TUNG-SOL

TRIODE

HEATER
6.3±10% VOLTS 7.5 AMP.
AC OR DC
ANY MOUNTING POSITION

GLASS BULB

THE 7242 IS A LONG LIFE, HIGH POWER TRIODE DEVELOPED ESPECIALLY FOR USE AS A PASSING TUBE IN SERIES REGULATED POWER SUPPLIES. FOR THIS SERVICE, A TUBE MUST BE ABLE TO PASS LARGE CURRENTS OVER A WIDE VOLTAGE RANGE AND STILL EXHIBIT A LOW INTRINSIC VOLTAGE DROP WHEN OPERATED "WIDE OPEN". THE 7242 NOT ONLY MEETS THESE REQUIREMENTS BUT POSSESES THE ADDITIONAL ADVANTAGE OF REQUIRING LITTLE GRID VOLTAGE SWING TO CONTROL THESE CURRENTS. THIS PERMITS THE USE OF SIMPLER CONTROL AMPLIFIER CIRCUITS IN THE REGULATED SUPPLY.

THE 7242 FEATURES ONE LARGE ZIRCONIUM COATED GRAPHITE ANODE, WITH THREE SEPARATE GRID-CATHODES STRUCTURES. THIS ANODE, WHILE LIGHTER IN WEIGHT THAN SIMILAR METAL ANODES, REMAINS WARP FREE DURING LIFE AND PROVIDES ONE OF THE BEST GAS "GETTERING" MEANS KNOWN. THE ANODE IS SUPPORTED BY CERAMIC INSULATORS. THE USE OF THESE INSULATORS AND THE HARD GLASS ENVELOPE PERMIT THE TUBE TO BE OUTGASSED AT HIGH TEMPERATURES DURING THE MANUFACTURING EXHAUST PROCESS. THIS ALLOWS THE TUBE TO BE RUN AT HIGH TEMPERATURES DURING OPERATION, WITHOUT THE EVOLUTION OF HARMFUL GAS FROM THE TUBE PARTS.

MASSIVE CATHODES PROVIDE ADEQUATE EMISSION CURRENT RESERVE. GOLD PLATED MOLYBDENUM WIRES ARE EMPLOYED IN THE RUGGED GRID STRUCTURE. THE TUBE MOUNT IS BUILT ON A RUGGED BUTTON STEM, AND IS SUPPORTED FROM THE BULB BY MEANS OF FLEXIBLE METAL VIBRATION SNUBBERS.

IN MANY CIRCuits, ONE 7242 CAN REPLACE FOUR TYPE 5998 REGULATOR TUBES. FOR EVEN HIGHER LEVELS OF CURRENT OR POWER, SEVERAL 7242 TUBES CAN BE PARALLELED AS EXPLAINED IN THE APPLICATION NOTES.
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

ELECTRICAL DATA

HEATER VOLTAGE 6.3±10% VOLTS
HEATER CURRENT \(E_2 = 6.3 \text{ V.}\) 7.5 AMP.
MINIMUM CATHODE HEATING TIME 30 SECONDS
TRANSCONDUCTANCE 111,000 AMMOS
AMPLIFICATION FACTOR 9.0
PLATE RESISTANCE 82 OHMS

MECHANICAL DATA

MOUNTING POSITION ANY
(IF TUBE IS TO BE MOUNTED IN A HORIZONTAL POSITION IT IS
RECOMMENDED THAT IT BE MOUNTED SO THAT THE BASE LUG KEY
BE EITHER DIRECTLY UP OR DIRECTLY DOWN)

BULB TT 18 NONEX
BASE GIANT 7 PIN WITH CERAMIC
INSERT, JETEC #A7-17
SOCKET E.F. JOHNSON #122-237 OR EQUIVALENT
AVERAGE NET WEIGHT 6.0 OUNCES
MAXIMUM SHOCK RATING (NAVY HI IMPACT SHOCK MACHINE) 450 G
MAXIMUM VIBRATION RATING (10 TO 25 CPS) 2.5 G

RATINGS

ABSOLUTE VALUES

TOTAL PLATE DISSIPATION --- 100 WATTS
TOTAL PLATE CURRENT DC --- 0.9 AMP.

IF TUBE VOLTAGE DROP IS TO BE SWUNG MORE THAN 6 VOLTS, THIS
CURRENT CANNOT BE REALIZED. SEE PLATE CHARACTERISTICS CURVE

CURRENT PER CATHODE (DC) --- 300 MA.
PLATE VOLTAGE (DC) 0 400 VOLTS
HEATER-CATHODE VOLTAGE (DC) -300 +300 VOLTS
GRID VOLTAGE (DC) -900 0 VOLTS
GRID CURRENT PER GRID --- 0 MA.
HEATER VOLTAGE 5.7 6.9 VOLTS
ENVELOPE TEMPERATURE --- 300 °C
ALTITUDE FOR FULL RATINGS --- 10,000 FEET

IF COOLING IS PROVIDED TO KEEP BULB TEMPERATURE WITHIN
RATINGS, ALTITUDE RATING CAN BE EXTENDED TO 60,000 FT.

