TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 7802WA

JANUARY 1963

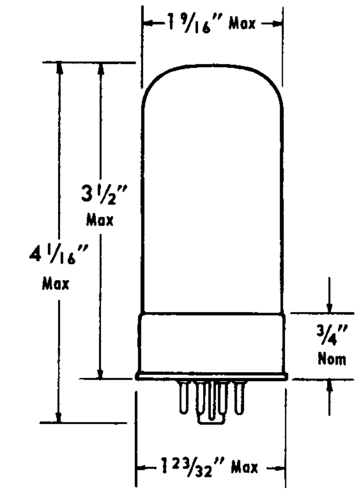
RUGGED, RELIABLE MEDIUM-MU TWIN POWER TRIODE

DESCRIPTION — The 7802WA is a rugged, reliable version of the 7802 medium-mu, high current twin triode designed for use in electronically regulated power supplies. Its high perveance permits passage of large currents at low plate voltages, thus providing for efficient series regulation. The medium-mu 7802WA requires a smaller signal voltage as compared with that required by equivalent low-mu types.

The 7802WA is run in lots with many destructive tests performed on randomly selected samples. Thus a tube may pass all required tests and still be rejected if it is from an unsatisfactory lot. Longer life tests with multiple and closer test limits assure a highly reliable tube with a long life expectancy.

ELECTRICAL DATA

Heater Voltage	6.3 ±5%	Volts
Heater Current — E_f = 6.3 Volts	2.5	Amperes
Cathode Heating Time — Minimum	30	Seconds
Transconductance per Section	20,000	Micromhos
Amplification Factor	9	
Interelectrode Capacitance — per Section		
Grid to Cathode	7.8	Micromicrofarads
Grid to Plate	9.5	Micromicrofarads
Cathode to Plate	1.3	Micromicrofarads
Cathode to Heater	7.8	Micromicrofarads
Interelectrode Capacitance — Between Sections		
Grid to Grid	0.82	Micromicrofarad
Plate to Plate	2.3	Micromicrofarads



OUTLINE DRAWING

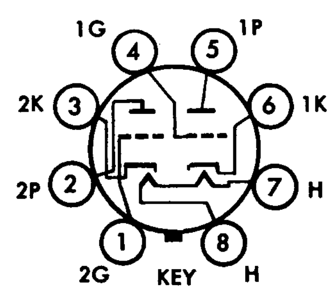
MECHANICAL DATA

Mounting Position	Any
If tube is mounted in a horizontal position, it should be mounted so that the base lug key is directly up or down.	
Bulb	T12
Base	Large wafer octal 8-pin with metal sleeve, JEDEC type B8-98
Maximum Net Weight	3 ounces

RATINGS, ABSOLUTE VALUES

	Minimum	Maximum	
Heater Voltage	6.0	6.6	Volts
Plate Voltage	—	250	Volts dc
Plate Current per Section — Note 1	—	160	Milliamperes
Power Dissipation per Section	—	13	Watts
Grid Voltage	—	0	Volts dc
Grid Current per Section	—	5	Milliamperes
Heater — Cathode Voltage	−300	+300	Volts
Envelope Temperature	—	230	Degrees Centigrade
Altitude for Full Ratings	—	60,000	Feet
Grid Circuit Resistance Values			
For Cathode Bias Operation	500	500,000	Ohms
For Fixed Bias, or Cathode and Fixed Bias Operation	500	50,000	Ohms

Note 1. If several tube sections are used in parallel with each other, do not exceed 125 milliamperes per section.



BOTTOM VIEW

ADDITIONAL TESTS TO INSURE RELIABILITY

Randomly Selected Samples Are Subjected to the Following Tests.

