RAYTHEON

TECHNICAL INFORMATION SERVICE

Technical Information

CK8096

RELIABLE LOW NOISE SUBMINIATURE TRIODE

The Raytheon Reliable type CK8096 is a heater–cathode, low noise, high mu triode of subminiature construction, designed for applications requiring low quiescent noise (a function of 1/F), and freedom from microphonic response. Its cathode is designed for long periods of operation with freedom from interface or electrode insulation resistance. The CK8096 is electrically similar to the type CK6533WA. The mechanical design is such that microphonic output due to structural resonances is reduced throughout the audio frequency range by approximately 20 db as compared to more conventional triodes.

The CK8096 is intended for service where extreme conditions of mechanical shock or vibration are encountered. 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.

ENVIRONMENTAL CHARACTERISTICS:

Quiescent Noise (Referred to Grid)		
at 10 cps	–130	dbV/cycle Min.
at 1000 cps	–153	dbV/cycle Min.
Impact Acceleration (Shock, 3/4 msec duration)	450	G Max.
Uniform Acceleration (Centrifuge)	1,000	G Max.
Vibrational Acceleration for Extended Periods (Fatigue)		
96 Hour	2.5	G Max.
6 Hour	10	G Max.
Vibration Output at F=40 cps, G=15 (Ep)	1.0	mVac Max.
Variable Frequency Vibration Output at F=30–1000 cps, 15 G (ep)	15	mvpp Max.
On–Off Heater Cycles	2,000	Min.
Bulb Temperature	220	°C Max.
Altitude	60,000	Ft. Max.

ELECTRICAL DATA

HEATER CHARACTERISTICS:

Heater Voltage	6.3	V
Heater Current	200	mA

DIRECT INTERELECTRODE CAPACITANCES: (Without Shield)

Grid to Plate	2.0	pf max.
Input	1.75	pf
Output	0.60	pf

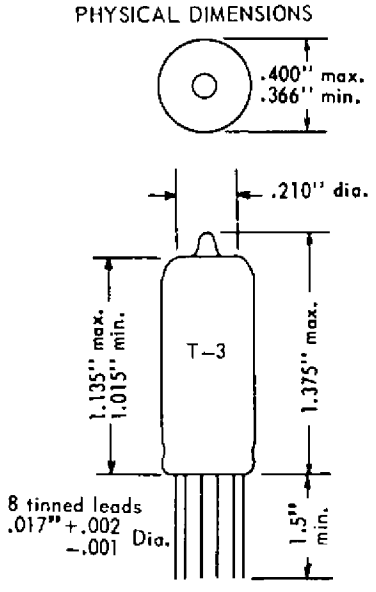
RATINGS (Absolute Maximum) *

Heater Voltage	6.3(±10%)	V
Plate Voltage	150	Vdc
Grid Voltage	0	Vdc
Grid Voltage (Minimum)	–55	Vdc
Heater–Cathode Voltage		
Heater Positive with Respect to Cathode	200	Vdc
Heater Negative with Respect to Cathode	200	Vdc
Grid Resistor **	0.1	Meg.
Plate Current	2.5	mAdc
Plate Dissipation	0.5	W

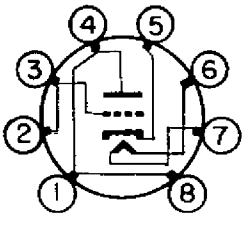
MECHANICAL DATA

ENVELOPE . . . . . T–3 Glass
OUTLINE . . . . . JEDEC (3–1)
BASE . . . . . E8–10 Subminiature Button flexible leads.
BASING 8FY
CATHODE . . . Coated Unipotential
MOUNTING POSITION . . . . Any

PHYSICAL DIMENSIONS



BASING



BOTTOM VIEW

TERMINAL CONNECTIONS

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

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ELECTRICAL DATA (cont'd.)

* To Electronic Equipment Design Engineers: Special attention should be given to the temperature at which the tubes are to be operated. 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 heater voltage ratings or bulb temperature 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.

