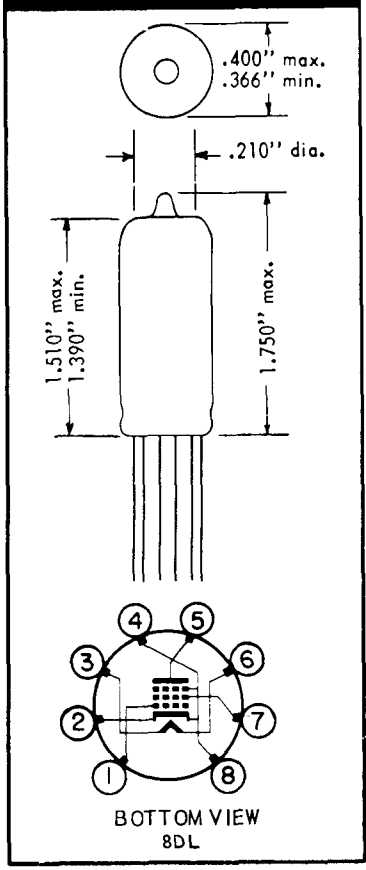
TYPE CK5639WA

The CK5639WA is a heater-cathode type video amplifier pentode of subminiature construction. This type is characterized by long life and stable performance. It is suitable for service where severe conditions of mechanical shock or vibration are encountered. It is designed for wide band, RF or video power amplifier service in equipments with low plate supply voltages. The flexible terminal leads may be soldered or welded directly to the terminals of circuit components without the use of sockets. Standard 8-pin subminiature sockets may be used by cutting the leads to a suitable length.



MECHANICAL DATA

ENVELOPE: T-3 Glass

BASE: Subminiature Button 8-Pin (0.017" tinned flexible leads Length: 1.5".)

TERMINAL CONNECTIONS:

Lead 1 Grid #1	Lead 5 Plate
Lead 2 Cathode, Grid #3	Lead 6 Heater
Lead 3 Heater	Lead 7 Grid #2
Lead 4 Cathode, Grid #3	Lead 8 Cathode, Grid #3

MECHANICAL RATINGS:

Maximum Impact Acceleration (Shock Test-Note 3)	450 G
Maximum Uniform Acceleration (Centrifuge Test-Note 4)	1000 G
Maximum Vibrational Acceleration (96 Hour Fatigue Test-Note 5)	2.5 G
Maximum Bulb Temperature	220 °C

ELECTRICAL DATA

CAUTION-----To Electronic Equipment Design Engineers: Special attention should be given to the temperature at which the tubes are to be operated. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy may be reduced if conditions other than those specified for life test are imposed on the tube and will be reduced appreciable if maximum ratings are exceeded. Life and reliability of performance are closely related to the degree that regulation of the heater voltage is maintained at its center rated value.

RATINGS AND NORMAL OPERATION:	MIL-E-1 SYMBOL	DESIGN MINIMUM	NORMAL TEST CONDITIONS (Note 7)	NORMAL OPERATION (Note 6)	DESIGN MAXIMUM	MIL-E-1 UNITS
Heater Voltage (Note 8)	Ef:	6.0	6.3	6.3	6.6	V
Plate Voltage	Eb:	----	150	150	250	Vdc
Peak Plate Voltage	eb:	----	----	----	360	v
Grid #1 Voltage	Ec1:	–55	0	0	0	Vdc
Grid #2 Voltage	Ec2:	----	100	100	155	Vdc
Plate Dissipation	Pp:	----	----	3.15	3.5	W
Grid #2 Dissipation	Pg2:	----	----	0.4	1.0	W
Grid #1 Circuit Resistance	Rg1:	----	----	----	0.5	Meg.
Heater-Cathode Voltage	Ehk:	–200	----	----	+200	Vdc
Cathode Current	Ik:	----	----	----	40	mAdc
Cathode Resistance	Rk:	----	100	100	----	ohms
Plate Current (1)	Ib(1):	----	----	21.0	----	mAdc
Grid #2 Current	Ic2:	----	----	4.0	----	mAdc
Transconductance (1)	Sm(1):	----	----	9000	----	μmhos
Plate Resistance	rp:	----	----	0.05	----	Meg.

