MECHANICAL DATA

Bulb .................................. T-3
Base .................................. E8-10, Subminiature Button Flexible Leads
Outline .................................. JETEC 3-1
Basing .................................. 8DL
Cathode .................................. Coated Unipotential
Mounting Position .......................... Any

RATINGS* (Absolute Maximum)

Impact Acceleration ......................... 450 G
Uniform Acceleration ...................... 1000 G
Fatigue (Vibrational Acceleration for Extended Periods) 2.5 G
Bulb Temperature .......................... 220° C
Altitude* .................................. 80000 Ft.

ELECTRICAL DATA

HEATER CHARACTERISTICS

Min.  Bogey  Max.
Heater Voltage .......................... 6.0  6.3  6.6 V
Heater Current .......................... 190  mA

DIRECT INTERELECTRODE CAPACITANCES

Shielded*  Unshielded
Grid No. 1 to Plate ....................... 0.015  0.03 μf Max.
Input .................................. 4.20  4.00 μf
Output .................................. 3.40  1.90 μf

RATINGS** (Absolute Maximum)

Plate Voltage .......................... 165 Vdc
Peak Plate Forward Voltage* ............ 330 v
Grid No. 3 Voltage ....................... 22 Vdc
Grid No. 2 Voltage ....................... 155 Vdc
Plate Dissipation ......................... 1.1 W
Grid No. 2 Dissipation ................... 0.55 W
Cathode Current .......................... 16.5 mAdc
Grid No. 1 Voltage
Positive Value .......................... 0 Vdc
Negative Value .......................... 55 Vdc
Heater-Cathode Voltage
Heater Positive with Respect to Cathode 200 v
Heater Negative with Respect to Cathode 200 v
Grid No. 1 Circuit Resistance ............. 1.1 Mecg

CHARACTERISTICS

Plate Voltage .......................... 100 Vdc
Grid No. 3 Voltage ....................... 0 Vdc
Grid No. 2 Voltage ....................... 100 Vdc
Cathode Resistor .......................... 120 Ohms
Plate Current .................................. 7.2 mAdc
Grid No. 2 Current ......................... 2.2 mAdc
Transconductance ......................... 4500 μmhos
Plate Resistance .......................... 260,000 Ohms
Grid No. 1 Voltage for Transconductance = Approx. 25 μmhos (75 μmhos Max.) .......................... -14 Vdc

NOTES:

1. Limitations beyond which normal tube performance and tube life may be impaired.
2. If altitude rating is exceeded, reduction of instantaneous voltages (E2 excluded) may be required.
3. Tube life and reliability of performance are directly related to the degree of regulation of the heater voltage to its center rated value of 6.3 volts.
4. External shield of 0.405 inch diameter connected to cathode.
5. Values shown are as registered with RETMA.
6. Per MIL-E-1C par. 6.5 and General Section of this Sylvania Subminiature Tube Manual titled Specifications and Ratings.

PREPARED AND RELEASED BY THE TECHNICAL PUBLICATIONS SECTION
EMPIRION, PENNSYLVANIA
FEBRUARY 1957
PAGE 1 OF 11
## ACCEPTANCE CRITERIA

### Test Conditions
- **Heater Voltage**: 6.3 V
- **Plate Voltage**: 100 Vdc
- **Grid No. 1 Voltage**: 0 V
- **Grid No. 2 Voltage**: 100 Vdc
- **Grid No. 3 Voltage**: MIL-E-1 Par. 3.2.2.1 Note 4
- **Heater-Cathode Voltage**: MIL-E-1 Par. 3.2.2.1.3
- **Cathode Resistor**: 120 Ohms

For the purposes of inspection, use applicable reliable paragraphs of MIL-E-1 and Inspection Instructions for Electron Tubes.

