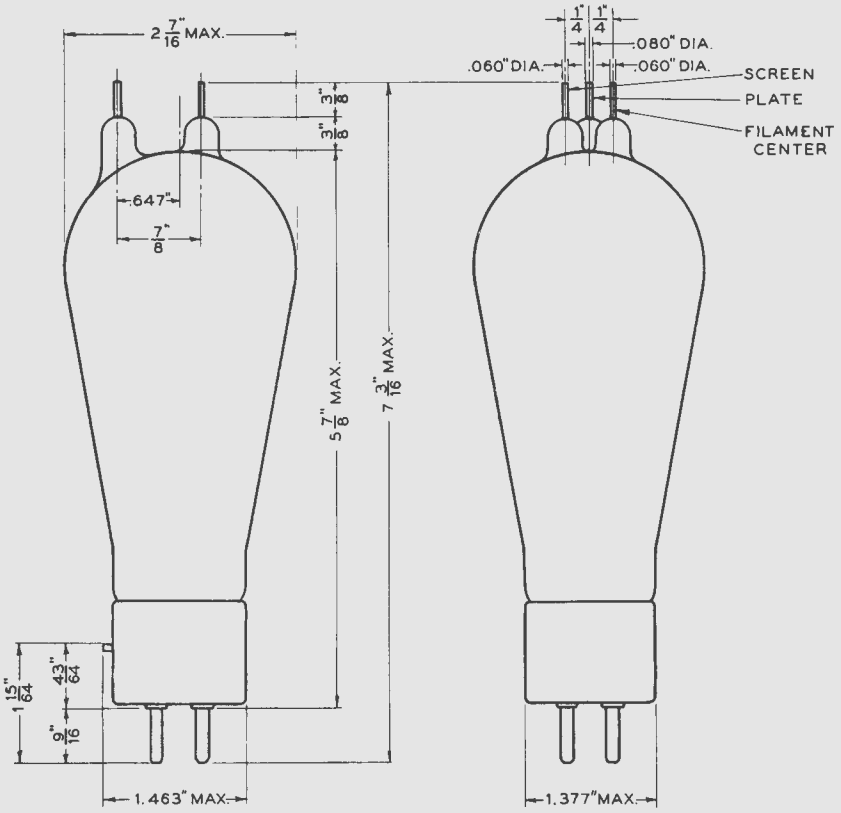

FIG. 1

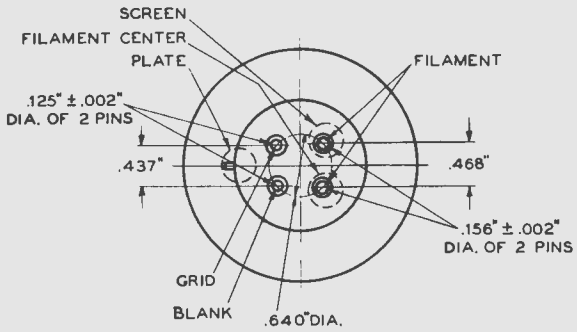

FIG. 2

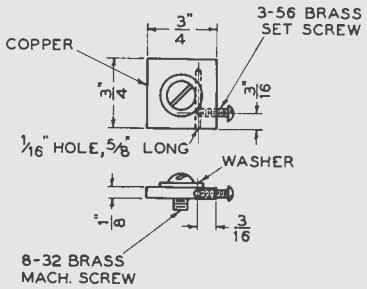

FIG. 3

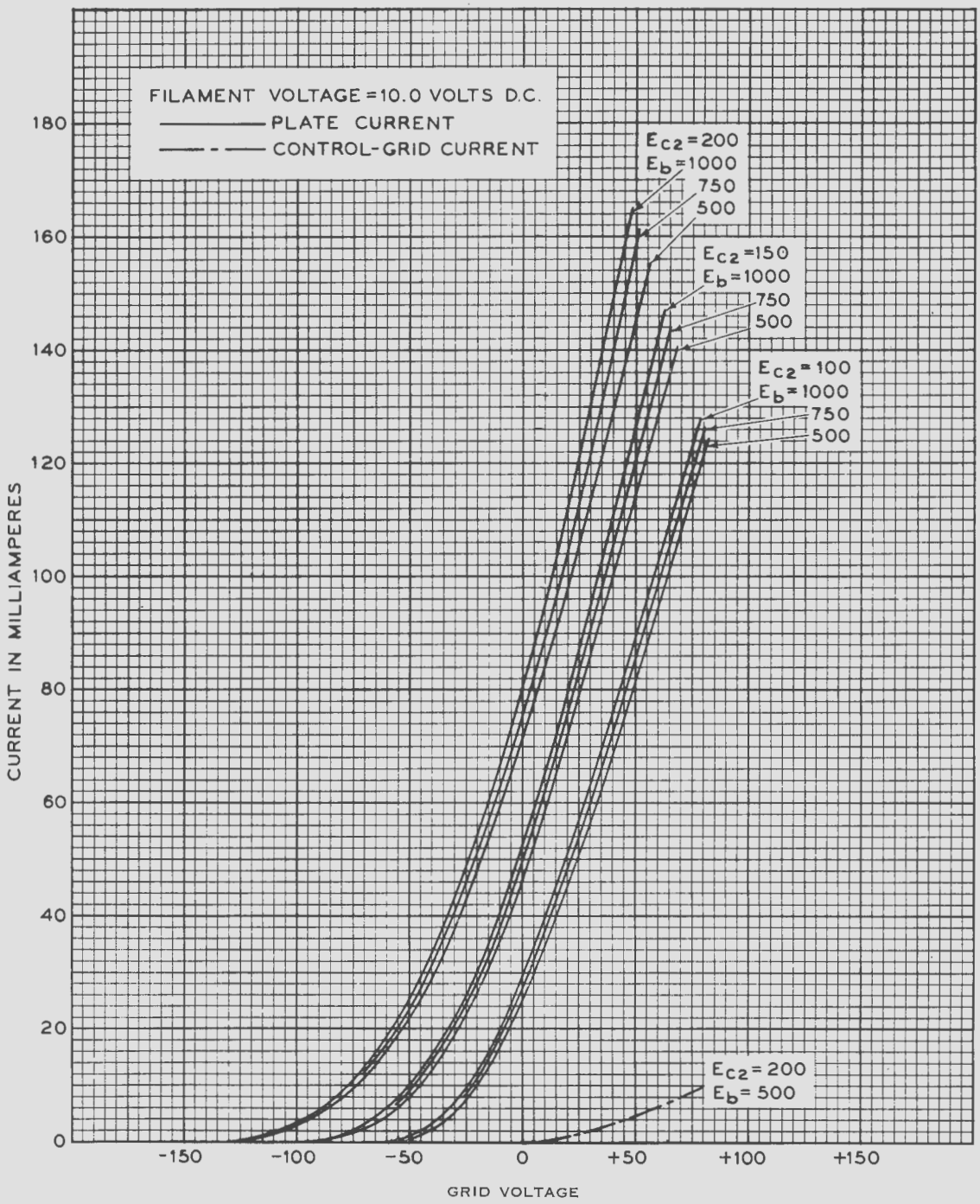
FILAMENT VOLTAGE = 10.0 VOLTS D.C.
PLATE CURRENT
CONTROL-GRID CURRENT
Ec2 = 200
Eb = 1000
750
500
Ec2 = 150
Eb = 1000
750
500
Ec2 = 100
Eb = 1000
750
500
Ec2 = 200
Eb = 500