Tentative Data

ELECTRICAL DATA (Cont'd.)

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1)

TEST	CONDITIONS	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOGIE	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 1				Combined AQL = 1.0% excluding Mechanical and Inoperatives						
Heater Current:		0.4	If:	427	----	----	----	473	----	mA
Heater-Cathode Leakage:	Ehk = +100 Vdc Ehk = −100 Vdc	0.4	Ihk: Ihk:	---- ----	---- ----	---- ----	---- ----	10 10	---- ----	μAdc μAdc
Grid Current:	Rg = 1.0 Meg.	0.4	Ic(1):	----	----	----	----	−1.0	----	μAdc
Plate Current (1):		0.4	Ib(1):	14.0	----	21.0	----	28.0	----	mAdc
Plate Current (2):	Ec1 = −14.0 Vdc	0.4	Ib(2):	----	----	----	----	50	----	μAdc
Transconductance (1):		0.4	Sm(1):	7500	----	9000	----	10500	----	μmhos
Continuity and Shorts (Inoperatives):	(Note 12)	0.4	----	----	----	----	----	----	----	----
Mechanical:	Envelope (8−4) (Note 10)	----	----	----	----	----	----	----	----	----
MEASUREMENTS ACCEPTANCE TESTS PART 2										
Insulation of Electrodes:	Ef = 6.3 V Eg1-all = −100 Vdc Ep-all = −300 Vdc	2.5	Rg1-all: Rp-all:	250 250	---- ----	---- ----	---- ----	---- ----	---- ----	Meg. Meg.
Power Output:	Esig = 2.0 Vac; Rp = 9000 ohms	2.5	Po:	0.75	----	----	----	----	----	W
Screen Current:		2.5	Ic2:	2.0	----	4.0	----	6.0	----	mAdc
Transconductance (2):	Ef = 5.7 V (Note 9)	2.5	Δ_{Ef} Sm(2):	----	----	----	----	10	----	%
Grid Emission:	Eb = 250 Vdc, Rg = 1.0 meg; Rk = 390 ohms; Ec2 = 150 Vdc; Ef = 7.5 V; preheat 5 minutes at Ec1 = 0; Test at Ec1 = −20 Vdc	6.5	Ic(2):	----	----	----	----	−2.0	----	μAdc
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; Cg2 = 4μf	2.5	EB:	----	----	----	----	17	----	VU
Plate Resistance:		6.5	rp:	0.040	----	----	----	----	----	Meg.
Capacitance:			Cgp:	----	----	----	----	0.13	----	μμf
Capacitance:	Note 2	6.5	Cin:	8.0	----	9.0	----	10.0	----	μμf
Capacitance:			Cout:	7.0	----	8.0	----	9.0	----	μμf
Low Pressure Voltage Breakdown:	Pressure = 21 ± 3 mmHg; Voltage = 300 Vac	6.5	----	----	----	----	----	----	----	----
Vibration (2):	F = 40 Cps; G = 15; Rp = 2000 ohms	2.5	Ep:	----	----	----	----	40	----	mVac
Vibration (3):	F = 70 − 2000 cps; G = 15; T = 3 minutes; Rp = 2000 ohms positions X1 and X2 only.	6.5	ep:	----	----	----	----	250 peak to peak	----	mv
Operation Time:	(Note 11)	4.0	t:	----	----	----	----	20	----	sec.
DEGRADATION RATE ACCEPTANCE TESTS										
Subminiature Lead Fatigue:		2.5	----	4.0	----	----	----	----	----	arcs
Shock (1):	Ehk = +100 Vdc; Rg = 0.1 Meg.; Hammer Angle = 30° (Note 3)	20	----	----	----	----	----	----	----	----
Fatigue (1):	96 hours; G = 2.5; Fixed frequency; F = 25 min., 60 max. (Note 5)	6.5	----	----	----	----	----	----	----	----

ELECTRICAL DATA (Cont'd)

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1) (cont'd)

