

MECHANICAL DATA

Bulb	T-3
Base	E8-10, Subminiature Button Flexible Leads
Outline	JETEC 3-1
Basing	8DG
Cathode	Coated Unipotential
Mounting Position	Any

RATINGS¹ (Absolute Maximum)

Impact Acceleration	450 G
Uniform Acceleration	1000 G
Fatigue (Vibrational Acceleration for Extended Periods)	2.5 G
Bulb Temperature	220° C
Altitude ²	60000 Ft.

ELECTRICAL DATA

HEATER CHARACTERISTICS

	Min.	Bogey	Max.
Heater Voltage ³	6.0	6.3	6.6 V
Heater Current		300	mA

DIRECT INTERELECTRODE CAPACITANCES

	Shielded ⁴	Unshielded
Grid to Plate (Each Section)	1.0	1.0 μf
Input (Each Section)	1.9	1.7 μf
Output		
Section No. 1	1.5	0.23 μf
Section No. 2	1.5	0.28 μf
Grid to Grid	0.011	0.014 μf Max.
Plate to Plate	0.60	0.80 μf Max.

RATINGS¹ & ⁵ (Absolute Maximum)

Plate Voltage	165 Vdc
Peak Plate Forward Voltage ⁶	330 v
Plate Dissipation (Per Plate)	0.55 W
Plate Current (Each Section)	3.3 mA _{dc}
Grid Voltage	
Positive Value	0 Vdc
Negative Value	55 Vdc
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	200 v
Heater Negative with Respect to Cathode	200 v
Grid Circuit Resistance	1.1 Meg

CHARACTERISTICS (Each Section)

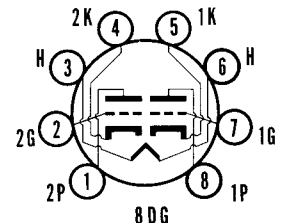
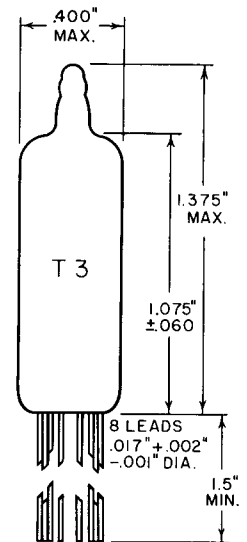
Plate Voltage	100	150 Vdc
Cathode Resistor	1500	820 Ohms
Transconductance	1800	2500 μmhos
Amplification Factor	70	70
Plate Current	0.8	1.75 mA _{dc}
Grid Voltage for $I_b \pm 50 \mu\text{A}_{dc}$ Max.	-2.8	-3.7 Vdc

NOTES:

1. Limitations beyond which normal tube performance and tube life may be impaired.
2. If altitude rating is exceeded, reduction of instantaneous voltages (E_f excluded) may be required.
3. Tube life and reliability of performance are directly related to the degree of regulation of the heater voltage to its center rated value of 6.3 volts.
4. External shield of 0.405 inch diameter connected to cathode.
5. Values shown are as registered with RETMA.
6. Per MIL-E-1C par. 6.5 and General Section of this Sylvania Subminiature Tube Manual titled Specifications and Ratings.

QUICK REFERENCE DATA

The Premium Subminiature Type 6112 is a high mu double triode having separate cathode connections for each section. It is intended primarily for use in low level audio circuits and is designed to provide dependable service under conditions of severe shock, vibration, high temperature and high altitude. The 6112 is manufactured and inspected to meet the applicable MIL-E-1 specification for reliable operation.



SYLVANIA ELECTRIC PRODUCTS INC.

**RADIO TUBE DIVISION
EMPORIUM, PA.**

*Prepared and Released By The
TECHNICAL PUBLICATIONS SECTION
EMPORIUM, PENNSYLVANIA*

FEBRUARY 1957

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ACCEPTANCE CRITERIA

Test Conditions

Heater Voltage	6.3 V	Heater-Cathode Voltage MIL-E-1 Par. 3.2.2.1	0 V
Plate Voltage	100 Vdc	Cathode Resistance Per Cathode MIL-E-1	
Grid Voltage	0 V	Par. 3.2.2.1	1500 Ohms

For the purposes of inspection, use applicable reliable paragraphs of MIL-E-1 and Inspection Instructions for Electron Tubes.