CIRCUIT VALUES

TOTAL GRID CIRCUIT RESISTANCE IN 500 50,000 OHMS
REGULATED SERVICE OR WITH FIXED BIAS
TOTAL GRID CIRCUIT RESISTANCE WITH 500 200,000 OHMS
CATHODE BIAS ONLY
RESISTANCE PER GRID LEG WHEN 500 --- OHMS
TUBES ARE PARALLELED

CATHODE RESISTANCE: MINIMUM CATHODE RESISTANCE PER CATHODE LEG SHALL
BE 27 OHMS OR THAT RESISTANCE NECESSARY TO PRO-
VIDE 10% OF THE GRID BIAS VOLTAGE, WHICHEVER IS
GREATER.

CONTINUED ON FOLLOWING PAGE
**ADDIONAL TESTS TO INSURE RELIABILITY**
RANDOMLY SELECTED SAMPLES ARE SUBJECTED TO THE FOLLOWING TESTS

**SHOCK:** 30° HAMMER ANGLE IN NAVY, FLYWEIGHT, HIGH IMPACT MACHINE (450G/MSEC)

**LIFE TEST:** 1000 HOURS UNDER PLATE CURRENT TEST CONDITIONS \( R_g = .05 \text{ MEG.} \)

**POST SHOCK AND LIFE TEST END POINTS:**

<table>
<thead>
<tr>
<th>PLATE CURRENT (MIN.)</th>
<th>390</th>
<th>MA</th>
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<tbody>
<tr>
<td>TRANSCONDUCTANCE (MIN.)</td>
<td>70,000</td>
<td>( \mu \text{MHO} )</td>
</tr>
<tr>
<td>HK LEAKAGE (MAX.)</td>
<td>150</td>
<td>( \mu \text{A} )</td>
</tr>
<tr>
<td>GRID CURRENT (MAX.)</td>
<td>-12</td>
<td>( \mu \text{A} )</td>
</tr>
</tbody>
</table>

**RANGE OF VALUES**

**CONDITIONS:**
\[ E_C = 6.5V, \ E_B = 100V. \]
\[ E_C = -4, \ R_g = 500 \Omega \]

READINGS TAKEN AFTER 2 MINUTES PREHEATING UNDER CONDITIONS OF
\[ E_f = 6.3, \ E_{bb} = 190V, E_C = 0, \]
\[ R_K = 6.3 \text{ OHMS}. \]

<table>
<thead>
<tr>
<th>TOTAL PLATE CURRENT</th>
<th>420</th>
<th>690</th>
<th>MA, DC</th>
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<tbody>
<tr>
<td>AMPLIFICATION FACTOR</td>
<td>7.0</td>
<td>11.0</td>
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<tr>
<td>TRANSCONDUCTANCE</td>
<td>87,000</td>
<td>135,000</td>
<td>( \mu \text{MHO} )</td>
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<tr>
<td>HEATER CURRENT PER TUBE</td>
<td>7.12</td>
<td>7.88</td>
<td>AMP.</td>
</tr>
</tbody>
</table>

**CONDITIONS:**
\[ E_f = 6.3V, \ E_B = 400V. \]
\[ E_C = -75V, R_K = 0 \]

| CURRENT PER CATHODE | 0 | 10 | MA |

CONTINUED ON FOLLOWING PAGE
THE 7242 IS WIDELY USED AS A "PASSING" TUBE OR SERIES REGULATOR IN CONTROLLED POWER SUPPLIES BECAUSE OF ITS HIGH TRANSDUCTANCE AT RELATIVELY LOW PLATE VOLTAGES. TO PROVIDE THE DESIRED OUTPUT CURRENT, MANY TRIODE SECTIONS CAN BE PARALLELED. IF TUBE SECTIONS ARE TO BE PARALLELED, HOWEVER, THE DESIGNER IS STRONGLY URGED TO USE SUFFICIENT RESISTANCE IN EACH CATHODE LEG TO EQUALIZE CURRENT DIVISION AMONG THE TRIODE SECTIONS. RECOMMENDED VALUES FOR VARIOUS OPERATING CURRENTS ARE SHOWN ON THE PLATE CHARACTERISTICS CURVE. IF THE OUTPUT CURRENT OF THE SUPPLY IS NOT FIXED, USE THE RESISTANCE INDICATED FOR THE LOWEST CURRENT THAT APPROACHES THE MAXIMUM PLATE DISSIPATION LINE. CATHODE RESISTANCE IS SUPERIOR TO ANODE RESISTANCE BECAUSE IT PROVIDES MORE BIAS ON THE SECTIONS TAKING GREATER PLATE CURRENT. A CATHODE RESISTOR NEED BE ONLY ONE TENTH THE VALUE \( \frac{E}{I} \) OF A PLATE RESISTOR, AND THEREFORE WILL DISSIPATE ONLY ONE TENTH THE POWER. IN ANY CASE, THE ONLY LOSSES INCURRED IN USING A RESISTOR IS THE INSERTION LOSS OF THE RESISTOR ITSELF (LESS THAN ONE WATT) AND THE ADDITIONAL VOLTAGE (LESS THAN 6 VOLTS) NECESSARY FROM THE UNREGULATED SUPPLY. A CATHODE RESISTOR ADDS A SMALL ADDITIONAL LOSS BY CAUSING THE PASSING TUBE TO WORK WITH HIGHER BIAS AND HENCE WITH GREATER TUBE DROP.