** Value is for operation under fixed bias conditions. With cathode bias, Rg may be 5.6 megohms maximum.

AVERAGE CHARACTERISTICS:

Plate Voltage	120	Vdc
Grid #1 Voltage	0	Vdc
Cathode Resistance	1500	ohms
Plate Current	0.9	mAdc
Transconductance	1750	μmhos
Amplification Factor	54	
Grid Voltage for Ib=50 μAdc max.	−3.5	Vdc

CHARACTERISTIC RANGES AND CONTROLS:

PRODUCTION TESTS (Inspection Level II, 0.65% AQL individual tests, 1.0% all tests combined)

	Min.	Max.	
Heater Current (Ef=6.3 V)	190	210	mA
Heater–Cathode Leakage (Ehk=±100 Vdc; Ef=6.3 V)	---	5	μAdc
Grid Current (Ef=6.3 V)	---	−0.1	μAdc
Plate Current (1) (Ef=6.3 V)	0.6	1.25	mAdc
Plate Current (2) (Ec1=−3.5 Vdc; Ef=6.3 V)	---	50	μAdc
Transconductance (1) (Ef=6.3 V)	1400	2100	μmhos

DESIGN TESTS (Lot Sampling Tests)

	Min.	Max.	
Insulation of Electrodes (Ef=6.3 V)			
Eg–all=−300 V	1000	---	Meg.
Ep–all=−100 V	1000	---	Meg.
Transconductance (2) Δ_{Ef} Sm			
Ef=5.7 V	---	7.5	%
Grid Emission			
Ef=7.5 V; Ec1=−3.5 Vdc	---	−0.3	μAdc
Amplification Factor	48	62	
Capacitance			
Grid to Plate (No Shield)	1.2	2.0	pf
Input (No Shield)	1.3	2.2	pf
Output (No Shield)	0.4	0.8	pf
Vibration (1), Fixed Frequency			
F=40 cps; Acc=15 G; Rp=10,000 ohms; Ck=1000 μf	---	1.0	mVac
Vibration (2), Variable Frequency			
F=30 cps tp 1000 cps; Acc=15 G; Rp=10,000 ohms; Ck=1000 μf	---	15	mvpp
Quiescent Noise (1)			
cps=10, Circuit per Figure 1	−130	---	dbV/cycle
Quiescent Noise (2)			
cps=1000, Circuit per Figure 1	−153	---	dbV/cycle

SPECIAL TESTS TO INSURE RELIABILITY

Randomly selected statistical samples are subjected to the following tests:

LOT SAMPLED TESTS

Shock Test – 30° hammer angle in Navy High Impact Shock machine. Sample is subjected to twenty (20) impact accelerations, five impact accelerations in each of four different positions. Ehk=+100 Vdc; Rgl=0.1 meg. Voltages applied. At the end of this test tubes are required to meet established limits for low frequency vibration, heater–cathode leakage current, grid current, quiescent noise (1) and (2), and change in transconductance individual tubes.

Glass Strain – Sample is subjected to a forty–eight hour holding period at room temperature. The sample is immersed in water at 97–100°C for 15 seconds and immediately immersed in water at not more than 5°C. The sample is then dried at room temperature for 48 hours and inspected for evidence of air leaks.

Heater Cycling – Life Test Sample is subjected to 2000 on–off heater cycles at the following conditions: Ef=7.5 volts; Ehk=140 Vac and other elements grounded. At the conclusion of this test the tubes will not show open heater or cathode circuits or heater to cathode shorts, or heater–cathode leakage current in excess of 20 μAdc.

Stability Life Test– Sample is operated for 1 hour to assure initial electrical stability (Δ_t Sm= 10% max.). Tubes are operated with a plate voltage of 150 Vdc and an Ehk of +200 Vdc. Rk=680 ohms; Rgl=1.0 Meg; TA=Room.

Survival Rate – Life Test Sample is operated 100 hours to assure electrical stability (Sm=1200 μmhos min.) and freedom from inoperatives. Tubes operated under Stability Life Test Conditions.

Intermittent Life – Test (1) 1000 hours. Sample is operated under Stability Life conditions with a minimum envelope temperature of +220°C, for 500 and 1000 hours. At the end of 1000 hours, tubes will not show shorts, discontinuities, or air leaks, and will be monitored for total defects and tubes failing to meet established limits of grid current, heater current, change in transconductance (1) of individual tubes, heater–cathode leakage, and insulation of electrodes.