MIL-E-1 Ref.	Test	AQL (%)	Limits					Units
			Min.	LAL	Bogey	UAL	Max.	
Measurements Acceptance Tests, Part 1, Note 1								
4.1.1.7	(Method A)							
4.10.8	Heater Current: ALD = 24	—	—	288	300	312	—	mA
4.10.8	Heater Current:	0.65	280	—	—	—	320	mA
4.10.15	Heater-Cathode Leakage: Note 4	0.65	—	—	—	—	—	
	Ehk = +100 Vdc	—	—	—	—	—	5.0	μA _{dc}
	Ehk = -100 Vdc	—	—	—	—	—	5.0	μA _{dc}
4.10.6.1	Grid Current: Note 4 I _c Eb = 150 Vdc; Ec = 0 V; Rk = 820 Ohms; Rg/g = 1.0 Meg	0.65	0	—	—	—	-0.3	μA _{dc}
4.10.4.1	Plate Current (1): Note 4	0.65	0.50	—	—	—	1.10	mA _{dc}
4.10.4.1	Plate Current (2): Note 4 Ec = -2.8 Vdc; Rk = 0 Ohms	0.65	—	—	—	—	50	μA _{dc}
4.1.1.7	(Method A)							
4.10.9	Transconductance (1): Note 4 ALD = 350 Sm	—	—	1650	1800	1950	—	μmhos
4.10.9	Transconductance (1): Note 4 Sm	0.65	1500	—	—	—	2100	μmhos
4.7.5	Continuity and Shorts (Inoperatives):	0.4	—	—	—	—	—	
4.9.1	Mechanical: Envelope (8-1)	—	—	—	—	—	—	
Measurements Acceptance Tests, Part 2								
4.8.2	Insulation of Electrodes: Note 4	2.5	—	—	—	—	—	
	g-all	—	100	—	—	—	—	Meg
	p-all	—	100	—	—	—	—	Meg
4.10.9	Transconductance (2): Note 4 Δ Sm Ef = 5.7 V Ef	2.5	—	—	—	—	15	%
4.10.6.2	Grid Emission: Notes 4 and 5 I _c Ef = 7.5 V; Ec = -4.0 Vdc; Eb = 150 Vdc; Rk = 0 Ohms; Rg/g = 1.0 1.0 Meg	2.5	0	—	—	—	-0.5	μA _{dc}
4.10.3.2	AF Noise: Note 6 Esig = 45 mVac; Rg = 0.5 Meg; Rp = 0.2 Meg; Rk = 750 Ohms; Ck = 1000 μf	2.5	—	—	—	—	17	VU
4.10.11.1	Amplification Factor: Note 4	6.5	60	—	70	—	80	
4.10.11.2	AC Amplification: Note 4 Ebb = 100 Vdc; Ecc = 0 Vdc; Esig = 0.2 Vac; Rk = 0 Ohms	6.5	8.0	—	—	—	—	Vac
4.10.14	Capacitance:	6.5	—	—	—	—	—	
	No Shield; Note 4 Cgp	—	0.8	—	—	—	1.20	μμf
	No Shield; Note 4 Cin	—	1.30	—	—	—	2.10	μμf
	No Shield; Section 1 Cout	—	0.16	—	—	—	0.30	μμf
	No Shield; Section 2 Cout	—	0.21	—	—	—	0.35	μμf
	No Shield Cgg	—	—	—	—	—	0.014	μμf
	No Shield Cpp	—	—	—	—	—	0.80	μμf
4.9.12.1	Low Pressure Voltage Breakdown: Pressure = 20 ± 5 mm Hg.; Voltage = 300 Vac	6.5	—	—	—	—	—	

The information presented on this data sheet is furnished without assuming any obligation.

