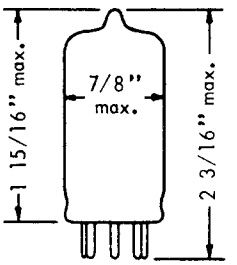
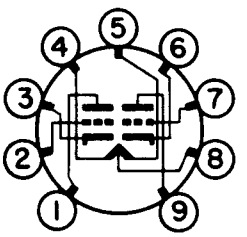
Excellence in Electronics

TYPE CK5687WA

The CK5687WA is a heater-cathode type medium-mu double triode of miniature construction designed for use in applications requiring high transconductance, high perveance or high emission capabilities. The cathode material in this type assures that high values of interface resistance will not develop when operated at cut-off conditions. This type employs separate cathode connections and a heater center-tap permitting either series or parallel operation. This type is characterized by long life and stable performance and is designed for service where severe conditions of mechanical shock or vibration are encountered.





BOTTOM VIEW

9H

MECHANICAL DATA

ENVELOPE: T – 6½ Glass

BASE: Miniature Button 9 – Pin

TERMINAL CONNECTIONS:

Pin 1 Plate, Unit #2	Pin 6 Cathode, Unit #1
Pin 2 Grid, Unit #2	Pin 7 Grid, Unit #1
Pin 3 Cathode, Unit #2	Pin 8 Heater Center-Tap
Pin 4 Heater	Pin 9 Plate, Unit #1
Pin 5 Heater	

MECHANICAL RATINGS:

Maximum Impact Acceleration (Shock Test – Note 3)	450 G
Maximum Vibrational Acceleration (96 Hour Fatigue Test – Note 4)	2.5 G
Maximum Bulb Temperature	225 °C

MOUNTING POSITION: Any

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 appreciably if maximum ratings are exceeded. Both reliability and performance will be jeopardized if filament voltage 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 6)	NORMAL OPERATION (Note 5)	DESIGN MAXIMUM	MIL-E-1 UNITS
Heater Voltage (Note 7)	Ef: Series	12.0	12.6	12.6	13.2	V
	Parallel	6.0	----	6.3	6.6	V
Plate Voltage	Eb:	----	120	120	330	Vdc
Grid Voltage	Ec1:	–200	–2.0	–2.0	0	Vdc
Plate Dissipation (per Plate) (Note 9)	Pp/p:	----	----	----	3.75	W
Heater-Cathode Voltage	Ehk:	–100	----	----	+100	v
Plate Current (per Plate)	Ib/p:	----	----	36	----	mAdc
Cathode Current (per cathode)	Ik/k:	----	----	----	65	mAdc
Grid Circuit Resistance per Grid (Note 10)	Rg/g:	----	----	----	0.1	Meg.
Transconductance per Plate	Sm/p:	----	----	11,500	----	μmhos
Amplification Factor	Mu/p:	----	----	18.5	----	----

ELECTRICAL DATA (Cont'd.)

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1)

(In the following tests each unit is tested separately.)