TEST	CONDITIONS	AQL %	MIL-E-1 SYMBOL	MIN	MAX	MIL-E-1 UNITS	Allowable Defects per Characteristic 1st Sample	Allowable Defects per Characteristic Combined Samples
DEGRADATION RATE ACCEPTANCE TESTS (cont'd)								
Shock (2):	Ehk=+100 Vdc; Rg=0.1 Meg.; Hammer Angle=120° + Rubber Pad; G=75; t=10 milliseconds (Note 14)	20	----	----	----	----	----	----
Fatigue (2):	6 hours; G=10; F=130–2000–130 cps; (Note 13)	6.5	----	----	----	----	----	----
Post Shock (1) & (2) and Fatigue (1) & (2) Test End Points:								
Vibration (2):	F=40 Cps; G=15; Rp=2000 ohms	----	Ep:	----	80	mVac	----	----
Heater-Cathode Leakage:	Ehk=+100 Vdc	----	Ihk:	----	20	μAdc	----	----
	Ehk=–100 Vdc	----	Ihk:	----	20	μAdc	----	----
Change in Transconductance (1) of individual tubes:	Ef=6.3 V	----	Δ_tSm(1):	----	15	%	----	----
Grid Current (1):		----	Ic1:	----	–3.0	μAdc	----	----
Glass Strain (Thermal Shock):		6.5	----	----	----	----	----	----
ACCEPTANCE LIFE TESTS								
Heater Cycling Life Test:	Ef=7.0 V; Eb=Ec1=Ec2=0 V; 1 min. on 4 min. off; Ehk=140 Vac	1.0	----	2000	----	cycle	----	----
Heater Cycling Life Test End Points:								
Heater-Cathode Leakage:	Ehk=+100 Vdc	----	Ihk:	----	20	μAdc	----	----
	Ehk=–100 Vdc	----	Ihk:	----	20	μAdc	----	----
2 & 20 Hour Stability Life Test:	Eb=250 Vdc; Ec2=150 Vdc; Rk=390 ohms; TA=Room; Ehk=+200 Vdc; Rg=0.47 Meg.	----	----	----	----	----	----	----
2 & 20 Hour Stability Life Test End Points:		----	----	----	----	----	----	----
Change in Transconductance (1) of individual tubes:	(Typical Sample Size=50 tubes)	1.0	Δ_tSm(1):	----	10	%	----	----
100 Hour Survival Rate	Eb=250 Vdc; Ec2=150 Vdc; Rk=390 ohms; TA=Room; Ehk=+200 Vdc; Rg=0.47 Meg.	----	----	----	----	----	----	----
100 Hour Survival Rate Life Test:	(Typical Sample Size=200 tubes)	----	----	----	----	----	----	----
Inoperatives:		0.65	----	----	----	----	----	----
Transconductance (1):		1.0	Sm(1):	6750	----	μmhos	----	----
200 Hour Intermittent Life Test (1):	Eb=250 Vdc; Ec2=150 Vdc; Rk=390 ohms; TA=Room; Ehk=+200 Vdc; Rg=0.47 Meg.	----	----	----	----	----	----	----
200 Hour Intermittent Life Test (1) End Points:	(Typical Sample Size=10 tubes 1st sample, 40 tubes 2nd sample)	----	----	----	----	----	----	----
Inoperatives:								
Grid Current (1):		----	Ic(1):	0	–2.0	μAdc	1	3

ELECTRICAL DATA (Cont'd)

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1) (cont'd)

