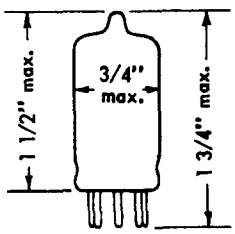
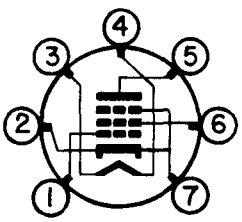
# TYPE CK5654/ 6AK5W/6096

The CK5654/6AK5W/6096 is a heater-cathode type, sharp cutoff, RF pentode of miniature construction for use in low power applications at high and ultra-high frequencies. It is designed for dependable operation under conditions of shock vibration usually found in mobile and aircraft applications.




BOTTOM VIEW

## MECHANICAL DATA

ENVELOPE: T-5½ Glass

BASE: Miniature Button 7-Pin

TERMINAL CONNECTIONS:

| | |
|---|---|
| Pin 1 Grid #1 | Pin 5 Plate |
| Pin 2 Cathode, Grid #3 | Pin 6 Grid #2 |
| Pin 3 Heater | Pin 7 Cathode, Grid #3 |
| Pin 4 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 | 165 °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 absolute maximum ratings are exceeded. Both reliability and performance will be jeopardized if filament voltage ratings are exceeded. Life and reliability of performance are directly related to the degree that regulation of the heater voltage is maintained at its centered rated value.

| RATINGS AND NORMAL OPERATION: | MIL-E-1B SYMBOL | ABSOLUTE MINIMUM | NORMAL TEST CONDITIONS (Note 6) | NORMAL OPERATION (Note 5) | | ABSOLUTE MAXIMUM | MIL-E-1B UNITS |
|---|---|---|---|---|---|---|---|
| Heater Voltage (Note 7): | Ef: | 5.7 | 6.3 | 6.3 | 6.3 | 6.9 | V |
| Plate Voltage: | Eb: | | 120 | 120 | 150 | 200 | Vdc |
| Grid #1 Voltage: | Ec1: | | -2.0 | 0 | 0 | | Vdc |
| Grid #2 Voltage: | Ec2: | | 120 | 120 | 140 | 155 | Vdc |
| Plate Dissipation: | Pp: | | | 0.9 | 1.05 | 1.65 | W |
| Grid #2 Dissipation: | Pg2: | | | 0.3 | 0.31 | 0.55 | W |
| Heater-Cathode Voltage: | Ehk: | -130 | | | | +130 | Vdc |
| Cathode Current (Note 9) | Ik: | | | 10.0 | 9.2 | 20 | mAdc |
| Cathode Resistance: | Rk: | | | 200 | 330 | | ohms |

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1)

| TEST | CONDITIONS | AQL % | MIL-E-1B SYMBOL | MIN. | LAL. | BOGIE | UAL. | MAX. | ALD. | MIL-E-1B UNITS |
|---|---|---|---|---|---|---|---|---|---|---|
| **ACCEPTANCE TEST-GROUP C** | | | | | | | | | | |
| Continuity and Short: | | 0.4 | | | | | | | | |
| **ACCEPTANCE TESTS-GROUP D** | | COMBINED AQL=1.0% | | | | | | | | |
| Heater Current: | | 0.65 | If: | 160 | | 175 | | 190 | | mA |
| Heater-Cathode Leakage | Ehk=100 Vdc, Heater Positive | 0.65 | Ihk: | | | | | 10 | | µAdc |
| | Ehk= 100 Vdc, Heater Negative | | Ihk: | | | | | 10 | | µAdc |

