

Pentode— Beam Power Tube

For Combined Limiter, Quadrature-Grid Discriminator, and
Audio Power Output Applications in FM and TV Receivers

DUODECAR TYPE

Electrical:

Heater Characteristics and Ratings:

Voltage (AC or DC) 6.3 ± 0.6 volts

Current at heater volts = 6.3 0.950 amp

Peak heater-cathode voltage:

Heater negative with respect to cathode 200 max. volts

Heater positive with respect to cathode 200^a max. volts

Direct Interelectrode Capacitances:^b

Beam Power Unit:

Grid No.1 to plate 0.2 pf

Input: $G1_B$ to ($K_B + G3_B, G2_B, H$) 11 pf

Output: P_B to ($K_B + G3_B, G2_B, H$) 7.0 pf

Pentode Unit:

Grid No.1 to plate 0.01 pf

$G1_P$ to ($K_P + IS, P_P, G3_P, G2_P, H$) 4.0 pf

$G3_P$ to ($K_P + IS, P_P, G2_P, G1_P, H$) 3.2 pf

Mechanical:

Operating Position Any

Types of Cathodes Coated Unipotential

Maximum Overall Length 2.375"

Seated Length 1.750" to 2.000"

Diameter 1.062" to 1.188"

Dimensional Outline (JEDEC 9-58) See *General Section*

Bulb T9

Base Small-Button Duodecar 12-Pin (JEDEC E12-70)

Basing Designation for BOTTOM VIEW 12BT

Pin 1—Heater

Pin 2—Beam Power Grid No.2

Pin 3—Beam Power Cathode,
Beam Power Grid No.3

Pin 4—Pentode Plate

Pin 5—Pentode Grid No.3

Pin 6—Pentode Grid No.2

Pin 7—Pentode Grid No.1

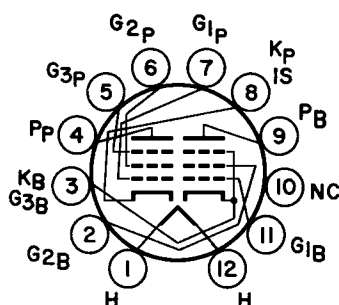
Pin 8—Pentode Cathode,
Internal Shields

Pin 9—Beam Power Plate

Pin 10—No Internal Connection

Pin 11—Beam Power Grid No.1

Pin 12—Heater



PENTODE UNIT — LIMITER & DISCRIMINATOR SERVICE

Maximum Ratings, Design-Maximum Values:

Plate Supply Voltage.	330	volts
Grid-No.3 (Quadrature-Grid) Voltage	c	
Grid-No.2 (Accelerator-Grid) Voltage. . . .	110	volts
Grid-No.1 (Limiter-Grid) Voltage:		
Positive-peak value	60	volts
Cathode Current	13	ma

Typical Operation:*Input-Signal*

<i>Center Frequency</i>	<i>4.5</i>	<i>10.7</i>	<i>10.7</i>	<i>Mc</i>
Plate Supply Voltage. . .	270	85	285	volts
Plate Voltage	62	121	122	volts
Grid-No.3 Voltage	c	c	c	c
Grid-No.2 Voltage	100	55	100	volts
Cathode-Circuit				
Resistance ^d	200-400	200-400	200-400	ohms
Peak AF Output Voltage. .	16.8	6	16.6	volts
Minimum Grid-No.1				
Signal Voltage (RMS)				
for AM rejection ^d . . .	2	1.25	2	volts
Minimum Grid-No.1				
Signal Voltage (RMS)				
for limiting action ^e . .	1.25	1.25	1.25	volts
Plate Current	0.44	0.25	0.49	ma
Grid-No.2 Current	10	4.1	9.8	ma
Plate Load Resistor . . .	0.33	0.085	0.33	megohm
Linearity Resistor. . . .	1000	470	1500	ohms
Integrating Capacitor . .	0.001	0.002	0.001	μf
Coupling Capacitor. . . .	0.25	0.25	0.01	μf
Frequency Deviation . . .	±25	±75	±75	kc
AM Rejection:				
For grid-No.1 signal				
volts (RMS) = 2 . . .	25	31	20	db
For grid-No.1 signal				
volts (RMS) = 3 . . .	30	30	29	db
Total Harmonic				
Distortion.	1.8	2	1.6	%