TEST	CONDITIONS	AQL %	MIL-E-1 SYMBOL	MIN	MAX	MIL-E-1 UNITS	Allowable Defects per Characteristic 1st Sample	Allowable Defects per Characteristic Combined Samples
ACCEPTANCE LIFE TESTS (cont'd)								
Heater Current:		----	If:	414	492	mA	1	3
Change in Transconductance (1) of Individual Tubes:		----	Δ_fSm(1):	----	20	%	1	3
Transconductance (2):	(Note 9)	----	Δ_{Ef}Sm(2):	----	20	%	1	3
Heater-Cathode Leakage:	Ehk=+100 Vdc Ehk=–100 Vdc	---- ----	Ihk: Ihk:	---- ----	20 20	µAdc µAdc	1	3
Electrode Insulation:								
g1-all p-all		---- ----	Rg1-all Rp-all	50 50	---- ----	Meg. Meg.	1	3
Total Defectives:		----	----	----	----	----	3	6
Intermittent High Temperature Life Test (2):	T Bulb=220°C; Ehk=+200 Vdc; Rg=0.5 Meg.	----	----	----	----	----	----	----
500 Hour Intermittent High Temperature Life Test (2) End Points:	(Typical Sample Size=20 tubes 1st sample, 40 tubes 2nd sample)	----	----	----	----	----	----	----
Inoperatives:		----	----	----	----	----	1	3
Grid Current:		----	Ic1:	----	–2.0	µAdc	1	3
Heater Current:		----	If:	414	492	mA	1	3
Change in Transconductance (1) of individual tubes		----	Δ_fSm(1):	----	20	%	1	3
Transconductance (2):	(Note 9)	----	Δ_{Ef}Sm(2):	----	15	%	1	3
Heater-Cathode Leakage:								
Ehk=+100 Vdc Ehk=–100 Vdc		---- ----	Ihk: Ihk:	---- ----	20 20	µAdc µAdc	1	3
Insulation of Electrodes:								
g1-all p-all		----	Rg1-all: Rp-all:	50 50	---- ----	Meg. Meg.	1	3
Transconductance (1) Average Change:		----	Avg.Δ_f	----	15	%	----	----
Total Defectives:		----	----	----	----	----	3	6
1000 Hour Intermittent High Temperature Life Test (2) End Points:	(Typical Sample Size=20 Tubes 1st sample; 40 tubes 2nd sample)	----	----	----	----	----	----	----
Inoperatives:		----	----	----	----	----	1	3
Grid Current (1):		----	Ic1:	----	–2.0	µAdc	1	3
Heater Current:		----	If:	414	496	mA	1	3
Transconductance (1) Change of Individual Tubes:		----	Δ_fSm:	----	25	%	1	3
Transconductance (2):	(Note 9)	----	Δ_{Ef}Sm(2):	----	20	%	1	3
Heater-Cathode Leakage:	Ehk=+100 Vdc Ehk=–100 Vdc	---- ----	Ihk: Ihk:	---- ----	20 20	µAdc µAdc	1	3
Electrode Insulation:								
g1-all: p-all:		---- ----	Rg1-all: Rp-all:	25 25	---- ----	Meg. Meg.	2	5
Total Defectives:		----	----	----	----	----	4	8

ELECTRICAL DATA (Cont'd)

NOTES

Note 1: Characteristics, Quality Control Test Procedures, and Inspection Levels are made according to the appropriate paragraphs of MIL-E-1, "Inspection Instructions for Electron Tubes," and MIL-STD-105A.

Note 2: With a cylindrical shield (0.405" I.D. 1 7/8" long) connected to cathode lead.

Note 3: Test conditions and acceptance criteria per Shock Test procedures of MIL-E-1 basic specifications.

Note 4: Centrifuge test with forces applied in any direction.

Note 5: Test conditions and acceptance criteria per Fatigue Test procedures of MIL-E-1 basic specifications.

Note 6: These normal values represent conditions at which control of reliability may be expected.

Note 7: These normal test conditions are used for all characteristic tests unless otherwise stated under the individual test item.

Note 8: For most applications the performance will not be adversely affected by ± 5% heater voltage variation, but when the application can provide a closer control of heater voltage, an improvement in reliability will be realized.

Note 9: Change of transconductance for individual tubes from that value measured at Ef=6.3 V to that value measured at Ef=5.7 V.

Note 10: In addition to meeting the tightened electrical, physical and mechanical tests described in this data sheet, these Raytheon Reliable Tubes are now guaranteed to be free from "potential" defects identifiable by microscopic inspection as described by appendix B of MIL-E-1 basic specifications.

Note 11: Operation time is the time in seconds required for the plate current to attain a value within ± 15% of the three (3) minute plate current (1) value measured at plate current (1) test conditions. No preheating before this test is allowed. A cold tube must be used.