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:	Ef = 6.3 V	0.65	If:	820	850	880	910	940	50	mA
Heater-Cathode Leakage:	Ehk = +100 Vdc Ehk = −100 Vdc	0.65	Ihk: Ihk:	----	----	----	----	30 30	---- ----	μAdc μAdc
Grid Current (1):	Rp = 0.1 Meg.	0.65	Ic (1):	0	----	----	----	−1.5	----	μAdc
Plate Current (1):		0.65	Ib (1):	27	33	36	39	45	7.0	mAdc
Emission:	Es = 15 Vdc	0.65	Is:	125	----	----	----	----	----	mAdc
Transconductance (1):		0.65	Sm (1):	8500	10500	11500	12500	14500	2500	μmhos
Continuity and Shorts: (Inoperatives)										
Mechanical:	Envelope Outline No. (6–7)	----	----	----	----	----	----	----	----	----
MEASUREMENTS ACCEPTANCE TESTS – PART 2										
Insulation of Electrodes:	Ef = 12.6 V Eg-all = −100 Vdc Ep-all = −300 Vdc	---- 2.5	---- Rg – all: Rp-all:	---- 100 100	---- ---- ----	---- ---- ----	---- ---- ----	---- ---- ----	---- ---- ----	---- Meg. Meg.
Plate Current (2):	Eb = 300 Vdc; Ec1 = −20 Vdc	2.5	Ib (2):	----	----	----	----	6.0	----	mAdc
Plate Current (3):	Eb = 300 Vdc; Ec1 = −25 Vdc	2.5	Ib (3):	----	----	----	----	1.0	----	mAdc
Transconductance (2):	Ef = 11.4 V (Note 8)	2.5	Δ_{Ef} Sm (2):	----	----	----	----	15	----	%
Grid Emission:	Ef = 14.0 V; Rg/g = 1.0 Meg. After 5 minutes preheat	2.5	Ic (2):	0	----	----	----	−5.0	----	μAdc
AF Noise:	Ebb = 300 Vdc; Ec1 = 0; Rp = 2000 ohms; Eca1 = 70 mVac Rg = 1.0 Meg; Rk = 680 ohms (units connected in parallel)	2.5	EB:	----	----	----	----	17	----	VU
Plate Emission:	Eb = 195 Vac; Rk/Ib = 10.5 mAdc; Ec1 = 0; after 5 minutes, measure reverse plate current	2.5	Ib:	----	----	----	----	25	----	μAdc
Amplification Factor:		2.5	Mu:	16	----	18.5	----	21	----	----
Capacitance:	(Note 2)	6.5	Cgp:	2.8	----	4.0	----	5.2	----	μμf
Capacitance:			Cin:	2.8	----	4.0	----	5.2	----	μμf
Capacitance:			Cout (1):	0.42	----	0.6	----	0.78	----	μμf
Capacitance:			Cout (2):	0.34	----	0.5	----	0.66	----	μμf
Capacitance:			Chk:	----	----	----	----	9.7	----	μμf
Low Pressure Voltage Breakdown:	Pressure = 55 ± 5 mmHg; Voltage = 500 Vac	6.5	----	----	----	----	----	----	----	----
Vibration (2):	G = 2.5; F = 25 cps; Rp = 2000 ohms	6.5	Ep:	----	----	----	----	100	----	mVac
DEGRADATION RATE ACCEPTANCE TESTS										
Shock:	Hammer Angle = 30°C; (Note 3)	----	----	----	----	----	----	----	----	----
Fatigue:	96 Hours; Fixed Frequency; F = 25 min. 60 max. (Note 4)	6.5	----	----	----	----	----	----	----	----
Post Shock and Fatigue Test End Points:										
Vibration (2):	F = 25 cps; G = 2.5; Rp = 2000 ohms	----	Ep:	----	----	----	----	150	----	mVac

ELECTRICAL DATA (Cont'd.)

