SYLVANIA

engineering data service

MECHANICAL DATA

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

RATINGS[1] (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]	80000 Ft.

ELECTRICAL DATA

HEATER CHARACTERISTICS

	Min.	Bogey	Max.	
Heater Voltage[3]	25.2	26.5	27.8	V
Heater Current		45		mA

DIRECT INTERLODE CAPACITANCES

	Shielded[4]	Unshielded	
Grid No. 1 to Plate	0.015	0.03 μμf	Max.
Input	4.2	4.0 μμf	
Output	3.4	1.9 μμf	

RATINGS[1 & 5] (Absolute Maximum)

Plate Voltage	165 Vdc
Peak Plate Forward Voltage[6]	330 v
Grid No. 2 Voltage	155 Vdc
Plate Dissipation	1.1 W
Grid No. 2 Dissipation	0.55 W
Cathode Current	16.5 mAdc
Grid No. 1 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 No. 1 Circuit Resistance	1.1 Meg

CHARACTERISTICS

Plate Voltage	100 Vdc
Grid No. 2 Voltage	100 Vdc
Cathode Resistor	150 Ohms
Plate Current	7.5 mAdc
Grid No. 2 Current	2.4 mAdc
Transconductance	5000 μmhos
Plate Resistance	260000 Ohms
Grid No. 1 Voltage for Ib = 50 μAdc Max.	-9.0 Vdc

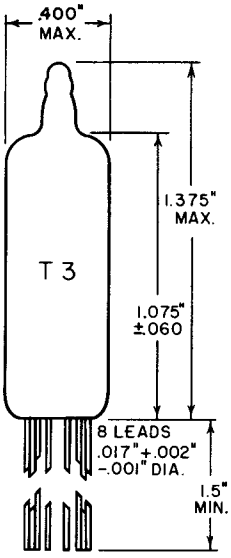
NOTES:

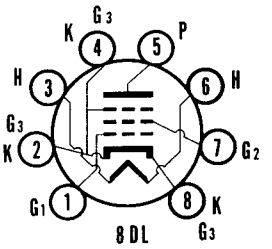
1. *Limitations beyond which normal tube performance and tube life may be impaired.*
2. *If altitude rating is exceeded, reduction of instantaneous voltage (Ef excluded) may be required.*
3. *Tube life and reliability of performance are directly related to the degree of regulation of the heater voltage to its center rated value of 26.5 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 5906 is a sharp cutoff pentode characterized by long life and stable performance under conditions of severe shock, vibration, high temperature and high altitude. Except for heater characteristics, the Type 5906 is identical to the Type 5840. The 5906 employs a 26.5 volt, 45 ma heater.

The 5906 is suited to a variety of low frequency applications as well as rf amplifier service at frequencies up to 400 mc.





SYLVANIA ELECTRIC PRODUCTS INC.

RADIO TUBE DIVISION
EMPORIUM, PA.

Prepared and Released By The
TECHNICAL PUBLICATIONS SECTION
EMPORIUM, PENNSYLVANIA
AUGUST, 1957

ACCEPTANCE CRITERIA

Test Conditions

Heater Voltage	26.5 V	Grid No. 2 Voltage	100 Vdc
Plate Voltage	100 Vdc	Heater-Cathode Voltage MIL-E-1 Par. 3.2.2.1	0 V
Grid No. 1 Voltage	0 V	Cathode Resistor	150 Ohms