BEAM POWER UNIT — AMPLIFIER — Class A₁**Maximum Ratings, Design-Maximum Values:**

Plate Voltage	275	volts
Grid-No.2 (Screen-Grid) Voltage.	275	volts
Plate Dissipation.	10	watts
Grid-No.2 Input.	2	watts

Typical Operation and Characteristics:

Plate Voltage.	250	volts
Grid-No.2 Voltage.	250	volts
Grid-No.1 (Control-Grid) Voltage	-8	volts
Peak AF Grid-No.1 Voltage.	8	volts



Zero-Signal Plate Current.	35	ma
Max.-Signal Plate Current.	39	ma
Zero-Signal Grid No.2 Current.	2.5	ma
Max.-Signal Grid No.2 Current.	7	ma
Plate Resistance (Approx.)	0.1	megohm
Transconductance	6500	μ mhos
Load Resistance.	5000	ohms
Total Harmonic Distortion.	10	%
Max.-Signal Power Output	4.2	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance:

For fixed-bias operation	0.25	megohm
For cathode-bias operation	0.5	megohm

- a The dc component must not exceed 100 volts.
- b Without external shield.
- c For proper operation of the pentode unit of the type shown in the accompanying Typical Quadrature-Grid-FM Detector Circuit, the Q of the tuned circuit (L_1 , C_6) should be sufficiently high to develop a 4-volt rms signal at the quadrature grid when a 2-volt rms signal at the center frequency is applied to grid No.1.
- It is recommended that L_1 be shunted by a capacitance of at least 10 μ mf. This capacitance may be composed of tube capacitance, stray capacitance, the distributed capacitance of L_1 , and a fixed capacitor.
- d The cathode-circuit resistance should be adjusted for maximum AM rejection at the AF output of the circuit at the specified grid-No.1 signal voltage. AM rejection is measured with an applied signal containing 30 per cent amplitude modulation and 30 per cent frequency modulation.
- e At signal levels above specified value, limiting is within ± 3 decibels.

OPERATING CONSIDERATIONS FOR PENTODE UNIT

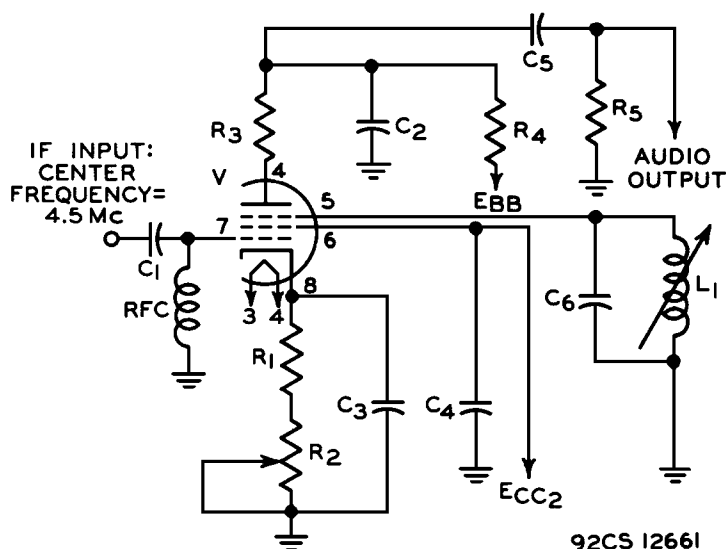
To insure proper phasing of the signal voltage developed at the quadrature grid, the components of the quadrature-grid circuit should be shielded from those of the control-grid circuit.

To obtain a symmetrical discriminator-response curve, the plate currents for no input signal and for unmodulated input signal should be equal. To assure this equality, it is necessary that the plate voltage and grid-No.2 voltage have the proper values.

The proper plate voltage for any grid-No.2 voltage may be determined from the accompanying *Operating Characteristics, Pentode Unit* curve. This curve may also be used to determine the average dynamic plate current for any combination of grid-No.2 voltage and plate voltage.



