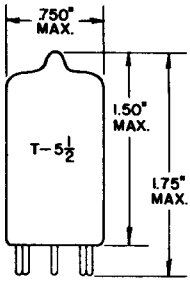
TUNG-SOL

PENTODE

MINIATURE TYPE

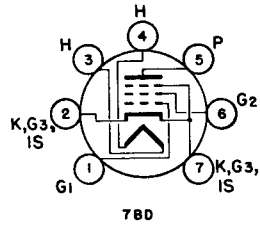


GLASS BULB
SMALL-BUTTON MINIATURE
7 PIN BASE E7-1

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 175 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BD

THE 5654 IS A MINIATURE, SHARP-CUTOFF, RF PENTODE. IT IS DESIGNED FOR DEPENDABLE OPERATION UNDER CONDITIONS OF SHOCK AND VIBRATION USUALLY FOUND IN MOBILE AND AIRCRAFT APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES

WITH SHIELD #316 CONNECTED TO PIN #7.

GRID #1 TO PLATE (MAX.)	0.02	pf
GRID #1 TO ALL OTHER ELECTRODES EXCEPT PLATE	4.0	pf
PLATE TO ALL OTHER ELECTRODES EXCEPT GRID #1	2.9	pf

RATINGS

DESIGN CENTER VALUES

MAXIMUM HEATER CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	140	VOLTS
MAXIMUM PLATE DISSIPATION	1.7	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATTS
MAXIMUM DC CATHODE CURRENT	18	MA.

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TUNG-SOL

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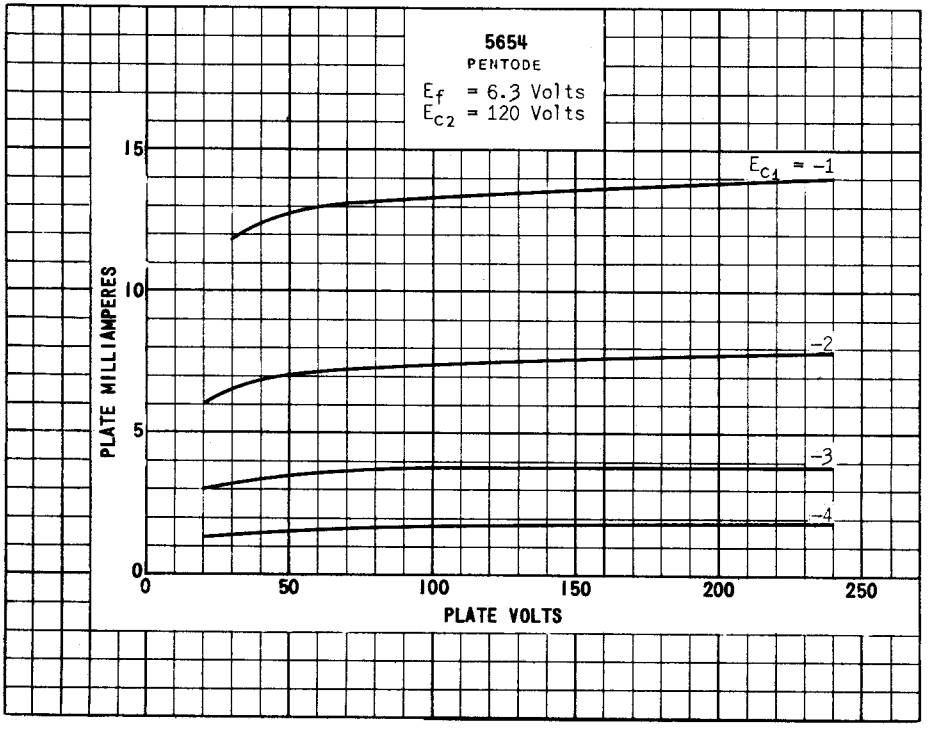
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

