MECHANICAL DATA

Bulb	T-3
Base	E8-10, Subminiature Button Flexible Leads
Outline	JETEC 3-3
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]	6.0	6.3	6.6 V
Heater Current		450	mA

DIRECT INTERELECTRODE CAPACITANCES

	Shielded[4]	Unshielded
Grid No. 1 to Plate	0.15	0.18 μμf Max.
Input	9.00	9.00 μμf
Output	8.00	4.60 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	4.0 W
Grid No. 2 Dissipation	1.0 W
Cathode Current	40 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	
Self Bias	500000 Ohms
Fixed Bias	100000 Ohms

CHARACTERISTICS

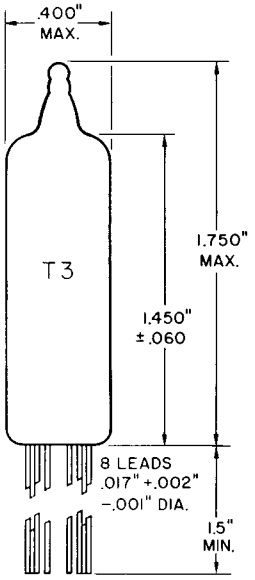
Plate Voltage	150 Vdc
Grid No. 2 Voltage	100 Vdc
Cathode Resistor	100 Ohms
Plate Current	21 mAdc
Grid No. 2 Current	4.0 mAdc
Transconductance	9000 μmhos
Plate Resistance	50000 Ohms
Grid No. 1 Voltage for Ib = 75 μAdc	−14 Vdc Max.

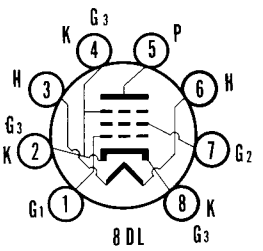
NOTES:

1. *Limitations beyond which normal tube performance and tube life may be impaired.*
2. *If altitude rating is exceeded, reduction of instantaneous voltages (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 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 Manual titled Specifications and Ratings.*

QUICK REFERENCE DATA

The Premium Subminiature Type 5639 is a high gm video pentode intended for operation under conditions of severe shock, vibration, high temperature and high altitude.
The Sylvania Type 5639 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
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FEBRUARY 1957

ACCEPTANCE CRITERIA

Test Conditions

Heater Voltage	6.3 V	Grid No. 2 Voltage	100 Vdc
Plate Voltage	150 Vdc	Heater-Cathode Voltage MIL-E-1 Par. 3.2.2.1	0 V
Grid No. 1 Voltage	0 V	Cathode Resistor (MIL-E-1 Par. 3.2.2.1)	100 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 Min.	LAL	Bogey	UAL	Max.	Units
Measurements Acceptance Tests, Part 1, Note 1								
4.1.1.7 4.10.8	(Method A) Heater Current: ALD = 36	—	—	432	450	468	—	mA
4.10.8	Heater Current:	0.65	420	—	—	—	480	mA
4.10.15	Heater-Cathode Leakage:	0.65	—	—	—	—	—	
	Ehk = +100 Vdc	—	—	—	—	—	15	μAdc
	Ehk = −100 Vdc	—	—	—	—	—	15	μAdc
4.10.6.1	Grid Current: Ic1 Rg1 = 1.0 Meg	0.65	0	—	—	—	−1.0	μAdc
4.10.4.1	Plate Current (1):	0.65	14.0	—	—	—	28.0	mAdc
4.10.4.1	Plate Current (2): Ec1 = −14.0 Vdc; RK = 0 Ohms	0.65	—	—	—	—	75	μAdc
4.10.9	Transconductance (1): Sm	0.65	7500	—	—	—	10500	μmhos
4.7.5	Continuity and Shorts (Inoperatives):	0.4	—	—	—	—	—	
4.9.1	Mechanical: Envelope (8-4)	—	—	—	—	—	—	
Measurements Acceptance Tests, Part 2								
4.8.2	Insulation of Electrodes:	2.5	–	—	—	—	—	
	g1-all	—	100	—	—	—	—	Meg
	p-all	—	100	—	—	—	—	Meg
4.10.16.1	Power Output: Esig = 2.0 Vac; Rp = 9000 Ohms	2.5	0.75	—	—	—	—	W
4.10.4.3	Screen Grid Current: Ic2	2.5	2.0	—	—	—	6.0	mAdc
4.10.9	Transconductance (2): $\triangle$ Sm Ef = 5.7 V $\triangle$ Ef	2.5	—	—	—	—	10	%
4.10.6.2	Grid Emission: Note 4 Ic1 EF = 7.5 V; Ec1 = −14 Vdc; Rg1 = 1.0 Meg; Rk = 0 Ohms	2.5	0	—	—	—	−2.0	μAdc
4.10.3.2	AF Noise: Esig = 200 mVac; Ecc2 = 100 Vdc; Ec1 = −2.5 Vdc; Rg1 = 0.5 Meg; Rg2 = 0.01 Meg; Rp = 2000 Ohms; Rk = 0 Ohms; Cg2 = 4 μf	2.5	—	—	—	—	17	VU
4.10.10	Plate Resistance:	6.5	0.040	—	—	—	—	Meg
4.10.14	Capacitance:	6.5	—	—	—	—	—	
	0.405 In. Dia. Shield Cglp	—	—	—	—	—	0.13	μμf
	0.405 In. Dia. Shield Cin	—	8.0	—	—	—	10.0	μμf
	0.405 In. Dia. Shield Cout	—	7.0	—	—	—	9.0	μμf
4.9.12.1	Low Pressure Voltage Breakdown: Pressure = 20 ±5 mm Hg.; Voltage = 300 Vac	6.5	—	—	—	—	—	