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

In the following tests each unit is tested separately

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.)								
Heater-Cathode Leakage:	Ehk=+100 Vdc	----	Ihk:	----	50	μAdc		
	Ehk=−100 Vdc	----	Ihk:	----	50	μAdc		
Transconductance (1):		----	Sm (1):	6500	----	μmhos		
Grid Current (1):		----	Ic (1):	0	−3.0	μAdc		
Miniature Tube Base Strain:		----	----	----	----	----		
Glass Strain:	(Thermal Shock)	2.5	----	----	----	----		
ACCEPTANCE LIFE TESTS								
Heater Cycling:	Ef=7.5 V (heater in parallel); Ehk=+135 Vdc; Eb=Ec=0 Vdc; 1 min. on, 4 min. off	----	----	2000	----	cycles		
Heater Cycling Life Test End Point:								
Heater-Cathode Leakage:	Ehk=+100 Vdc	----	Ihk:	----	30	μAdc		
	Ehk=−100 Vdc	----	Ihk:	----	30	μAdc		
1 Hour Stability Life Test:	TA=Room; Ec1=0; Ehk=+135 Vdc; Rg/g=1.0 meg.; Rk/k=68 ohms	----	----	----	----	----		
1 Hour Stability Life Test End Points:	(Typical Sample Size=50 tubes)	----	----	----	----	----		
Transconductance (1) Change of individual tubes from initial:		1.0	Δ_t Sm (1):	----	10	%		
100 Hour Survival Rate Life Test:	TA=Room; Ec1=0; Ehk=+135 Vdc; Rg/g=1.0 meg.; Rk/k=68 ohms	----	----	----	----	----		
100 Hour Survival Rate Life Test End Points:	(Typical Sample Size=200 tubes)	----	----	----	----	----		
Shorts-Continuity		0.65	----	----	----	----		
Transconductance (1):		1.0	Sm (1):	7500	----	μmhos		
500 and 1000 Hour Intermittent High Temperature life test:	T Bulb=225°C; Ec1=0; Ehk=+135 Vdc; Rg/g=1.0 meg.; Rk/k=68 ohms	----	----	----	----	----		
500 Hour Intermittent High Temperature Life Test End Points:	(Typical Sample Sizes=20 tubes 1st sample, 40 tubes 2nd sample)	----	----	----	----	----		
Inoperatives:		----	----	----	----	----	1	3
Grid Current (1):		----	Ic (1):	0	−2.0	μAdc	1	3
Heater Current:		----	If:	800	960	mA	1	3
Change in Transconductance (1) of individual tubes:		----	Δ_t Sm (1):	----	20	%	1	3
Transconductance (2) (Note 8)		----	Δ_{Ef} Sm (2):	----	25	%	1	3
Heater-Cathode Leakage:	Ehk=+100 Vdc	----	Ihk:	----	50	μAdc	1	3
	Ehk=−100 Vdc	----	Ihk:	----	50	μAdc		
Electrode Insulation:								
(p−all)		----	Rp−all:	50	----	Meg.	2	5
(g−all)		----	Rg−all:	50	----	Meg.		
Total Defectives:		----	----	----	----	----	4	8

ELECTRICAL DATA (Cont'd.)

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

In the following tests each unit is tested separately

TEST	CONDITIONS	AQL %	MIL-E-1 SYMBOL	MIN	MAX	MIL-E-1 UNITS	Allowable defects per Characteristics 1st Sample	Allowable defects per Characteristics Combined Samples
ACCEPTANCE LIFE TESTS (Cont'd)								
1000 Hour Intermittent High Temperature Life Test End Points:	(Typical Sample Size= 20 tubes 1st sample, 40 tubes 2nd sample)	----	----	----	----	----	---	---
Inoperatives:		----	----	----	----	----	2	5
Grid Current (1):		----	Ic (1):	0	−2.5	μAdc	2	5
Heater-Current:		----	If:	800	960	mA	2	5
Change in Transconductance (1) of individual tubes:		----	Δ_t Sm (1):	----	25	%	2	5
Transconductance (2) (Note 8)		----	Δ_{Ef} Sm (2):	----	30	%	2	5
Heater-Cathode Leakage:	Ehk=+100 Vdc	----	Ihk:	----	50	μAdc	2	5
	Ehk=−100 Vdc	----	Ihk:	----	50	μAdc		
Electrode Insulation:								
(p−all)		----	Rp−all:	25	----	Meg.	4	8
(g−all)		----	Rg−all:	25	----	Meg.		
Total Defectives:		----	----	----	----	----	5	10

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: Without Shield.

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

Note 4: Test conditions and acceptance criteria per Fatigue Test procedures of MIL-E-1 basic specifications.

Note 5: These normal values represent conditions at which control of reliability may be expected.

Note 6: These normal test conditions are used for all characteristics unless otherwise stated under the individual test item.

Note 7: For most applications the performance will not be adversely affected by ± 10% heater voltage variation, but when the application can provide a closer control of heater voltage, an improvement in reliability will be realized.