ACCEPTANCE CRITERIA (Continued)

MIL-E-I Ref.	Test	AQL (%)	Limits					Units
			Min.	LAL	Bogey	UAL	Max.	
Measurements Acceptance Tests, Part 2 (Continued)								
4.9.20.3	Vibration (1): No Voltages; Post Shock and Fatigue Test End Points Apply.....	10.0	—	—	—	—	—	
4.9.19.1	Vibration (2): Note 4 Rp = 10,000 Ohms; Ck = 1000 μf; F = 40 cps; G = 15.....	2.5	—	—	—	—	25	mVac
4.9.19.1	White Noise: (Each Section); Note 7; Rp = 10,000 Ohms; Ck = 1000 μf;..... Peak Acceleration = 15 G.....	2.5	—	—	—	—	175	mv pk-pk
		2.5	—	—	—	—	25	mVac
Degradation Rate Acceptance Tests, Note 2								
4.9.5.3	Subminiature Lead Fatigue:.....	2.5	4	—	—	—	—	arcs
4.9.20.5	Shock: Hammer Angle = 30°; Ehk = +100 Vdc; Rg = 0.1 Meg.....	20	—	—	—	—	—	
4.9.20.6	Fatigue: G = 2.5; Fixed Frequency; F = 25 min., 60 max.....	6.5	—	—	—	—	—	
-----	Post Shock and Fatigue Test End Points:							
	Vibration (2).....	—	—	—	—	—	100	mVac
	Heater-Cathode Leakage Ehk = +100 Vdc.....	—	—	—	—	—	20	μAdc
	Ehk = -100 Vdc.....	—	—	—	—	—	20	μAdc
4.9.6.3	Change in Transconductance (1) of Individual Tubes ΔS_m Δ_t	—	—	—	—	—	20	%
		6.5	—	—	—	—	—	

MIL-E-I Ref.	Test	AQL (%)	Allowable Defectives per Characteristic		Limits		Units
			1st Sample	Combined Samples	Min.	Max.	
Acceptance Life Tests, Note 2							
4.11.7	Heater Cycling Life Test: Ef = 7.0 V; 1 min. on, 4 min. off; Ehk = 140 Vac; Ec = Eb = 0 V.....	2.5	—	—	—	—	
4.11.3.1	Stability Life Test: (1 Hour) Note 4 Eb = 150 Vdc; Ehk = +200 Vdc; Rg/g = 1.0 Meg; Rk/k = 820 Ohms; TA = Room.....	1.0	—	—	—	—	
4.11.4	Stability Life Test End Points: Change in Transconductance (1) of Individual Tubes ΔS_m Δ_t	—	—	—	—	10	%
4.11.3.1	Survival Rate Life Test: (100 Hours) Stability Life Test Conditions or Equivalent; TA = Room.....	—	—	—	—	—	
4.11.3.1.1		—	—	—	—	—	
4.11.4	Survival Rate Life Test End Points: Continuity and Shorts (Inoperatives).....	0.65	—	—	—	—	
4.11.5	Intermittent Life Test: Notes 3 and 4 Stability Life Test Conditions; T Envelope = +220°C min.; 1000 Hour Requirements Do Not Apply.....	1.0	—	—	1200	—	μmhos
4.11.3.1		—	—	—	—	—	

ACCEPTANCE CRITERIA (Continued)

MIL-E-I Ref.	Test	AQL (%)	Allowable Defectives per Characteristic		Limits		Units
			1st Sample	Combined Samples	Min.	Max.	
Acceptance Life Tests, Note 2 (Continued)							
4.11.3.1	Intermittent Life Test End Points:						
4.11.4	(500 Hours)						
	Inoperatives.....	—	1	3	—	—	
	Grid Current.....	—	1	3	0	-0.9	μAdc
	Heater Current.....	—	2	5	276	328	mA
	Change in Transconductance (1) of Individual Tubes Δ _t S _m	—	1	3	—	25	%
	Transconductance (2) Δ _{Ef} S _m	—	2	5	—	15	%
	Heater-Cathode Leakage.....	—	2	5	—	—	
	Ehk = +100 Vdc.....	—	—	—	—	10	μAdc
	Ehk = -100 Vdc.....	—	—	—	—	10	μAdc
	Insulation of Electrodes.....	—	2	5	—	—	
	g-all.....	—	—	—	50	—	Meg
	p-all.....	—	—	—	50	—	Meg
	Transconductance (1) Average Change, Avg Δ _t S _m	—	—	—	—	15	%
	Total Defectives.....	—	4	8	—	—	

ACCEPTANCE CRITERIA NOTES:

- 1: The AQL for the combined defectives for attributes in Measurements Acceptance Tests, Part 1, excluding inoperatives and mechanical shall be one (1) percent. A tube having one (1) or more defects shall be counted as one (1) defective.
- 2: Tubes subjected to the following destructive tests are not to be accepted under this specification.
 - 4.9.5.3 Subminiature lead fatigue
 - 4.9.20.5 Shock
 - 4.9.20.6 Fatigue
 - 4.11.7 Heater cycling life test
 - 4.11.5 Intermittent life test
- 3: Envelope temperature is defined as the highest temperature indicated when using a thermocouple of # 40 BS or smaller diameter elements welded to a ring of 0.025 inch diameter phosphor bronze placed in contact with the envelope. Envelope temperature requirement will be satisfied if a tube, having bogey Ib (± 5%) under normal test conditions, is determined to operate at maximum specified temperature at any position on the life test rack.
- 4: Test each section separately.
- 5: Prior to this test tubes shall be preheated five (5) minutes with both sections operating separately at conditions indicated below. Test within three (3) seconds after preheating. Three-minute test is not permitted. Grid Emission shall be the last test performed on the sample selected for the Grid Emission Test.

Ef	Ec1	Eb	Rk	Rg
V	Vdc	Vdc	Ohms	Meg
7.5	0	150	820	1.0

- 6: Tie 1k to 2k; 1g to 2g; and 1p to 2p.
- 7: The tube shall be rigidly mounted on a table vibrating such that the instantaneous values of acceleration shall constitute approximately a "White Noise" spectrum which is free from discontinuities from 100 cps to 5000 cps. The spectrum of instantaneous acceleration shall be such that each octave of bandwidth delivers 2.3 G's rms acceleration. With this case, the rms value of acceleration for any bandwidth within the specified spectrum is equal to

$$G_{rms} = 2.3 G \sqrt{3.32 \log_{10} (f2/f1)}$$

f2 and f1 are the upper and lower frequencies respectively of the band under consideration. The degree of clipping of the peak accelerations shall be such that the peak value of acceleration is at least 15 G's.

The voltage (ep) produced across the resistor (Rp) as a result of vibration shall be coupled through a compensating amplifier to a low pass filter. The compensating amplifier shall have a high input impedance (0.25 megohm or more) and shall be adjusted to compensate for any insertion losses in the filter. The combined frequency response of amplifier and filter shall be flat within ±0.5 db from 50 cps to 8000 cps, shall be down no more than 5 db at 10,000 cps and at 20 cps, and down at least 40 db at 13,000 cps. For reading the peak to peak value of output voltage the filter output shall be fed directly to the input of a Ballantine Model 305 peak to peak electronic voltmeter or equal, while the rms value shall be measured with a Hewlett-Packard Model 400C or equal.

APPLICATION DATA

The Sylvania Premium Subminiature Type 6112 is a high mu, double triode of subminiature construction intended primarily for application as a low level, resistance coupled amplifier. In such circuits the high mu (70) of the 6112 can easily yield a voltage gain of 50 for each section. Resistance coupled amplifier data is shown in the accompanying tables for both cathode bias and zero bias operation. In zero bias circuits a grid circuit resistance of from 5 to 10 megohms should be employed to reduce contact potential loading and provide better plate current balance between sections and/or individual tubes.

Electrically, the 6112 is essentially equivalent to two Type 5719's in one envelope. The 6112 is particularly useful in applications where the power requirements permit the use of two tubes in one envelope.

To insure correlation with actual field conditions and thereby enhance equipment reliability, vibrational noise output is controlled by the "white noise test" as shown in the acceptance criteria. Briefly, this test consists of subjecting the tubes to a white noise vibration spectrum covering the frequency band of 100 to 5000 cps at a rms level of 2.3 g's per octave and a peak level of 15 g's. Limits are shown for both peak and rms output. A fur-

APPLICATION DATA (Continued)

ther discussion of the white noise vibrational test is included in the frontal section of this manual.

Life expectancy is described by the life tests, specified on the attached pages and/or individual MIL-E-1 specifications. The actual life expectancy of the tubes in an operating circuit is affected by both the operating and environmental conditions involved. Likewise, the life tests specified indicate performance under certain operating criteria to a set of specified end points. Performance at conditions other than those specified can usually be estimated only roughly as giving better or poorer life expectancy. For further discussion of life expectancy,

reference should be made to the frontal section of this manual.

The 6112 is manufactured and inspected to meet the applicable MIL-E-1 specification for reliable operation and is intended for service under conditions of severe vibration, shock, high temperature and high altitude.