TYPICAL QUADRATURE-GRID- FM-DETECTOR CIRCUIT



- C_1 : 100 $\mu\mu\text{f}$
 C_2 : Integrating capacitor,
 0.001 μf
 C_3, C_4 : 0.01 μf
 C_5 : 0.25 μf
 C_6 : 10 $\mu\mu\text{f}^c$
 L_1 : c
 R_1 : 200 ohms
 R_2 : Cathode-bias
 potentiometer, 200 ohms

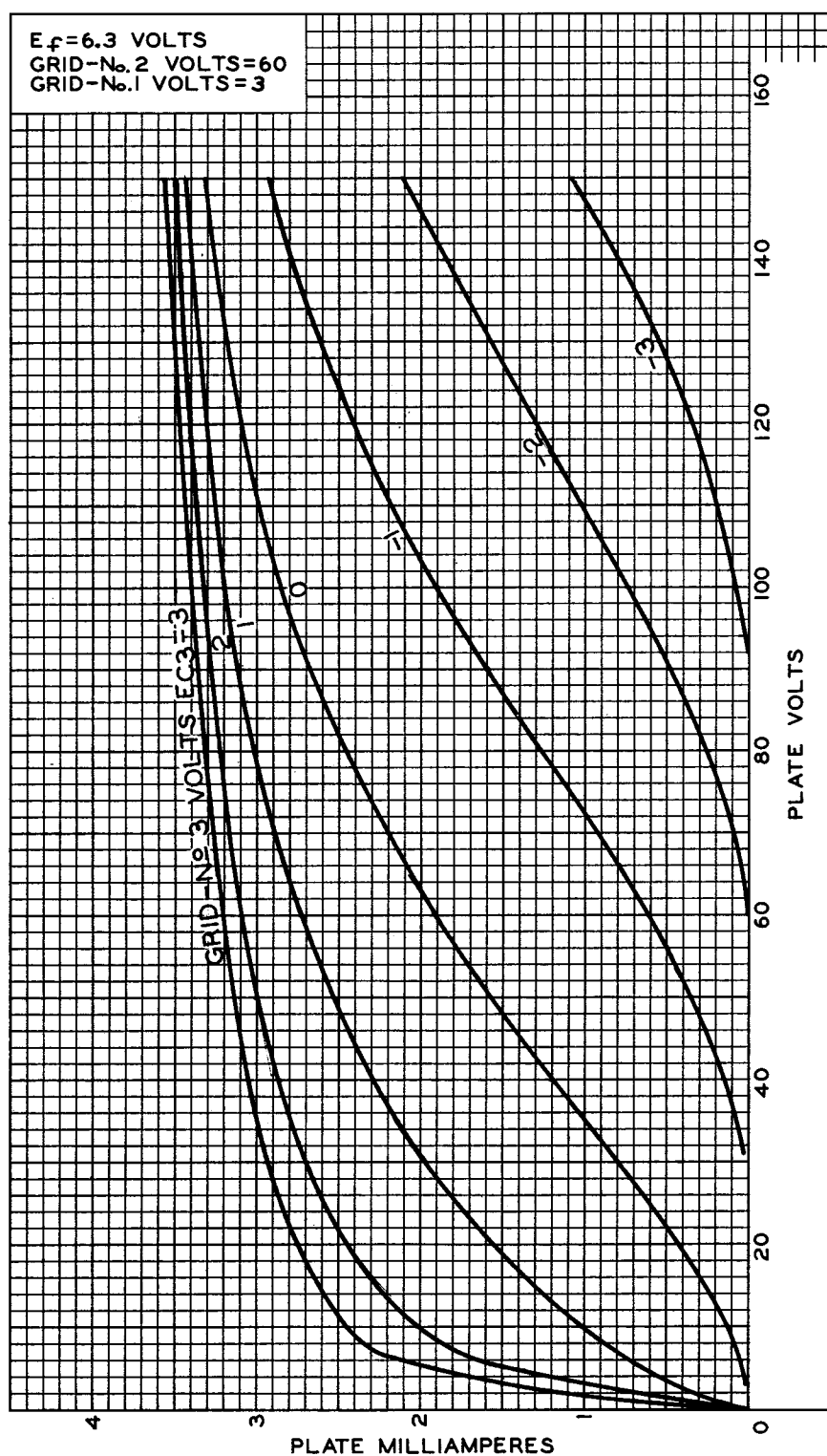
- R_3 : Linearity resistor,
 1000 ohms
 R_4 : Plate-load resistor,
 0.33 megohm
 R_5 : 0.47 megohm
 V: Pentode Unit of
 Electron-tube-type
 6J10

^c For footnote see end of data.