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

MIL-E-1 Ref.	Tests	Limits Min.	Limits Bogey	Limits Max.	Units
Production Tests					
4.10.8	Heater Current:	40	45	50	mA
4.10.6.1	Grid No. 1 Current:	0	—	-0.3	μAdc
4.10.4.1	Plate Current: (1)	5.5	7.5	9.5	mAdc
4.10.4.1	Plate Current (2) Ec1 = -9 Vdc	0	—	50	μAdc
4.10.4.3	Grid No. 2 Current:	0.5	2.4	3.5	mAdc
4.10.9	Transconductance (1):	4100	5000	5900	μmhos
Special Design Tests					
4.9.5.3	Subminiature Lead Fatigue:	4	—	—	Arcs
4.9.19.2	Vibration: F = 40 cps; G = 15; Rp = 10K Ohms; Ck = 1000 μf	—	—	60	mVac
4.10.15	Heater-Cathode Leakage:				
	Ehk = +100 Vdc	0	—	7	μAdc
	Ehk = -100 Vdc	0	—	7	μAdc
4.8	Insulation of Electrodes: Eg1-all = -100 Vdc; Ef = 26.5 V	100	—	—	Megs
4.10.3.2	AF Noise: Esig = 70 mVac; Rg1 = 0.1 Meg; Rg2 = 1000 Ohms; Rp = 0.2 Meg; Ecc2 = 19 Vdc; Ebb = 100 Vdc	—	—	17	VU
Design Tests					
4.10.9	Transconductance (2): Ef = 24.0 V;	3750	—	—	μmhos
4.10.10	Plate Resistance:	0.150	—	—	Meg
4.10.14	Capacitance: 0.405" Dia. Shield Tied to Cathode				
	Cg1p	—	—	0.015	μμf
	Cin	3.5	4.2	4.9	μμf
	Cout	2.9	3.4	3.9	μμf
Degradation Tests					
4.9.20.5	Shock: Note 1 Hammer Angle = 30°	—	—	—	
4.9.20.6	Fatigue: Note 1 F = 60 cps; G = 2.5; Ef = 26.5 V	—	—	—	
- - - - -	Post Shock Test End Points: Vibration	—	—	200	mVac
- - - -	Post Fatigue Test End Points: Vibration	—	—	100	mVac
- - - - -	Post Shock and Fatigue Test End Points:				
	Heater-Cathode Leakage	—	—	20	μAdc
	Transconductance (1)	3750	—	—	μmhos

ACCEPTANCE CRITERIA (Continued)

MIL-E-1 Ref.	Tests	Limits Min.	Limits Bogey	Limits Max.	Units
Acceptance Life Tests					
4.11.7	Heater Cycling Life Test Ef = 29.0 V; 1 min. On, 4 min. Off; Eb = Ec2 = Ec1 = 0 V; Ehk = 140 Vac	2500	—	—	Cycles
4.11.5	Intermittent Life Test: Note 2 Rg1 = 1.0 Meg; Ehk = +200 Vdc; TA = 175°C	500	—	—	Hours
4.11.4	Intermittent Life Test End Points Transconductance (1)	3250	—	—	μmhos
	Heater-Cathode Leakage	0	—	20	μAdc
	Grid Current	—	—	-0.9	μAdc

ACCEPTANCE CRITERIA NOTES

1: Acceptance sampling procedure shall be in accordance with the shock test sampling procedure of the Inspection Instructions for Electron Tubes.

2: At the conclusion of the five hundred hour life test, the average life of the life test sample shall be not less than four hundred fifty hours. Life test sample size shall be ten tubes. Provision for release of tubes prior to completion of life test on a reduced basis as specified in 4.3.1.3 Inspection Instructions for Electron Tubes shall not apply.

APPLICATION DATA

The 5906 is a subminiature sharp cutoff pentode characterized by long life and stable performance under conditions of severe shock, vibration, high altitude and high temperature. Except for heater characteristics, the 5906 is identical to the Type 5840. The 5906 employs a 26.5 volt, 45 ma heater. The 5906 is suited to a variety of low frequency applications as well as rf amplifier service at frequencies up to 400 mc.

As the frequency of operation is increased, consideration should be given to the resultant decrease in input and output resistance, Figure 1. Assuming matched input and output impedances, approximate tube gain can be obtained from the formula:

$$\text{Voltage Gain} = Gm \sqrt{\frac{R_{input} \times R_{output}}{2}}$$

where the values of Rinput and Routput are obtain from the curves of Figure 1. The use of this formula assumes matched impedances into and out of the amplifier stage under consideration. If the source impedance is lower than the input resistance or if the load resistance is higher than the output resistance, much greater voltage gain per stage can be obtained than that indicated by the above formula. The voltage gain of a matching circuit is equal to the square root of the impedance ratio.