When operated under conditions common to on-off control applications the tube exhibits freedom from the development of interface resistance. The heater-cathode construction is designed to withstand intermittent operation.

RESISTANCE COUPLED AMPLIFIER DATA
SELF-BIAS OPERATION

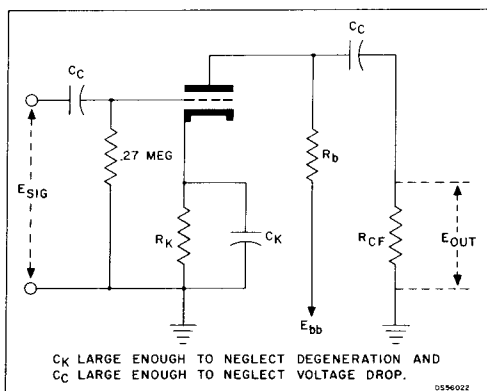
Rb (megohms)	Ebb = 100 Volts						Ebb = 200 Volts					
	0.10		0.27		0.47		0.10		0.27		0.47	
Rcf (megohms)	0.27	0.47	0.47	1.0	0.47	1.0	0.27	0.47	0.47	1.0	0.47	1.0
Rk (ohms)	2200	2200	4700	4700	6800	8200	1200	1500	3300	3900	4700	5600
Ib (ma)	.375	.37	.175	.175	.11	.105	.92	.845	.385	.365	.25	.235
Ec (volts)	.825	.813	.822	.822	.75	.862	1.10	1.27	1.27	1.42	1.17	1.31
Eb (volts)	61.7	62.2	52	52	47.5	49.8	106.9	114.2	94.7	100.1	81.8	88.2
Esig (volts, rms)	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
Eout (volts, rms)	3.9	4.05	4.20	4.5	4.15	4.42	4.80	4.80	4.95	5.1	4.95	5.15
Gain	39.0	40.5	42.0	45.0	41.5	44.2	48.0	48.0	49.5	51.0	49.5	51.5
% Distortion	2.04	2.2	2.15	1.8	2.2	1.95	0.90	1.42	1.43	1.46	1.50	1.58
Esig* (volts, rms)	.24	.26	.26	.28	.25	.32	.55	.58	.56	.66	.52	.67
Eout (volts, rms)	9.2	10.4	10.8	12.4	10.3	13.9	26.1	27.8	27.8	33.0	25.3	33.9
Gain	38.3	40.0	41.5	44.2	41.2	43.4	47.5	48.0	49.6	50.0	48.6	50.5
% Distortion	5.00	4.95	4.90	4.25	5.00	5.00	4.95	5.00	4.95	5.00	5.0	5.0

*Maximum signal for 5% distortion or 1/8 microampere grid current.

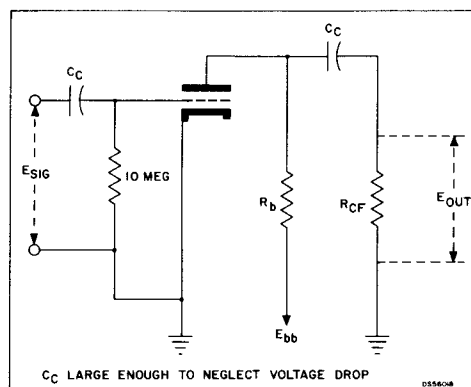
RESISTANCE COUPLED AMPLIFIER DATA
ZERO-BIAS OPERATION

Rb (megohms)	Ebb = 100 Volts						Ebb = 200 Volts					
	0.1		0.27		0.47		0.1		0.27		0.47	
Rcf (megohms)	.27	.47	.47	1.0	.47	1.0	.27	.47	.47	1.0	.47	1.0
Rk (ohms)	—	—	—	—	—	—	—	—	—	—	—	—
Ib (ma)	.41	.41	.19	.19	.12	.12	1.14	1.14	.50	.50	.31	.31
Ec (volts)	—	—	—	—	—	—	—	—	—	—	—	—
Eb (volts)	59	59	48.7	48.7	43.7	43.7	86	86	65	65	54	54
Esig (volts, rms)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Eout (volts, rms)	4.0	4.2	4.4	4.5	4.28	4.6	5.0	5.35	5.5	5.75	5.3	5.65
Gain	40.0	42.0	44.0	45.0	42.8	46.0	50.0	53.5	55.0	57.5	53.0	56.5
% Distortion	2.2	2.0	2.2	1.9	2.35	1.95	1.6	1.6	1.6	1.6	1.7	1.6
Esig* (volts, rms)	.23	.25	.25	.31	.23	.30	.54	.58	.56	.65	.51	.65
Eout (volts, rms)	8.6	9.45	10.4	12.8	9.3	12.9	25.2	28.0	27.8	33.3	24.9	33.0
Gain	37.4	37.8	41.6	41.3	40.4	43.0	46.7	48.2	49.7	51.2	48.8	50.8
% Distortion	5.0	5.0	5.0	4.9	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0