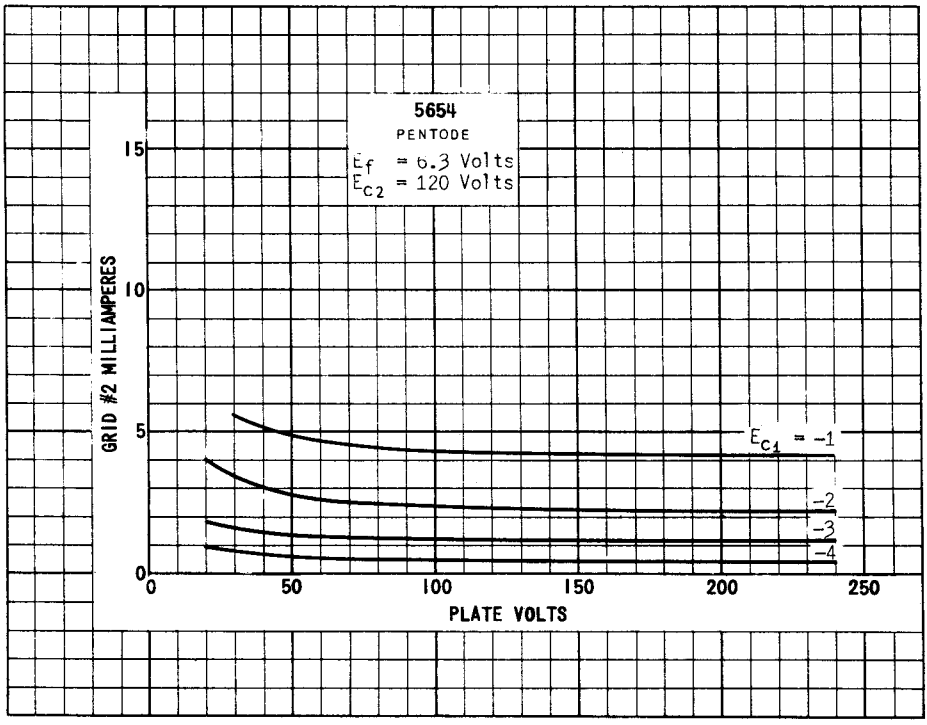
CLASS A_1 AMPLIFIER

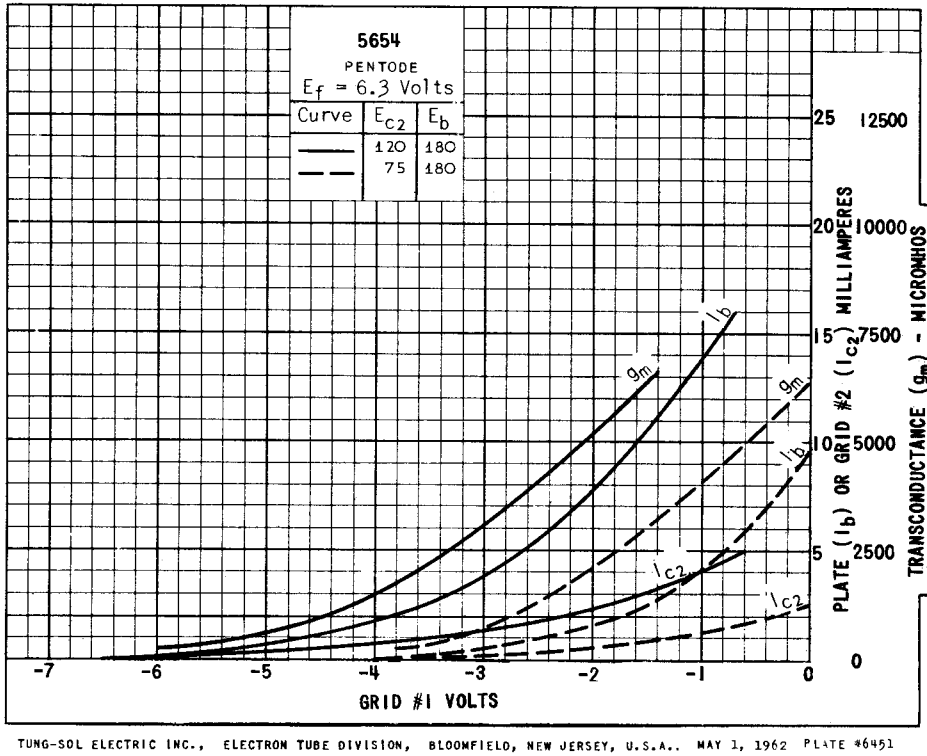
PLATE VOLTAGE	120	VOLTS
GRID #2 VOLTAGE	120	VOLTS
CATHODE RESISTOR	200	OHMS
PLATE RESISTANCE	0.34	MEGOHM
TRANSCONDUCTANCE	5 000	µMHOS
PLATE CURRENT	7.5	MA.
GRID #2 CURRENT	2.5	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 µAMP.	−12	VOLTS
HEATER CYCLES OF INTERMITTENT OPERATION[A] (MIN.)	5 000	CYCLES