In some applications it may be advantageous to employ an unbypassed resistance in the cathode circuit to compensate for the change in input capacitance with bias. This unbypassed resistance reduces the effective Gm of the tube by the factor

$$\frac{1}{1 + Gm\ Rk\left(\frac{Ib + Ic2}{Ib}\right)}$$

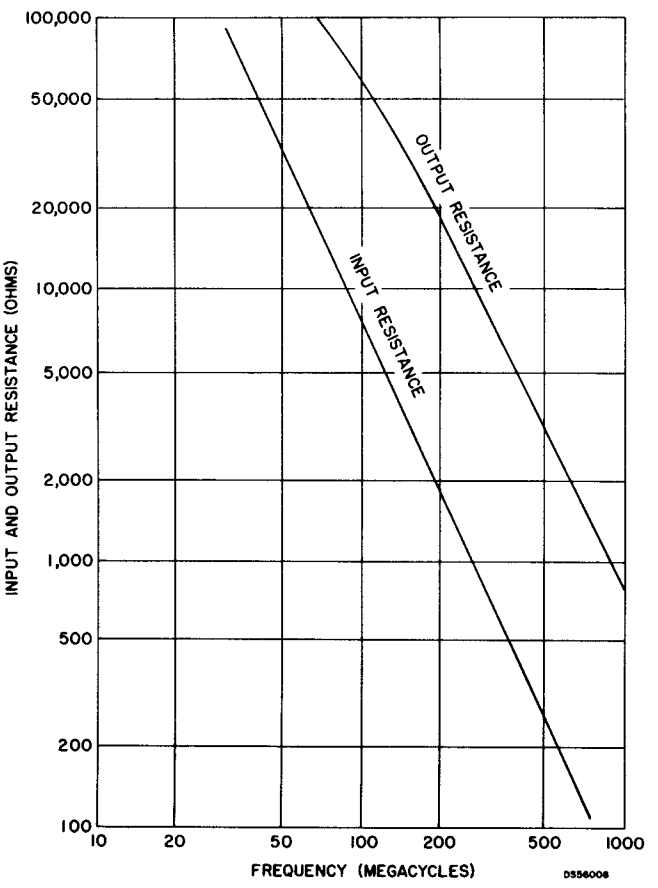


Figure 1—Input and output resistance vs frequency

APPLICATION DATA (Continued)

However, this unbypassed resistance also has the effect of raising the input resistance of the tube under certain operating conditions so that both a net increase in gain and a net decrease in input capacitance change may result. Some increase in effective grid-plate coupling may accompany these advantages.

The self neutralization frequency of the 5906 is approximately 200 mc. At this point the inductance of tube leads resonate with the grid plate capacitance to effect neutralization. At higher frequencies the feedback is inductive and takes place through the tube leads. Three cathode leads are provided to permit isolation of the input and output circuits.

Resistance coupled amplifier data is presented in the accompanying table.

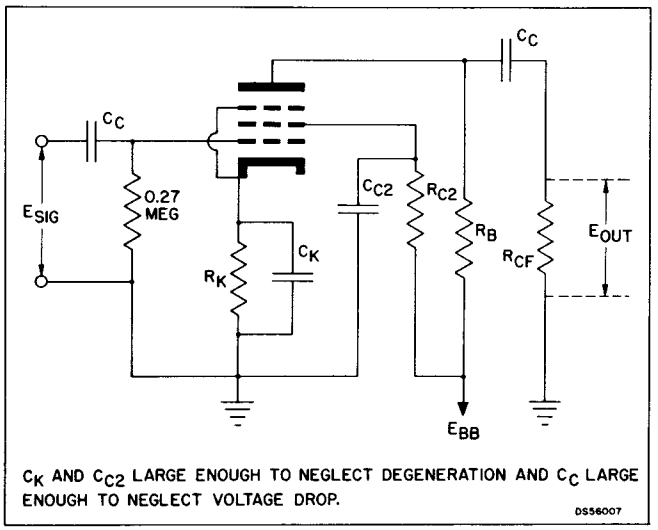
Life expectancy is described by the life tests, specified on the attached pages and/or individual MIL-E-1 specifications. The actual life expectancy of the tube in an operating circuit is affected by both the operating and environmental conditions involved. Likewise, the life tests specified indicate 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.

