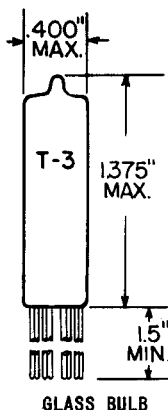


## TUNG-SOL

## TWIN TRIODE

SUBMINIATURE TYPE



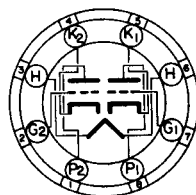
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.3 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SUBMINIATURE - 8  
FLEXIBLE LEADS

806

THE 6021 IS A RUGGEDIZED MEDIUM MU TWIN TRIODE OF THE LIGHT LEAD, BUTTON, SUBMINIATURE CONSTRUCTION. THE TUBE MAY BE USED AT FREQUENCIES IN THE UHF REGION, PERMITTING APPLICATIONS SUCH AS UHF AND VHF OSCILLATORS AND MIXERS. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS HEATER CURRENT, PLATE CURRENT, AND TRANSCONDUCTANCE ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET THE TEST SPECIFICATION, THE 6021 IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

## DIRECT INTERELECTRODE CAPACITANCES - EACH SECTION

|                                | WITH SHIELD* | WITHOUT SHIELD |            |
|--------------------------------|--------------|----------------|------------|
| GRID TO PLATE (RATED)          | 1.4          | 1.5            | $\mu\mu f$ |
| MAXIMUM                        | ---          | 1.7            | $\mu\mu f$ |
| MINIMUM                        | ---          | 1.3            | $\mu\mu f$ |
| INPUT (RATED)                  | 2.1          | 2.4            | $\mu\mu f$ |
| MAXIMUM                        | ---          | 2.8            | $\mu\mu f$ |
| MINIMUM                        | ---          | 2.0            | $\mu\mu f$ |
| OUTPUT (SECTION #1) (RATED)    | 1.3          | 0.28           | $\mu\mu f$ |
| MAXIMUM                        | ---          | 0.33           | $\mu\mu f$ |
| MINIMUM                        | ---          | 0.23           | $\mu\mu f$ |
| OUTPUT (SECTION #2) (RATED)    | 1.4          | 0.32           | $\mu\mu f$ |
| MAXIMUM                        | ---          | 0.39           | $\mu\mu f$ |
| MINIMUM                        | ---          | 0.25           | $\mu\mu f$ |
| MAXIMUM GRID TO GRID (RATED)   | 0.011        | 0.013          | $\mu\mu f$ |
| MAXIMUM PLATE TO PLATE (RATED) | 0.33         | 0.52           | $\mu\mu f$ |

## RATINGS

ABSOLUTE MAXIMUM VALUES

|                                         |              |        |
|-----------------------------------------|--------------|--------|
| HEATER VOLTAGE                          | 6.3 $\pm$ 5% | VOLTS  |
| MAXIMUM DC PLATE VOLTAGE                | 165          | VOLTS  |
| MAXIMUM DC GRID VOLTAGE                 | 0            | VOLTS  |
| MAXIMUM HEATER-CATHODE VOLTAGE          | $\pm$ 200    | VOLTS  |
| MAXIMUM GRID RESISTANCE (EACH SECTION)  | 1.1          | MEGOHM |
| MAXIMUM DC PLATE CURRENT (EACH SECTION) | 22           | mA     |

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**RATINGS — CONT'D.**  
ABSOLUTE MAXIMUM VALUES

|                                          |        |       |
|------------------------------------------|--------|-------|
| MAXIMUM DC GRID CURRENT (EACH SECTION)   | 5.5    | mA    |
| MAXIMUM PLATE DISSIPATION (EACH SECTION) | 0.7    | WATT  |
| MAXIMUM BULB TEMPERATURE                 | 220    | °C    |
| MAXIMUM ALTITUDE <sup>A</sup>            | 60 000 | FEET  |
| LIFE EXPECTANCY:                         |        |       |
| 30°C AMBIENT TEMPERATURE                 | 5 000  | HOURS |
| 175°C AMBIENT TEMPERATURE                | 1 000  | HOURS |

**TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS**

|                                     |       |       |
|-------------------------------------|-------|-------|
| HEATER VOLTAGE                      | 6.3   | VOLTS |
| HEATER CURRENT                      | 0.3   | AMP.  |
| DC PLATE VOLTAGE                    | 100   | VOLTS |
| CATHODE BIAS RESISTOR               | 150   | OHMS  |
| PLATE CURRENT                       | 6.5   | mA    |
| TRANSCONDUCTANCE                    | 5 400 | μMHOS |
| AMPLIFICATION FACTOR                | 35    |       |
| GRID VOLTAGE FOR 10μA PLATE CURRENT | -6.5  | VOLTS |

**CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN**E<sub>f</sub> = 6.3V, E<sub>b</sub> = 100Vdc, E<sub>c</sub> = 0 Vdc, R<sub>k</sub>/k = 150 OHMS

EXCEPT AS MODIFIED BELOW

|                                                                                                                                                    | 500 HOUR LIFE TEST |                    |               |              |                    |                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|---------------|--------------|--------------------|--------------------|
|                                                                                                                                                    | INDIVIDUAL<br>MIN. | INDIVIDUAL<br>MAX. | PROD.<br>MIN. | AVG.<br>MAX. | INDIVIDUAL<br>MIN. | INDIVIDUAL<br>MAX. |
| HEATER CURRENT                                                                                                                                     | 280                | 320                | 288           | 312          | 276                | 328                |
| HEATER-CATHODE LEAKAGE <sup>B</sup><br>(E <sub>hk</sub> =±100Vdc)                                                                                  | ---                | ±5.0               | ---           | ---          | ---                | ±10                |
| GRID CURRENT<br>(E <sub>b</sub> =150Vdc, R <sub>k</sub> =300,<br>R <sub>g1</sub> =1.0 MEG.)                                                        | 0                  | -0.3               | ---           | ---          | 0                  | -0.9               |
| PLATE CURRENT (1)                                                                                                                                  | 4.5                | 8.5                | 5.6           | 7.3          | ---                | ---                |
| PLATE CURRENT (1)<br>DIFFERENCE BETWEEN SECTIONS---                                                                                                | ---                | 1.6                | ---           | ---          | ---                | ---                |
| PLATE CURRENT (2)<br>(E <sub>c</sub> =6.5Vdc, R <sub>k</sub> =0)                                                                                   | ---                | 100                | ---           | ---          | ---                | ---                |
| TRANSCONDUCTANCE (1)                                                                                                                               | 4450               | 6350               | 5000          | 5800         | ---                | ---                |
| CHANGE IN INDIVIDUAL TUBES---                                                                                                                      | ---                | ---                | ---           | ---          | ---                | 25                 |
| AVERAGE CHANGE                                                                                                                                     | ---                | ---                | ---           | ---          | ---                | 15                 |
| INSULATION OF ELECTRODES <sup>C</sup><br>g-ALL                                                                                                     | 100                | ---                | ---           | ---          | 50                 | ---                |
| p-ALL                                                                                                                                              | 100                | ---                | ---           | ---          | 50                 | ---                |
| Δ TRANSCONDUCTANCE<br>(E <sub>f</sub> = 5.7V)                                                                                                      | ---                | 15                 | ---           | ---          | ---                | 15                 |
| GRID EMISSION <sup>D</sup><br>(E <sub>f</sub> =7.5V, E <sub>c</sub> =-7.5Vdc<br>E <sub>b</sub> =150Vdc, R <sub>k</sub> =0, R <sub>p</sub> =1.0MEG) | ---                | -0.5               | ---           | ---          | ---                | ---                |
| PULSE EMISSION <sup>E</sup><br>(E <sub>f</sub> =6.0V, e PULSE=50V,<br>tp=25 usec, prr=200pps)                                                      | 300                | ---                | ---           | ---          | ---                | ---                |
| AMPLIFICATION FACTOR <sup>F</sup>                                                                                                                  | 30                 | 40                 | ---           | ---          | ---                | ---                |