Note 12: During both continuity and short testing, the tube under test shall be tapped at least three times in each of two planes 90° apart with a tapper which shall be adjusted to give an impulse of approximately one half sine wave of 300 ± 50 micro seconds duration and having a minimum average amplitude of 80 G's peak acceleration as measured with a Gulton A-305 accelerometer and KA-1 kit. The shorts detecting equipment shall be a device capable of detecting as shorts, the following interelement resistances of the given time duration.

Duration	Sensitivity
Permanent short	600,000 ohms
500 μsec.	500,000 ohms
100 μsec.	100,000 ohms
60 μsec.	1,000 ohms

Tubes which give an indication of one or more of the following shall be rejected as inoperable:

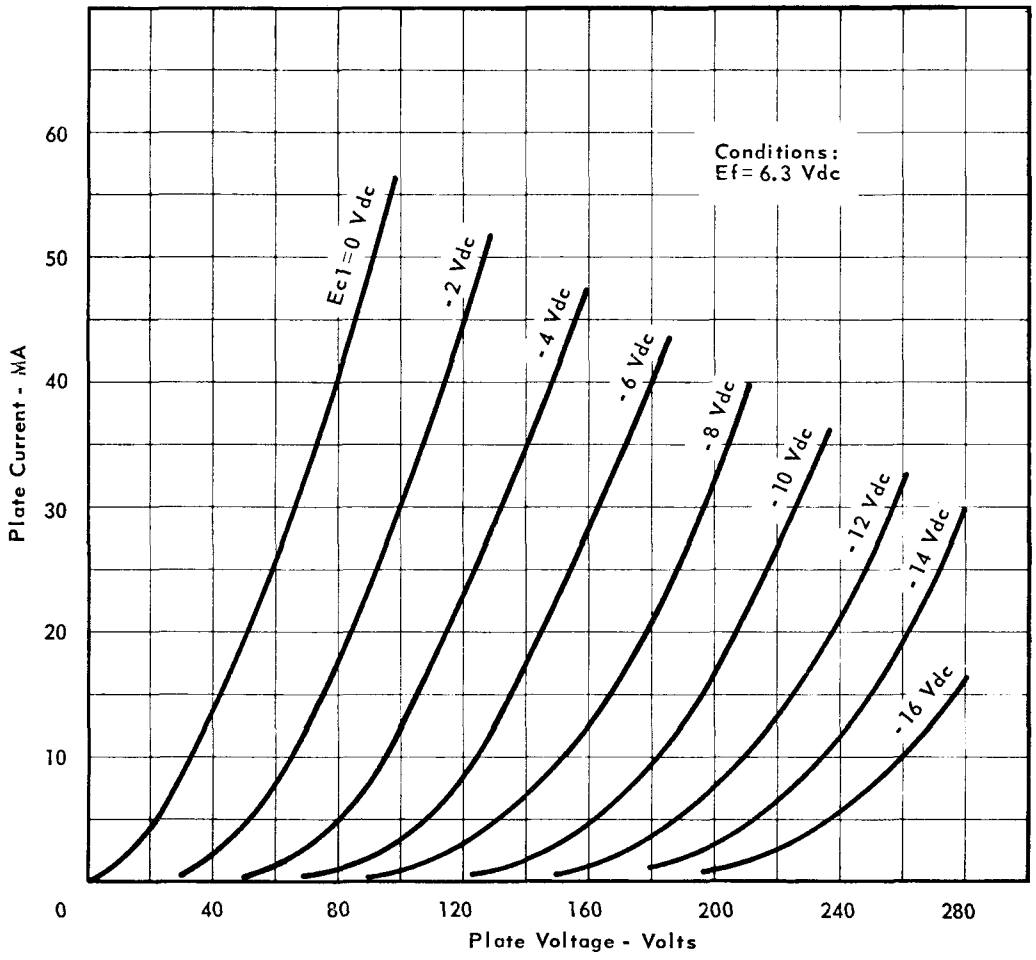
A. either a permanent or tap short at any time during the tapping procedure
B. any open circuit
C. any leaks

Note 13: The tubes shall be rigidly mounted on a table vibrating with simple harmonic motion. The tubes shall be vibrated for a total of 6 hours, 2 hours in each of three positions, X1, X2, and Y1. Only rated heater voltage shall be applied. Tubes which show one or more of the following defects shall be considered failures.