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

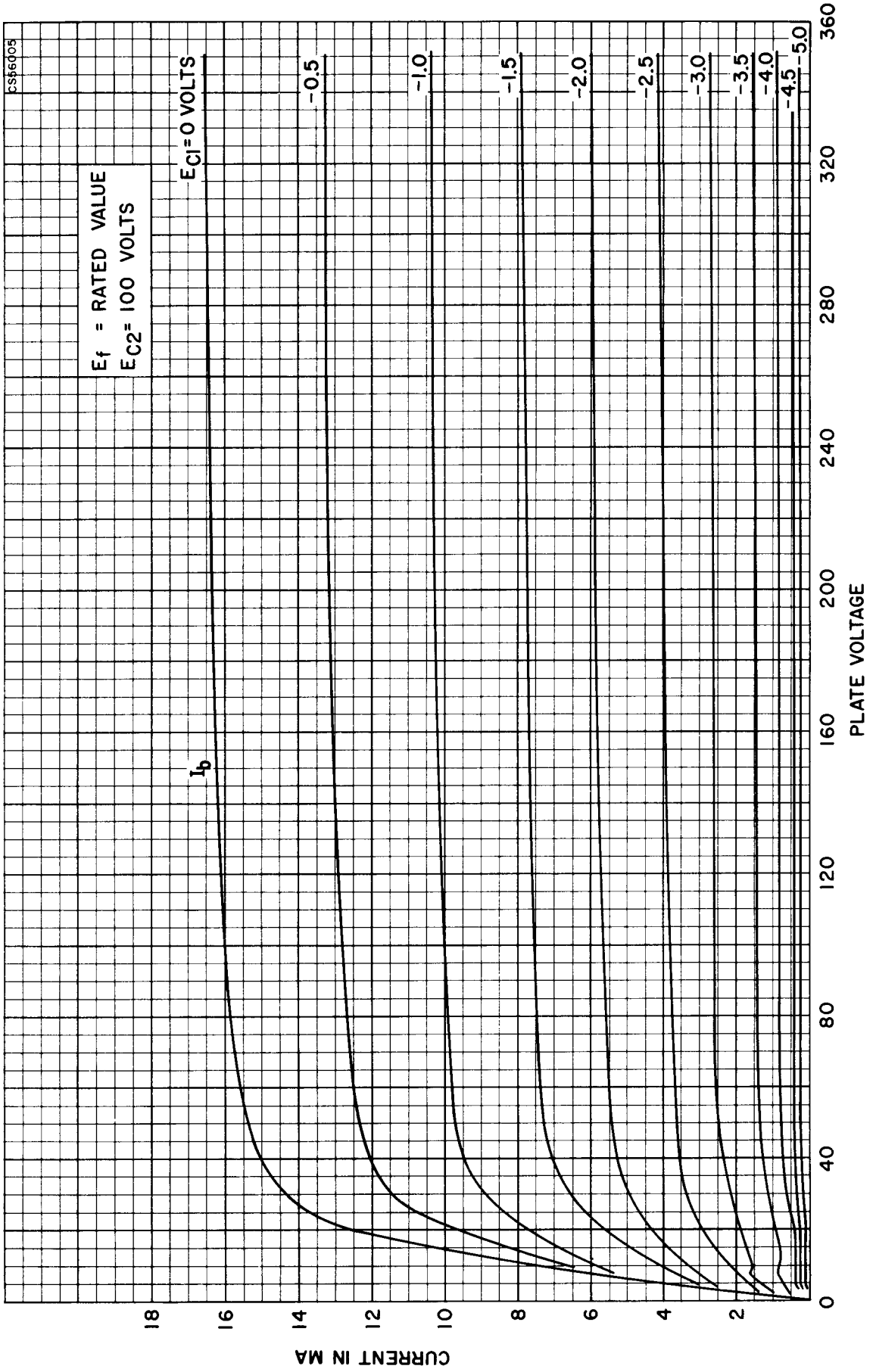
	Ebb = 100 Volts						Ebb = 150 Volts					
Rb (megohms)	0.100		0.270		0.470		0.100		0.270		0.470	
Rc2 (megohms)	0.220		0.680		1.20		0.270		0.820		1.50	
Rcf (megohms)	0.27	0.47	0.47	1.0	0.47	1.0	0.27	0.47	0.47	1.0	0.47	1.0
Rk (ohms)	820	820	2200	2200	3300	3300	560	560	1500	1500	2200	2200
Ib (ma)	0.75	0.75	0.273	0.273	0.164	0.164	1.13	1.13	0.42	0.42	0.247	0.247
Ic2 (ma)	0.292	0.292	0.102	0.102	0.062	0.062	0.41	0.41	0.143	0.143	0.083	0.083
Ec1 (volts)	−0.855	−0.855	−0.825	−0.825	−0.746	−0.746	−0.862	−0.862	−0.845	−0.845	−0.726	−0.726
Ec2 (volts)	35.8	35.8	31.4	31.4	25.5	25.5	39.3	39.3	32.8	32.8	25.6	25.6
Eb (volts)	25.0	25.0	26.3	26.3	22.9	22.9	37.0	37.0	36.7	36.7	34.0	34.0
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)	8.2	9.0	9.5	11.8	9.2	11.7	11.5	12.5	13.2	15.5	13.0	16.7
Gain	82	90	95	118	92	117	115	125	132	155	130	167
% Distortion	2.8	3.8	2.5	3.0	3.1	2.3	1.5	2.2	2.4	2.4	3.7	3.0
Esig* (volts, rms)	0.23	0.22	0.15	0.16	0.12	0.14	0.20	0.18	0.16	0.16	0.11	0.14
Eout (volts, rms)	17.7	18.6	13.6	17.0	11.0	16.0	21.7	21.7	20.5	24.0	14.0	22.2
Gain	77	85	91	106	92	114	109	120	128	150	127	159
% Distortion	4.9	4.8	4.7	4.4	4.8	5.0	4.8	5.0	4.9	4.8	4.2	4.8