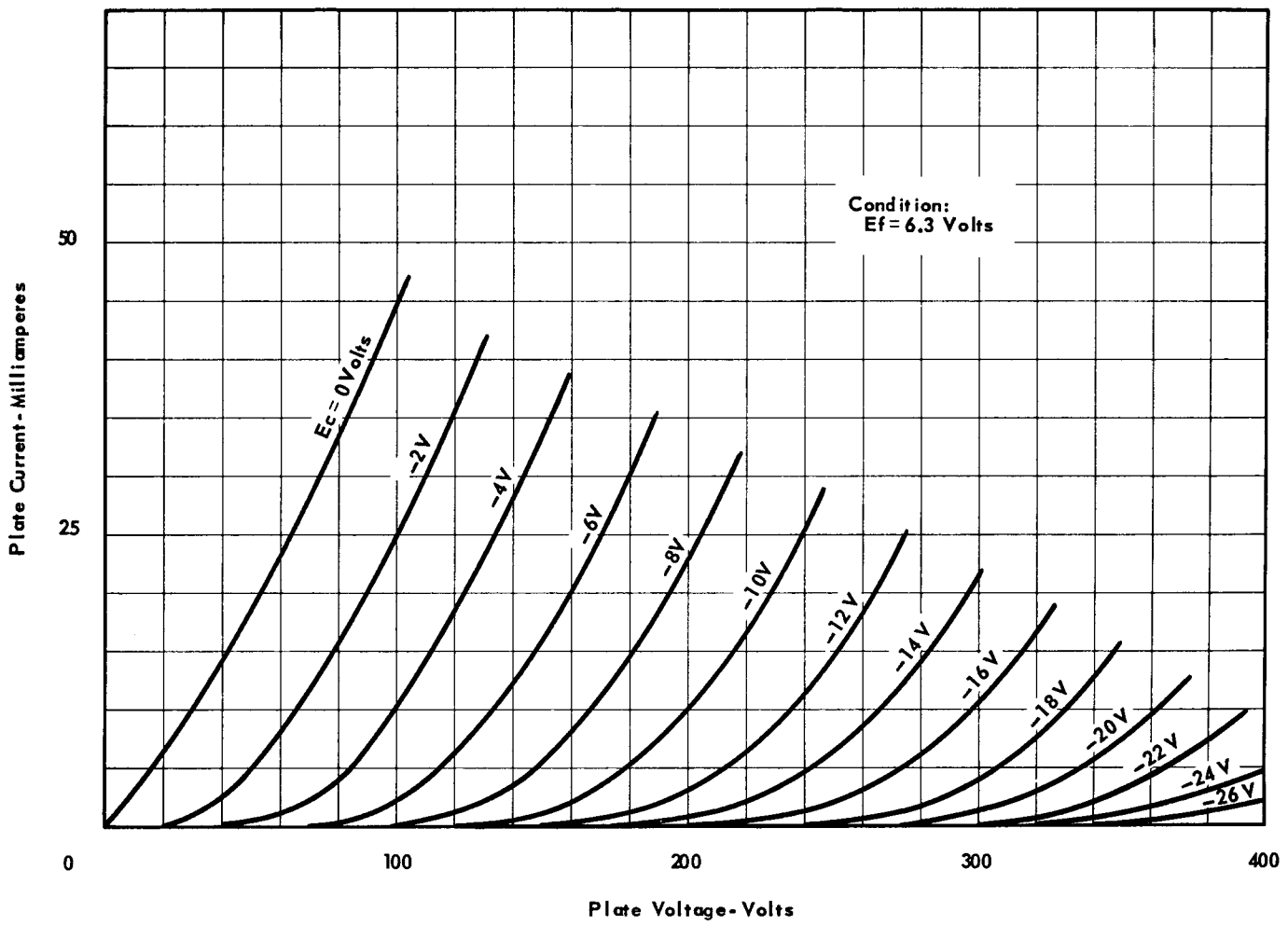
Note 8: Change of transconductance for individual tubes from that value measured at Ef= 12.6 volts to that value measured at Ef= 11.4 volts.

Note 9: The plate dissipation of one section may be as great as 4.2 watts provided that the maximum dissipation for both sections does not exceed 7.5 watts.

Note 10: The maximum Rg/g may be 1.0 meg. providing cathode bias is used.