A. tubes which show permanent or tap shorts or open circuits following fatigue test, when tested as specified in 4.7.2 and 4.7.3.
B. tubes which do not comply with past fatigue limits, this is a destructive test

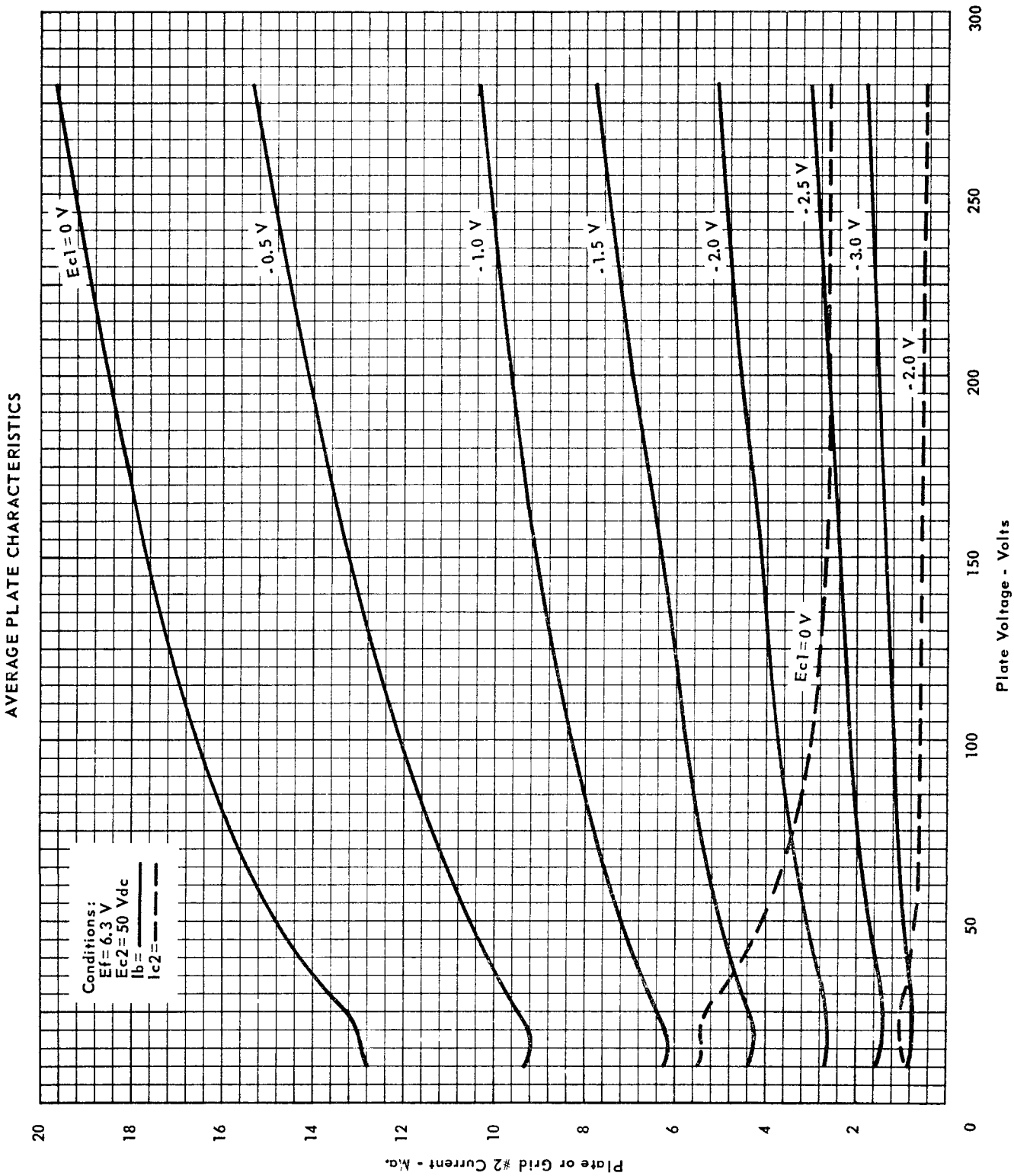
Note 14: The provisions of paragraph 4.9.20.5 of Specification MIL-E-1 shall apply, except for test conditions listed for shock test (2).