ACCEPTANCE CRITERIA (Continued)

MIL-E-1 Ref.	Test	AQL (%)	Limits Min.	LAL	Bogey	UAL	Max.	Units
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): Rp = 2000 Ohms; Ck = 1000 μf; G = 15; F = 40 cps	2.5	—	—	—	—	100	mVac
4.9.19.1	White Noise: Rp = 10,000 Ohms; Ck = 1000 μf; Note 5	2.5	—	—	—	—	4500	mv pk-pk
	Peak Acceleration = 15 G	2.5	—	—	—	—	500	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; Rg1 = 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)	—	—	—	—	—	350	mVac
	Heater-Cathode Leakage Ehk = +100 Vdc	—	—	—	—	—	40	μAdc
	Ehk = −100 Vdc	—	—	—	—	—	40	μAdc
	Change in Transconductance (1) of Individual Tubes $\Delta \frac{Sm}{t}$	—	—	—	—	—	20	%
4.9.6.3	Glass Strain:	6.5	—	—	—	—	—	

MIL-E-1 Ref.	Test	AQL (%)	Allowable Defectives per Characteristic 1st Sample	Combined Samples	Limits Min.	Max.	Units
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; Ec1 = Ec2 = Eb = O V	2.5	—	—	—	—	
4.11.3.1	Stability Life Test: (1 Hour) Ehk = +200 Vdc; Rg1 = 0.5 Meg; TA = Room	1.0	—	—	—	—	
4.11.4	Stability Life Test End Points: Change in Transconductance (1) of Individual Tubes $\Delta \frac{Sm}{t}$	—	—	—	—	10	%
4.11.3.1 4.11.3.1.1	Survival Rate Life Test: (100 Hours) Stability Life Test Conditions or Equivalent; TA = Room	—	—	—	—	—	
4.11.4	Survival Rate Life Test End Points: Continuity and Shorts (Inoperatives)	0.65	—	—	—	—	
	Transconductance (1) Sm	1.0	—	—	6750	—	μmhos
4.11.5 4.11.3.1	Intermittent Life Test: Note 3 Stability Life Test Conditions; T Envelope = +220°C min.; 1000 Hour Requirements Do Not Apply	—	—	—	—	—	
4.11.3.1 4.11.4	Intermittent Life Test End Points: (500 Hours)						
	Inoperatives	—	1	3	—	—	
	Grid Current	—	1	3	0	−2.0	μAdc
	Heater Current	—	2	5	414	492	mA

ACCEPTANCE CRITERIA (Continued)