Life Test (2) – 1000 hours. Sample is operated under conditions per circuit, Figure 2, at TA=Room, for 500 and 1000 hours At the end of 1000 hours, tubes will be monitored for total defects and failure to meet established limits of quiescent noise (1) and (2) and insulation of electrodes.

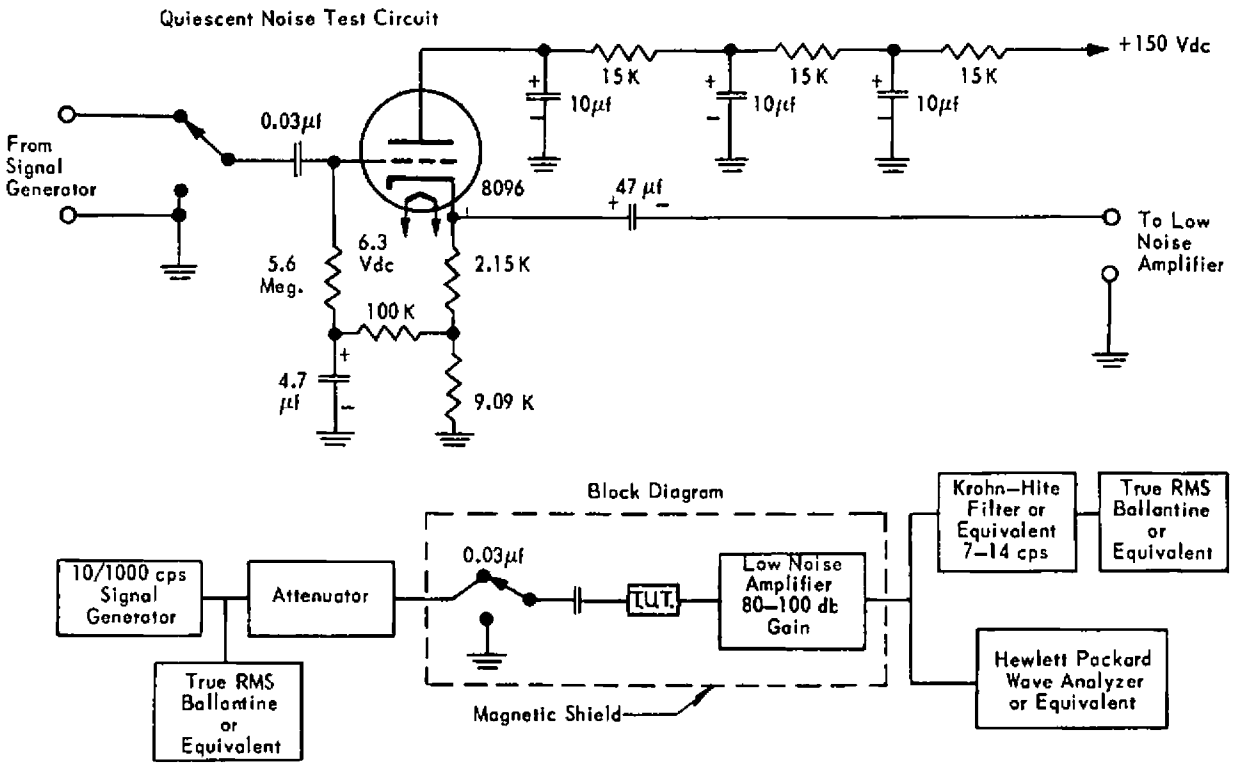
PERIODICALLY CHECKED TESTS

Altitude – Sample is subjected to a pressure=55±5 mmHg (60,000 ft) at 500 Vac to assure freedom from flashover or corona at the leads of the tube.

Fatigue (1) – Sample is subjected to vibrational acceleration of 2.5G for 96 hours (32 hours in each of three positions). The sinusoidal vibration is applied at a fixed frequency between 25 and 60 cycles per second. Post Fatigue (1) End Points are the same as for Shock Test.

Fatigue (2) – Sample is subjected to vibrational acceleration of 10G for 6 hours (2 hours in each of three positions). The sinusoidal vibration is applied at a fixed frequency between 25 and 60 cycles per second. Post Fatigue (2) End Points are the same as for Shock Test.