[A]THE TYPE 5654 HAS A HEATER WHICH IS DESIGNED TO WITHSTAND AT LEAST 3000 CYCLES OF INTERMITTENT OPERATION AT 7.5 VOLTS.

SIMILAR TYPE REFERENCE: Similar to the 6AK5.







TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A.. MAY 1, 1962 PLATE #6451

TUNG-SOL

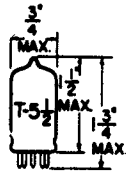
PENTODE

MINIATURE TYPE

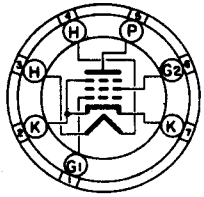
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.175 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7B0

THE 5654/6AK5W/6096 IS A RUGGEDIZED, SHARP CUT-OFF PENTODE OF THE SEVEN PIN MINIATURE CONSTRUCTION. IT IS CHARACTERIZED BY LOW HEATER POWER REQUIREMENTS, HIGH TRANSCONDUCTANCE AND INPUT IMPEDENCE AND LOW INTER-ELECTRODE CAPACITANCES AND LEAD INDUCTANCES. THESE FACTORS CONTRIBUTE GREATLY TO EXCELLENT PERFORMANCE IN HIGH FREQUENCY WIDE-BAND APPLICATIONS SUCH AS RADAR EQUIPMENT IF STAGES. THE 5654/6AK5W/6096 IS ELECTRICALLY EQUIVALENT TO THE 6AK5, BUT CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS PLATE CURRENT, SCREEN GRID CURRENT AND TRANSCONDUCTANCE ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5654/6AK5W/6096 IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY AIRBORNE NAVIGATIONAL EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD #316	
MAXIMUM GRID #1 TO PLATE (RATED)	0.03	0.02	μμf
INPUT: (RATED)	4.0	4.0	μμf
MAXIMUM	---	4.6	μμf
MINIMUM	---	3.4	μμf
OUTPUT: (RATED)	2.1*	2.85	μμf
MAXIMUM	---	3.25	μμf
MINIMUM	---	2.45	μμf

*NOMINAL VALUE.

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	200	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	155	VOLTS
MAXIMUM PLATE DISSIPATION	1.65	WATTS
MAXIMUM HEATER CATHODE VOLTAGE	130	VOLTS
MAXIMUM DC CATHODE CURRENT [A]	20	mA
MAXIMUM GRID #2 DISSIPATION	0.55	WATT
MAXIMUM BULB TEMPERATURE	+165	°C

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.175	AMP.
PLATE VOLTAGE	120	VOLTS
GRID #2 VOLTAGE	120	VOLTS
CATHODE BIAS RESISTOR [B]	200	OHMS
PLATE RESISTANCE (APPROX.)	0.34	MEGOHM
TRANSCONDUCTANCE	5000	µMHOS
PLATE CURRENT	7.5	mA
GRID #2 CURRENT	2.5	mA
GRID #1 VOLTAGE (APPROX.) I_p=10 µa	-12	VOLTS