Shock: 30° Hammer angle in Navy Flyweight High Impact Machine (450 G/msec)	
Fatigue: 25 cps at 2.5 G for 32 hours in each of three mutually perpendicular planes	
Post Shock and Fatigue Limits:	
Vibration (R_p = 2000 ohms, E_c = −7vdc, Tie 1k to 2k, 1g to 2g, 1p to 2p), Generated Plate Voltage	300 mVac max
Heater-Cathode Leakage (E_{hk} = ±100 Vdc)	50 uAdc max
Change in Transconductance from Initial Value	15% max
Grid Current	−4.5 uA max
Heater Cycling Life Test (E_f = 7.5v, E_{hk} = 300 Vac. Duration of 2000 cycles of 1 minute on and 4 minutes off)	
End Point E_{hk} = ±100 Vdc),	50 uAdc max

Stability Life Test (1 hour) End Point:	
Change in Transconductance from Initial Value	10% max
Survival Rate Life Test (100 hours) End Point:	
Transconductance	13,500 umhos min
Intermittent Life Test (1000 hours, bulb temperature = 300°C min) End Points:	
Grid Current	−5 uAdc max
Change in Transconductance by reducing E_f to 5.7v	15% max
Change in Transconductance from zero hour reading	15% max
Heater-Cathode Leakage E_{hk} = ±100Vdc	25 uAdc max
Heater Current	2.35 min 2.75 max amperes
Insulation of Electrodes: Grid to all others and Plate to all others	100 megohm min

RANGE OF VALUES

Test Conditions: E_f = 6.3V, E_b = 100V, E_c = −4 Vdc, $R_g/_g$ = 500 ohms min. Both sections operating, each section read separately

	Min	Max
Individual Section Plate Current	80	150 Milliamperes dc
Lot Average Plate Current	100	130 Milliamperes dc
Plate Current, Difference between Sections	—	35 Milliamperes dc
Individual Section Transconductance	16,500	23,500 Micromhos

	Min	Max
Lot Average Transconductance	18,800	21,000 Micromhos
Amplification Factor	6.5	10.5
Heater Current @ 6.3 v	2.35	2.65 Amperes

APPLICATION NOTES

The 7802 WA is widely used as a "passing" tube or series regulator tube in controlled power supplies because of its high transconductance 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 helps to provide increasing bias on the sections taking greater plate current. A cathode resistor too, need be only one third the value $\left(\frac{R}{u+1}\right)$ of a plate resistor, and therefore will dissipate only one third 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 10 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.

The regulator circuit shown 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 regulated output voltage 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. If Figure 1 is used, a clamping diode rated at 300 volts piv should be employed to prevent the grid from swinging positive. The use of this diode is of extreme importance for without it, during warmup the amplifier tube draws little current, there is little IR drop across the resistor, and the grid of the passing tube is effectively tied to the plate. The grid then will attempt to draw excessive current from the passing tube's cathode and may seriously impair cathode life.

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. If the cathode resistors as suggested on the plate characteristic curve are used, a minimum bias of 5.0 volts will be provided. Sufficient bias excursion should be allowed for overcoming ripple. The amplifier circuit should be able to swing the passing tube grid far enough to counteract the effect of unbalance due to tube ageing.

A grid resistor should be used for each triode section. This should be high 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.