* Maximum signal for 5% distortion or ⅛ microampere grid current.



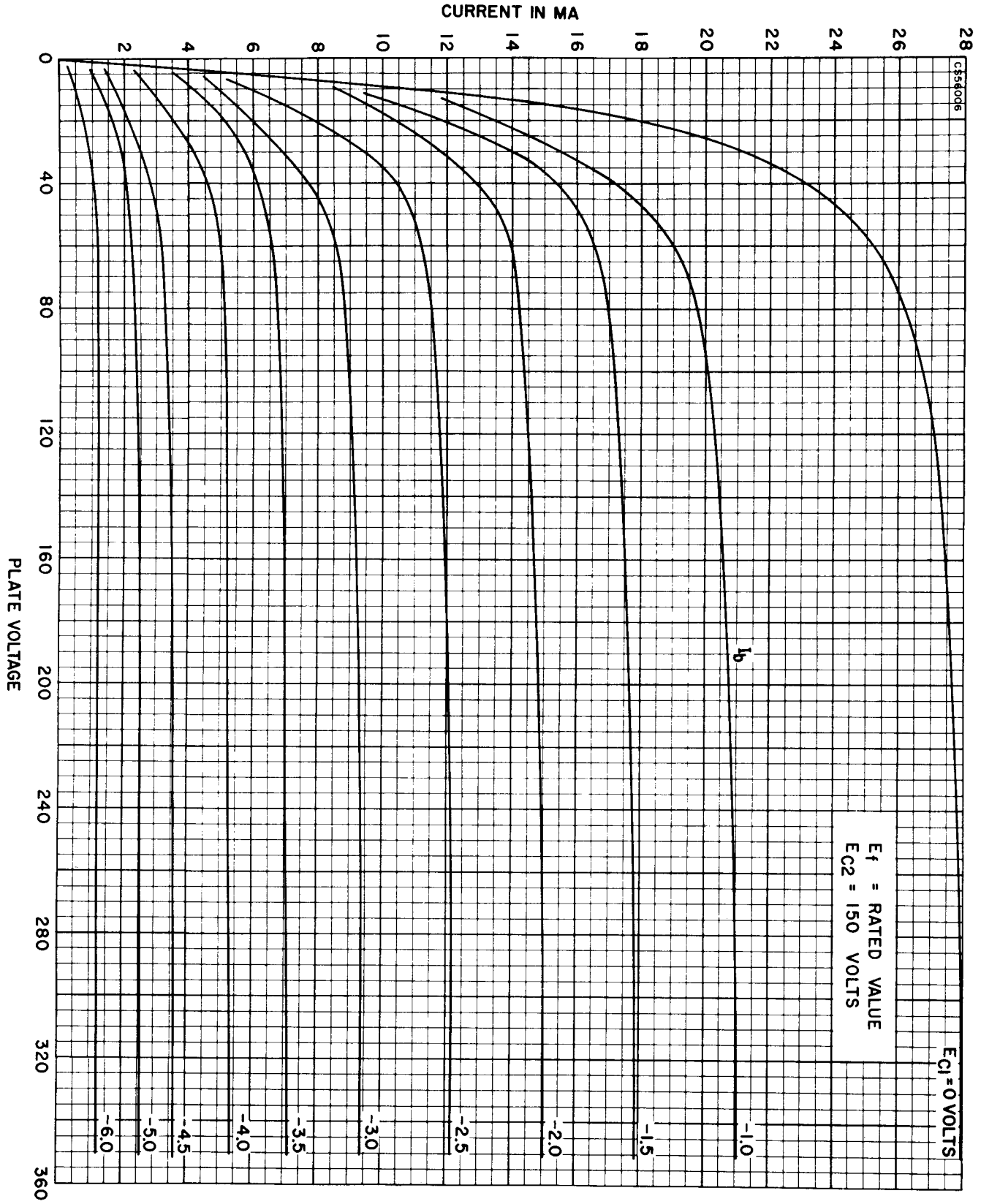
Resistance coupled amplifier circuit.

