RAYTHEON

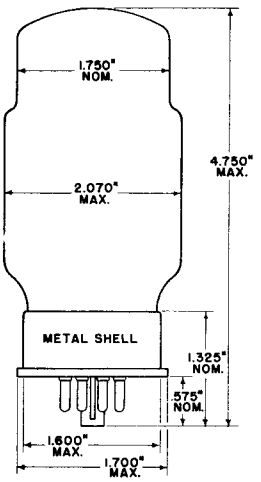
TECHNICAL INFORMATION

TWIN POWER TRIODE

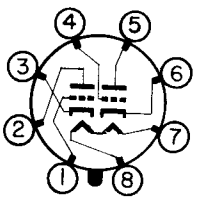
Excellence in Electronics

TYPE CK6528

The Raytheon CK6528 is a medium MU twin power triode used especially in series regulated power supplies. It is mechanically rugged and is designed for long life operation. In operation it is able to handle large currents over a wide voltage range. The anodes are zirconium coated graphite supported by ceramic insulators. The use of large cathodes provide more than sufficient emission current. The grid wires are gold plated molybdenum and the mount is set on a rugged button stem supported by flexible metal vibration snubbers. The use of these elements and the hard glass envelope makes it possible to degas the tube at high temperatures during processing enabling the tube to be used at high temperatures without the fear of harmful gases which may be given off by tube elements. The Raytheon CK6528 can in some circuits replace 2 or 3 type CK6080WA or 3 or 4 beam power tubes. Many CK6528 tubes can be paralleled as desired for increased levels of current or power.



(BOTTOM VIEW)



MECHANICAL DATA

ENVELOPE: ST-16-Nonex

BASE: Large wafer octal with metal sleeve, 8-Pin, JEDEC #B8-86

TERMINAL CONNECTIONS:

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

MECHANICAL RATINGS:

Maximum Impact Acceleration (Shock Test-Note 2)	720 G
Maximum Bulb Temperature	250 °C

MOUNTING POSITION: Any (Note 5)

ELECTRICAL DATA

CAUTION----- To Electron 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 maybe 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	ABSOLUTE MINIMUM	NORMAL TEST CONDITIONS (Note 4)	NORMAL OPERATION (Note 3)	ABSOLUTE MAXIMUM	MIL-E-1 UNITS
Heater Voltage: (Note 7)	Ef:	5.7	6.3	6.3	6.9	V
Plate Voltage:	Eb:	----	100	100	400	Vdc
Grid Voltage:	Ec1:	-300	-4.0	-4.0	----	Vdc
Heater Cathode Voltage:	Ehk:	-300	----	----	+300	Vdc
Cathode Resistance (Percathode):	Rk/k:	(Note 6)	0	0	----	Ohms
Plate Dissipation (Per Plate):	Pp/p:	----	----	----	30	Watts
Grid Resistance (Total):	Rg:	500	500 Min.	----	500,000	Ohms
Resistance Per Grid Leg When Triode Sections Are Paralleled:	Rg/g:	500	----	----	----	Ohms
Transconductance (Per Plate):	Sm/p:	----	----	37,000	----	μmhos
Amplification Factor:	Mu/p:	----	----	9.0	----	----
Plate Current (Per Plate):	Ib/p:	----	----	----	300	mAdc
Cathode-Conditioning Time:	TK:	(Note 13)	----	----	----	Sec.

Tentative Data

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ELECTRICAL DATA (Cont'd)