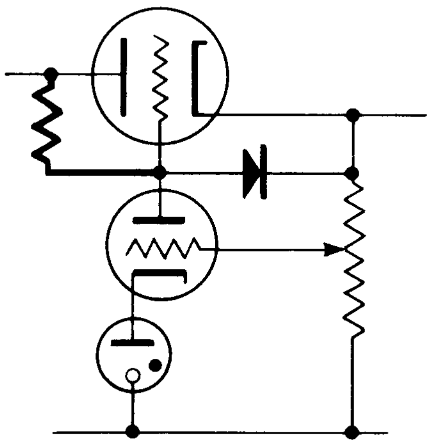


FIGURE 1

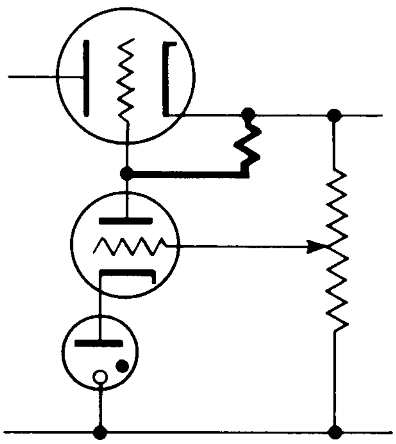


FIGURE 2

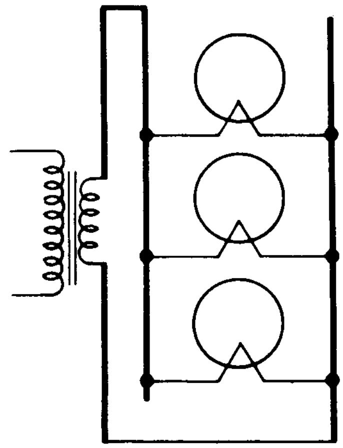


FIGURE 3

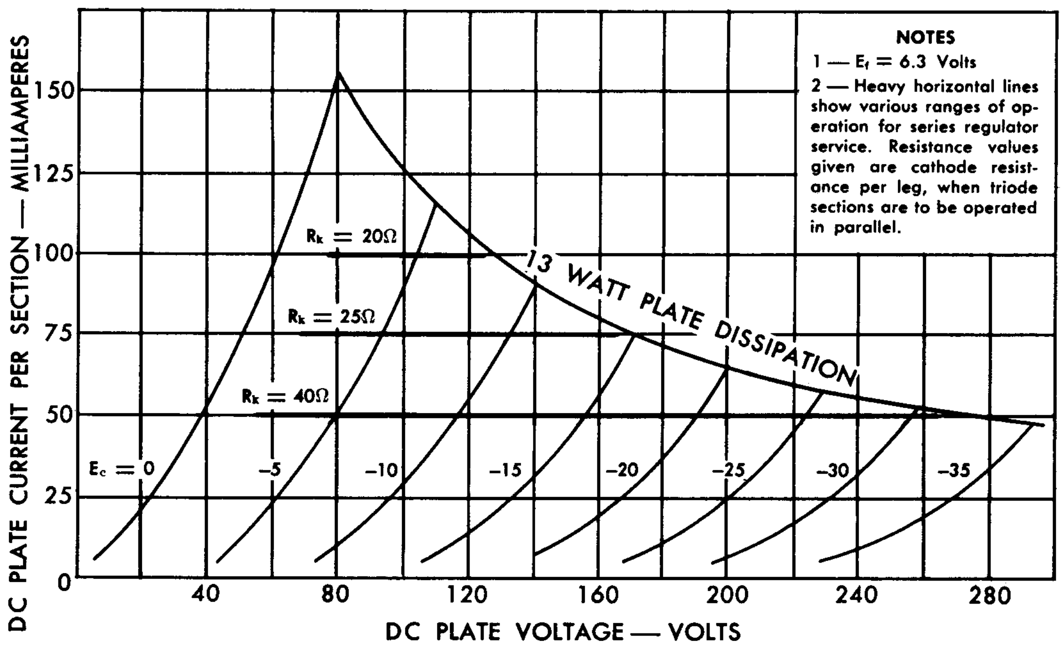


FIGURE 4. PLATE CHARACTERISTICS FOR EACH TRIODE SECTION