Tentative Data

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

| TEST | CONDITIONS | AQL % | MIL-E-1B SYMBOL | MIN. | LAL. | BOGIE | UAL. | MAX. | ALD. | MIL-E-1B UNITS |
|---|---|---|---|---|---|---|---|---|---|---|
| Grid Current (1): | Rg1=0.1 Meg. | 0.65 | Ic1(1): | | | | | -0.1 | | μAdc |
| Plate Current (1): | | 0.65 | Ib(1): | 5.0 | 6.5 | 7.5 | 8.5 | 11.0 | 2.5 | mAdc |
| Screen Current: | | 0.65 | Ic2: | 0.8 | 1.8 | 2.5 | 3.2 | 4.0 | 1.5 | mAdc |
| Transconductance (1): | | 0.65 | Sm(1): | 4000 | 4525 | 5000 | 5475 | 6250 | 1025 | μmhos |
| **ACCEPTANCE TESTS-GROUP E** | | | | | | | | | | |
| Insulation of Electrodes: | EF=6.3V E(g1-all)=100 Vdc; g1 Negative | 2.5 | R(g1-all): | 100 | | | | | | meg. |
| | E(g2-all)=300 Vdc; g2 Negative | | R(g2-all): | 100 | | | | | | meg. |
| | E(p-all)=300 Vdc P Negative | | R(p-all): | 100 | | | | | | meg. |
| Plate Current (2): | Ec1=-10 Vdc | 2.5 | Ib(2): | | | | | 200 | | μAdc |
| Plate Current (3): | Ec1=-5.5 Vdc | 2.5 | Ib(3): | 5.0 | | | | | | μAdc |
| Transconductance (2): | Ef=5.7V; (Note 8) | 2.5 | ΔSm: | | | | | 15 | | % |
| Grid Current (2): | Eb=150 Vdc; Ec2=125 Vdc; Ec1=0; Ef=7.0 Vac; RK=130 ohms; Rg1=0.1 Meg; after 5 min. at Ef=7.0 Vac; measure grid current at Ef=7.0 Vac; 3 min. test not permitted. | 2.5 | Ic1(2): | 0 | | | | -0.5 | | μAdc |
| RF Noise: | Ec1=0; E cal=15.0 m-Vac; RK=200 ohms; CK=0.2 uf | 2.5 | | | | | | 3.0 | | mW |
| Noise and Microphonics: | Ef=6.3 Vac; Ebb=Ecc2=200 Vdc; Ec1=0; Rk=1000 ohms; Rp=0.1 meg.; Rg2=0.5 Meg.; Cg2=2 uf. Ehk=0; CK=1000μf. | 2.5 | Ep: | | | | | 100 | | mVac |
| **ACCEPTANCE TESTS-GROUP A** | | | | | | | | | | |
| Shock: | Hammer Angle=30° (Note 3) | | | | | | | | | |
| Fatigue: | 96 Hours: (Note 4) | 6.5 | | | | | | | | |
| Post shock and Fatigue Test end Points: | | | | | | | | | | |
| Vibration (2): | F=25 cps; G=2.5; Rp=10,000 ohms | | Ep(2): | | | | | 450 | | mVac |
| Heater-Cathode Leakage (1): | Ehk=+100 Vdc: | | Ihk(1): | | | | | 30 | | μAdc |
| Heater-Cathode Leakage (2): | Ehk=-100 Vdc | | Ihk(2): | | | | | 30 | | μAdc |
| Transconductance (1): | | | Sm(1): | 3500 | | | | | | μmhos |
| Grid Current (1): | | | Ic1(1): | 0 | | | | -0.2 | | μAdc |
| **ACCEPTANCE TEST-GROUP F** | | | | | | | | | | |
| Vibration (2): | F=25 cps; G=2.5; Rp=10,000 ohms | 6.5 | Ep: | | | | | 150 | | mVac |
| Capacitance: | (Note 2) | | Cg1P: | | | | | 0.020 | | uuf |
| Capacitance: | (Note 2) | 6.5 | Cin: | 3.40 | | | | 4.6 | | uuf |
| Capacitance: | (Note 2) | | Cout: | 2.45 | | | | 3.25 | | uuf |
| Low Pressure Voltage Breakdown: | | 6.5 | | 500 | | | | | | Vac |

## RELIABLE PENTODE

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

| TEST | CONDITIONS | AQL % | MIL-E-1B SYMBOL | MIN. | LAL. | BOGIE | UAL. | MAX. | ALD | MIL-E-1B UNITS |
|---|---|---|---|---|---|---|---|---|---|---|
| **ACCEPTANCE TEST - GROUP B** | | | | | | | | | | |
| Glass Strain: | | 2.5 | | | | | | | | |
| **ACCEPTANCE LIFE TEST** | | | | | | | | | | |
| Heater Cycling: | Ef=7.5 V; Ehk=+135 Vdc; Ec1=Eb=Ec2=0 | | | 2000 | | | | | | cycles |
| Heater Cycling Life Test End Points: | | | | | | | | | | |
| Heater-Cathode Leakage (1): | Ehk=+100 Vdc | | Ihk(1): | | | | | 20 | | μAdc |
| Heater Cathode Leakage (2): | Ehk=-100 Vdc | | Ihk(2): | | | | | 20 | | μAdc |
| 1 Hour Stability Life Test: | TA=Room; Ehk=+135 Vdc; Eb=150 Vdc; Ec1=0; Ec2=125 Vdc; Rg1=0.1 Meg.; Rk=130 ohms | | | | | | | | | |
| 1 Hour Stability Life Test End Points: | | | | | | | | | | |
| Transconductance (1): Change of individual tube from initial: | (typical sample size=50 tubes) | 1.0 | ΔSm(1): | | | | | 10 | | % |
| 100 Hour Survival Rate Life Test: | TA=Room; Ehk=+135 Vdc; Eb=150 Vdc; Ec1=0; Ec2=125 Vdc; Rg1=0.1 Meg; Rk=130 ohms | | | | | | | | | |
| 100 Hour Survival Rate Life Test End Points: | | | | | | | | | | |
| Inoperatives: | (Typical sample size=200 tubes) | 0.65 | | | | | | | | |
| 500 and 1000 Hour Intermittent High Temperature Life Test: | T-Bulb=165° C; Ehk=+135 Vdc Eb=150 Vdc; Ec1=0; Ec2=125 Vdc Rg1=0.1 Meg; Rk=130 ohms | | | | | | | | | |