CHARACTERISTICS AND QUALITY CONTROL (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 Cathode Leakage:	Ehk=+300	0.65	Ihk:	----	----	----	----	40	----	μAdc
	Ehk=–300 (Note 11)	0.65	Ihk:	----	----	----	----	40	----	μAdc
Grid Current (1):	Rg/g=50 K (Note 8)	0.65	Ic1:	----	----	----	----	–2.0	----	μAdc
Plate Current (1):	(Note 8)	0.65	Ib1:	140	----	185	----	230	----	mAdc
Emission:	Eb=10 Vdc; Ec=10 Vdc (Note 10)	0.65	Is:	150	----	----	----	----	----	mAdc
Plate Current (1):	Eb=400 Vdc; Ec=–75 Vdc; Rk=0 (Note 3)	0.65	Δ Ib (1):	0	----	----	----	3.0	----	mAdc
Continuity and Shorts (Inoperatives):		0.4	----	----	----	----	----	----	----	----
Mechanical:	Envelope ST–16–Nonex	----	----	----	----	----	----	----	----	----
MEASUREMENTS ACCEPTANCE TESTS, PART 2										
Insulation of Electrodes:		6.5	Rg-all:	10	----	----	----	----	----	Meg.
			Rp-all:	10	----	----	----	----	----	Meg.
Transconductance (1):	(Note 8)	6.5	Sm (1):	29000	----	37000	----	45000	----	μmhos
Plate Current (2):	Eb=60 Vdc; Ec=0; (Note 8)	6.5	Ib (2):	135	----	----	----	----	----	mAdc
Transconductance (2):	Ef=5.7 V; (Note 8 & 9)	6.5	Δ_{Ef} Sm (2):	----	----	----	----	15	----	%
Amplification Factor:	(Note 8)	6.5	Mu:	7.0	----	9.0	----	11.0	----	----
Vibration (1):	F=10–50–10 cps; G=2.5; Ebb=190 Vdc; Ec/Ib=75 mAdc; Rp=2000 ohms; Per MIL-E-1 ref. par. 4.9.20.3	6.5	Ep:	----	----	----	----	500	----	mVac
Heater Current:	Ef=6.3 V	6.5	If:	4.75	----	5.0	----	5.25	----	A
DEGRADATION RATE ACCEPTANCE TESTS										
Shock:	Ef=6.3 V; Hammer Angle=48°; 720G–1 Msec; (Note 2)	----	----	----	----	----	----	----	----	----
Post Shock End Points:										
Heater Cathode Leakage:	Ehk=+300 Vdc	Note 11	Ihk:	----	----	----	----	100	----	μAdc
	Ehk=–300 Vdc Units Connected in Parallel		Ihk:	----	----	----	----	100	----	μAdc
Grid Current (1):	Note 8	----	Ic:	----	----	----	----	–8	----	μAdc
Plate Current (1):	Note 8	----	Ib (1):	130	----	----	----	----	----	mAdc
Transconductance (1) per Section:	Note 8	----	Gm (1):	23000	----	----	----	----	----	μmhos

ELECTRICAL DATA (Cont'd)

CHARACTERISTICS AND QUALITY TESTS (Note 1)
In the following test each unit is tested separately

TEST	CONDITIONS	AQL %	MIL-E-1 SYMBOL	MIN	MAX	MIL-E-1 UNIT
ACCEPTANCE LIFE TESTS						
1000 Hours Intermittent Life Test:	Ef = 6.3 V; Eb = 100 Vdc; Ec = −4 Vdc; Ehk = 300 V; Rg/g = 500,000 ohms Rk/k = 0 ohms; T Bulb = 250 °C ± 25° C Note 12	----	----	----	----	----
1000 Hour Intermittent Life Test End Points:	(Typical sample size = 5 tubes)	----	----	----	----	----
Inoperatives:		----	----	----	----	----
Plate Current (1):	Note 8	----	Ib:	130	----	mAdc
Grid Current (1):	Note 8	----	Ic1:	0	−8	μAdc
Transconductance (1):	Note 8	----	Sm:	23000	----	μmhos
Heater Cathode Leakage:	Ehk = + 300 Vdc Ehk = −300 Vdc Note 11	----	Ihk: Ihk:	---- ----	100 100	μAdc μAdc

NOTES:

Note 1: Characteristic, 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: Test Conditions and Acceptance criteria per Shock Test procedures of MIL-E-1 basic specifications.

Note 3: These normal values represent conditions at which control of reliability may be expected.

Note 4: These normal test conditions are used for all characteristics unless otherwise stated under the individual test item.

Note 5: If the tube is to be mounted in a horizontal position it is recommended that it be mounted so that the base lug key be either directly up or directly down.

Note 6: Minimum cathode resistance per cathode leg shall be 10 ohms or that resistance necessary to provide 10 percent of the grid bias voltage, whichever is greater.