MIL-E-1 Ref.	Test	AQL (%)	Allowable Defectives per Characteristic: 1st Sample	Allowable Defectives per Characteristic: Combined Samples	Limits: Min.	Limits: Max.	Units
Acceptance Life Tests, Note 2 (Continued)							
	Change in Transconductance (1) of Individual Tubes $\frac{\Delta Sm}{t}$	—	1	3	—	20	%
	Transconductance (2) $\frac{\Delta Sm}{Ef}$	—	2	5	—	15	%
	Heater-Cathode Leakage	—	2	5	—	—	
	Ehk = +100 Vdc	—	—	—	—	60	μAdc
	Ehk = —100 Vdc	—	—	—	—	60	μAdc
	Insulation of Electrodes	—	2	5	—	—	
	g1-all	—	—	—	50	—	Meg
	p-all	—	—	—	50	—	Meg
	Transconductance (1) Average Change Avg $\frac{\Delta Sm}{t}$	—	—	—	—	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: Prior to this test, tubes shall be preheated five (5) minutes 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 V	Ec1 Vdc	Ec2 Vdc	Ec3 Vdc	Eb Vdc	Rk Ohms	Rg1 Meg
7.5	0	100	0	150	100	0.5

5: 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 the 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 5639 is a Premium Subminiature beam power pentode characterized by long life and stable operation under conditions of severe shock, vibration, high altitude and high temperature.

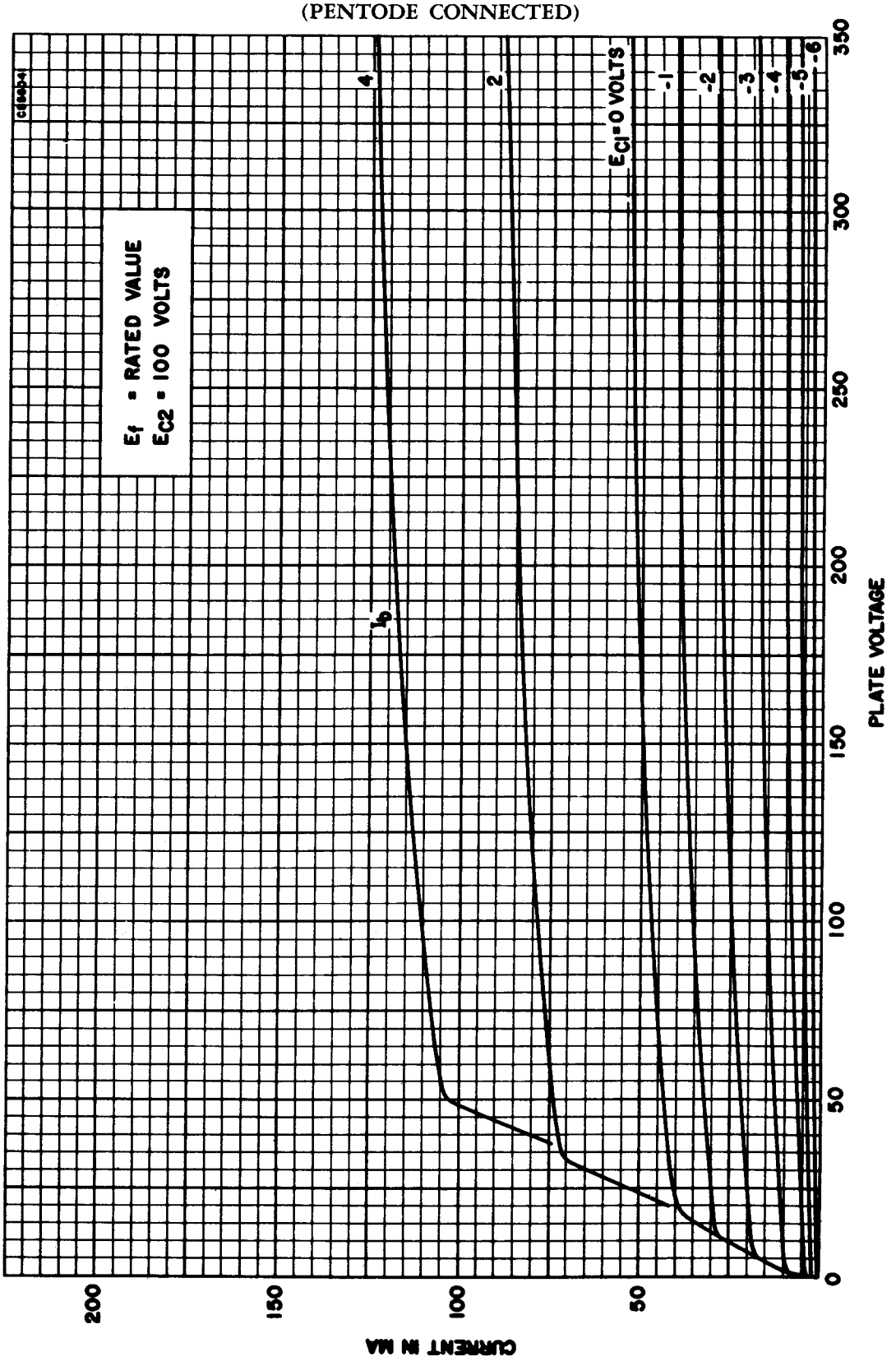
The tube features a high gm and is intended primarily for service as a video amplifier. The high power sensitivity and high gm combined with efficient operation at low supply voltages lends this type to many applications.