RELIABLE DOUBLE TRIODE

AVERAGE PLATE CHARACTERISTICS



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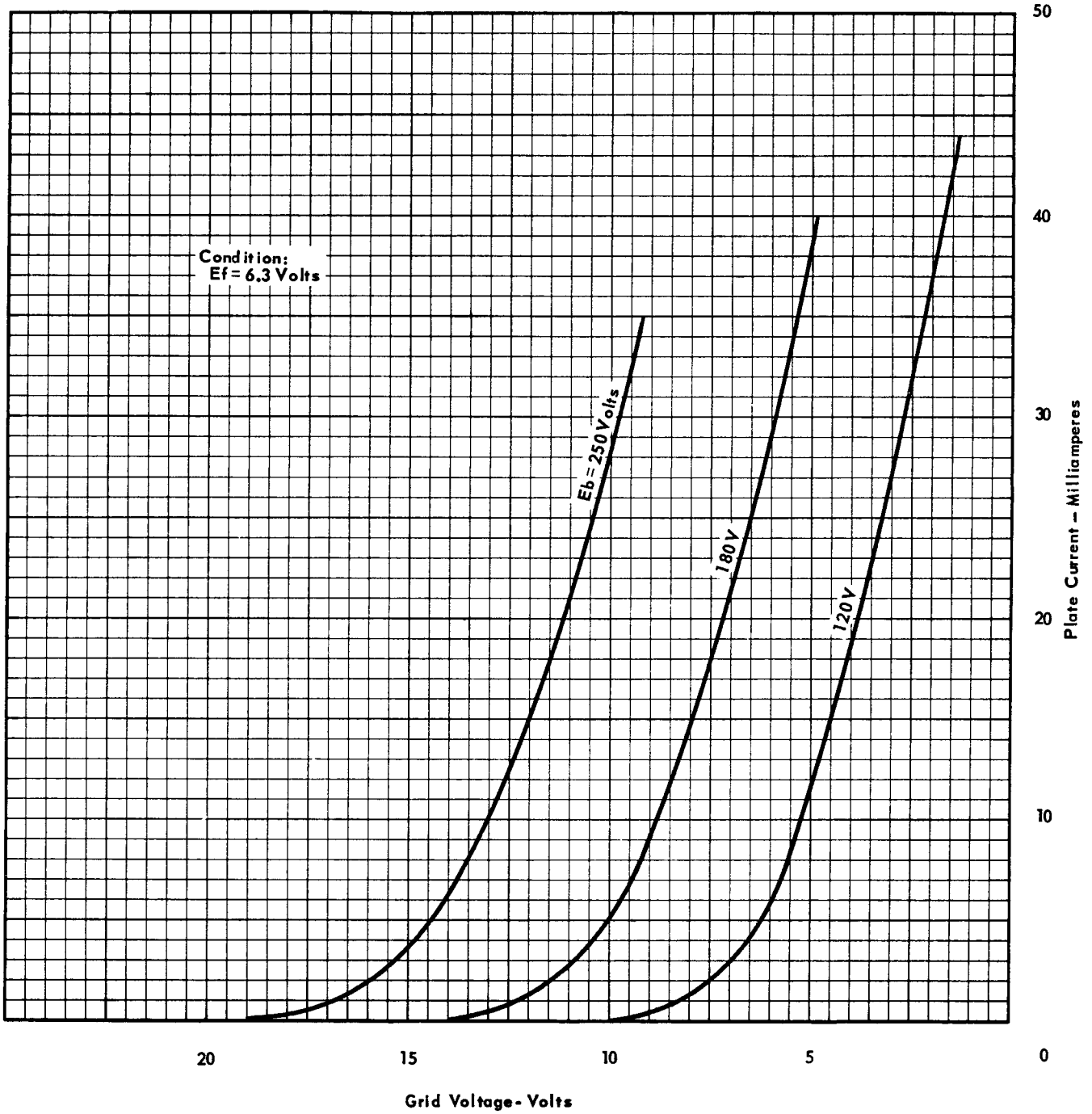
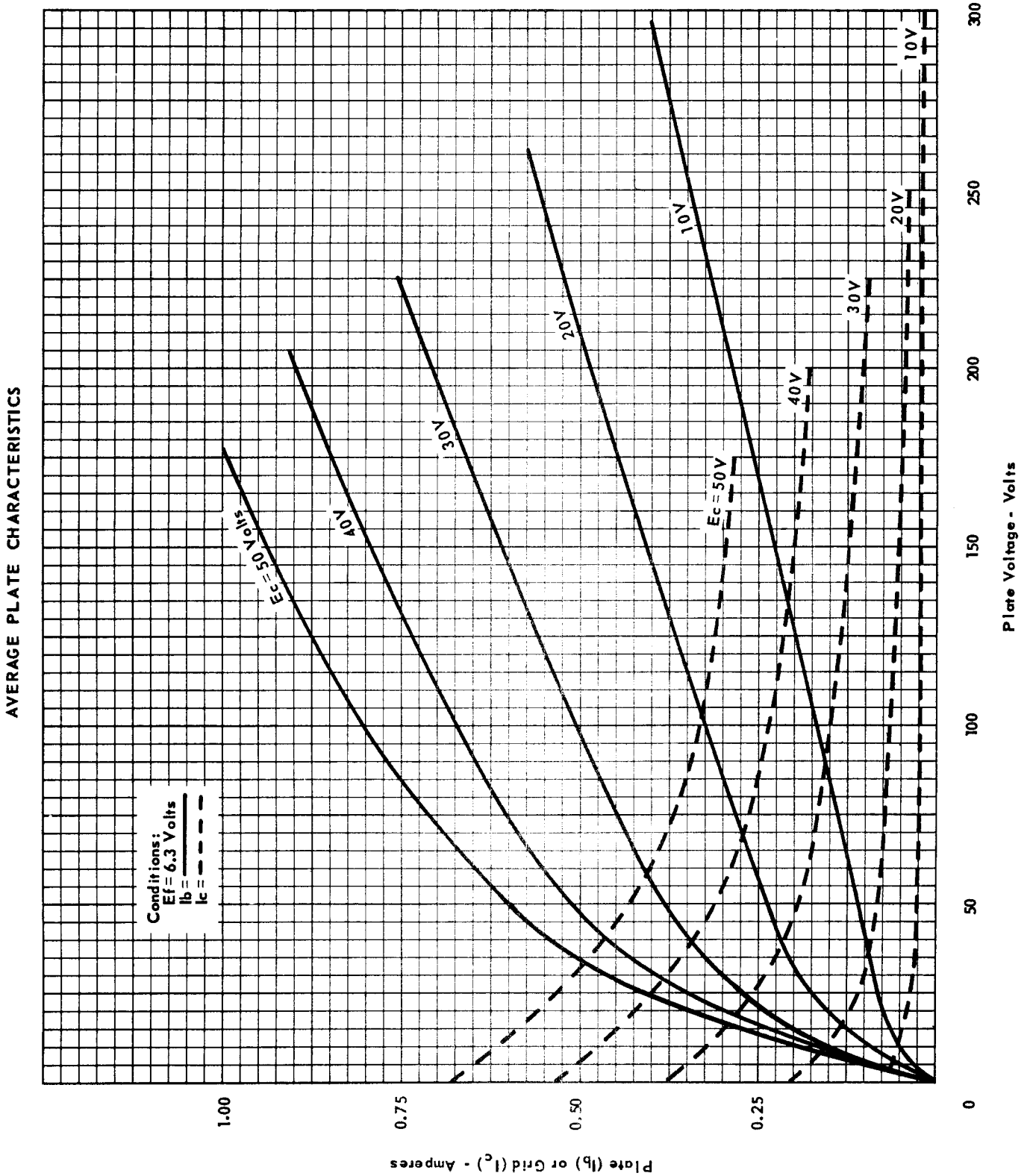