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: Voltages are applied to both sections, but each section is tested separately. Values specified herein are for individual sections, except for heater current. Readings shall be taken after the tube has been preheated for at least 2 minutes under conditions EF = 6.3 V, Ebb = 190 V, Ec = 0, Rk = 200 ohms.

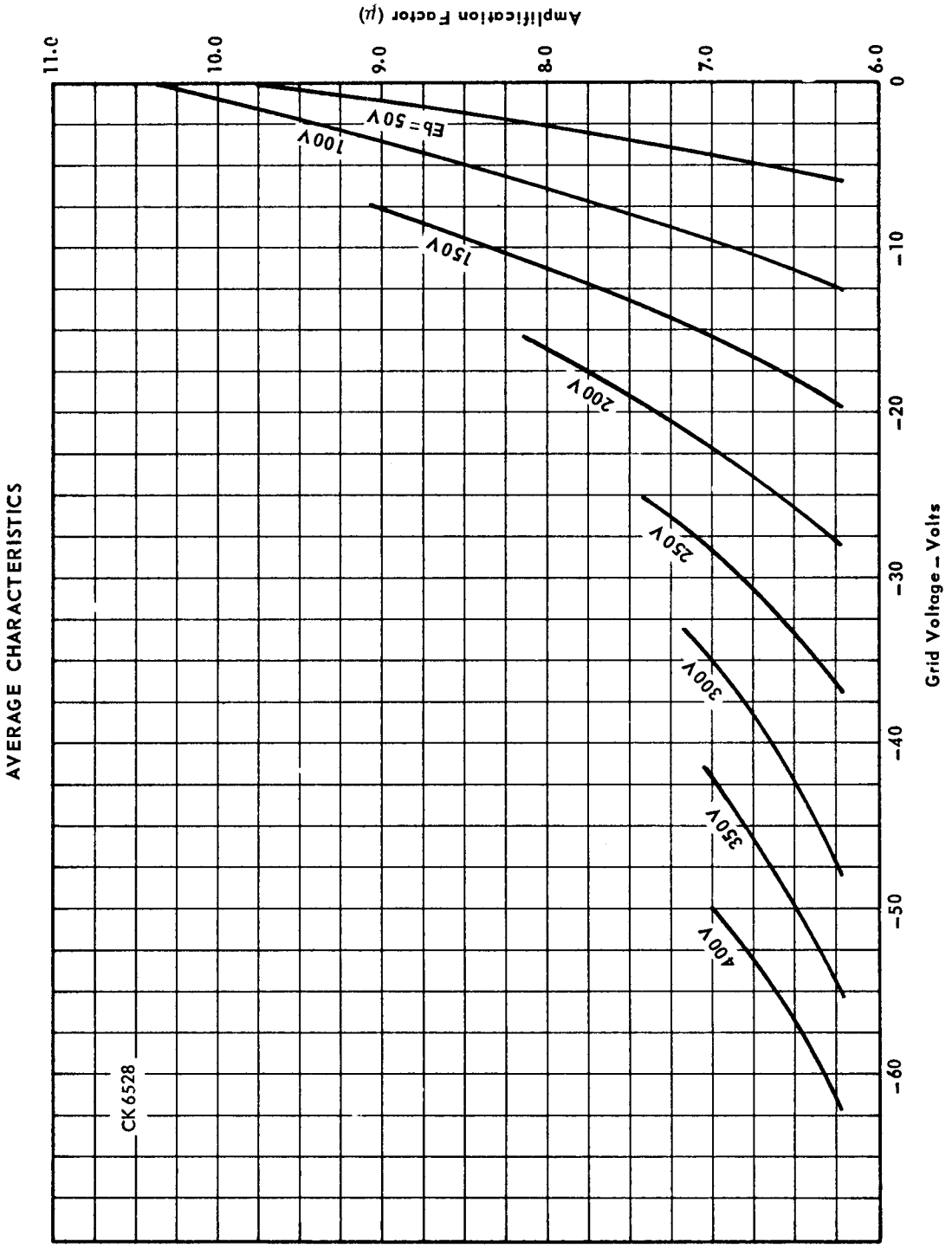
Note 9: Change of transconductance for individual tubes from that value measured at Ef = 6.3 volts to that value measured at Ef = 5.7 volts.

Note 10: Each unit shall be read separately. Unit not under test shall be grounded.