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AVERAGE PLATE CHARACTERISTICS

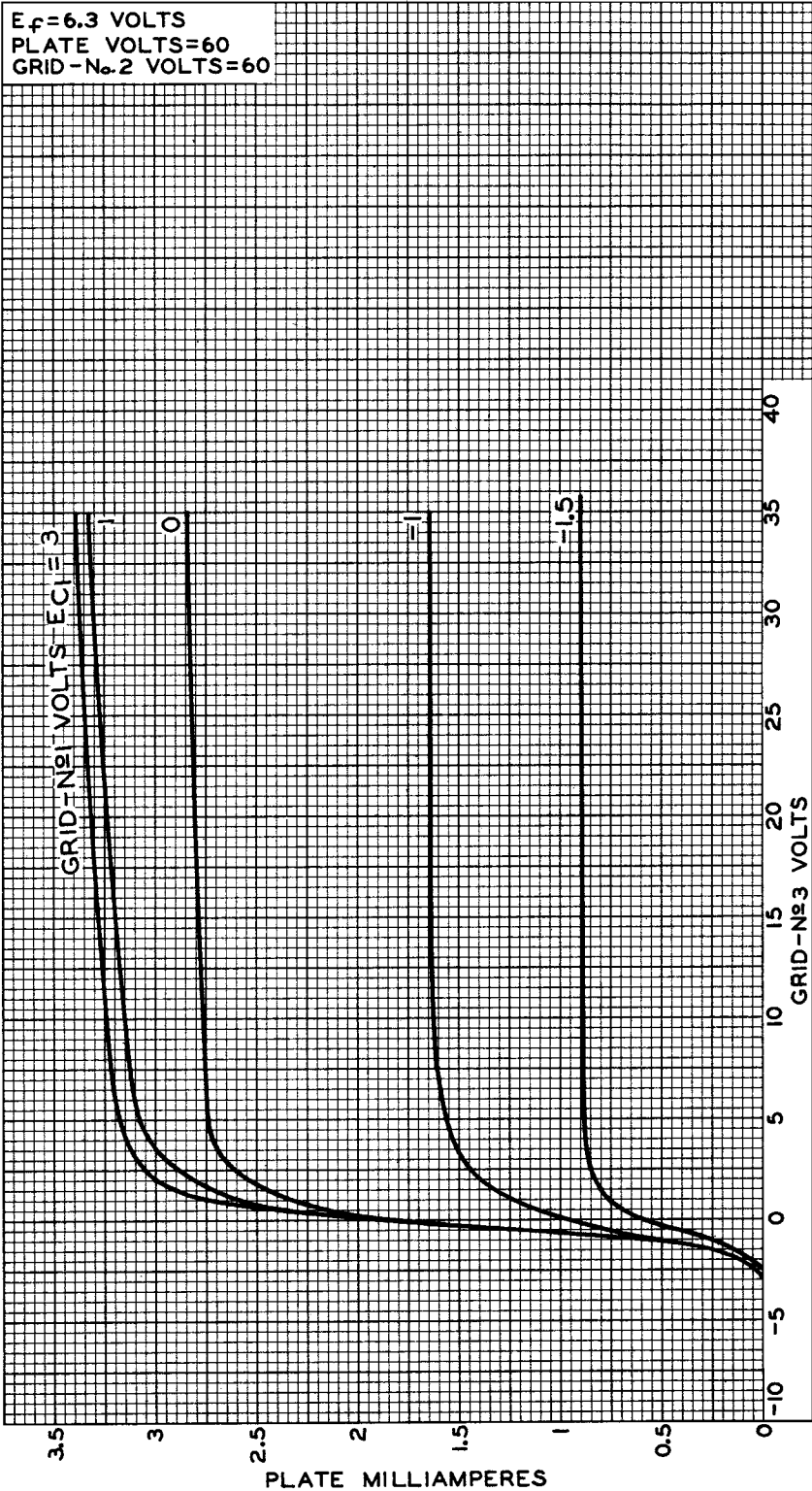
Pentode Unit



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AVERAGE CHARACTERISTICS
Pentode Unit