AVERAGE PLATE CHARACTERISTICS
(PENTODE CONNECTED)

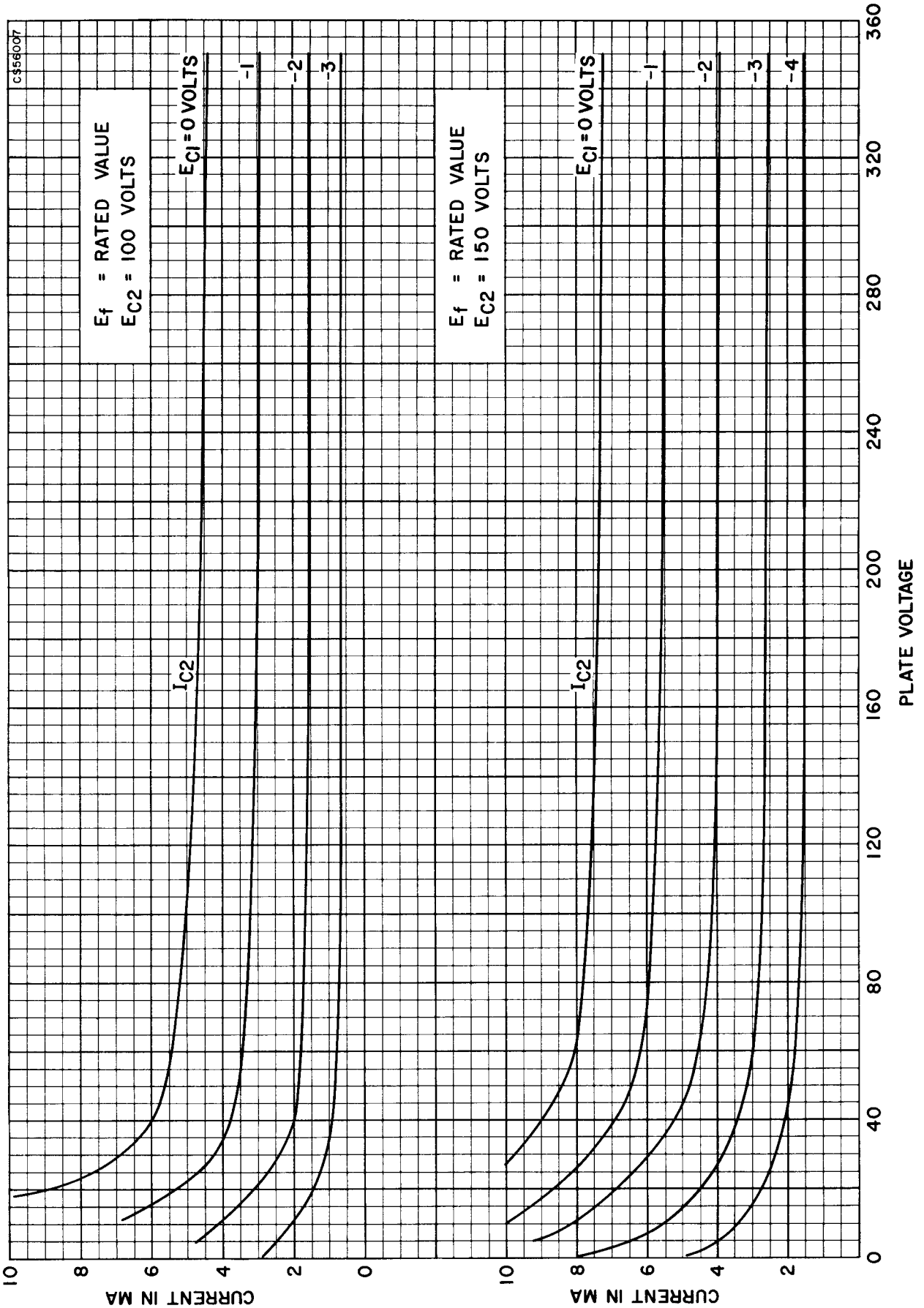


AVERAGE PLATE CHARACTERISTICS

(PENTODE CONNECTED)