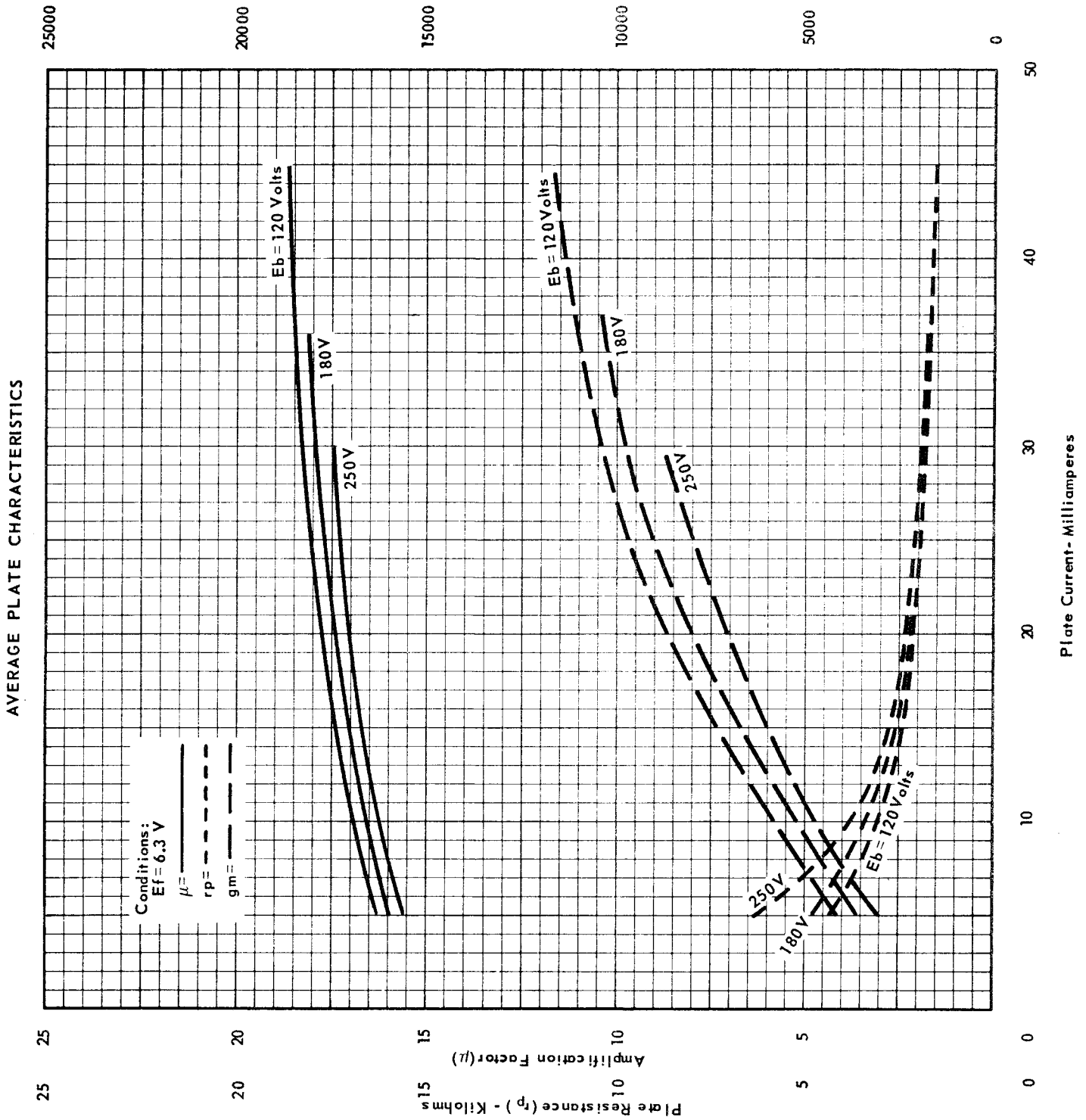
AVERAGE CHARACTERISTICS



RELIABLE DOUBLE TRIODE




AVERAGE PLATE CHARACTERISTICS
Plate Current - Milliamperes
Plate Resistance (r_p) - Kilohms
Amplification Factor (μ)
25000
20000
15000
10000
5000
0
50
40
30
20
10
0
25
20
15
10
5
0
Eb = 120 Volts
180V
250V
Conditions:
Ef = 6.3 V
μ =
rp =
gm =