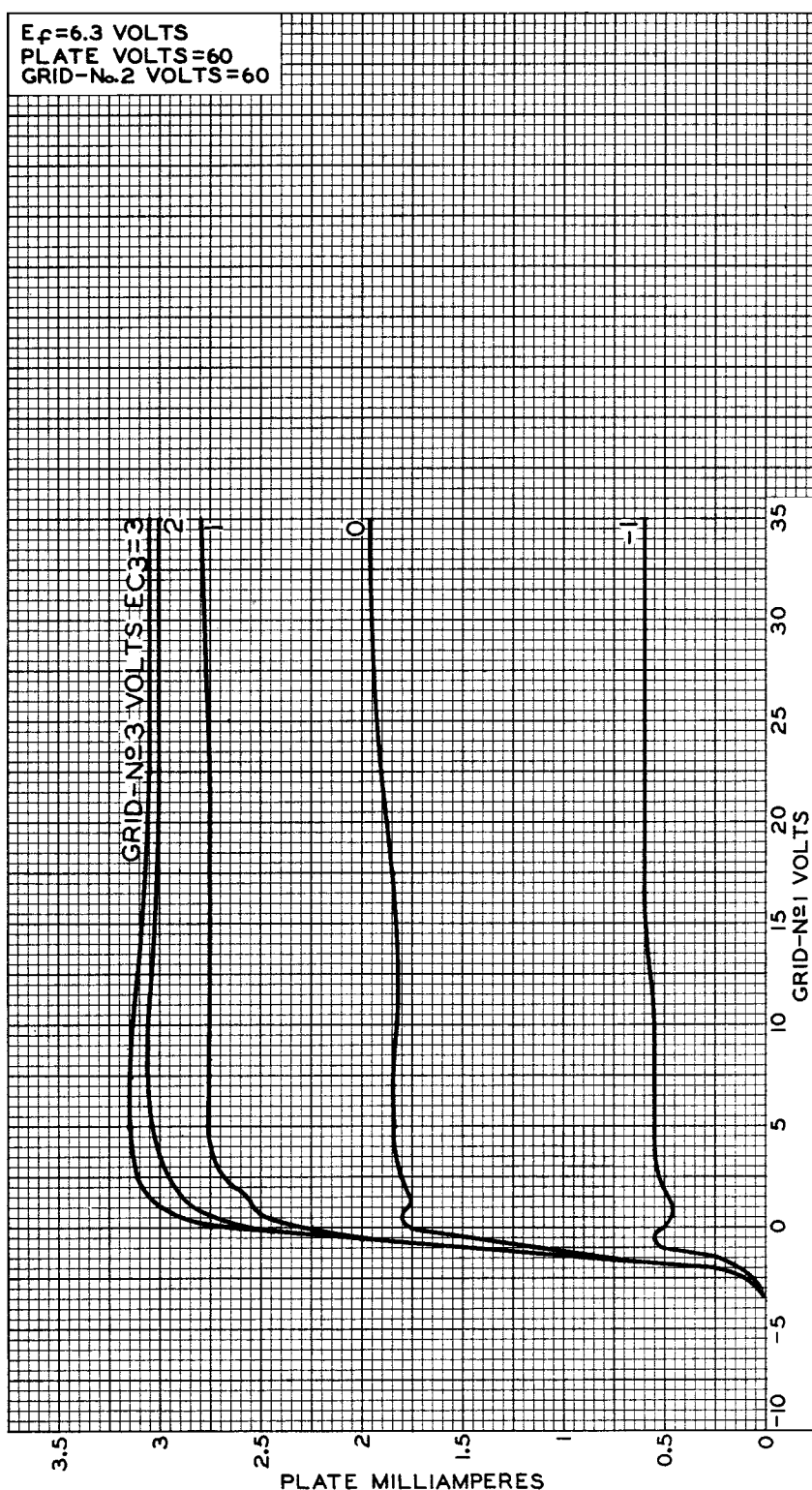


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AVERAGE CHARACTERISTICS

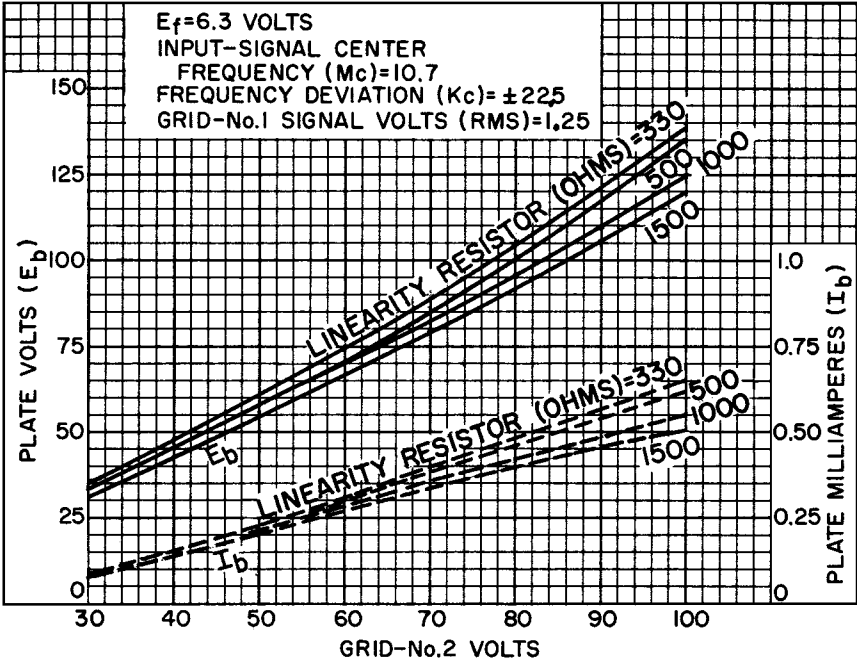
Pentode Unit