A THIRTY SECOND CATHODE WARMUP TIME IS RECOMMENDED BEFORE THE PLATE VOLTAGE IS APPLIED. THIS IS ESPECIALLY NECESSARY IN CIRCUITS WHERE THE AMPLIFIER TUBE PLATE RESISTOR IS RETURNED TO THE PLATE SIDE OF THE PASSING TUBE, AS ILLUSTRATED IN THE SIMPLIFIED CIRCUIT IN FIGURE 1. IN THIS CASE DURING WARMUP THE AMPLIFIER TUBE DRIVES LITTLE CURRENT, THERE IS LITTLE IR DROP ACROSS THE RESISTOR, AND THE GRID OF THE PASSING TUBE IS EFFECTIVELY TIED TO THE PLATE. THE PLATE WILL ATTEMPT TO DRAW EXCESSIVE CURRENT FROM THE PASSING TUBE’S CATHODE AND MAY SERIOUSLY IMPAIR TUBE LIFE. THE CIRCUIT IN FIGURE 2 IS PREFERABLE FROM THE CONSIDERATION OF THE SAFETY OF THE PASSING TUBE BOTH DURING WARMUP AND IN THE EVENT OF TROUBLE IN THE AMPLIFIER CIRCUIT OR IF THE AMPLIFIER TUBE IS REMOVED FROM ITS SOCKET. IT HAS THE ADDITIONAL ADVANTAGE OF PROVIDING A CONSTANT VOLTAGE FOR THE AMPLIFIER CIRCUIT. HOWEVER, IF THE REGULATOR OUTPUT IS LOW (BELOW 250 VOLTS) IT WILL BE NECESSARY TO PROVIDE ADDITIONAL NEGATIVE VOLTAGE FOR THE REFERENCE TUBE CIRCUIT. ALSO, IF THE REGULATED OUTPUT VOLTAGE IS TO BE VARIABLE, IT MAY BE NECESSARY TO FOLLOW FIGURE 1.

PASSING TUBE OPERATION CONDITIONS SHOULD BE CHOSEN TO PROVIDE AS LOW A TUBE DROP AS POSSIBLE. A SAFETY MARGIN OF AT LEAST 5 VOLTS FROM THE ZERO BIAS LINE SHOULD BE ALLOWED HOWEVER, FOR VARIATIONS OF INDIVIDUAL TUBES. SUFFICIENT BIAS EXCURSION SHOULD BE ALLOWED FOR OVERCUMING RIPPLE. THE AMPLIFIER CIRCUIT SHOULD BE ABLE TO COUNTERACT THE EFFECT OF UNBALANCE DUE TO TUBE AGING.

A GRID RESISTOR SHOULD BE USED FOR EACH TRIODE SECTION. THIS SHOULD BE ENOUGH TO PREVENT PARASITIC OSCILLATION BUT NOT LARGE ENOUGH TO PREVENT LOSS OF CONTROL DUE TO A SMALL AMOUNT OF "GAS" GRID CURRENT. A VALUE OF GRID RESISTANCE THAT MEETS BOTH THESE CONDITIONS IS 1,000 OHMS. HEATER VOLTAGE SHOULD BE KEPT AS CLOSE AS POSSIBLE TO 6.3 VOLTS AS MEASURED ON THE TUBE PINS. WHEN CONNECTING MANY HIGH DRAIN TUBE HEATERS ACROSS A SINGLE TRANSFORMER, BUS BARS FEEDING FROM "ALTERNATE ENDS" (FIGURE 3) SHOULD BE USED WITH A STRANDED PAIR FEEDING INDIVIDUAL SOCKETS.
7242

$E_f = 6.3$ Volts

Heavy horizontal lines show various ranges of operation for series regulator service. Resistance values given are cathode resistance per leg.

PLATE VOLTS DC

PLATE CURRENT - MILLIAMPERES

$E_f = 6.3$ Volts

100 WATT PLATE DISSIPATION

$R_p = 10X$

$E_f = 0$

$E_f = 250$

$E_f = 50$

$E_f = 0$

$E_f = 50$

GRID VOLTS

PLATE CURRENT - MILLIAMPERES

400

350

300

250

200

150

100

50

0

-50

-40

-30

-20

-10

0

-60
TENTATIVE DATA

7242

$E_f = 6.3$ Volts

GRID VOLTS

AMPLIFICATION FACTOR

400 350 300 250 200 150 100 50

-60  -50  -40  -30  -20  -10  0

FIGURE 1

FIGURE 2

FIGURE 3