**SPECIAL REQUIREMENTS**

|                                                                                                                                                         | MIN. | MAX. |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|
| AF NOISE <sup>GH</sup><br>(E <sub>sig</sub> =65mVac, R <sub>g</sub> =0.1 meg., R <sub>p</sub> =0.1 meg.,<br>R <sub>k</sub> =75, C <sub>k</sub> =1000μf) | ---  | 17   |
| LOW PRESSURE VOLTAGE BREAKDOWN <sup>J</sup><br>(PRESSURE =55±5mm Hg., VOLTAGE =300Vdc)                                                                  | ---  | ---  |

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## TUNG-SOL

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## SPECIAL REQUIREMENTS - CONT'D.

|                                                                                                                            | MIN. | MAX.  |            |
|----------------------------------------------------------------------------------------------------------------------------|------|-------|------------|
| VARIABLE FREQUENCY VIBRATION <sup>K</sup><br>(NO VOLTAGES, POST SHOCK AND VIBRATIONAL<br>FATIGUE TEST END POINTS APPLY)    | ---  | ---   |            |
| LOW FREQUENCY VIBRATION <sup>MG</sup><br>( $R_p = 10,000$ , $C_k = 1,000 \mu f$ , $F = 40 cps$ , $G = 15$ )                | ---  | 50    | mVac       |
| SUBMINIATURE LEAD FATIGUE <sup>N</sup>                                                                                     | 4    | ---   | ARCS       |
| SHOCK <sup>P</sup><br>(HAMMER ANGLE = $30^\circ$ , $E_{hk} = \pm 100 Vdc$ , $R_g = 0.1 meg.$ )                             | ---  | ---   |            |
| VIBRATIONAL FATIGUE <sup>R</sup><br>( $G = 2.5$ ; FIXED FREQUENCY; $F = 25 min.$ 60 max.)                                  | ---  | ---   |            |
| POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS                                                                         | ---  | ---   |            |
| LOW FREQUENCY VIBRATION                                                                                                    | ---  | 200   | mVac       |
| HEATER CATHODE LEAKAGE ( $E_{hk} = \pm 100 Vdc$ )                                                                          | ---  | 20    | $\mu A dc$ |
| $\Delta$ TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES                                                                          | ---  | 20    | PERCENT    |
| GLASS STRAIN <sup>S</sup>                                                                                                  | ---  | ---   |            |
| 1 HOUR STABILITY LIFE TEST <sup>G</sup><br>( $E_{hl} = +200 Vdc$ , $R_{g1g} = 1.0 meg.$ , $T_A = ROOM$ )                   | ---  | ---   |            |
| STABILITY LIFE TEST END POINTS                                                                                             | ---  | ---   |            |
| $\Delta$ TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES                                                                          | ---  | 15    | PERCENT    |
| 100 HOUR SURVIVAL RATE LIFE TEST<br>(STABILITY LIFE TEST CONDITIONS OR<br>EQUIVALENT $T_A = ROOM$ )                        | ---  | ---   |            |
| SURVIVAL RATE LIFE TEST END POINTS<br>CONTINUITY AND SHORTS (INOPERATIVES)                                                 | ---  | ---   |            |
| TRANSCONDUCTANCE (1)                                                                                                       | ---  | 4 000 | $\mu MHOS$ |
| HEATER CYCLING LIFE TEST <sup>U</sup><br>( $E_f = 7.0V$ , 1 min. on, 4 min. off,<br>$E_{hk} = 140 Vdc$ , $E_c = E_b = 0$ ) | ---  | ---   |            |
| INTERMITTENT LIFE TEST<br>(STABILITY LIFE TEST CONDITIONS, BULB TEMP =<br>$220^\circ C$ )                                  | ---  | ---   |            |