Note 11: IK shall be tied to 2K.

Note 12: The tube shall be cycled 30 seconds heater positive and 30 seconds heater negative.

Note 13: TK = 30 seconds minimum. This is especially necessary in regulator circuits where the plate of the amplifier tube ties back to the plate side of the passing tube. In such a circuit, during warmup, the grid bias may swing highly positive causing the cathode to lose its ability to sustain current.


Amplification Factor (μ)
11.0
10.0
9.0
8.0
7.0
6.0
0
-10
-20
-30
-40
-50
-60
Grid Voltage - Volts
AVERAGE CHARACTERISTICS
CK6528
Eb = 50V
100V
150V
200V
250V
300V
350V
400V

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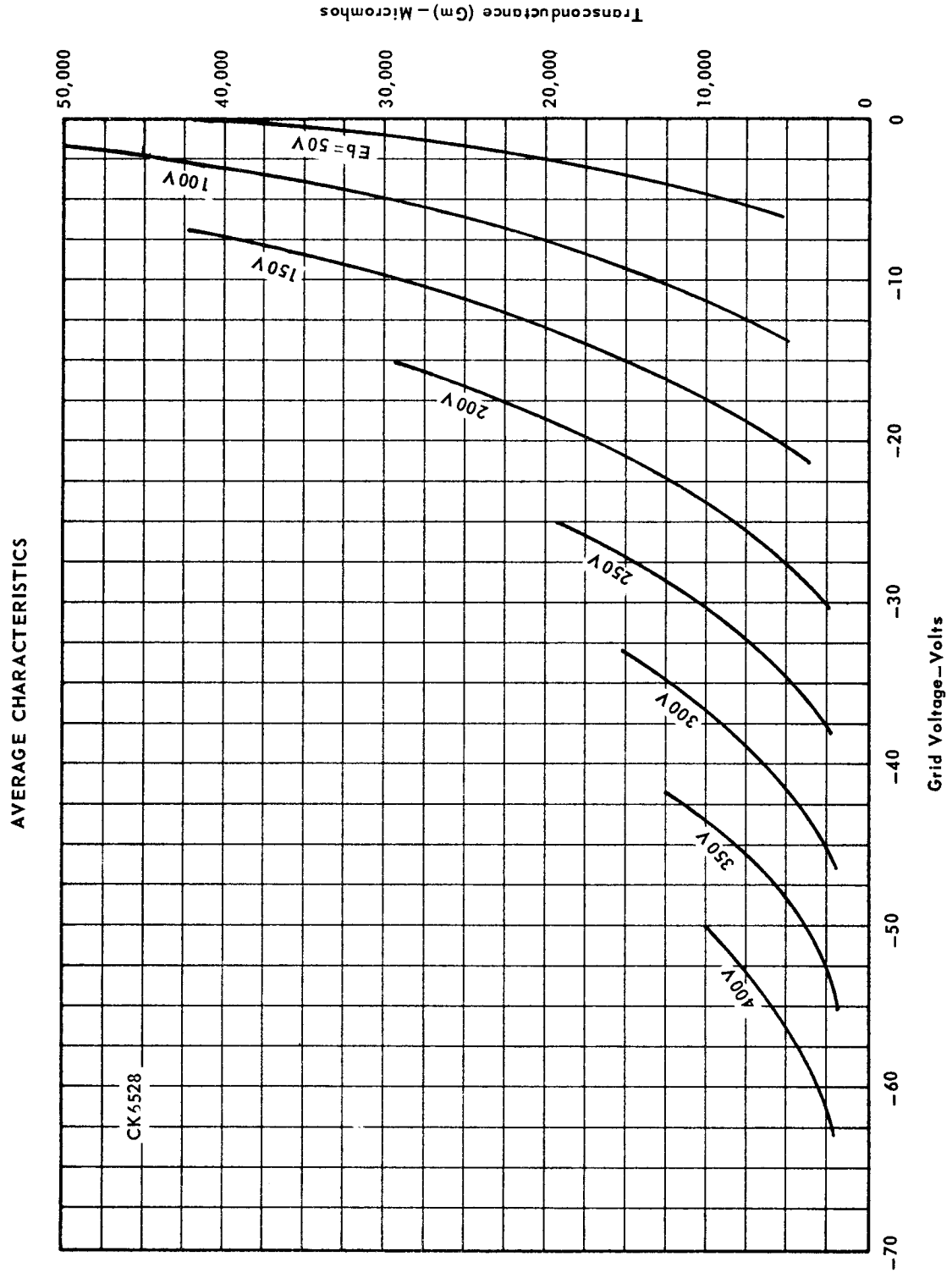
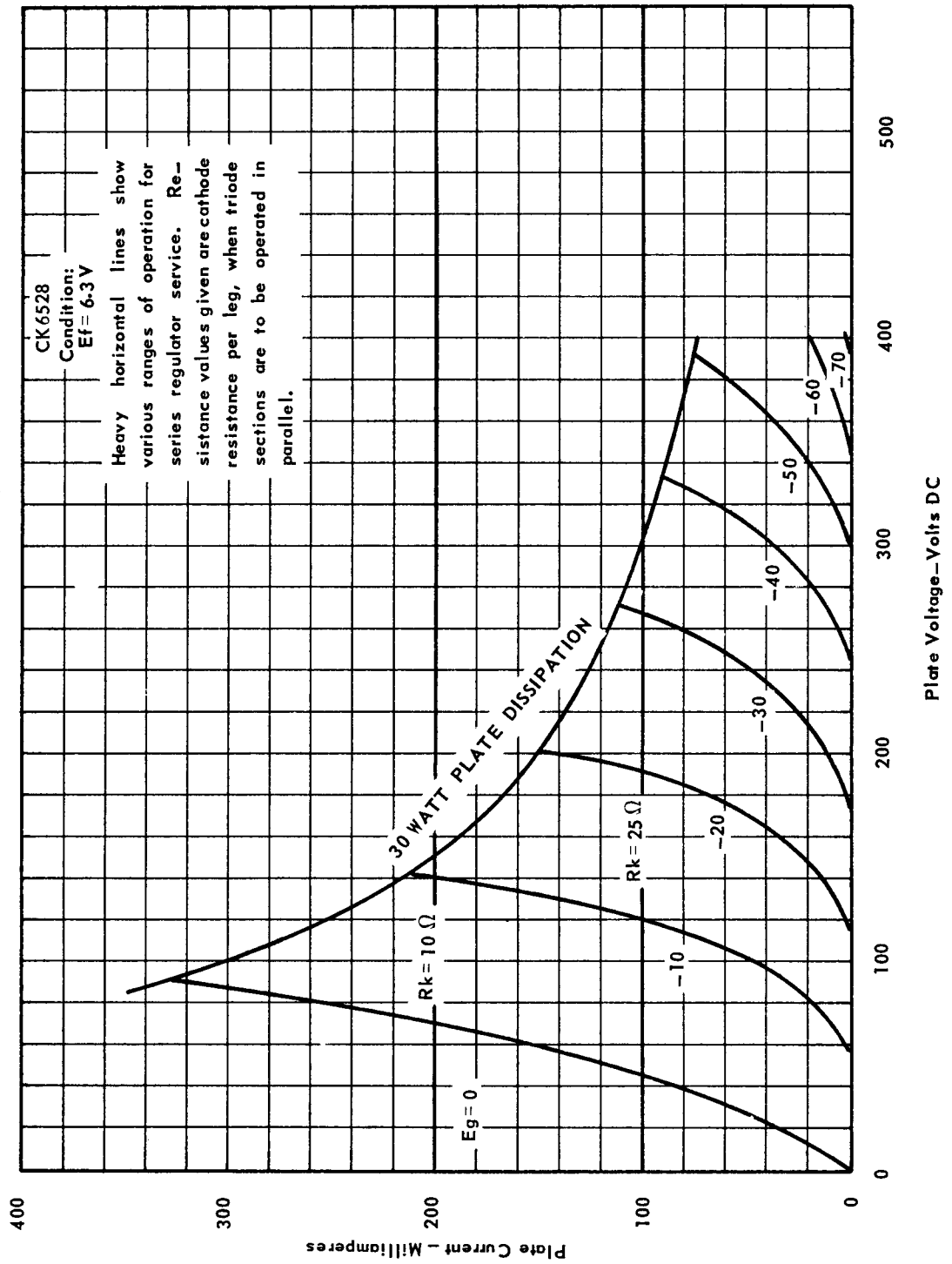