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN
E_f = 6.3v, E_b = 120Vdc, E_{c1} =-2Vdc, E_{c2} = 120Vdc
EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	160	190	---	---	160	190	mA
HEATER-CATHODE LEAKAGE (E_{hk}=±100Vdc)	---	10	---	---	---	10	µAdc
GRID #1 CURRENT (R_g=0.1 MEG.)	0	-0.1	---	---	0	-0.1	µAdc
PLATE CURRENT (1)	5.0	11.0	6.5	8.5	4.5	11.0	mAdc
TRANSCONDUCTANCE (1)	4000	6250	4525	5475	3750	6250	µMHOS
INSULATION OF ELECTRODES [C] (E_f=6.3V, E(g1-ALL)= -100Vdc, E(p-all)= -300Vdc, E(g2-all)= -300Vdc,							
R(g1-all)	100	---	---	---	50	---	MEGOHMS
R(p-all)	100	---	---	---	50	---	MEGOHMS
R(g2-all)	100	---	---	---	50	---	MEGOHMS
SCREEN CURRENT	0.8	4.0	1.8	3.2	---	---	mAdc
Δ AVERAGE TRANS-CONDUCTANCE (1)	---	---	---	---	---	15	PERCENT
PLATE CURRENT (2) (E_{c1}=-10Vdc)	---	200	---	---	---	---	µAdc
PLATE CURRENT (3) (E_{c1}=-5.5Vdc)	5.0	---	---	---	---	---	µAdc
Δ TRANSCONDUCTANCE (2) [D] (E_f=5.7V.)	---	---	---	---	---	15	PERCENT
GRID CURRENT (2) [E] (E_f=7.0 V, R_{g1}=0.1MEG)	0	-0.5	---	---	---	---	µAdc

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION [F] (R_p = 10,000)	---	150	mVac
VIBRATIONAL FATIGUE [G]	---	---	
SHOCK [H] (HAMMER ANGLE=30°, E_{hk}=100Vdc, HEATER POS., R_{g1} = 0.1 MEG.)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	450	mVac
HEATER-CATHODE LEAKAGE	---	±30	µAdc
TRANSCONDUCTANCE (1)	3500	---	µMHOS
GRID #1 CURRENT	0	-0.2	µAdc

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TUNG-SOL

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SPECIAL REQUIREMENTS -CONT'D.

	MIN.	MAX.	
GLASS STRAIN [J]	---	---	
CONTINUITY AND SHORT [K]	---	---	
RF NOISE [L] (E_{c1}=0, E_{ca1}=15.0mVac, R_k=200, C_k=0.2 μf)	---	3.0	mW
NOISE AND MICROPHONICS [MN] (E_f=6.3Vac, E_{hk}=0, E_{bb}=E_{cc2}=200Vdc, E_{c1}=0, R_k=1000, R_p=0.1MEG, R_{g2}=0.5MEG., C_{g2}=2μf)	---	100	mVac
LOW FREQUENCY VIBRATION [P] (R_p=10,000)	---	150	mVac
LOW PRESSURE VOLTAGE BREAKDOWN [Q] (PRESSURE =±5mm mercury, TEMP=25±5°C, HUMIDITY=0, VOLTAGE =500Vac, 60 CYCLES, SINUSOIDAL WAVEFORM)	500	---	Vac
1 HOUR STABILITY LIFE TEST (INTERMITTENT LIFE TEST CONDITIONS)	---	---	
STABILITY LIFE TEST END POINTS Δ TRANSCONDUCTANCE (1)	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST (INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT)	---	---	
HEATER CYCLING LIFE TEST (E_f=7.5V, E_{hk}=135Vdc, HEATER POS., E_b=E_{c1}=E_{c2}=0)	---	---	
HEATER CYCLING LIFE TEST END POINTS HEATER CATHODE LEAKAGE	---	±20	μAdc
INTERMITTENT LIFE TEST [R] (E_b=150Vdc, E_{c1}=0, E_{c2}=125Vdc, E_{hk}=135Vdc, HEATER POSITIVE, R_{g1}=0.1MEG., R_k=130, MIN. BULB TEMPERATURE =+165°C)	---	---	

NOTES

[A] DIFFICULTY MAYBE ENCOUNTERED IF THIS TUBE IS OPERATED FOR LONG PERIODS OF TIME WITH VERY SMALL VALUES OF CATHODE CURRENT.

[B] FIXED-BIAS OPERATION NOT RECOMMENDED.

[C] SEE MIL-E-1C 4.8.2

[D] THE VALUE OF TRANSCONDUCTANCE (2) SHALL APPLY TO INDIVIDUAL TUBES AND IS EXPRESSED:

$$\frac{(\text{SM AT } 6.3)-(\text{SM AT } 5.7)}{(\text{SM AT } 6.3)} \times 100$$

[E] PRIOR TO THIS TEST TUBES TO BE PREHEATED 5 MINUTES AT CONDITIONS INDICATED BELOW. TEST IMMEDIATELY FOLLOWING PREHEATING. E_f=7.0Vac, E_{c1}=0Vdc, R_k=130OHMS, R_g=0.1MEG., E_v=150Vdc, E_{c2}=125 Vdc.