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 tube to a white noise vibration spectrum covering the frequency band of 100 to 5000 cps at an 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 further discussion of the white noise vibrational test is included in the frontal section of this manual.

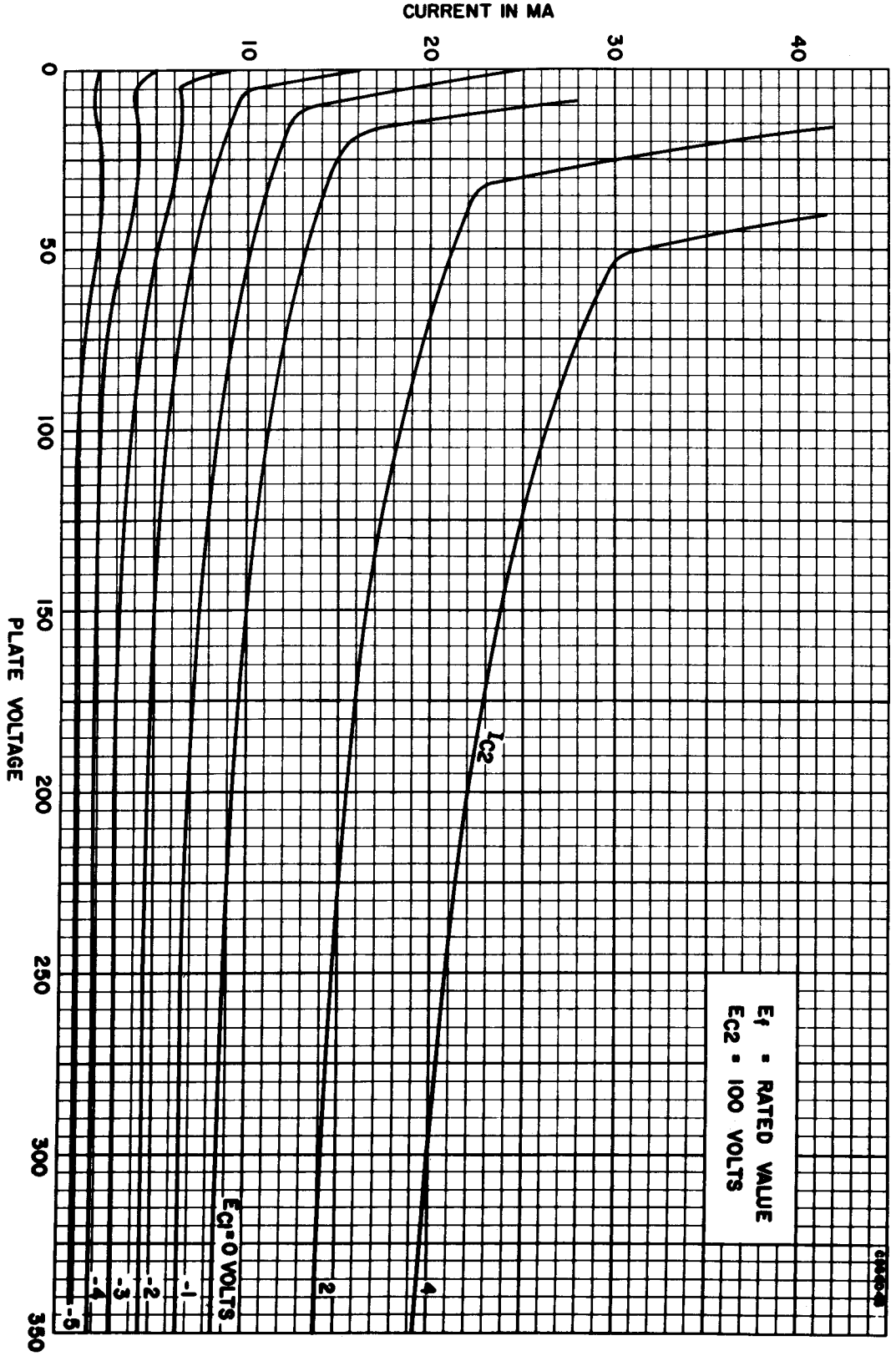
The 5639 is manufactured and inspected to meet the applicable MIL-E-1 specification for reliability. Life expectancy is described by the life tests, specified on the attached pages and/or individual MIL-E-1 specifications. The actual life expectancy of the tubes in an operating circuit is affected by 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.