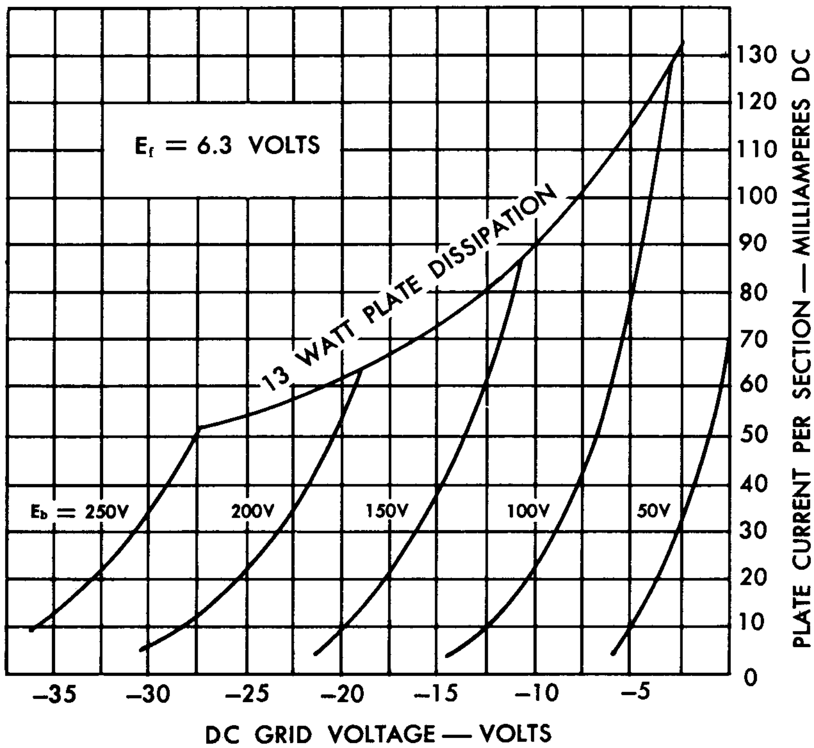


FIGURE 5. TRANSFER CHARACTERISTICS FOR EACH TRIODE SECTION

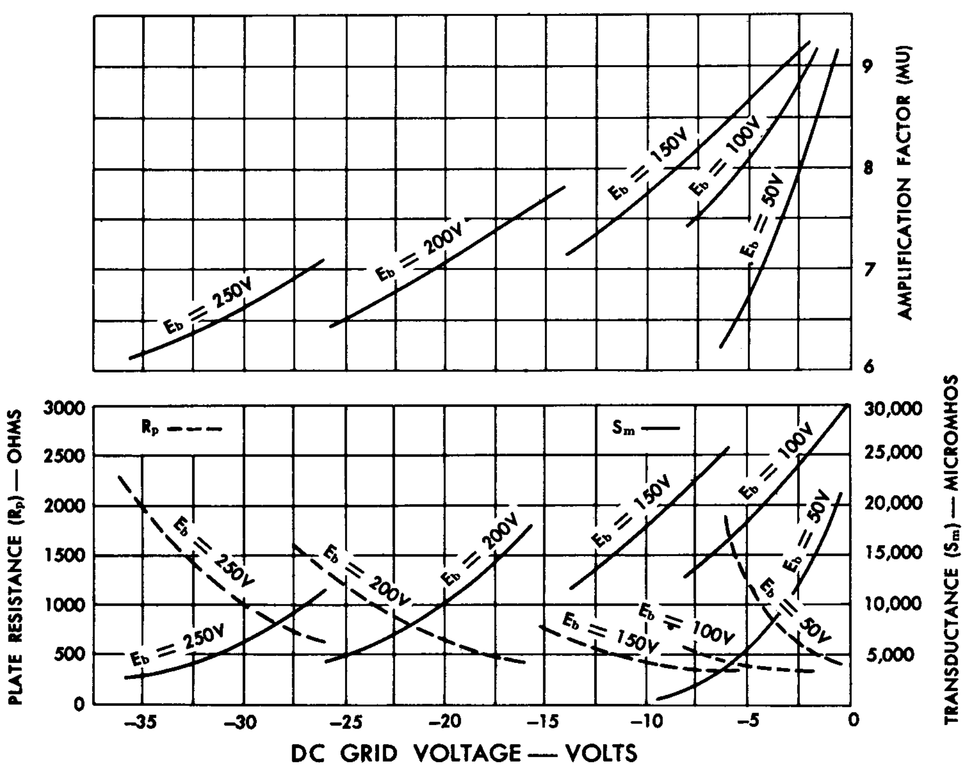


FIGURE 6. AMPLIFICATION FACTOR, PLATE RESISTANCE AND TRANSDUCTANCE CURVES