CURRENT IN MILLIAMPERES
0
20
40
60
80
100
120
140
160
180
-150
-100
-50
0
+50
+100
+150
GRID VOLTAGE

FIG. 4

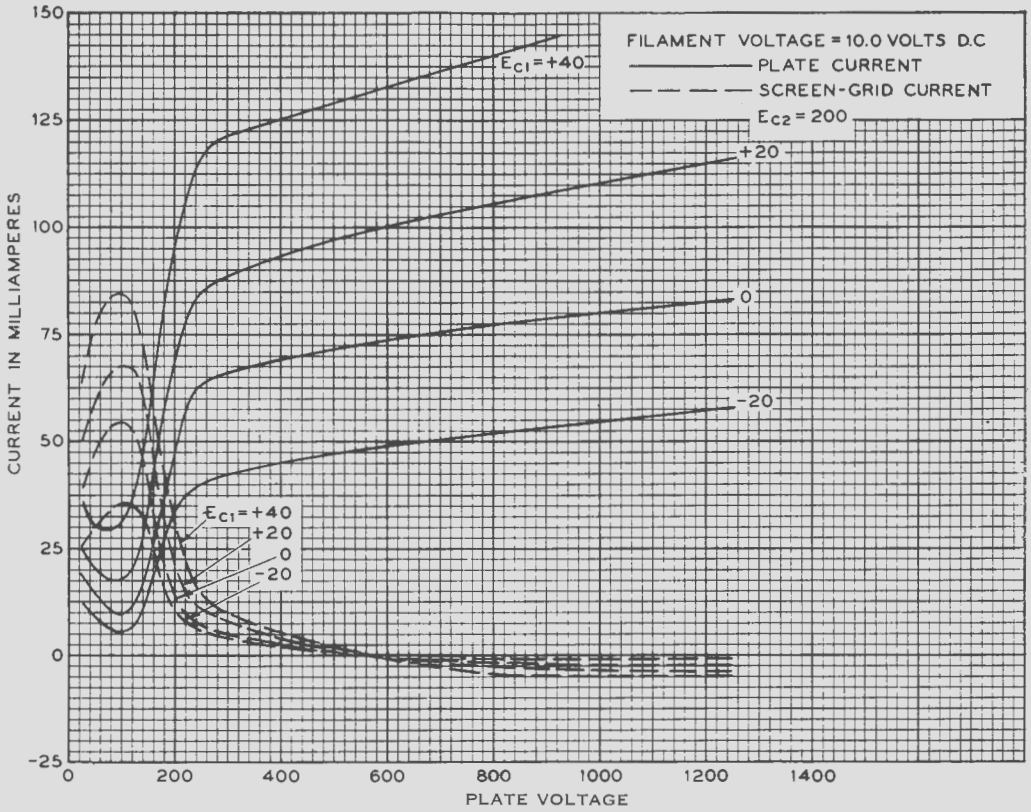
FILAMENT VOLTAGE = 10.0 VOLTS D.C
PLATE CURRENT
SCREEN-GRID CURRENT
Ec2 = 200
Ec1 = +40
+20
0
-20
Ec1 = +40
+20
0
-20
CURRENT IN MILLIAMPERES
PLATE VOLTAGE
150
125
100
75
50
25
0
-25
0
200
400
600
800
1000
1200
1400