### MIL-E-1 Ref. Test | AQL (%) | Limits |
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min.</td>
</tr>
<tr>
<td>4.1.1.7</td>
<td>(Method A)</td>
<td>12</td>
</tr>
<tr>
<td>4.10.8</td>
<td>Heater Current: ALD = 12</td>
<td>—</td>
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<tr>
<td>4.10.8</td>
<td>Heater Current: ALD = 2.3</td>
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<tr>
<td>4.10.6.1</td>
<td>Screen Grid Current: IC1</td>
<td>—</td>
</tr>
<tr>
<td>4.1.1.7</td>
<td>(Method A)</td>
<td>800 Sm</td>
</tr>
<tr>
<td>4.10.9</td>
<td>Transconductance (1): ALD = 800 Sm</td>
<td>—</td>
</tr>
<tr>
<td>4.10.9</td>
<td>Transconductance (3): Sm</td>
<td>—</td>
</tr>
<tr>
<td>4.7.5</td>
<td>Continuity and Shorts (Inoperatives):</td>
<td>0.4</td>
</tr>
<tr>
<td>4.9.1</td>
<td>Mechanical: Envelope (9-1)</td>
<td>—</td>
</tr>
</tbody>
</table>

### Measurements Acceptance Tests, Part 2
- **Insulation of Electrodes**: 2.5 — — — — Meg
- **Transconductance (2): M Sm**: 2.5 — — — 30 %
- **Transconductance (3): Sm**: 2.5 1.0 — 25 — 75 µmhos
- **Grid Emission**: 7.5 V; Ecl = 14 Vdc; Rg1 = 1.0 Meg; Rk = 0 Ohms: 2.5 0 — — — 0.5 µA dc
- **AF Noise**: Exig = 70 mVc; Ec2 = 19 Vdc; Rg1 = 0.1 Meg; Rg1 = 1000 Ohms; Rp = 0.2 Meg; Ck = 1000 µf: 2.5 0 — — 17 VU
- **Plate Resistance**: 6.5 0.175 — — — Meg
- **Capacitance**: 6.5 — — — — µµf
- **0.405 In. Dia. Shield Cglp**: 6.5 — — — 0.015 µµf
- **0.405 In. Dia. Shield Cin**: 6.5 — — — 4.8 µµf
- **0.405 In. Dia. Shield Cout**: 6.5 — — — 3.9 µµf
- **Low Pressure Voltage Breakdown**: Pressure = 20 ± 5 mm Hg.; Voltage = 300 Vac: 6.5 — — — —
### Acceptance Criteria (Continued)

<table>
<thead>
<tr>
<th>MIL-E-1 Ref.</th>
<th>Test Description</th>
<th>AQL (%)</th>
<th>Limits</th>
<th>Bogey</th>
<th>UAL</th>
<th>Max.</th>
<th>Units</th>
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<tbody>
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<td>Measurements Acceptance Tests, Part 2 (Continued)</td>
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<tr>
<td>4.9.20.3</td>
<td>Vibration (1): No Voltages, Post Shock and Fatigue Test End Points Apply</td>
<td>10.0</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<tr>
<td>4.9.19.1</td>
<td>Vibration (2): $F = 40$ cps; $G = 15$; $R_p = 10,000$ Ohms; $C_k = 1000 \mu F$...</td>
<td>2.5</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>60</td>
<td>mVac</td>
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<tr>
<td>4.9.19.1</td>
<td>White Noise: Note 6 $R_p = 10,000$ Ohms; $C_k = 1000 \mu F$;...</td>
<td>2.5</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1000</td>
<td>mV pk-pk</td>
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<td></td>
<td>Peak Acceleration = 15 G</td>
<td>2.5</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>150</td>
<td>mVac</td>
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<td>Degradation Rate Acceptance Tests, Note 2</td>
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<td>4.9.5.3</td>
<td>Subminiature Lead Fatigue:</td>
<td>2.5</td>
<td>4</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>arcs</td>
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<td>4.9.20.5</td>
<td>Shock: Hammer Angle = 30°; $E_{hk} = +100$ Vdc; $R_{gl} = 0.1$ Meg...</td>
<td>20</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<tr>
<td>4.9.20.6</td>
<td>Fatigue: $G = 2.5$; Fixed Frequency; $F = 25$ min, 60 max</td>
<td>6.5</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<td>Post Shock and Fatigue Test End Points:</td>
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<td></td>
<td>Vibration (2)</td>
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<td></td>
<td>Heater-Cathode Leakage</td>
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<tr>
<td></td>
<td>$E_{hk} = +100$ Vdc</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>20</td>
<td>μADC</td>
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<tr>
<td></td>
<td>$E_{hk} = -100$ Vdc</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>20</td>
<td>μADC</td>
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<tr>
<td></td>
<td>Change in Transconductance (1) of Individual Tubes $\Delta \tau$</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>20</td>
<td>%</td>
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<tr>
<td>4.9.6.3</td>
<td>Glass Strain:</td>
<td>6.5</td>
<td>—</td>
<td>—</td>
<td>—</td>
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### Acceptance Life Tests, Note 2