*Maximum signal for 5% distortion or 1/8 microampere grid current.

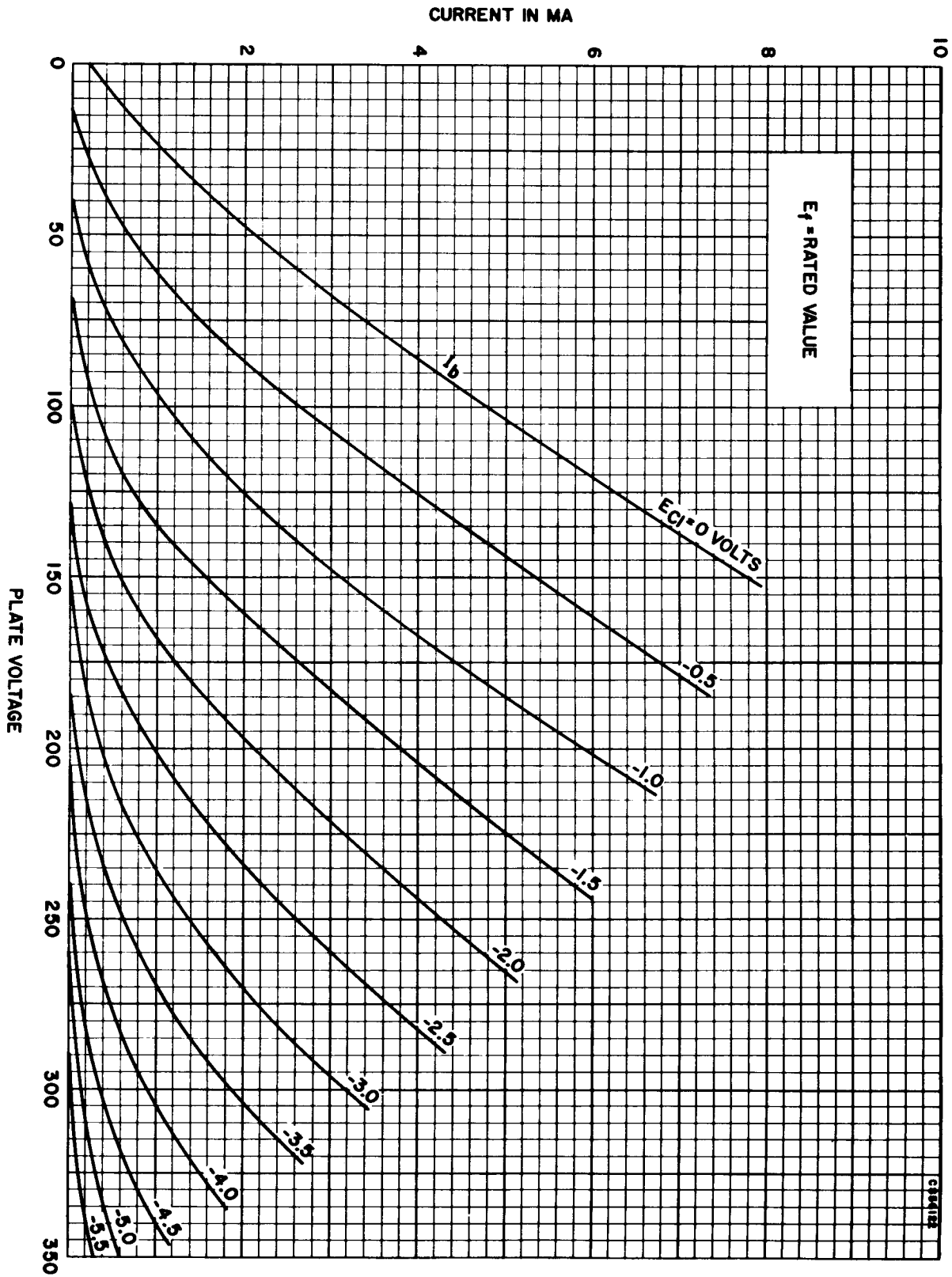


Resistance coupled amplifier circuit (Self-Bias).