FIG. 5

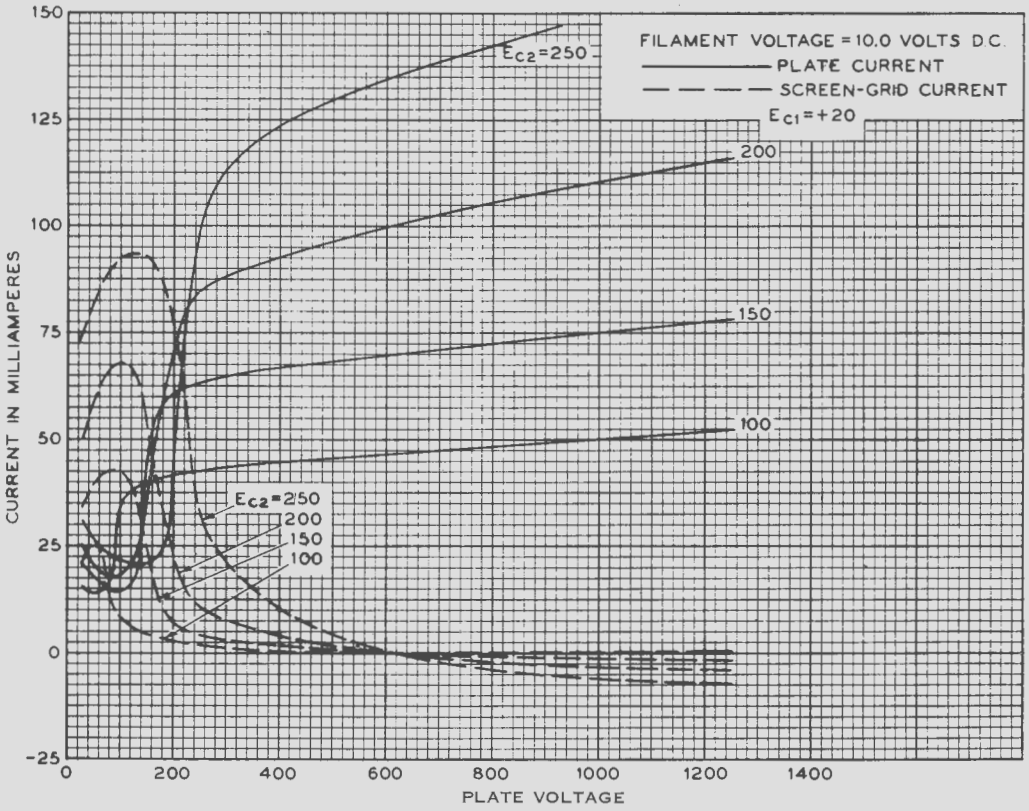
FILAMENT VOLTAGE = 10.0 VOLTS D.C.
PLATE CURRENT
SCREEN-GRID CURRENT
Ec1 = +20
Ec2 = 250
200
150
100
Ec2 = 250
200
150
100
CURRENT IN MILLIAMPERES
PLATE VOLTAGE
150
125
100
75
50
25
0
-25
0
200
400
600
800
1000
1200
1400

FIG. 6