FIGURE 1



The Low Noise Amplifier shall have an equivalent noise level of not less than −140 dbV/cycle at 10 cps and not less than −163 dbV/cycle at 1000 cps.

E noise – input/cycle = E out (in db) – Gain (db) – Bandwidth Factor (db)

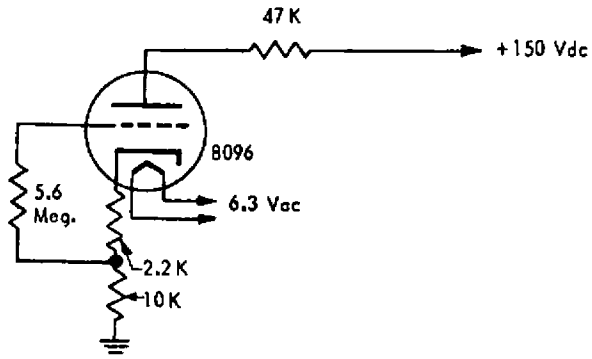
Where Bandwidth Factor = 8.5 db for 10 cps
Bandwidth Factor = 5.5 db for 1000 cps

METHOD OF MEASUREMENT

1. Measure the gain of the system at both 10 cps and 1000 cps.
2. Remove signal generator and terminate amplifier with a 0.03 μf capacitor.
3. After 30 seconds record average level indicated on the wave analyzer and also on the Ballantine VTVM.
4. Noise is referred to the input on a per cycle basis.

FIGURE 2

Life Test (2) Circuit:



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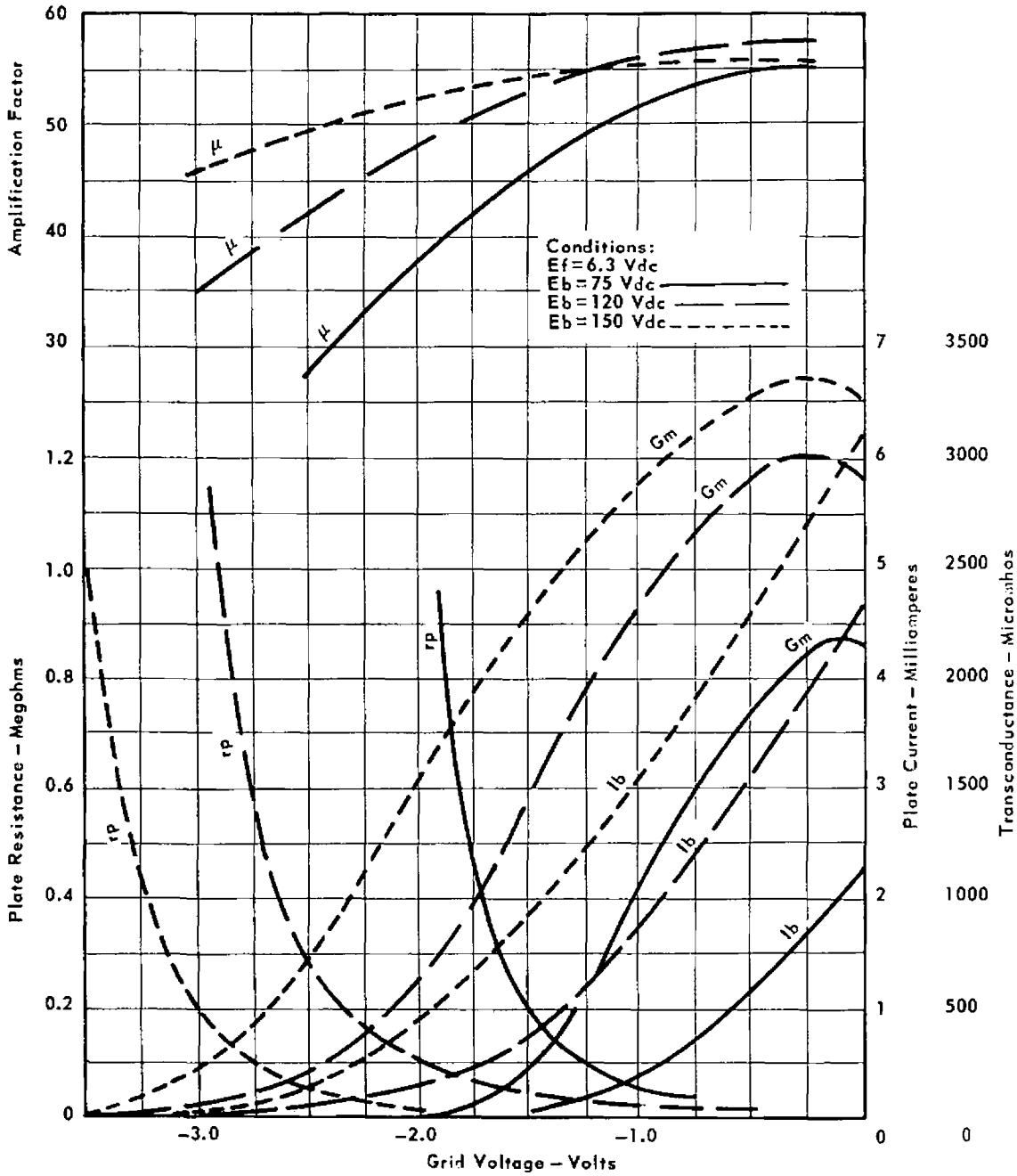
AVERAGE CHARACTERISTICS