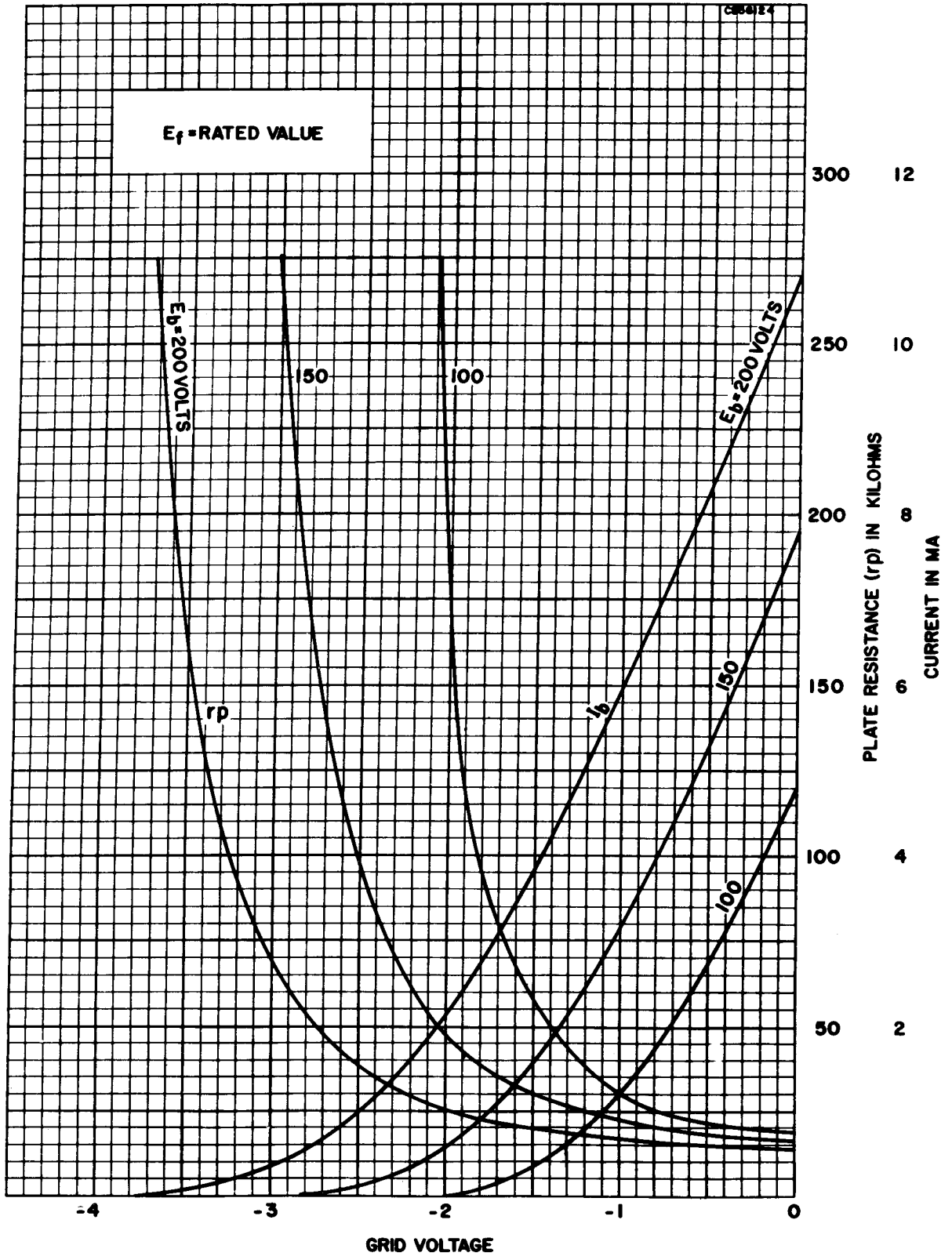


Resistance coupled amplifier circuit (Zero-Bias).

AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