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.

AVERAGE PLATE CHARACTERISTICS
(PENTODE CONNECTED)



AVERAGE GRID No. 2 CHARACTERISTICS
(PENTODE CONNECTED)



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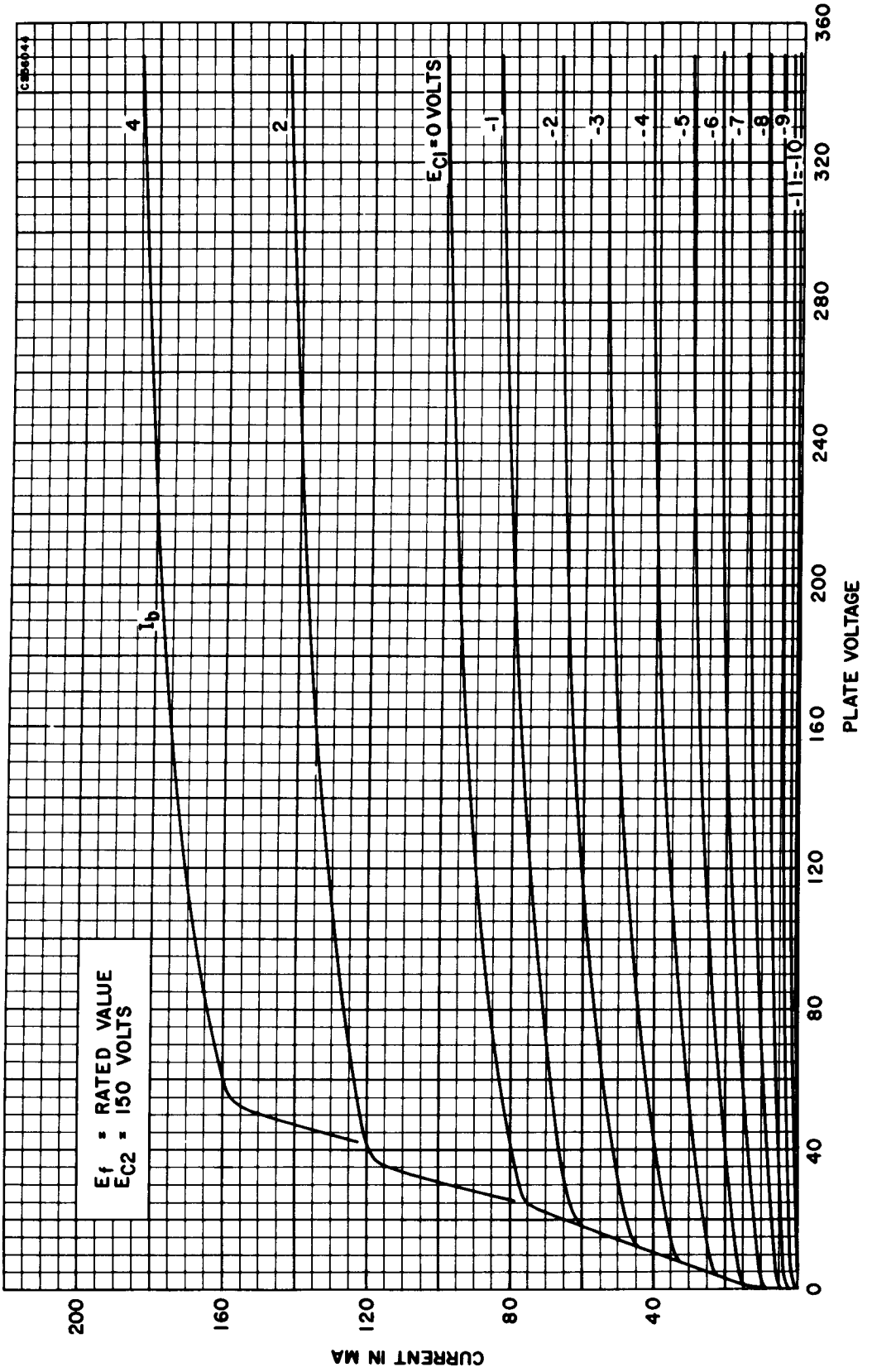
(PENTODE CONNECTED)