[F] SEE MIL-E-1C 4.9.20.3

[G] SEE MIL-E-1C 4.9.20.6

[H] SEE MIL-E-1C 4.9.20.5

[J] GLASS STRAIN TEST CONSISTS OF COMPLETELY SUBMERGING THE TUBE INTO BOILING WATER (97°C-100°C) FOR A PERIOD OF 15 SECONDS, THEN IMMEDIATELY PLUNGING INTO COLD WATER (0°C±3°C). THE AMOUNT OF WATER SHALL BE AT LEAST 2 LITERS PER FIFTEEN TUBES. TUBES FOR THIS TEST SHALL HAVE BEEN EXHAUSTED A MINIMUM OF 48 HOURS PRIOR TO PERFORMANCE OF THIS TEST. REJECT FOR EVIDENCE OF AIR LEAK.

[K] SEE MIL-E-1C 4.7.5

[L] SEE MIL-E-1C 4.10.3.1

[M] SEE MIL-E-1C 4.10.3.5

[N] THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEEDING 3 OHMS @ 60 CYCLES.

[P] SEE MIL-E-1C 4.9.20.4

[Q] BREAKDOWN SHALL BE DEFINED AS THE VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS.

[R] SEE MIL-E-1C 4.11.5

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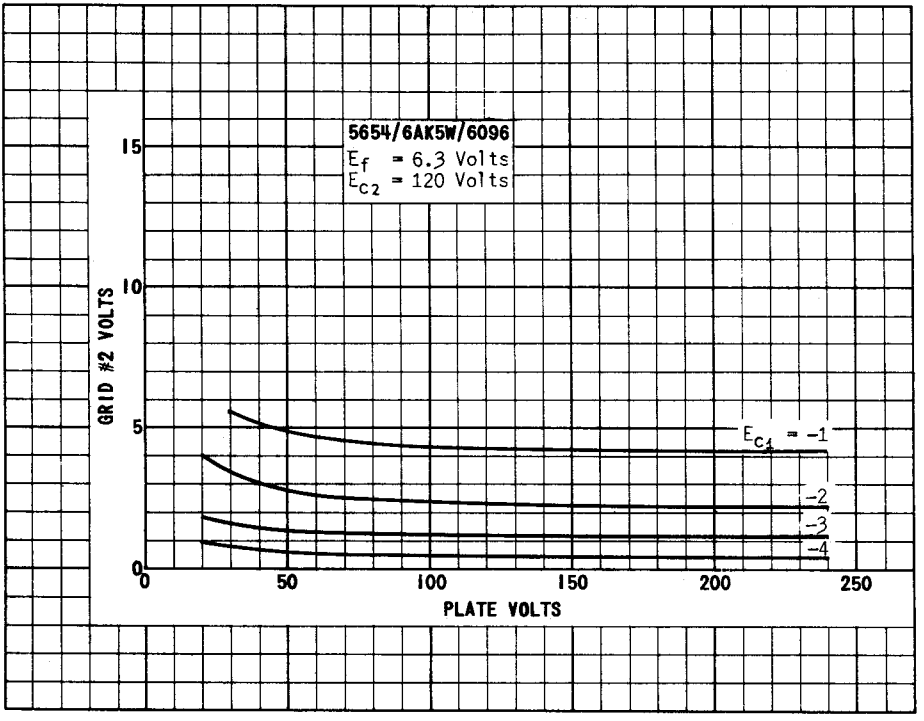
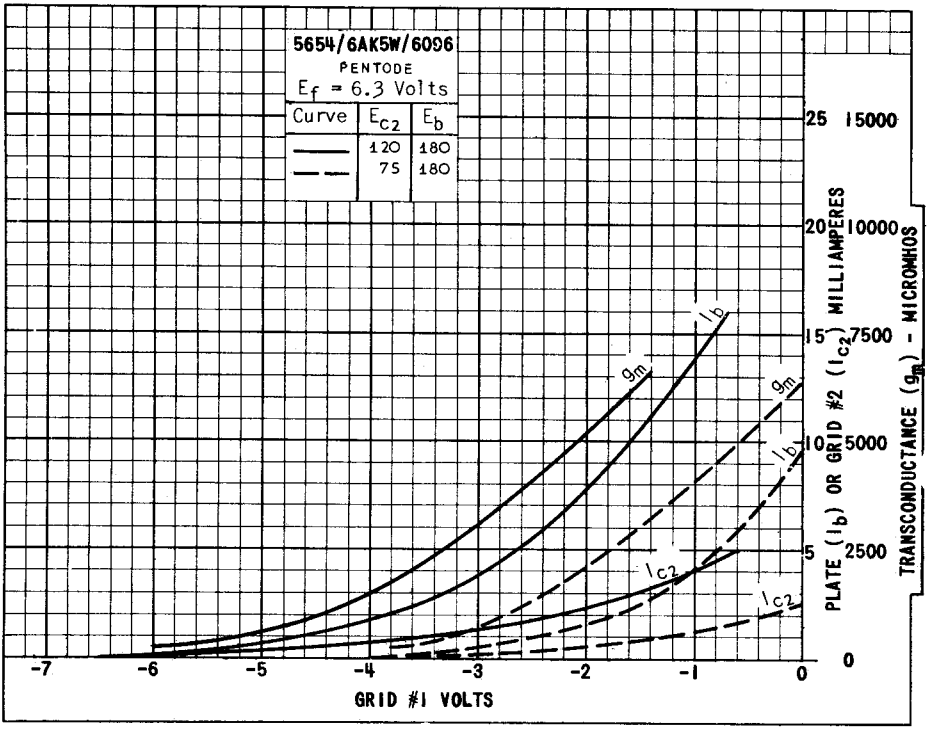
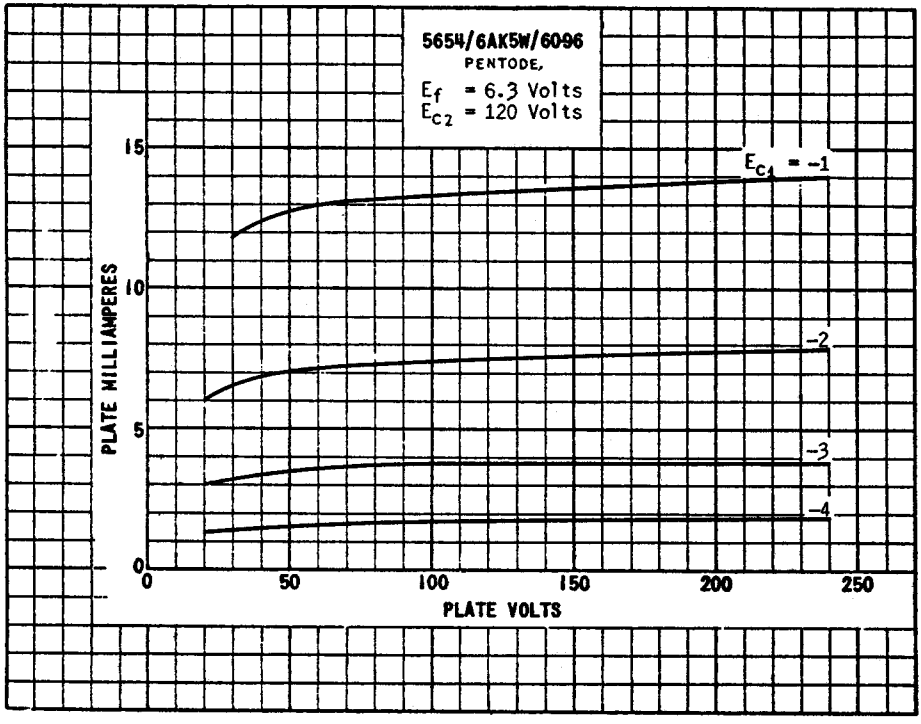
5654/6AK5W/6096
PREMIUM TUBE






5654/6AK5W/6096
PENTODE,
E_f = 6.3 Volts
E_{c2} = 120 Volts
E_{c1} = -1
-2
-3
-4
PLATE MILLIAMPERES
0
5
10
15
0
50
100
150
200
250
PLATE VOLTS