AVERAGE PLATE CHARACTERISTICS
(For Each Triode Unit)



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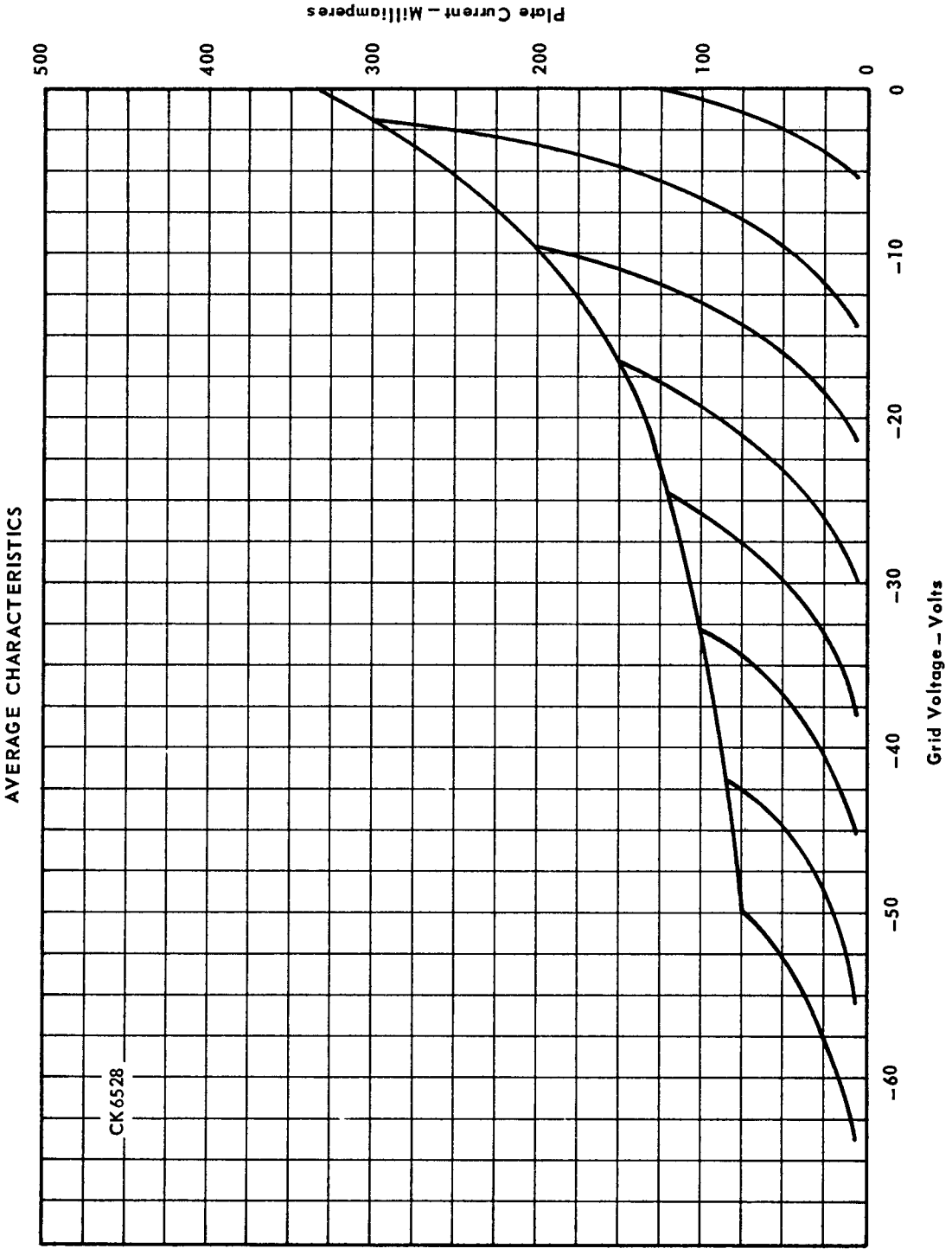
TWIN POWER TRIODE