## NOTES

A. IF ALTITUDE RATING IS EXCEEDED, REDUCTION OF INSTANTANEOUS VOLTAGES (E<sub>f</sub> EXCLUDED) MAYBE REQUIRED.

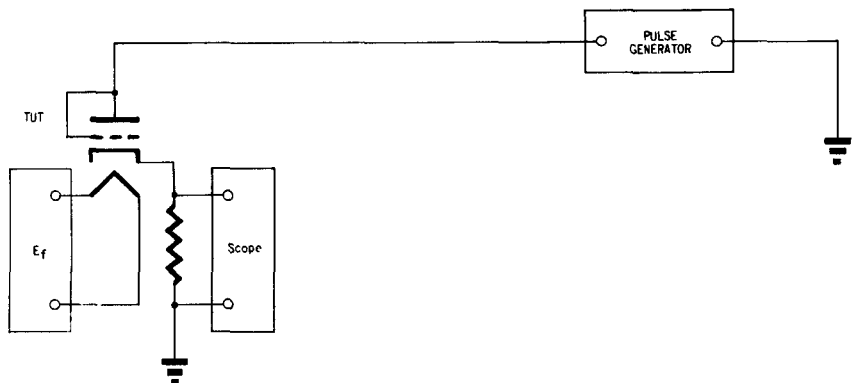
B. SEE MIL-E-1C 4.10.15

C. SEE MIL-E-1C 4.8.2

D. PRIOR TO THIS TEST PRE-HEAT TUBES FOR 5 MINUTES WITH BOTH SECTIONS OPERATING SEPARATELY AT CONDITIONS LISTED BELOW. TEST IMMEDIATELY AFTER PRE-HEATING. ( $E_f = 7.5V$ ,  $E_c = 0Vdc$ ,  $E_b = 150 Vdc$ ,  $R_k = 300 OHMS$ ,  $R_g = 1.0 MEG.$ )

E. THE PULSE IS ESSENTIALLY A SQUARE WAVE WITH 1.0 USEC RISE TIME AND 0.8 USEC FALL. THE PULSE SHALL BE APPLIED TO PLATE AND GRID TIED TOGETHER. PULSE EMISSION SHALL BE MEASURED IN TERMS OF VOLTAGE DEVELOPED ACROSS A 1.0 OHM RESISTOR IN THE CATHODE CIRCUIT. TEST LIMIT AS MEASURED BY THE LEADING EDGE OF A CALIBRATED TRACE. THE AMPLITUDE OF THE TRAILING EDGE OF WHICH SHALL NOT VARY BY MORE THAN 20% FROM THE VALUE OF THE LEADING EDGE. TEST EACH UNIT SEPARATELY.

MIL-E-1/198A



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## NOTES - CONT'D.

F SEE MIL-E-1C 4.10.11.1

G TIE 1K TO 2K, 1g TO 2g, AND 1p TO 2p.

H SEE MIL-E-1C 4.10.3.2

J THERE SHALL BE NO EVIDENCE OF ARCING OR CORONA BETWEEN ANODE PINS AND ADJACENT PINS WITH NO OTHER VOLTAGES APPLIED.