<table>
<thead>
<tr>
<th>MIL-E-1 Ref.</th>
<th>Test Description</th>
<th>AQL (%)</th>
<th>Allows Defectives per Characteristic</th>
<th>Limits</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td>1st Sample</td>
<td>Combined Samples</td>
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<tr>
<td>4.11.7</td>
<td>Heater Cycling Life Test: $E_f = 7.0$ V; 1 min. on, 4 min. off; $E_{hk} = 140$ Vdc; $E_{c1} = E_{c2} = E_b = E_c = 0$ V</td>
<td>2.5</td>
<td>—</td>
<td>—</td>
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<tr>
<td>4.11.3.1</td>
<td>Stability Life Test: (1 Hour) $E_{hk} = +200$ Vdc; $R_{gl} = 1.0$ Meg; TA = Room</td>
<td>1.0</td>
<td>—</td>
<td>—</td>
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<tr>
<td>4.11.4</td>
<td>Stability Life Test End Points: Change in Transconductance (1) of Individual Tubes $\Delta \tau$</td>
<td>—</td>
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<td>—</td>
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<tr>
<td>4.11.3.1</td>
<td>Survival Rate Life Test: (100 Hours) Stability Life Test Conditions or Equivalent; TA = Room</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<tr>
<td>4.11.4</td>
<td>Survival Rate Life Test End Points: Continuity and Shorts (Inoperatives) $\tau$</td>
<td>0.65</td>
<td>—</td>
<td>—</td>
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<tr>
<td>4.11.5</td>
<td>Transconductance (1) $\tau$</td>
<td>1.0</td>
<td>—</td>
<td>—</td>
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<tr>
<td>4.11.3.1</td>
<td>Intermittent Life Test: Note 3 Stability Life Test Conditions; $T$ Envelope = +220°C min., 1000 Hour Requirements Do Not Apply</td>
<td>—</td>
<td>—</td>
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</table>
APPLICATION DATA

The 6206 is a Premium Subminiature, semi-remote cut-off pentode having an external suppressor grid connection. Electrically, the 6206 is otherwise identical to the 5899. This type is characterized by long life and stable performance under conditions of severe shock, vibration, high altitude and high temperature.

The 6206 is intended for use as an age controlled rf and/or if amplifier at frequencies up to 400 mc, as well as many low frequency applications. As the frequency of operation is increased, consideration should be given to the resultant decrease in input and output resistance, Figure 1. Assuming matched input and output impedance, approximate tube gain can be obtained from the formula:

\[
\text{Voltage Gain} = \frac{\text{gm} \sqrt{\text{Rinput} \times \text{Routput}}}{2}
\]

where the values of Rinput and Routput are obtained from the curves of Figure 1. The use of this formula assumes matched impedances into and out of the ampli-
APPLICATION DATA (Continued)

fier stage under consideration. If the source impedance is lower than the input resistance or if the load resistance is higher than the output resistance, much greater voltage gain per stage can be obtained than that indicated by the above formula. The voltage gain of a matching circuit is equal to the square root of the impedance ratio.