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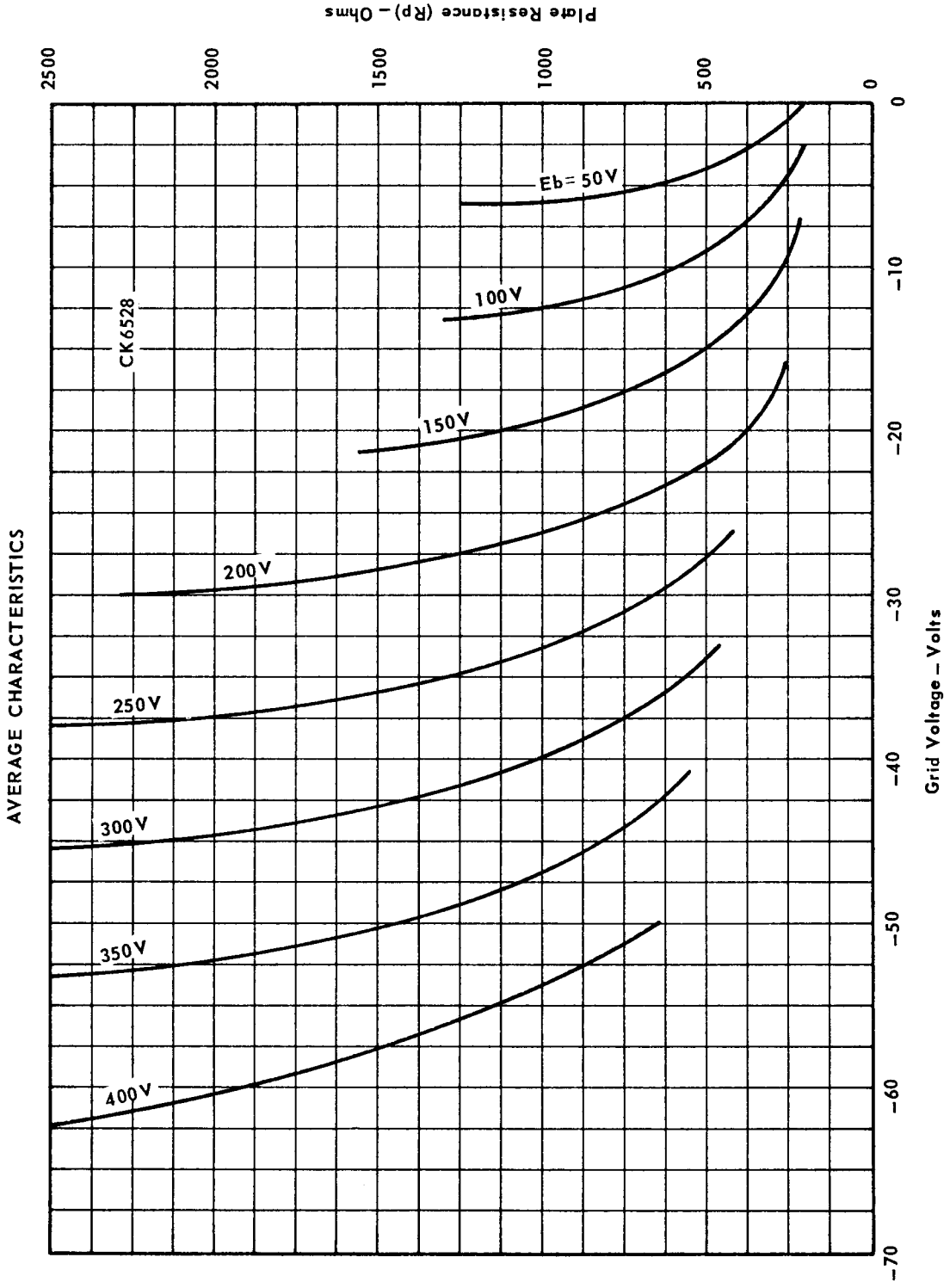
Plate Resistance (Rp) – Ohms
2500
2000
1500
1000
500
0
AVERAGE CHARACTERISTICS
CK6528
Eb = 50V
100V
150V
200V
250V
300V
350V
400V
0
-10
-20
-30
-40
-50
-60
-70
Grid Voltage – Volts