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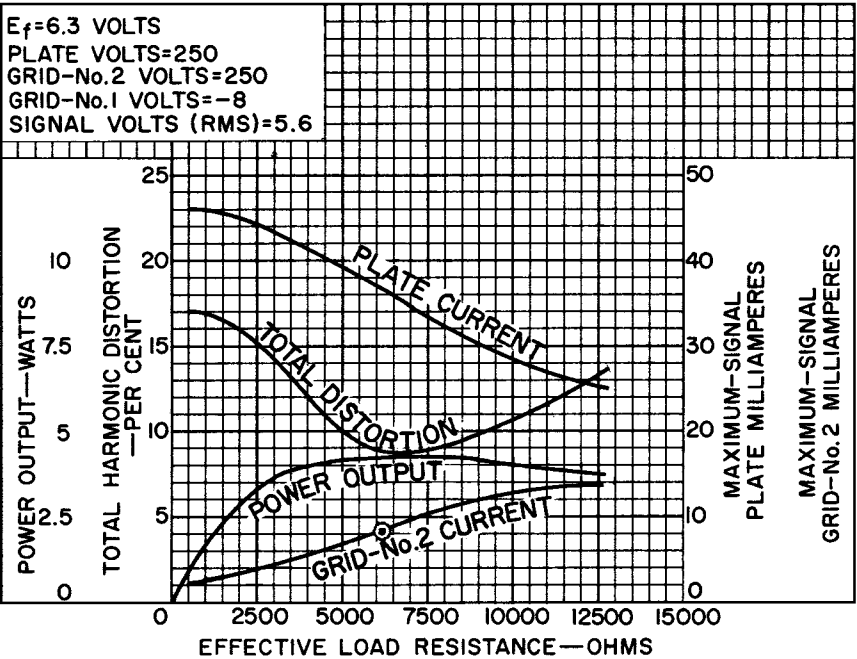


OPERATION CHARACTERISTICS
Pentode Unit



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OPERATION CHARACTERISTICS
Beam Power Unit