K SEE MIL-E-1C 4.9.20.3

M SEE MIL-E-1C 4.9.19.1

N SEE MIL-E-1C 4.9.5.3

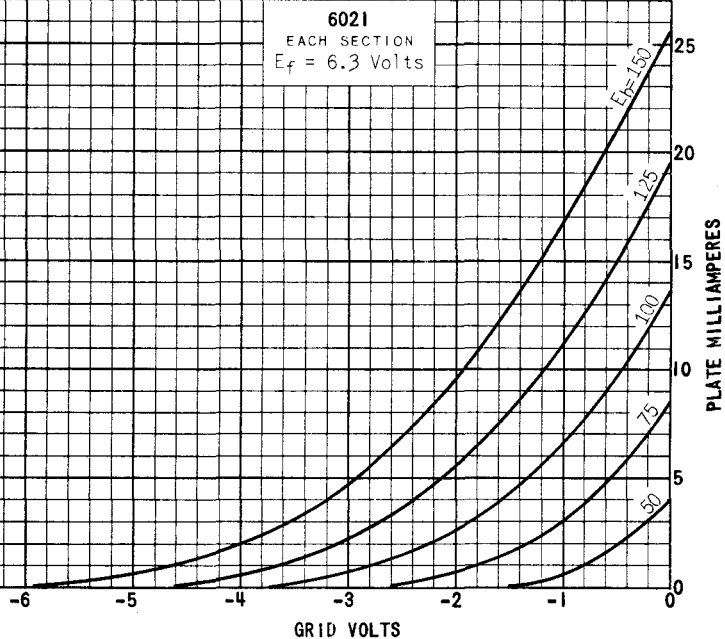
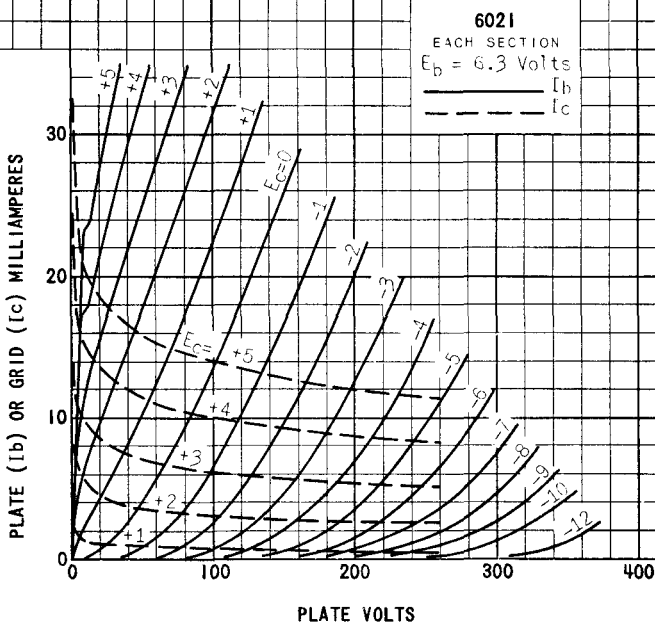
P SEE MIL-E-1C 4.9.20.5

R SEE MIL-E-1C 4.9.20.6

S ALL TUBES SHALL HAVE BEEN SEALED A MINIMUM OF 48 HOURS PRIOR TO CONDUCTING THIS TEST. TUBES SHALL BE AT ROOM TEMPERATURE. ENTIRE TUBE SHALL BE IMMERSSED IN WATER NOT LESS THAN 85° C FOR 15 SECONDS AND IMMEDIATELY THEREAFTER IMMERSSED IN ICE WATER NOT MORE THAN 50° C FOR 5 SECONDS. TUBES SHALL BE PLACED IN WATER SO THAT NO CONTACT IS MADE WITH THE CONTAINING VESSEL NOR EACH OTHER. TUBES SHALL THEN BE REMOVED AND ALLOWED TO COOL AT ROOM TEMPERATURE ON A WOODEN SURFACE. THE TUBES SHALL BE ALLOWED TO COOL FOR 48 HOURS AND THEN BE INSPECTED FOR EVIDENCE OF AIR LEAKS.

U THE REGULATION OF THE HEATER VOLTAGE SHALL NOT BE MORE THAN 3.0 PERCENT.

\* WITH SHIELD OF 0.405" INSIDE DIAMETER CONNECTED TO CATHODE OF SECTION UNDER TEST.



6021  
PREMIUM TUBE

