**TUNG-SOL**

# PENTODE

MINIATURE TYPE

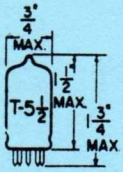
COATED UNIPOTENTIAL CATHODE

HEATER

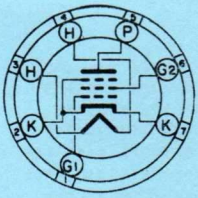
6.3 VOLTS 0.175 AMP.

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, $E_{cal}$=15.0mVac, $R_k$=200, $C_k$=0.2 $\mu$f) | --- | 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., $C_{g2}$=2$\mu$f) | --- | 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 | $\mu$Adc |
| 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. Ef=7.0Vac, Ec1=0Vdc, Rk=130OHMS, Rg=0.1MEG., Ev=150Vdc, Ec2=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.

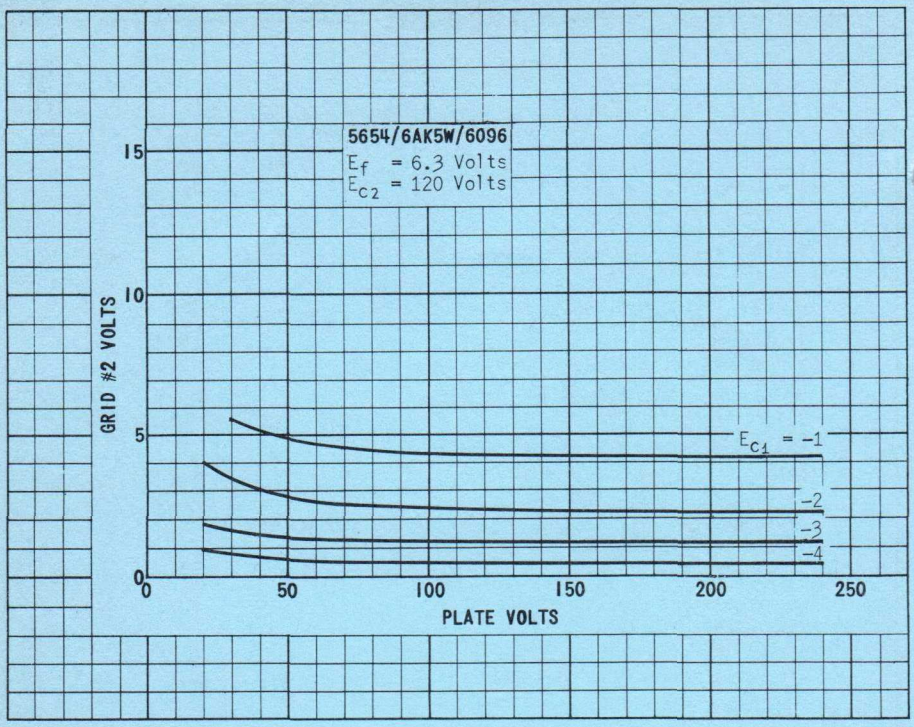
[P] SEE MIL-E-1C 4.9.20.4

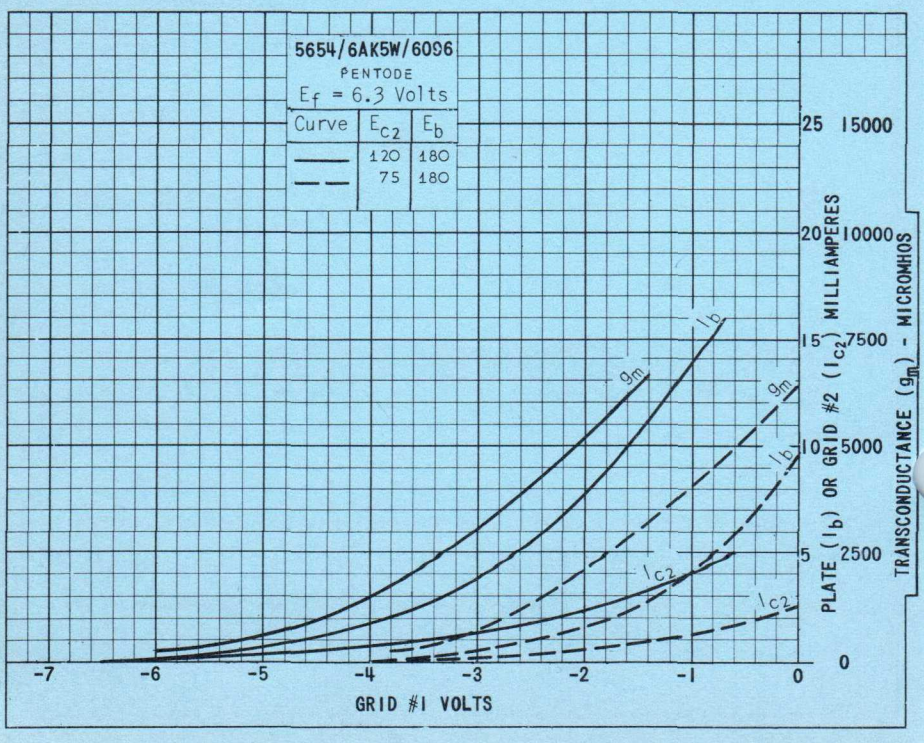
[Q] BREAKDOWN SHALL BE DEFINED AS THE VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS.

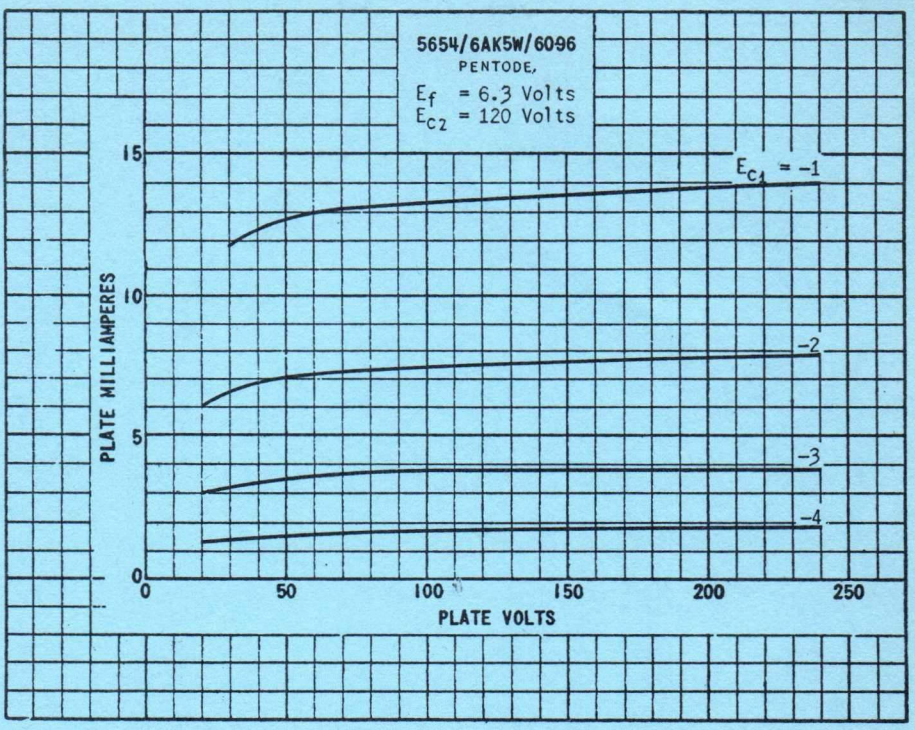
[R] SEE MIL-E-1C 4.11.5

PRINTED IN U.S.A.

# 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
15
10
5
0
0
50
100
150
200
250
PLATE VOLTS