| TEST | CONDITIONS | MIL-E-1B SYMBOL | MIN. | MAX. | MIL-E-1B UNITS | MAX. DEFECTS PER CHARACTERISTIC 1st Sample | Combined Sample |
|---|---|---|---|---|---|---|---|
| 500 Hour Intermittent High Temperature Life Test End Points: | (Typical sample size = 20 tubes 1st sample, 40 tubes 2nd sample (Total allowable combined defects=4 tubes 1st sample, 8 tubes 1st and 2nd samples) | | | | | | |
| Inoperatives: | | | | | | 1 | 3 |
| Heater Current: | | If; | 160 | 190 | mA | 1 | 3 |
| Heater-Cathode Leakage | | Ihk: | | 10 | μAdc | 1 | 3 |
| Grid Current (1): | | Ic1(1): | | -0.1 | μAdc | 1 | 3 |
| Transconductance (1): | | Sm(1): | 3750 | 6250 | μmhos | 1 | 3 |
| Transconductance (1) Average Change (Note 10): | | ave. Δ Sm(1): | | 15 | % | | |

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

| TEST | CONDITIONS | MIL-E-1B SYMBOL | MIN. | MAX. | MIL-E-1B UNITS | MAX. DEFECTS PER CHARACTERISTIC 1st Sample | Combined Sample |
|---|---|---|---|---|---|---|---|
| Plate Current (1): | | Ib(1): | 4.5 | 11.0 | mAdc | 2 | 5 |
| Electrode Insulation: | | | | | | | |
| (g1-all) | | Rg1-all: | 50 | | meg. | | |
| (g2-all) | | Rg2-all: | 50 | | meg. | 2 | 5 |
| (P-all) | | Rp-all: | 50 | | meg. | | |
| Transconductance (2) (Note 8) | | ΔSm(2): | | 15 | % | 2 | 5 |
| 1000 Hour Intermittent High Temperature Life Test End Points: | (Typical sample size= 20 tubes 1st sample, 40 tubes 2nd sample) | | | | | | |
| Inoperatives | | | | | | 2 | 5 |
| Heater Current: | | If: | 160 | 190 | mA | 2 | 5 |
| Heater-Cathode Leakage: | | Ihk: | | 10 | μAdc | 2 | 5 |
| Grid Current (1): | | Ic1(1): | | -0.1 | μAdc | 2 | 5 |
| Transconductance (1): | | Sm(1): | 3500 | 6250 | μmhos | 2 | 5 |
| Plate Current (1): | | Ib(1): | 4.0 | 11.0 | mAdc | 4 | 8 |

NOTES:

Note 1 Characteristics, Quality Control Test Procedures, and Inspection Levels are made according to the appropriate paragraphs of MIL-E-1B "Inspection Instructions for Electron Tubes" and MIL-STD-105A.

Note 2 With Shield #316 connected to cathode.

Note 3 Test Conditions and Acceptance criteria per Shock Test procedures of MIL-E-1B basic specification.

Note 4 Test Conditions and Acceptance criteria per Fatigue Test procedures of MIL-E-1B basic specification.

Note 5 These normal values represent conditions at which control 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.