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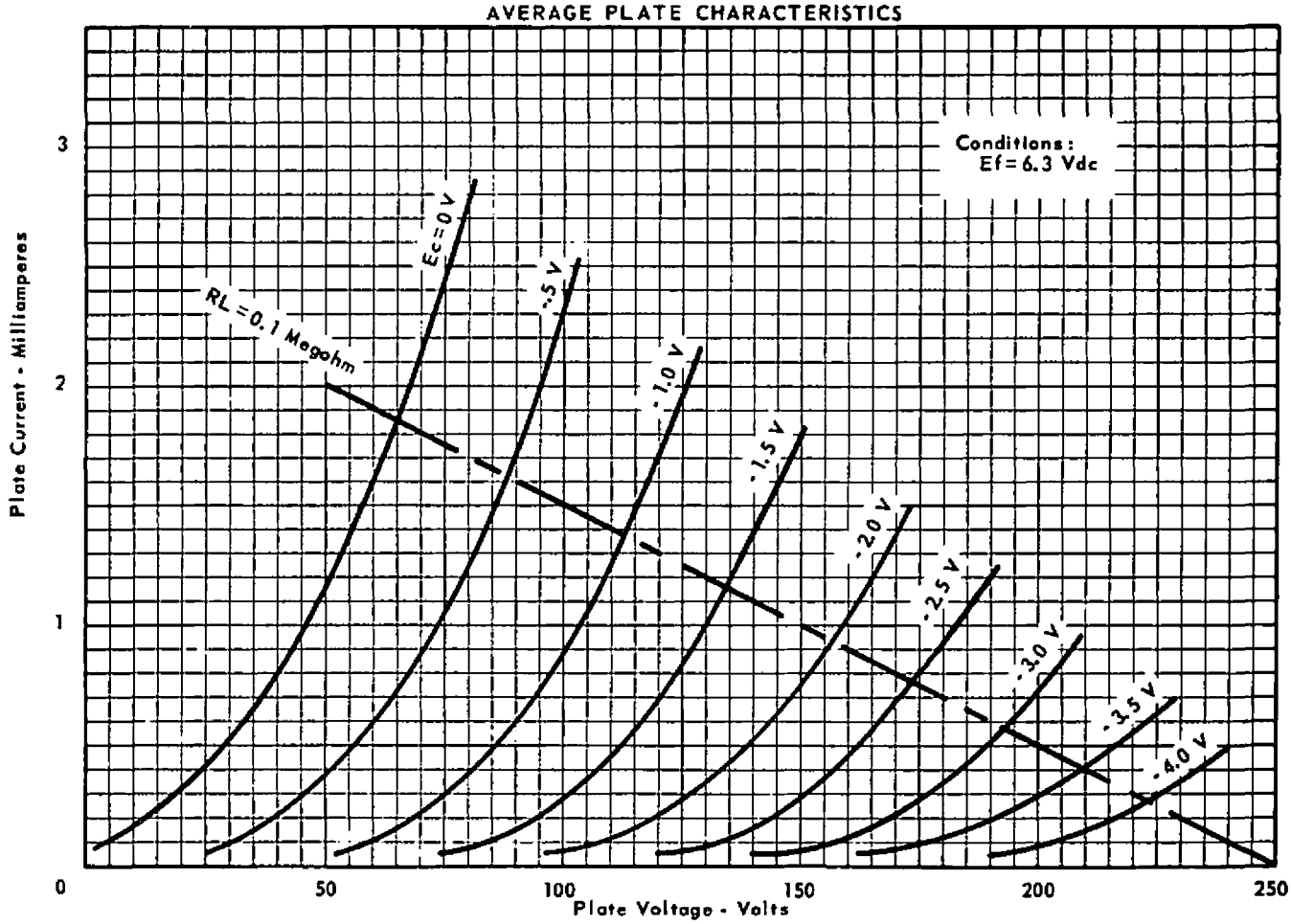
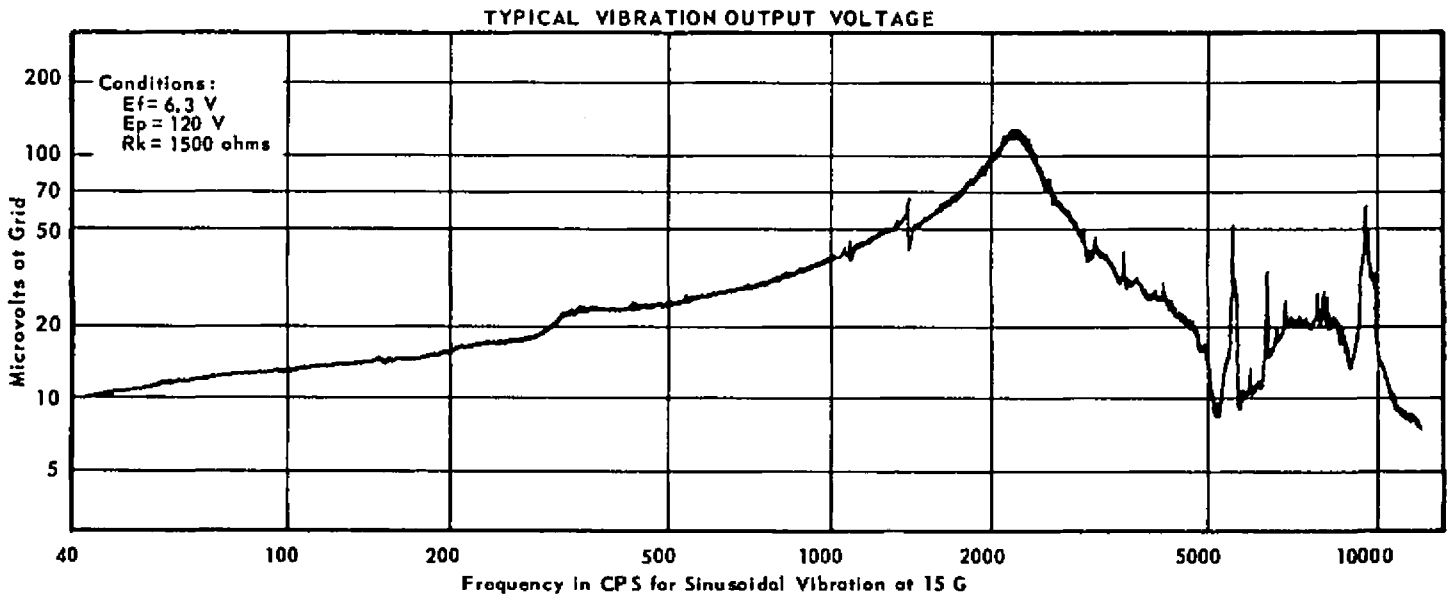
AVERAGE PLATE CHARACTERISTICS



TYPICAL VIBRATION OUTPUT VOLTAGE



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