In the use of age at high frequencies it may be advantageous to place an unbypassed resistance in the cathode circuit to compensate for the change in input capacitance with bias. This unbypassed resistance reduces the effective gm of the tube by the factor

\[ \frac{1}{1 + \text{gm} R_k \left( \frac{I_b + I_c}{I_b} \right)} \]

However, it also has the effect of raising the input resistance of the tube under certain operating conditions so that both a net increase in gain and a net decrease in input capacitance change may result. The 6206 is particularly well suited to such applications since the suppressor grid may be grounded directly, thus providing greater stability. It should be noted that the suppressor grid is not intended as a control electrode.

The self neutralization frequency of the 6206 is approximately 200 mc. At this point the inductance of the tube leads resonate with the grid plate capacitance to effect neutralization. At higher frequencies the feedback is inductive and takes place through the tube leads. Two cathode leads are provided to minimize this effect and permit isolation of the input and output circuits. The external suppressor grid connection also facilitates the possible employment of suppressor grid neutralization techniques*.

To insure correlation with actual field conditions and thereby enhance equipment reliability, vibrational noise output is controlled by the "white noise test" as shown in the acceptance criteria. Briefly, this test consists of subjecting the tube to a white noise vibration spectrum covering the frequency band of 100 to 5000 cps at a rms level of 2.3 g's per octave and a peak level of 15 g's. Limits are shown for both peak and rms output. A further discussion of the white noise vibrational test is included in the frontal section of this manual.

The 6206 is manufactured and inspected to meet the applicable MIL-E-1 specification for reliability.

Life expectancy is described by the life tests, specified on the attached pages and/or individual MIL-E-1 specifications. The actual life expectancy of the tubes in an operating circuit is affected by both the operating and environmental conditions involved. Likewise, the life tests specified indicate performance under certain operating criteria to a set of specified end points. Performance at conditions other than those specified can usually be estimated only roughly as giving better or poorer life expectancy. For further discussion of life expectancy, reference should be made to the frontal section of this manual.

When operated under conditions common to on-off control applications the tube exhibits freedom from the development of interface resistance. The heater-cathode construction is designed to withstand intermittent operation.


Figure 1—Input and output resistance vs frequency.

The information presented on this data sheet is furnished without assuming any obligation.
AVERAGE PLATE CHARACTERISTICS
(PENTODE CONNECTED)
CURRENT IN MA

PLATE VOLTAGE

GRID 100 VOLTS
GRID NO. 3 CONNECTED TO CATHODE
AVERAGE PLATE CHARACTERISTICS
(PENTODE CONNECTED)
AVERAGE PLATE CHARACTERISTICS
(TRIODE CONNECTED)
AVERAGE TRANSFER CHARACTERISTICS
(PENTODE CONNECTED)

\[ E_f = \text{RATED VALUE} \]
\[ \text{GRID NO. 3 CONNECTED TO CATHODE} \]
AVERAGE TRANSFER CHARACTERISTICS
(PENTODE CONNECTED)

$E_f = \text{RATED VALUE}$
GRID NO. 3
CONNECTED TO CATHODE

$E_2 = E_3 = 150 \text{ VOLTS}$

$E_1 = E_2 = 150 \text{ VOLTS}$

$rp$, $gm$

TRANSCONDUCTANCE ($gm$) IN MICROMHOS
PLATE RESISTANCE ($rp$) IN MEGOHMS

GRID NO.1 VOLTAGE

$-11$ $-10$ $-9$ $-8$ $-7$ $-6$ $-5$ $-4$ $-3$ $-2$ $-1$ $0$