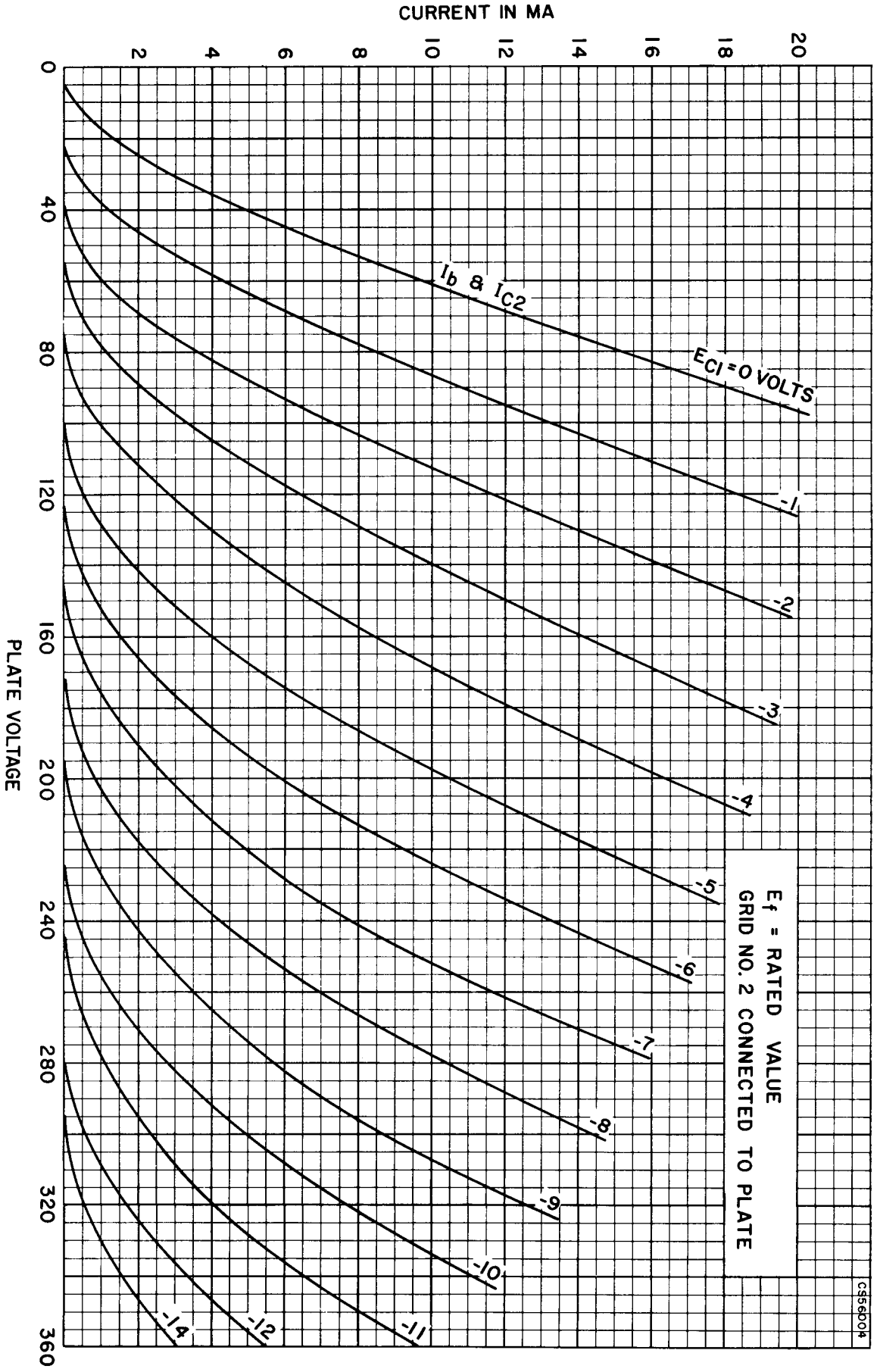


AVERAGE GRID No. 2 CHARACTERISTICS
(PENTODE CONNECTED)