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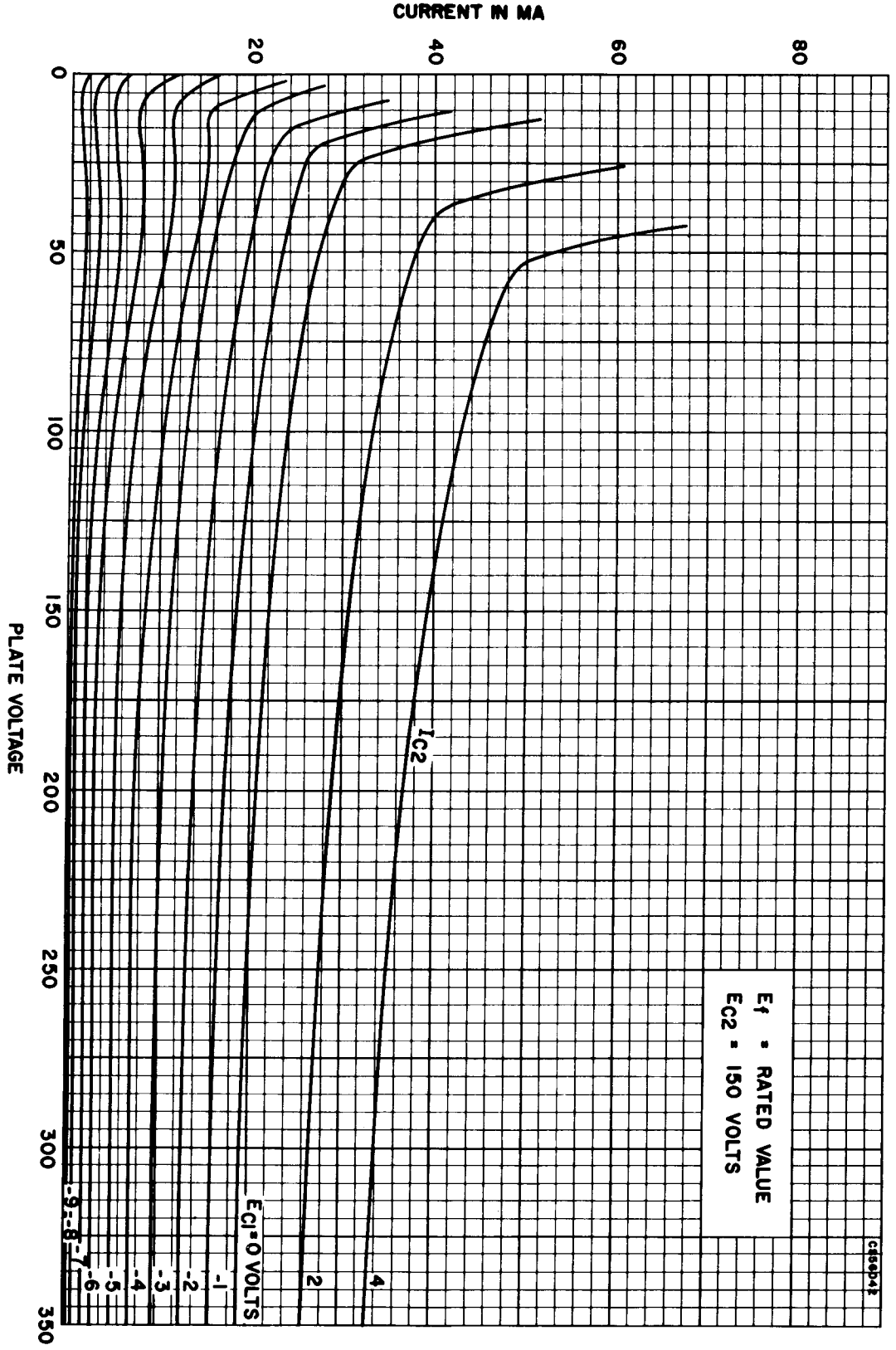
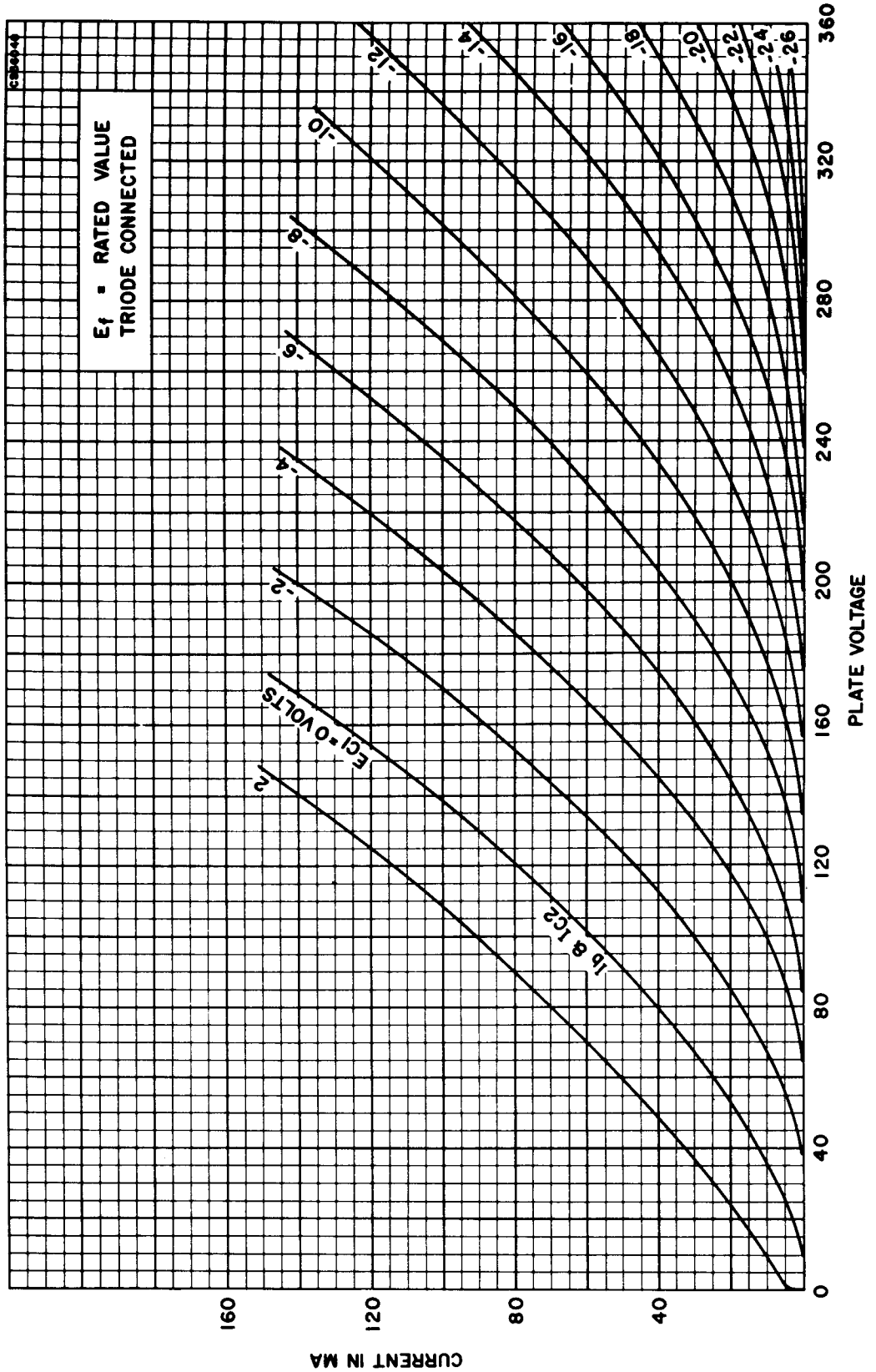