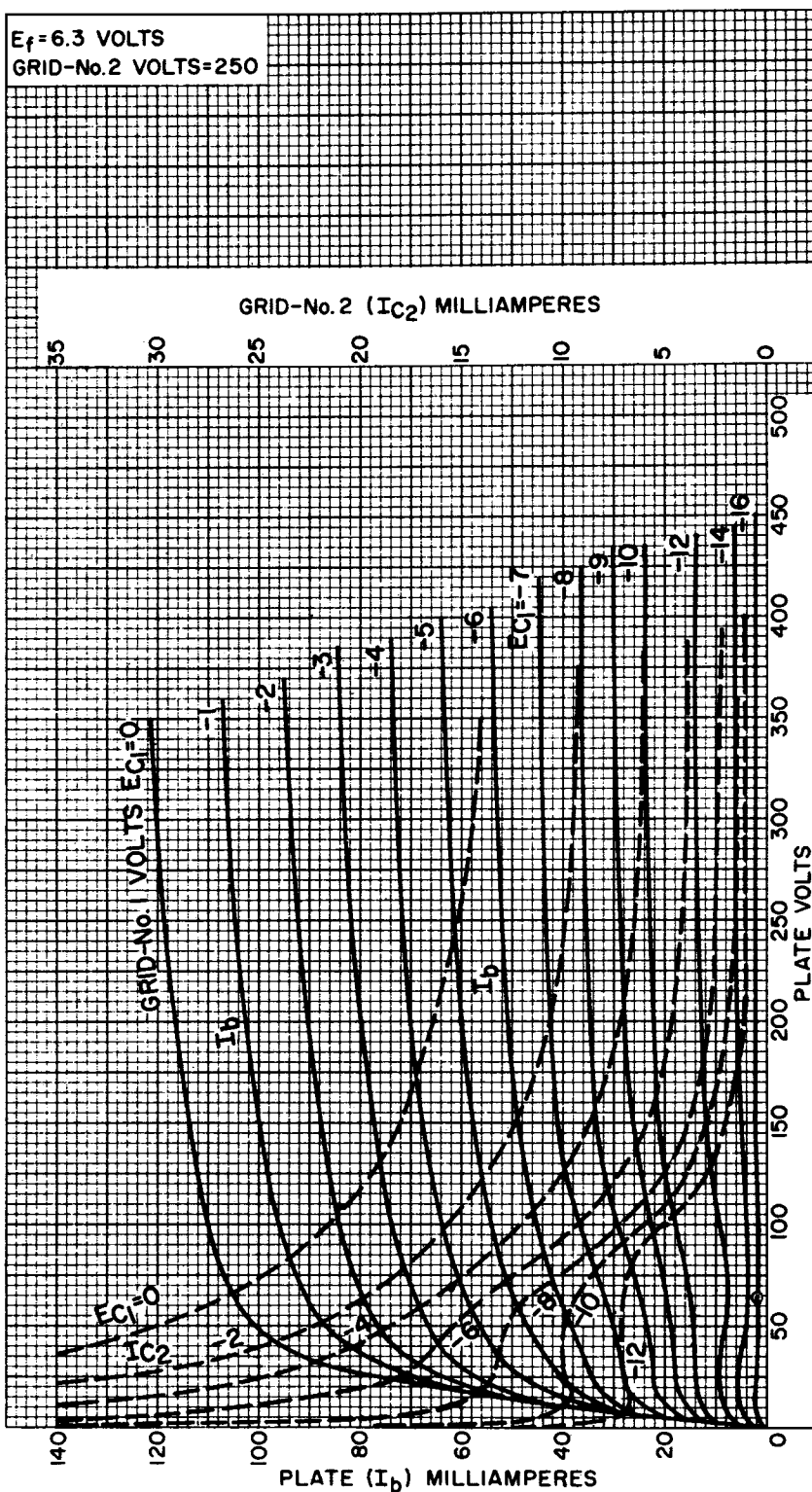
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AVERAGE CHARACTERISTICS

Beam Power Unit

$E_f = 6.3$ VOLTS
GRID-No.2 VOLTS=250



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