AVERAGE PLATE CHARACTERISTICS
(Triode Connected)



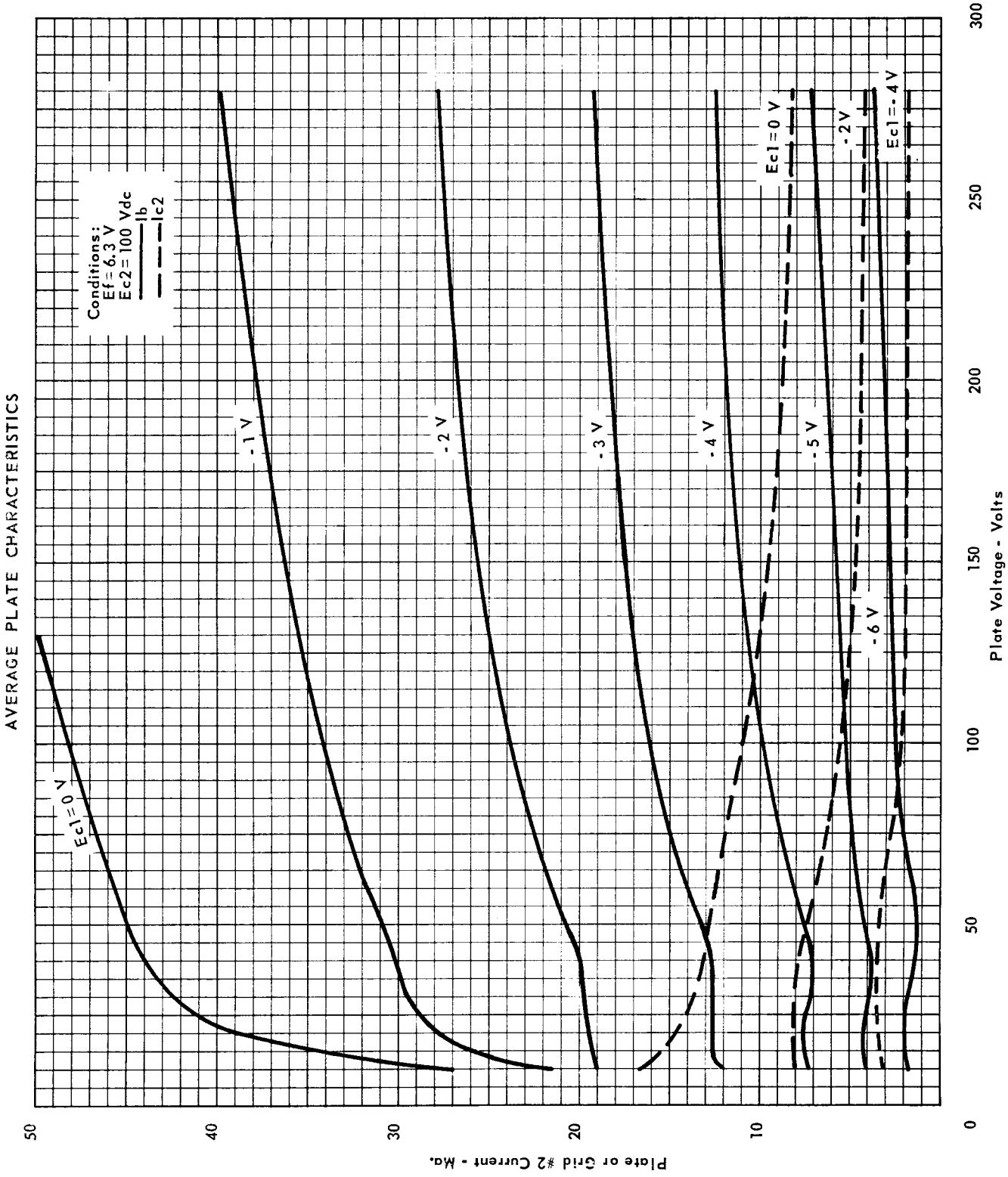
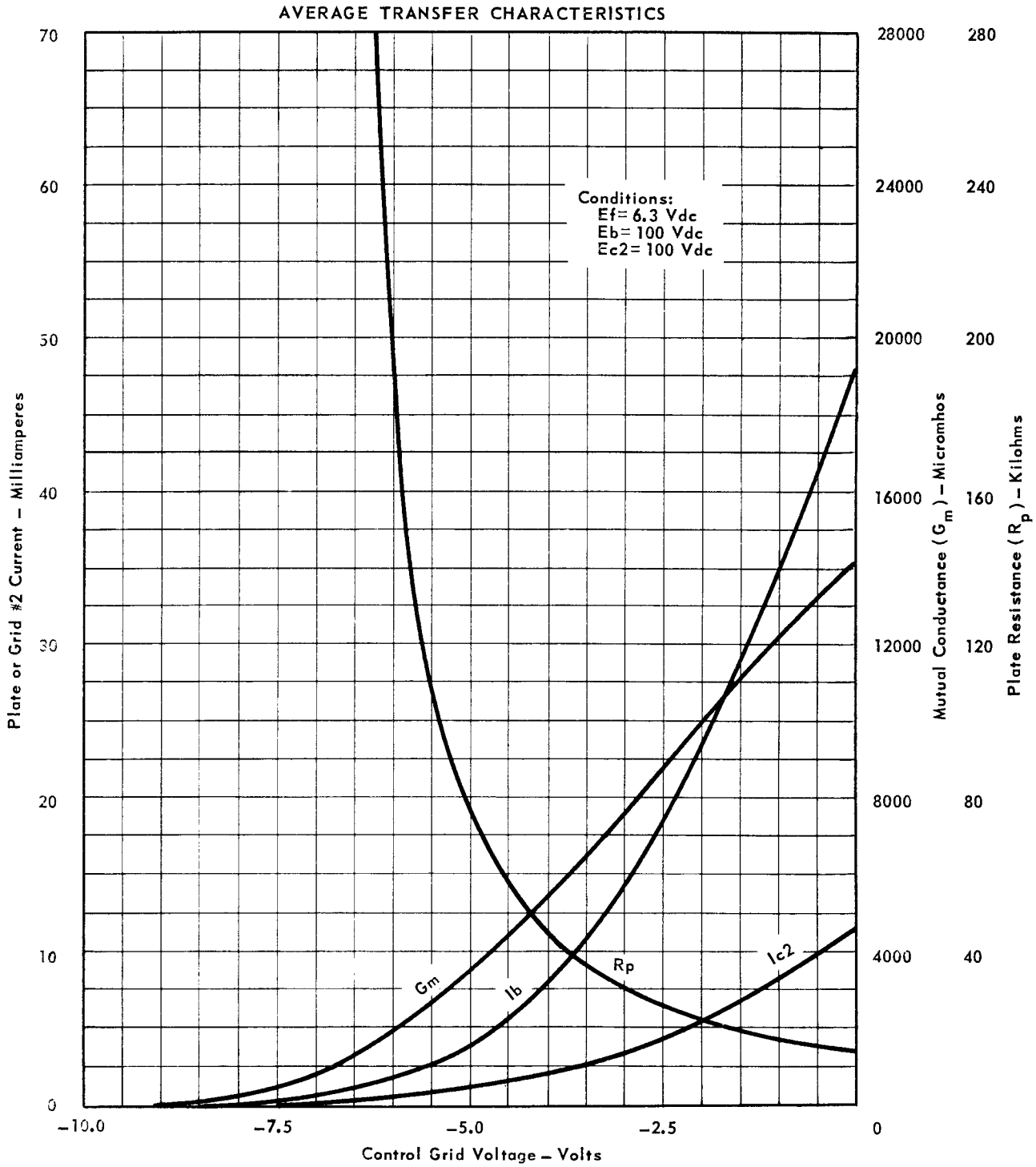
RAYTHEON

RELIABLE SUBMINIATURE PENTODE



RAYTHEON

RELIABLE SUBMINIATURE PENTODE



RELIABLE SUBMINIATURE PENTODE