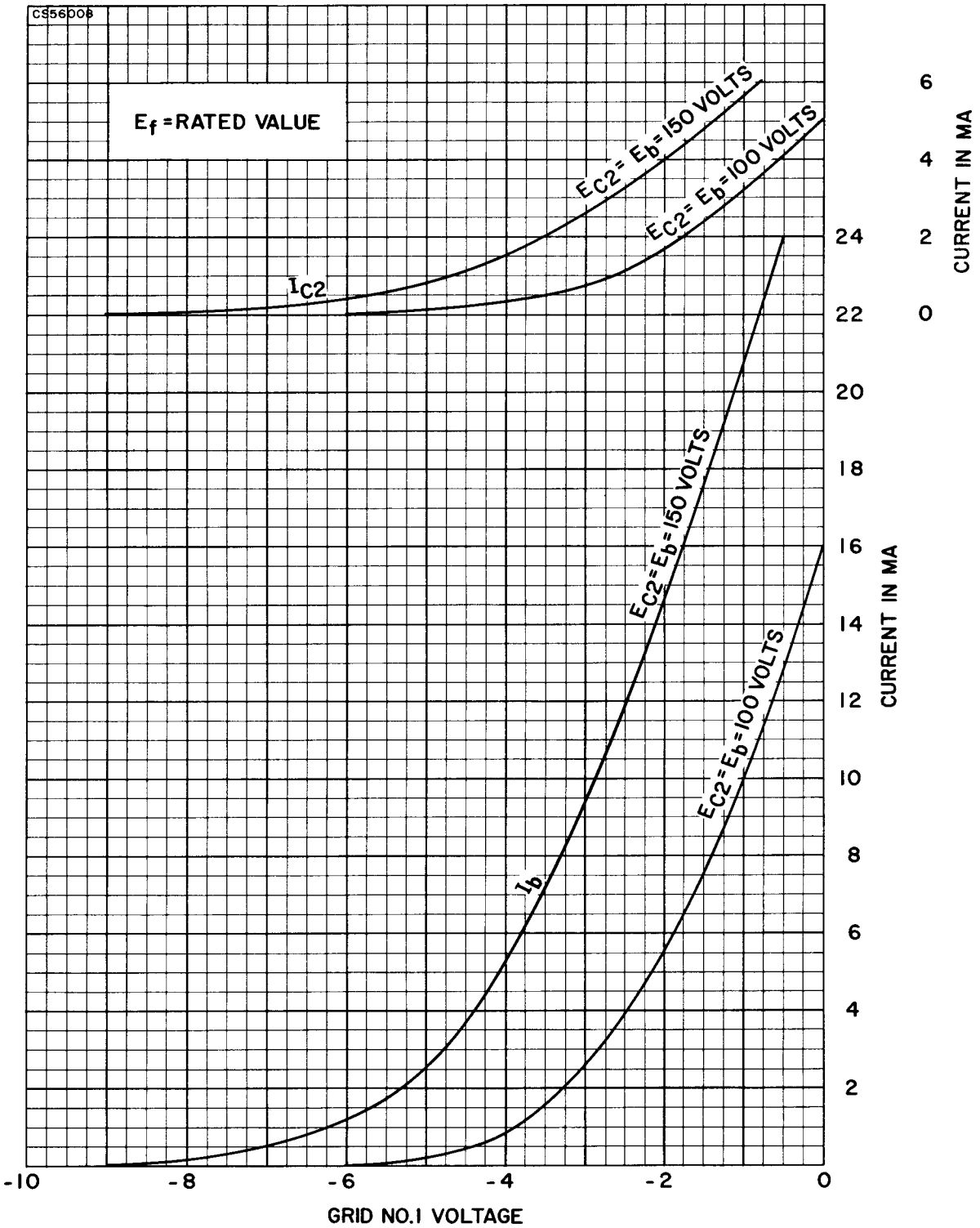


AVERAGE PLATE CHARACTERISTICS

(TRIODE CONNECTED)



AVERAGE TRANSFER CHARACTERISTICS
(PENTODE CONNECTED)



AVERAGE TRANSFER CHARACTERISTICS
(PENTODE CONNECTED)