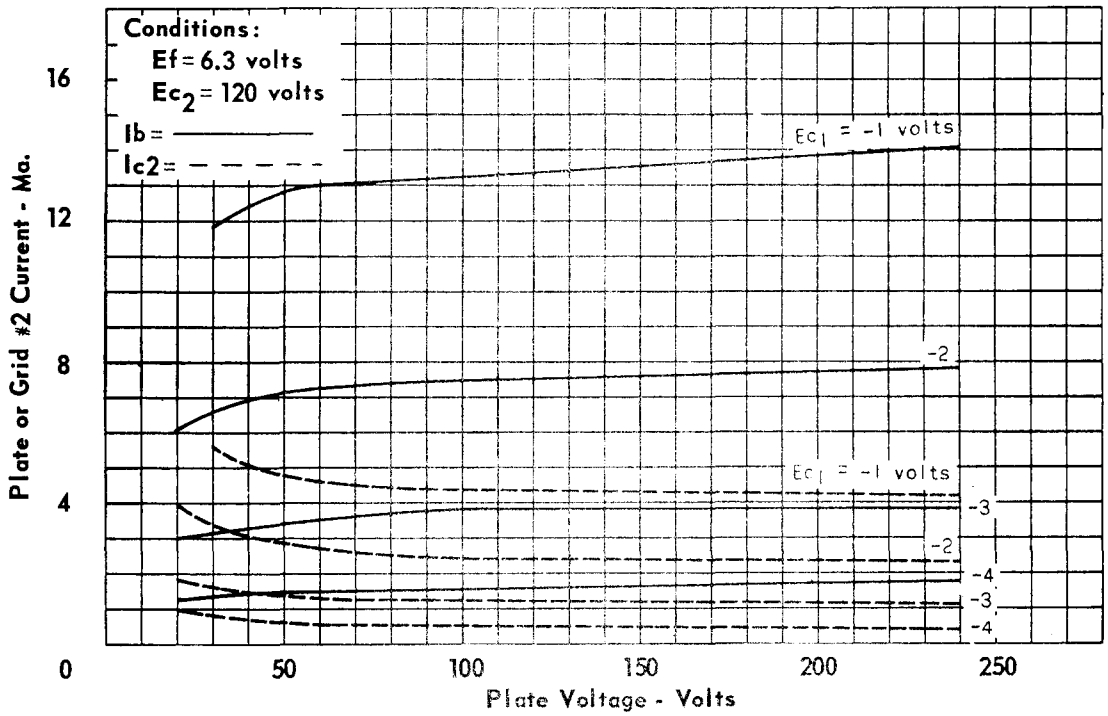
Note 8 Change of transconductance for individual tubes from that value measured at Ef= 6.3 V to that value measured at Ef= 5.7 V.

Note 9 Difficulty may be encountered if this tube is operated for long periods of time with very small values of cathode current.