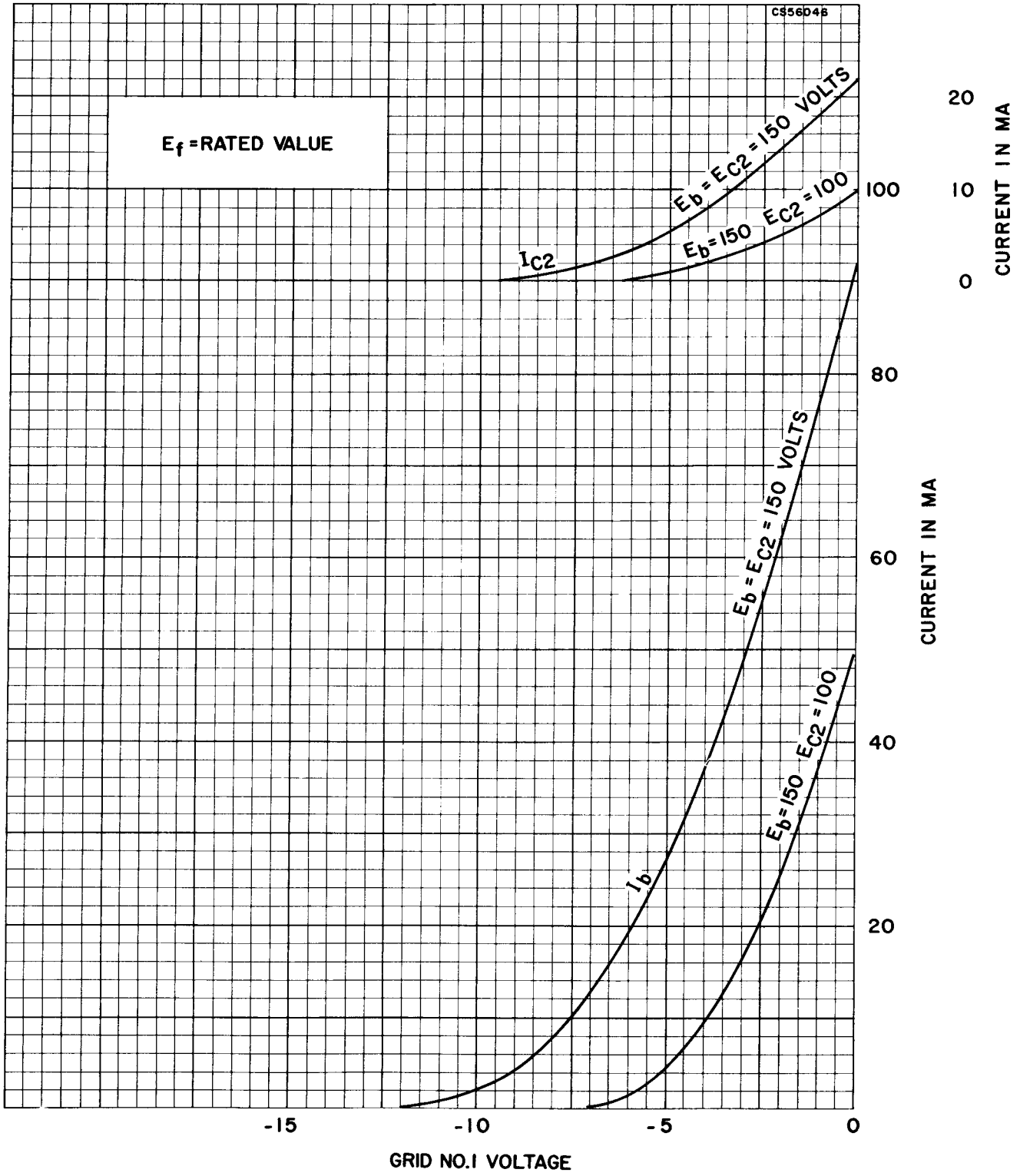
(PENTODE CONNECTED)



AVERAGE PLATE CHARACTERISTICS
(TRIODE CONNECTED)



AVERAGE TRANSFER CHARACTERISTICS
(PENTODE CONNECTED)



AVERAGE TRANSFER CHARACTERISTICS
(PENTODE CONNECTED)