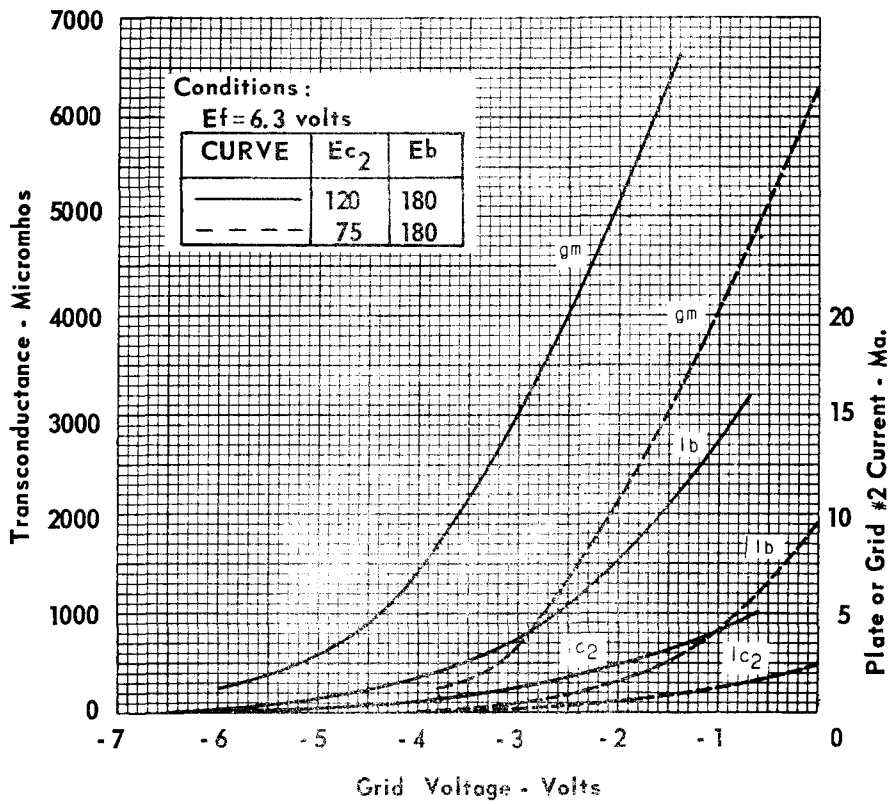
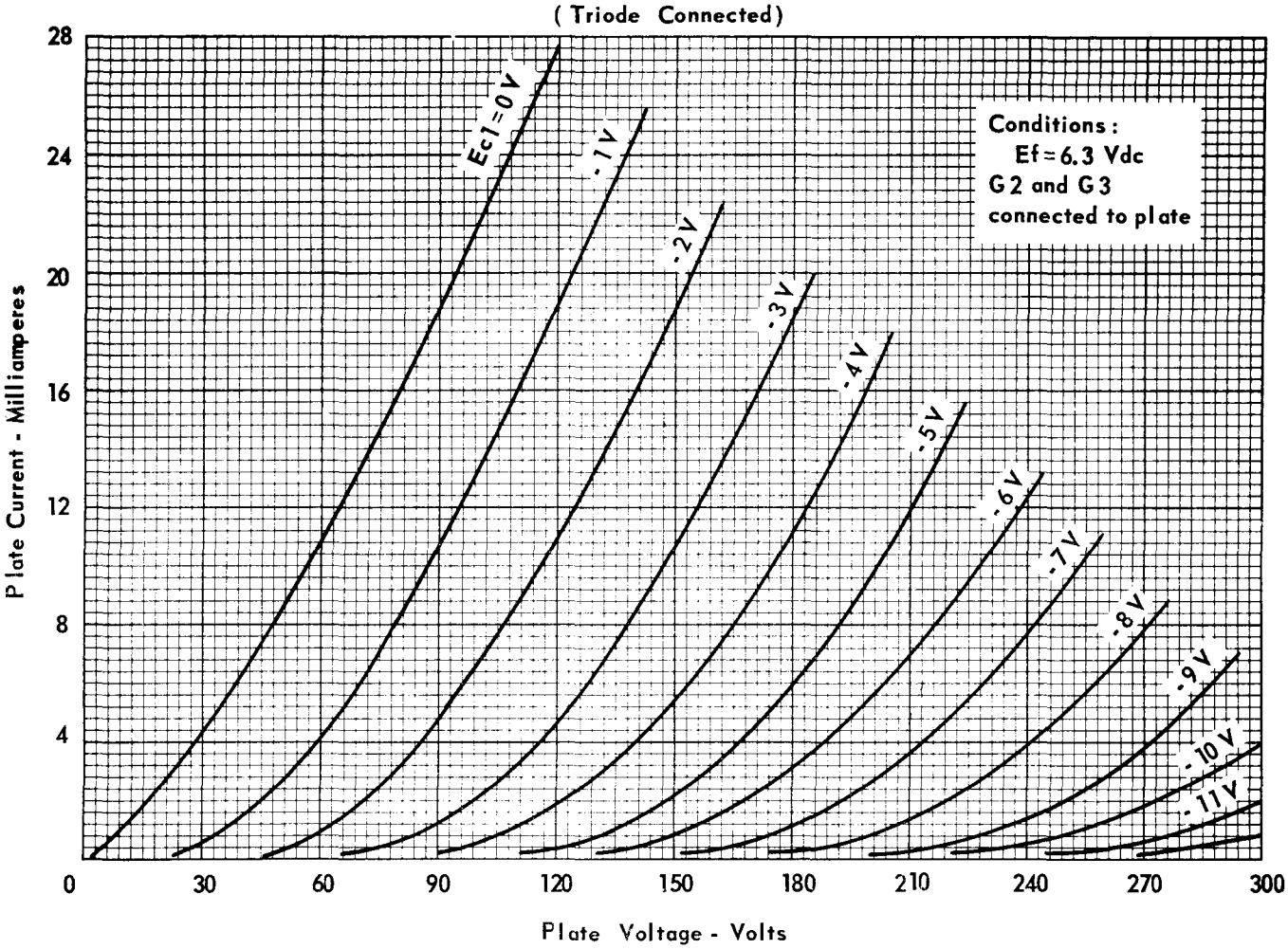
Note 10 The average percentage change shall be ascertained from the determination of the individual changes for each tube (inoperatives excluded) from the zero hour value for the referenced characteristic.

## RELIABLE PENTODE

### AVERAGE PLATE CHARACTERISTICS




### AVERAGE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS
(Triode Connected)